# Gaming and the Simulation of History
## Constructing Perspectives of Machu Picchu

by

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Abstract

In this research I have developed a new method for depicting historical sites using game-design concepts and technologies. I argue that using computer games, design environment researchers can integrate and consolidate historical documents, challenging the dichotomy of space and time as two discrete constructs, producing a dynamic rather than static "frozen" image of place. This method allows for movement from representation to simulation of historical places and events, and facilitates an active participation in the remaking of an historical place. While this method seeks to provide an accurate historical reconstruction, it also allows for the maintenance of a critical distance by exposing the mechanics of historiography. Stitching together various perspectives, I propose the making of a collage simulation of history in a game environment.

To test this method, I studied the historical site of Machu Picchu in Peru, and the story of its discovery by explorer Hiram Bingham in 1911. Bingham's expedition remains today the constituting myth of the site, captured in multiple documents, primarily Bingham's travel journal, but also in photography and cartographic drawings, made by Bingham himself during his discovery. In the contest of my work, Bingham's materials were integrated into a 3D game environment.

Taking-part in a collaborative project for 3D-scanning of Machu Picchu, on-site work produced accurate models of sections of the site. The 3D models became a basis-layer for my prototype, a hybrid of game and digital archive, producing a movement towards collage simulation of historical sites.

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This research would not have been possible without Professor Nagakura's research vision, his guidance and support in allowing me to take part in his collaborative projects, encouraging me to build on the digital materials produced during numerous trips to Peru. The research uses photogrammetry models made in a collaborative project in Professor Nagakura's laboratory, organized by Paloma Gonzalez, in collaboration with the Universidad de San Antonio de Abad in Cusco and Peru Regional Culture Directorate. The project is funded by MIT MISTI-Peru program and MIT SUTD IDC Research Fund. The photogrammetry materials were collected by Nikolaos Vlavianos, Chang Liu, Wenzhe Peng, Xu Xhang, Paloma Gonzalez, Takehiko Nagakura, and myself.

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# 1. Introduction

## 1.1. Hypothesis

Computer games are part and parcel of our present; both their audiovisual language and the interaction processes associated with them have worked their way into our everyday lives. Yet without their essential spatiality, there is no place at which, in which or even based on which a game can take place. Today, we face the development of new typologies of space – game spaces that are emerging from the superimposition of the physical and the virtual. Computer games *"are essentially concerned with spatial representation and negotiation, and therefore the classification of a computer game can be based on how it represents or, perhaps, implements space."*[1] Media theorist Espen Aarseth emphasizes spatiality more than other qualities of computer games. Games, he argues, celebrate and explore spatial representation as a central motif and raison d'être. Henry Jenkins also views games as inherently spatial, although deeply engaged with storytelling. Jenkins argues that game designers *"don't simply tell stories; they design worlds and sculpt spaces."*[2] A prehistory of video and computer games might take us through the evolution of paper mazes or board games, both preoccupied with the design of spaces. In the game 'Dungeons & Dragons' (1974), for example, the Dungeon Master's activities start with designing the space – the dungeon – where the players' quest will take place. Even many of the early text-based games, such as 'Adventure' (1977), on which I will expand, is centered on enabling players to move through compelling narrative spaces. Architectural historian Mark Wigley also claims that a computer game is not *"one more channel added to all those other media that we constantly monitor. It is a rival package of channels, an alternative reality that demands total attention, a space that compresses the logic of all other spaces into itself."*[3] Computer game's extraordinary sense of realism comes from taking hold of all the senses at the same time in a symphonic assault, claims Wigley, *"To choose a game is to choose an architecture."*

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[1] Friedrich von Borries, Steffen P. Walz, and Matthias BL, *Space Time Play: Computer Games, Architecture and Urbanism: The Next Level* (Springer Science & Business Media, 2007), 44.
[2] Henry Jenkins. "Game Design as Narrative" in *First person: New media as story, performance, and game*. (MIT Press, 2004).
[3] Mark Wigley. "Gamespace" in *Space Time Play: Computer Games, Architecture and Urbanism: The Next Level* (Springer Science & Business Media, 2007).

The sensual spatial experience evoked by computer games is intriguing when considering the possibility of gamifying real places and events. Moving from fantastic game settings such as in 'Dungeons and Dragons', towards real places with historical and political conditions, requires one to conceptualize digital gaming environments as a sort of mapping practice striving to provide a loyal account of reality. Unlike the conventional two-dimensional map, computer games evoke a deeper perception of space and narrative. In the field of digital humanities, computational scientists and designers have made advances in spatial multimedia, using GIS-enabled Big Data, geo-visualization, cyber geography, and virtual reality, among other tools, that provide capabilities far exceeding the abilities of conventional mapping platforms. Collectively, these technologies also allow us to probe the situated knowledge that resides in dynamic and contested memories and to understand what Stuart Aitken has called *"the affective or emotional geographies of space and place."* I have sought to join the experimentation with digital media for representation of space and narrative, as well as assess the possibility of simulating history as, captured by historical documents. Not only depiction of place is at stake, but also the reconstruction of its history.

**I maintain that computer games challenge the conventional map, offering a multilayered depiction of place. This entails a movement from *representation* to *simulation*, towards actively participating in the representation of a history. Simulation of space and events undermine static "frozen" image of place, offering instead a spatiotemporal depiction. Computer games, as I will show, differ from other visual and narrative-based forms of representation, in three ways that distinguish them as a new form of media and as potent instruments of deeper mapping: in their inherent *spatiality*, in their ability to depict non-linear narrative (*multiform*) and in their demand for active *participation* from a player. Putting aside other aspects of computer games such as the necessity to complete tasks and fulfill objectives, I focus on these three characteristics to show their potential for simulating real sites.**

Historical sites and events are particularly interesting when considering computer games as media of simulation. Historical sites are constituted from artifacts and symbolic meaning, architectural buildings as well as storytelling about who and how the structures inhabited and what events took place. The spatiotemporality of historical sites demands representation of

multiple points of view, times and narratives. Perhaps this is the reason that archaeologists adopted and developed new technologies for spatial simulation and storytelling, from photographs to remote sensing, for surveying and annotating their fields of study.

To develop a model for simulation of an historical site, I focused on the historical site of Machu Picchu in Peru and the story of its discovery. In 1911 the American explorer Hiram Bingham traveled to Peru, in a search for the lost Inca city of Vilcabamba. The expedition, a collaboration between Yale University and the National Geographic Society, sought to document the journey and collect artifacts to bring back to the United States for presentation. Hiram Bingham, not an archaeologist by education, documented his journal in multiple media, not confining himself to scientific surveying: a handwritten travel journal, photographs, drawings in his sketchbook, and notated maps. It was clear to Bingham that a story needed to be told, documented and brought me to celebrate the newly found wonder. Bingham's expedition integrated narrative and dramatic geography, each critical to his project. From Peru Bingham wrote to his wife: *"It (Machu Picchu) is far more wonderful and interesting than Choqquequirau. The stone is as fine as any in Cuzco! It is unknown and will make a fine story"*.[4]

By using computer games concepts and technology the various perspectives of Machu Picchu as rendered by Hiram Bingham in the day of his discovery, **are integrated, consolidated and compared in one environment. My prototype thus functions as simulation of history through reconstructed documents. I developed a method to integrate the various documents, and navigate between various mechanisms of representation using game design tools. Using the story of Hiram Bingham at Machu Picchu as a case study, I have sought to devise a method which can be used to simulate other historical sites, in a variety of settings, offering an historical tool that exposes the historiography of a place.**

***A recorded screen-capture the gameplay (10 mins. video), can be accessed here:***
https://www.vimeo.com/271485212
Password to access video: *mit*

[4] Amy Cox Hall, *Framing a Lost City: Science, Photography, and the Making of Machu Picchu* (University of Texas Press, 2017).

## 1.2. Motivation

In the past year I had the opportunity to join a collaborative research project undertaken by the Peruvian Regional Culture Directorate and Prof. Takehiko Nagakura at MIT Architecture Department[5], dedicated to the 3D-scanning of the historical site of Machu Picchu using photogrammetry.[6] While visiting the site I learned of its discovery in 1911 by the American explorer Hiram Bingham. At the Machu Picchu Archaeological Museum, I studied some of the photographs taken at the site shortly after its discovery. The photographs depict the structures and terraces of the ruined city emerging out of the dense vegetation of the jungle. While most are void of people, some of them also show human figures who were there at the time of the site's discovery - Hiram Bingham himself, Harry Foote, the naturalist who accompanied Bingham and local farmers sitting on the rocks posing for Bingham. Immediately I was taken by the evocative quality of the black and white photos and the stark differences as compared to the timelessness of the 3D digital models of the site we produced. The travel journal of Hiram Bingham provided imaginative representation of the place. The written account too has its own temporal rhythm unfolding as one reads.

These perceptual differences motivated me to attempt to reconstruct a portion of Hiram Bingham's experience 'inside' the virtual space of a game environment. This entailed devising a working method for importing historical documents into a three-dimensional virtual space. For this purpose, I studied the medium-specificity of computer games and their technological and conceptual affordances. I have designed a workflow that does not necessarily amount to a game at its end, in which there are clear objectives, rules, winners and losers, or particular tasks, but rather a game-environment, designed using gaming tools, enriched with game-like interactions between a player and its virtual environment. This method exemplifies the new possibilities of simulating historical site, using fundamental affordances of computer games, as well as raises critical questions regarding the possibility of using digital tools and computer

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[5] The photogrammetry project produced by: Takehiko Nagakura and Paloma Gonzalez, In collaboration with: Universidad de San Antonio de Abad in Cusco and Peru Regional Culture Directorate; Funded by: MIT MISTI-Peru program and MIT SUTD IDC Research Fund.

[6] Photogrammetry 3D scanning entails taking multiple photographs of the site from various points of view, including aerial photos using drones. The photographs are them processes to construct a 3d model of the site using Photoscan.

games to simulate history. By discussing various precedents of games which depict past events, situated in real places, I hope to contribute to the discussion about digital tools for historical storytelling, and the open new possibilities for historical archives.

At the same time, I have also attempted to develop a hybrid mapping environment and game-engine, each offering distinct affordances, which generate different types of images. Putting together mapping and surveying practices into gaming environments opens a rich new territory: the use of precision of geographic platforms in locating objects in space, relying on global coordinates of latitude and longitude, combined with interactivity inside a three-dimensional model. This technological innovation provides a hybrid virtual environment that draws from games as well as from GIS mapping platforms.

## 1.3. Intended audience:

The historical simulation developed here is intended as a scholarly historical platform for historians, archaeologists or others interested in the historiography of the discovery of Machu Picchu by Hiram Bingham. The game environment is meant to function as an experimental historical archive, to be used and further developed by future scholars. Accordingly, all the materials are drawn from primary sources, depicting mainly two historical times: 24 July, 1911, the day Hiram Bingham discovered Machu Picchu and contemporary Machu Picchu. Thus, the platform functions are based on two different time periods as well as different media of representation – textual, photography, drawings and 3D models.

## 1.4. Method

The methodology of my research is divided into two sections. First, I present a theoretical discussion of spatial storytelling: space, narrative and computer games as mediator between the two. Second, I develop a working prototype for a selected case study, to explore and exemplify the possibilities of simulating an historical site in a game-like environment. This includes collecting original materials on my case study from various resources, designing and composing a game environment.

In the *first section,* I discuss the dichotomy of time and space in geography and examples of thinkers who challenge it. I focus on literature that presents consolidation of space and narrative. In travel stories, detective novels and urban fiction, narrative and space are often consolidated, occurring inside and through spaces. To shed light on the various nuances of the relations between text and mapping, I will discuss the coupling of literary text and maps, formulating the discussion along an axis running between *literary work that incorporate maps*, to *maps which incorporate text*. This presents a dialectic relation between maps and text, space and narrative.

Building on the traditional tension between narrative-based media and spatial representation, digital media has recently introduced "mixed-reality" technologies, such as Augmented Reality and Virtual Reality, which facilitate new possibilities for combining narrative and spatial representation. In the *second section* of the theoretical background, I discuss the affordances of computer games as spatiotemporal media – integrating virtual space and narrative. Computer games, as I will show, have the capacity to simulate real places, historical sites and events. Here I elaborate on three fundamental affordances of computer games that seem most relevant when considering the simulation of an historical site.

In the second section of my research (section 3) I present my case study showing how it allowed me to examine some of the issues raised in the first section. As mentioned, the story of the discovery of Machu Picchu by American Explorer Hiram Bingham is revealed through multiple sources, including different technological framings of the place. Before presenting the workflow, tools and decisions made during the development of the prototype I discuss the story of Hiram Bingham and the Yale expedition of 1911. Building on materials collected during two trips to the historical site, as well as visits at archives in Machu Picchu, Cusco and Yale University, I developed my prototype.

In the *concluding section*, I reassert my initial hypothesis suggesting the use of computer game concepts for historical simulation. I examine critically the notion of moving from representation to simulation in historiography by discussing the limitations of using computers games for historical scholarship purposes. Here I will redefine the need for historical simulation based on original materials, showing that simulations tend to be disregarded by historians as suggestive and over-detailed account of events. I draw a line between simulation games and archive

games. Furthermore, in light of my conclusion, I discuss possible future implications emerging from my prototype.

## 1.5. Intended Contribution

The research seeks to contribute to the fields of *Digital Humanities* and *Digital Heritage*. Digital Humanities is an area of scholarly activity at the intersection of computing or digital technologies and the disciplines of the humanities. Digital Humanities call for new ways of doing scholarship that involve collaborative, interdisciplinary, and computationally engaged research, teaching, and publishing.[7] It brings digital tools and methods to the study of the humanities with the recognition that the printed word is no longer the main medium for knowledge production and distribution.

The intended contribution of the research is to create and define the media conditions of computer games as interactive platforms for presentation of architecture, artifacts and history. The research builds on work done by theorists who defined the medium of computer games and interactive storytelling.[8] Today, as computer games become exceedingly photorealistic in their rendering of fantastic landscapes and mythical characters, my research suggests focusing on computer games potential as historical archives, depicting real places and events. I believe that with the advent of mixed-reality technologies such as Augmented Reality and Virtual Reality[9], it is crucial to reflect on the methods and techniques of those alternate realities and to adapt them the larger program of heritage preservation. My model suggests not necessarily striving for seamless digitation of experience, but exposing the seams, allowing reflection on the mechanism of simulation.

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[7] Anne Burdick et al., *Digital_Humanities* (MIT Press, 2012).

[8] Janet Murray, *Hamlet on the Holodeck: The Future of Narrative in Cyberspace* (MIT Press, 2017); Nick Montfort, *Twisty Little Passages: An Approach to Interactive Fiction* (MIT Press, 2005); Michael Nitsche, *Video Game Spaces: Image, Play, and Structure in 3D Worlds* (MIT Press, 2008); Alexander R. Galloway, *Gaming: Essays on Algorithmic Culture* (U of Minnesota Press, 2006).

[9] See VR studio realities.io

# 2. Spatializing Narrative / Narrating Space

## 2.1. Introduction

Before discussing computer games and their ability to depict real places and events, I start with a theoretical background on earlier attempts to combine space and narrative, maps and stories. The need to expand the map beyond its two-dimensionality has been expressed by various theorists, most significantly, in the field of Digital Humanities, who have argued that digital representation shed light on human experience, and gives insight into spatial perception and its relation to experience.

The motivation to undermine the convention of mapping is not new. There are myriad artists and writers—Dziga Vertov, Walter Benjamin, Constant Nieuwenhuys and the Situationists, Lize Mogel and Alexis Bhagat, Joyce Kozloff, and Julie Mehretu among them—who discerned a similar need for new tools and strategies to represent modern spaces, and the dynamic modern city in particular. The "literary montage" form of Benjamin's Arcades Project, and the reader's experience in engaging with it, are regarded as "city-like"; its textual passages resemble, in their pace and structure, the passages of urban exhibition halls, arcades, and train stations.[10] Cartographers and geographers, too, have experimented with various critical, counter-, and radical cartographic approaches, including indigenous mapping, sensory mapping, and the collaborative development of OpenStreetMap, an opensource alternative to Google Earth.[11]

The appearance of geo-location technologies has a fundamental impact on our lives. Through GPS access, the way we conceive actual places has expanded to introduce new interactivity to the everyday spatial experience.[12] This new engagement with space reinforces what Fredric

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[10] Susan Buck-Morss, *The Dialectics of Seeing: Walter Benjamin and the Arcades Project* (MIT Press, 1991).

[11] William Rankin, *After the Map: Cartography, Navigation, and the Transformation of Territory in the Twentieth Century* (University of Chicago Press, 2018); Nadia Amoroso, *The Exposed City: Mapping the Urban Invisibles* (Taylor & Francis, 2010); David Pinder, iblesoroso, formation of Territory in the Twentieth CenturyRankin,*Environment and Planning A* 28, no. 3 (1996): 405ng A David Pinder, iblesoroso, formation of Territor*The Map Reader: Theories of Mapping Practice and Cartographic Representation* (John Wiley & Sons, 2011).

[12] Antoine Picon, *Smart Cities: A Spatialised Intelligence* (John Wiley & Sons, 2015); Anthony M. Townsend, *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia* (W. W. Norton &

Jameson (1991) and others have called the "Spatial Turn" of late twentieth century. The spatial turn is the recognition of material dimensions of society and culture and, in particular, of the importance of space and place in theory and method. This entails drawing upon a range of geographical concepts and metaphors to explore an increasingly complex and differentiated physical and social world. The spatial turn was aided by a new aesthetic sensibility that came to be understood as postmodernism, with a strong theoretical critique provided by structuralism and post-structuralism. Contrasting the "present epoch" to the nineteenth and early twentieth centuries, Michel Foucault declared our era to be "the epoch of space". [13] Geographers and urbanists such as David Harvey, Edward W. Soja, Derek Gregory, and Nigel Thrift have shown the postmodern condition has occasioned a "reassertion of space" in critical theory, particularly with respect to urban studies. Fredric Jameson announced a political project of "cognitive mapping" as the most suitable response to the bewildering novelty and velocity of postmodern culture.[14] In postcolonial studies, critics such as Edward Said have proposed a "geographical inquiry into historical experience" in which careful attention be paid to spatial experience. The transformational effects of globalization, and the rise of information technologies helped to push space and spatiality into the foreground, erasing or redrawing traditional spatial or geographic limits. As Jameson has noted, critics and theorists had to develop novel interpretive and critical models to address that "new spatiality implicit in the postmodern."[15]
Postmodern theory has put maps in the crosshairs of a critique of knowledge and representation. The impossibility of creating a perfectly accurate 1:1 map is sometimes invoked as an argument against scientific objectivity and the dream of total knowledge.[16] The

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Company, 2013); Hiawatha Bray, *You Are Here: From the Compass to GPS, the History and Future of How We Find Ourselves* (Basic Books, 2014).

[13] Michel Foucault, "Of Other Spaces," trans. Jay Miskowiec, Diacritics 16 (Spring 1986): 22.

[14] Edward W. Soja, *Postmodern Geographies: The Reassertion of Space in Critical Social Theory* (London: Verso, 1989); David Harvey, *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change* (Oxford: Blackwell, 1990); Derek Gregory, *Geographical Imaginations* (Oxford: Blackwell, 1994); Nigel Thrift, *Spatial Formations* (London: SAGE Publications, 1996); and Fredric Jameson, *Postmodernism, or, the Cultural Logic of Late Capitalism* (Durham: Duke University Press, 1991).

[15] Edward W. Said, *Culture and Imperialism* (New York: Knopf, 1993).

[16] The impossibility of a map both complete and accurate has been "demonstrated" by both Lewis Carroll and Jorge Luis Borges. In Sylvie and Bruno (1982, 727) Carroll argues that a map of a 1:1 scale (the only scale that allows a complete duplication of information) would cover the entire world. It would consequently block the sun, and the grass would die, to the consternation of the farmers. Since this map, by definition, must represent everything.

"deconstruction" of maps as instruments of power undercuts their claim to truth.[17] But maps are still put to multiple uses other than territorial domination: travelers and hikers depend on them for orientation; graphic designers treasure their ability to represent a wide variety of data; semioticians are fascinated by their complex mode of signification.

Geography and its intersection with literary studies, also known as 'Literary Geography'[18], offers an approach to cultural texts that emphasizes the relations between space and narrative, accompanied by a new perspective, as borders and boundaries seemed to be transgressed, erased, redrawn, or reconceived.[19] Leaving behind the static map image has been inspired by an attempt to introduce narrative into space. Narrative theory emphasizes the sequence of events— *"Narrative gives us what may be called the shape of time"*[20] —and all narratives imply a world of spatial extension. Some theorists recognize an explicit linkage of time and space, such as is reflected in Mikhail Bakhtin's concept of the chronotope (time space) showing the *"intrinsic connectedness of temporal and spatial relationships,"* with time supplying the fourth dimension of space.[21] In this view, narrative is the *"representation of movement within the coordinates of space and time,"* with events marked by the intersection of horizontal and vertical axes in a dynamic interplay between surface and depth.[22] The chronotope encompasses the intrinsic interconnectedness of time and space in literature, as well as the way in which specific spatiotemporal patterns characterize certain generic types; for example, the vast spaces and chance encounters of the chronotope of the road typify the picaresque novel. The two-way interactive relationship between space and narrative can be found in the representation of space through narrative, or space can function as the environment in which narrative is physically deployed, or to put in another way – as the medium in which narrative is realized. This can shed light on human experience, and give insight into spatial perception and its relation to narrative.

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[17] Marie-Laure Ryan, Kenneth E. Foote, and Maoz Azaryahu, *Narrating Space/Spatializing Narrative: Where Narrative Theory and Geography Meet* (Ohio State University Press, 2016).

[18] Sheila Hones, *Literary Geography* (Taylor & Francis Group, 2018); S. Hones, *Literary Geographies: Narrative Space in Let The Great World Spin* (Springer, 2014); Andrew Thacker and Professor of English Literature Andrew Thacker, *Moving Through Modernity: Space and Geography in Modernism* (Manchester University Press, 2003).

[19] Robert T. Tally Jr, *The Routledge Handbook of Literature and Space* (Routledge, 2017), 4.

[20] H. Porter Abbott, *The Cambridge Introduction to Narrative* (Cambridge University Press, 2008), 11.

[21] M. M. Bakhtin, *The Dialogic Imagination: Four Essays* (University of Texas Press, 2010). 278.

The interest in time and space, alongside the spatial turn in the second half of the twentieth century, gave way to a "narrative turn" which began in the 1980s and has grown to encompass narratives in many disciples and life situations, as well as in various media[23]. In the past several decades there has been an explosion of interest in narrative, with this multifaceted object of inquiry becoming a central concern in a wide range of disciplinary fields and research contexts. The narrative turn gained impetus from the development of structuralist theories of narrative in France in the mid to late 1960s. The French-Bulgarian literary theorist Tzvetan Todorov coined the term 'la narratologie' in 1969 to designate what he and other structuralists such as Roland Barthes, Claude Bremond, and Gérard Genette, conceived of as a science of narrative modeled after Saussure's structural linguistics. Noting that narratives can be presented in a wide variety of formats, media, and genres, structuralists such as Barthes argued explicitly for a cross-disciplinary approach to the analysis of stories — an approach in which stories can be viewed as supporting a variety of cognitive and communicative activities, from spontaneous conversations and courtroom testimony to visual art, dance, and architecture. As accounts of what happened to particular people in particular circumstances and with specific consequences, stories have come to be viewed as a basic human strategy for coming to terms with time, process, and change — a strategy that contrasts with, but is in no way inferior to, 'scientific' modes of explanations. Narrative now falls within the purview of many social-scientific, humanistic, and other disciplines, ranging from design, geography, cognition and computer-science[24]. Interest has grown in the role that differing conceptualizations of time play in shaping our understandings of the physical world.

## 2.2. Challenging the division of Space/Time

The "Spatial Turn" and "Narrative Turn", when considered as simultaneous movements attempting to come into terms with human experience, create a dialectic tension. Rather than thinking in terms of either time or space, Nigel Thrift and Jon May argue that our accounts of

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[23] Ryan, Marie-Laure, Kenneth Foote, and Maoz Azaryahu. *Narrating space/spatializing narrative: Where narrative theory and geography meet*. The Ohio State University Press, 2016.

[24] Narrative in design process-based computational design. In Computer Science and Artificial Intelligence, see Patrick Henry Winston, and Mark Alan Finlayson. "Advancing computational models of narrative." (2009).

the social world must draw instead upon the more complex notion of TimeSpace.[25] Thrift & May challenge Fredrick Jameson's definition of the spatial turn, arguing that he had the tendency to draw overly strict distinctions between Time and Space. They call our attention to the dualistic construction of time and space in geography, *"where time is understood as the domain of dynamism and progress, the spatial is relegated to the realm of stasis and thus excavated of any meaningful politics"*[26]. Doreen Massey, also calls for a revitalized imagination of geography at "spatialized time", which incorporate process rather than being mere objects. Massey suggests that we *"overcome ... the very formulation of space/time in terms of this kind of dichotomy ... [and ... recognize instead] that space and time are inextricably interwoven",* part of a multi-dimensional notion of space-time that copes with multiplicity.[27] Perhaps less widely acknowledged, increased attention turned to questions of space and spatiality among philosopher of science occurred simultaneously with renewed interest in questions of time and temporality across a range of disciplines including sociology, anthropology and human geography.

The concept of 'TimeSpace' is formulated on the assumption that there is a multiplicity of space-times, and specifically seeks to move away from any separation of the two. The relationship of time and space was explored, more that by anyone else at the time, by Henri Bergson (1859–1941). Bergson was known for his attention to cinematographic time, where time is a sequence of ordered frames, different from the succession of instants supposedly characteristic of scientific knowledge. Cinematic time is what Bergson considers as 'real time', of duration, that can be captured by intuition, a time which is continuous as opposed to the discontinuous time of the instant of science. Intuition perceives of time *"by allowing us to grasp in a single intuition multiple moments of duration"*.[28] This view defines space as no more inherently material than time, and is not the privileged domain of objects.

The overlaying of time and space is reaffirmed with the advent of digital media, which enables a new hybridization of space and time. In Janet Cardiff's art project 'Alter Banhof video walk'[29] (2012) viewers are given mobile device and headphones and asked to follow the prerecorded

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[25] Jon May and Nigel Thrift, *Timespace: Geographies of Temporality* (Routledge, 2003).
[26] Ibid. 15.
[27] Doreen Massey, *For Space* (SAGE, 2005). 56.
[28] Henri Bergson, *Matter and Memory* (George Allen & Unwin, 1972).
[29] Janet Cardiff, Documenta13, 2012, https://www.youtube.com/watch?v=sOkQE7m31Pw

video through the old train station in Kassel. The overlapping realities lead to a strange, perceptive confusion in the viewers' mind. When taking the walk, the real sounds mix with the recorded sounds, confusing what is real and what is fiction. This aural representation links the present-day Kassel to historical and fictitious events, making them present again. This video project is overlaid onto the physical time of the present, with the temporal events that are narrated through the audio. There is not merely an overlay of physical space by the space of the audio. Rather, physical time is overlaid by the time represented by the audio and the photographs, as we follow the narrator's voice along the train-station's hall, seeing the same frame she saw at the time of recording the video and audio. Creating an augmented type of reality, as the space of the past synchronizes contemporaneously with the space traversed in the present, while the present moment is thickened with two levels of temporality.[30] Time becomes physical, in the sense that the viewers can sense the physicality of people and objects through the changing of time. This sense of augmented reality and fusion of time and space, might soon be more prevalent as augmented reality technology is developing.


*Figure 1: Janet Cardiff, Alter Banhof Video Walk, 2012;*
*https://www.youtube.com/watch?v=sOkQE7m31Pw*

## 2.1. Maps and Texts

Looking back, we see there is actually no necessity for advanced digital technology to overlay space and time. Although primarily concerned with spatial representation, maps can hold and

[30] Timothy Scott Barker, *Time and the Digital: Connecting Technology, Aesthetics, and a Process Philosophy of Time* (UPNE, 2012), 20.

present temporality in various ways, telling stories overlaid on space. Literature, on the other hand, can evokes the space. The dialectic relations between space and time in geography is no better portrayed than in the relation between maps and narrative in literature – travel journals, detective stories and tourist guides. Examples form literature show that maps have the ability to induce powerful images in the human imagination.

Maps and storytelling are complementary to each other. Marie Laure-Ryan (et al)[31] show that when narrative uses the dual modalities of language and maps, each of these modalities expresses what the other cannot do by itself, or can only do inefficiently. Maps, because their content is projected to the viewer through a vertical, disembodied perspective, are not well-suited for expressing a subject's lived experience in an environment. Language-based narrative, because it relies on a temporal medium, is not well suited for conveying a mental image of space, namely a network of relations between objects. But when language and map complement each other, space can be represented in both its phenomenological and symbolic dimensions. When considering the interrelations between maps and narrative, space and time, insights arise from the intersection of literature and geography. 'Literary Geography' offers an approach to literary and cultural texts that emphasize the relations between space and writing, offering a perspective that seems particularly momentous in the twenty-first century. The French scholar Michel De Certeau, in 'The Practice of Everyday Life' explored the gap between the experienced city and its representation, claiming that everyday stories use spatial practices, which include temporal elements of experience. Spatial practices concern everyday tactics, narrated adventures, simultaneously producing geographies of actions and drifting into the commonplaces of social order.[32] Examining literary work which incorporate maps, as well as maps which incorporate stories, reveals the dialectic of time and space in the context of geography.

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[31] Ryan, Marie-Laure, Kenneth Foote, and Maoz Azaryahu. *Narrating space/spatializing narrative: Where narrative theory and geography meet*. The Ohio State University Press, 2016.

[32] Michel de Certeau, *The Practice of Everyday Life* (University of California Press, 2011); Beatrice Hanssen, *Walter Benjamin and the Arcades Project* (Bloomsbury Publishing, 2006).

### 2.1.1. Maps inside literary text:

Ryan (et al), following the division offered by the German critic Robert Stockhammer[33], defines several types of genetic relations between map and literary text, which show gradation in the emphasis given to narrative and mapping, in three scenarios:

Narrating Space . . . . . Spatializing Narrative

*Diagram 1: the reciprocal relations between maps and literature in their ability to overlay space and narrative. The movement between space and narrative undermines Space and Narrative as separate*

**Map precedes text:**

In this case the map is drawn before the text is written. The map constitutes a reference to the narrative while it is written, and stimulates the imagination of the author. For example, in 'Treasure Island' (1883) the famous pirate adventure by Robert Louis Stevenson, the relation between map and text is almost coincidental: when Stevenson started painting the island he had no idea that a novel would grow out of it.[34] In "My first Book", a text written by Stevenson years after the publication of his now classic story, Stevenson writes that 'Treasure Island' started as a painting that the he created to entertain himself on a rainy summer in Scotland, at a time when the story had not yet started to take shape in his mind. Stevenson explains that the map does not illustrate the novel, rather, it is the novel that grew out of the map:

*"The shape of the island took my fancy beyond expression; it contained harbors which pleased me like sonnets... I poured upon my map of "Treasure Island", the future characters of the book began to appear there visibly among imaginary woods... The next thing I knew I had some paper before me and was writing a list of chapters".*[35]

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[33] Barbara Piatti, Anne-Kathrin Reuschel, and Lorenz Hurni, "Literary Geography–or How Cartographers Open up a New Dimension for Literary Studies," in *Proceedings of the 24th International Cartography Conference, Chile*, 2009.

[34] Ryan, Marie-Laure, Kenneth Foote, and Maoz Azaryahu. *Narrating space/spatializing narrative: Where narrative theory and geography meet* (The Ohio State University Press, 2016). 48.

[35] Robert Louis Stevenson, "My First Book—Treasure Island," 1986.

The map that accompanies the novel appears to be an authentic eighteenth-century map. An elaborate drawing decorated with two mermaids defines the scale, the empty spots on the sea are filled with galleons, and an elegant compass drawing shows the orientation. But the map is not simply one of the many copies of a large-run edition: the handwriting identifies it as a particular copy given by a certain Captain Flint to Mr. Bones in Savannah, Georgia, on the twentieth of July 1754. Marie-Laure Ryan classified Treasure Island's map as diegetic, meaning that it is individuated object within the story-world. Just as travelers of old embarked on voyages to faraway places on the basis of maps, and returned with information that led to new mappings, so Stevenson's text is both the product and the source of a map. In a multi-iteration process Stevenson first drew the map which marked the territory of the story, then *poured* narrative into the landscape, augmenting the story onto the landscape.

*Figure 2: Map of Treasure Island, Robert Louis Stevenson, 1883*

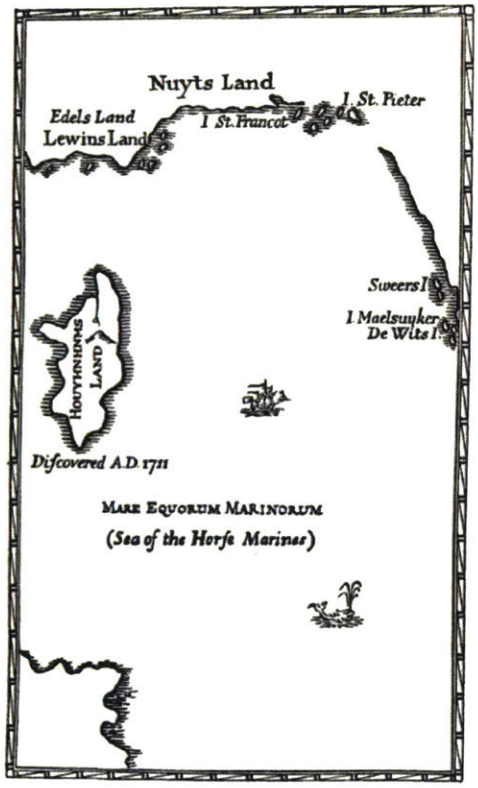


*Figure 3: Map of Gulliver's Travels, Jonathan Swift, 1726*

**Author draws map during writing:**

In this case, the author draws the map while the text is written, in a reciprocal manner. There is no primacy to either the drawing or textual narration. This is how Gulliver's Travels was conceived by Jonathan Swift's in his classic satire of human societies and eighteenth-century travel writing. 'Gulliver's Travels' is a mixture of real and imaginary landscapes: Gulliver lands on previously unknown islands and discovers societies of supernatural creatures—the diminutive Lilliputians, the giant Brobdingnagians, the arts-and-science-worshipping but unpractical Laputians, the savage human-like Yahoos, and the reason-despising, tolerant but righteous, horse-like Houyhnhms—which, for all their strangeness, either mimic or offer an inverted image of some aspect of human nature. At the end of each adventure Gulliver is rescued by ship and returned to England.[36] Although the story is obviously fiction, the map of Gulliver's travels is based on real places, tracing actual shorelines from atlases: Lilliput lies off the shore of Sumatra, a large island in western Indonesia, Brobdingnag is a peninsula jutting out of California, Laputa a copy of a shoreline in Indochina, and the land of the Houyhnhms is near Tasmania.[37] The integration of the imaginary countries within real-world geography is reinforced by frequent references to latitude and longitude, although the diegetic time precedes the invention of precise geographic coordinates. Gulliver recalls, "*About an hour before we saw the Pirates, I had taken an Observation and found we were in the Latitude of 46 N. and of Longitude 183*".[38] This shows that the landscape and the story developed simultaneously.

**Map is drawn by reader (after writing):**

The most common case of combining maps with text is literary critics or scholars, who map the narrative of storyworlds, after it has been written, to compare it with real world locations. These maps are drawn to determine to what extent literary texts are anchored in real geography. Since the focus is on the generative role of the real world in the

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[36] Ryan, Marie-Laure, Kenneth Foote, and Maoz Azaryahu. *Narrating space/spatializing narrative: Where narrative theory and geography meet* (The Ohio State University Press, 2016). 48.

[37] Nicole Didicher, "Mapping the Distorted Worlds of Gulliver's Travels," *Lumen: Selected Proceedings from the Canadian Society for Eighteenth-Century Studies/Lumen: Travaux Choisis de La Société Canadienne d'étude Du Dix-Huitième Siècle* 16 (1997): 179–196.

[38] Jonathan Swift, *Gulliver Swift, EM* (Rand, McNally, 1912), 125.

production of literary texts, not on the storyworld per se, the literary critic or scholar makes graphic representation on existing maps.

A good source of this type of map is Franco Moretti's 'Atlas of the European Novel, 1800-1900'.[39] Moretti's atlas locates the beginnings and endings of the plots of several of Jane Austen's novels on the map of England. Moretti's map represents both the fictional world and the real world; his focus is on the intertextual space of novels, rather than on any particular storyworld. He would carefully analyze "scenes" from novels, and locate them on existing maps, and try to bring them back to their original location.

### 2.1.2. Narrating (through) the map:

A contrasting situation is the depiction of narrative through mapping, when the map is the predominant medium. The use of maps for storytelling is not new, but gained new relevance with digital platforms. While literary authors ask how maps enhance storytelling, a distinctively separate question is how can a stories be told by the map. The digitization of maps and advent of GPS, GIS and mobile applications constitute new formats that narrate through maps.

**Tourist Guide Books:**

A common use of narrative maps can be found in tour guides and maps of tourist sites. Maps in printed guide books, a literary genre which is becoming extinct due to the digitalization of tourist maps, usually depicts a route, and calls the observer's attention to key locations. The organization of the experience in a route is narrative based, and needs to be "curated" by the author. Text, photography and drawings assist in depicting space.

**GIS, GPS and Digital Mapping:**

In the field of digital geography, GIS scientists have made recent advances in spatial multimedia, GIS-enabled Big Data, geovisualization, cyber geography, among other tools, that provide capabilities far exceeding the abilities of GIS on its own. There are various examples of GIS storytelling platforms, including products by the ESRI mapping company, Facebook and various companies engaging in digital journalism. In ESRI's StoryMaps one

[39] Franco Moretti, *Atlas of the European Novel, 1800-1900* (Verso, 1999).

is able to *"combine your maps with narrative text, images, and multimedia content to create compelling, user-friendly web apps"*, in an open-source platform.[40] Anyone can then use the maps for his or hers own travels, and add their own geographically pinned information.

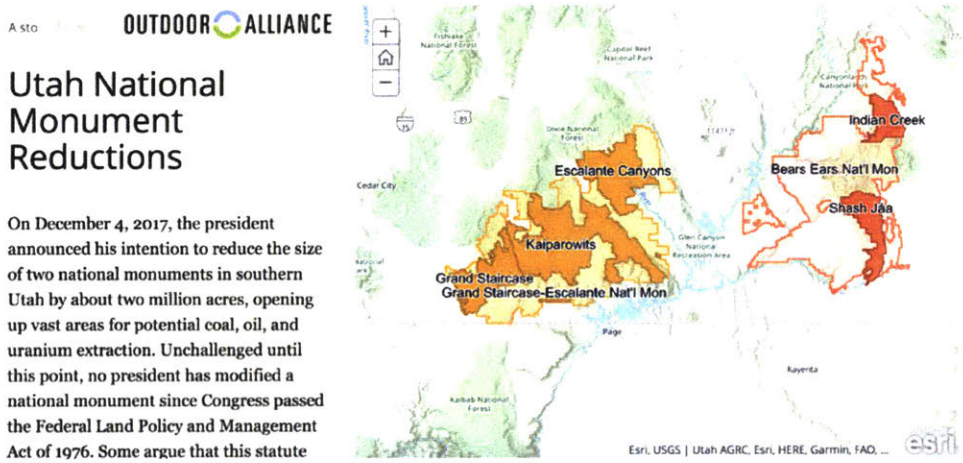


*Figure 4: ESRI Storymap, from story.maps.arcgis.com*

These technologies also allow users to probe for situated knowledge that resides in dynamic and contested memories and to understand what Stuart Aitken has called *"the affective or emotional geographies of space and place"*.[41] They have change the role of place in the humanities by moving beyond the two-dimensional map to explore dynamic representations and interactive systems that prompt an experiential, as well as rational, knowledge base.

**Augmented Reality:**

The reciprocal relations between map and narration present different degrees of integration between storytelling and geographic information. A high degree of narrative overlay onto space is obtained through what is called augmented reality, a technology that seeks to mix the actual with virtual information using cameras and depth sensors.

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[40] Quotation from ESRI Storymaps website: https://storymaps.arcgis.com/en/

[41] Alan M. MacEachren, Mark Gahegan, and William Pike, "Visualization for Constructing and Sharing Geo-Scientific Concepts," *Proceedings of the National Academy of Sciences* 101, no.1 (2004): 5279–5286.

New technologies developed by Google, Apple and Vuforia[42] allow the smartphone to sense architecture components such as floors and walls, adding visual imagery to the presently real picture, in the process called augmentation. This can be seen in a recent mobile-app that aims to bring glimpses of history to smartphone screens, using images tied to locations wherever one finds oneself. Users receive notifications when they are near a location from which an historical photo was taken; raising the phone brings up an image of that place as it appeared from that vantage point decades ago. An example of such an application is "Pivot", which focuses on the history of Jerusalem to evoke the memory of the Palestinian history at that particular place. Through mapping technologies (GPS and other spatial sensors integrated into the smartphone), new storytelling techniques are emerging.

*Figure 5: Augmented reality app Pivot, http://www.pivottheworld.com*

[42] There are a number of leading vendors for augmented reality technologies, based on the technology SLAM – Simultaneous Localization and Mapping, that constructs a map of an environment while simultaneously keeping track of location within it.

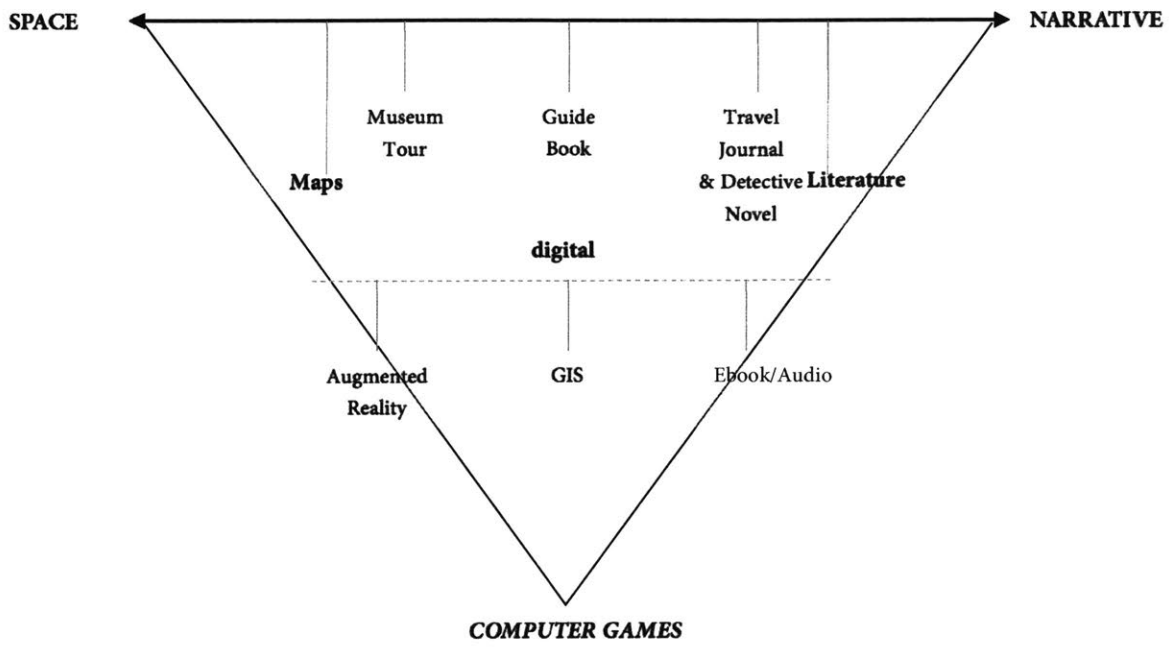


*Diagram 2: The notion of space and narrative are not two separate conceptions, but are intertwined in various techniques of place representation. Two major spatiotemporal forms of representation are Maps and Literature. Digital technologies such as augmentation of information and storytelling onto real spaces, GIS systems and Audio/Ebooks, decrease the gap between Space and Narrative. Computer games offer an overlaying of the two.*

# 3. Computer games: Overlaying Space and Narrative

In the previous section I described different forms of reciprocity in spatial representation of maps and narrative. This description shows that the division between space and narrative is blurred by various techniques of spatial storytelling. Digital technologies for spatial simulation, mapping and augmented-reality, have weakened the dichotomy space and text. In this section I show that computer games even more strongly interconnect space and narrative. The relatively new medium of computer games offers new forms of spatial storytelling, with gaming environments promoting agent-based exploration rather than linear movement as a means of discovery. Computer games push narrative beyond the linear constraints of written language into a fluid and reflexive process in which the uses can see and experience change and development creating a new method for understanding an event or a place.[43]

The history of the emergence of computer games is revealing in that it shows an overlaying of spatial simulation onto literary conventions in a computational environment. This history can be divided into two subfields. The first subfield focuses on the development of *strategic* games such as chess and other board games. The architects of the first computer recognized and investigated the strategic potential of computer games for stimulating processes in a playful way. In 1942, on the basis of a chess program, Konrad Zuse produced a programming language.[44] In 1947 Alan Turing developed a chess program, which he had processed in his own mind, and tested its capabilities in matches against opponents. And in 1950 Claude Shannon authored a 12-page article entitled 'Programming a Computer for Playing Chess'.[45] The second subfield in the history of computer-games emerges from *storytelling* games such as Dungeons and Dragons, and is generally considered in literary terms. This later history emphasizes the branching-out of games from literature in interactive literary forms. By the 1960's computers became smaller and performed better, but nonetheless remained accessible to only a small number of specialists. Narrative entered computer games later when experiments were conducted with text-based

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[43] David J. Bodenhamer, John Corrigan, and Trevor m. Harris, *Deep Maps and Spatial Narratives* (Indiana University Press, 2015).

[44] While working on his Z4 computer, Zuse realized that programming in machine code was too complicated. He started working on a PhD thesis on the first high-level programming language, Plankalkül ("Plan Calculus") and, as an elaborate example program, the first real computer chess engine.

[45] Claude E. Shannon, "Programming a Computer for Playing Chess," in *Computer Chess Compendium* (Springer, 1988), 2–13.

games. The text-based game 'Colossal Cave Adventure' (1977) was the first game based on an interactive narrative system portraying some of new conditions of storytelling made possible by computers. This pioneering medium shows both literary form and strategic rendering of space.

## 3.1. 'Colossal Cave Adventure' (1977): simulating a place

In contrast to the action games that were present at the time, Colossal Cave Adventure was not based on fast reflexes. In the game the player interacts with the computer textually, movement being initiated by typing the direction one wants to move in. A typical start of Adventure looks like this (">" marks what the player types.)

```
Welcome
to Adventure!
[...]
At End
Of Road
You are standing at the end of a road
before a small brick
building. Around you is a forest. A
small stream flows out of the building
and
down a gully.
>enter building (Input of player)
Inside Building
You are inside a building, a well house
for a large spring.
There are some keys on the ground here.
There is tasty food here.
There is a shiny brass lamp nearby.
There is an empty bottle here.
>get lamp  (Input of player)
Taken.
```


*Figure 6: game running on an 'Osborne 1' Computer, 1982*

Text is segmented into sections, appearing on the screen in reaction to the players input through the keyboard. A basic repertoire of actions is scripted into the games, enabling it to

accept certain words as commands. This interaction gives the illusion of Artificial Intelligence, because it is a machine that understands natural language.

Adventure has the player exploring a mysterious cave that is rumored to be filled with treasure and gold. To explore the cave, the player types in one or two word commands to move their character through the cave, interact with objects in the cave, pick up items to put into their inventory, and execute other actions. The program acts as a narrator, describing to the player each location in the cave, the results of certain actions, and if it did not understand the player's commands, the program asks the player to retype their commands. The program's replies are typically made in a humorous, conversational tone, such as a dungeon master would use in leading players in a tabletop role-playing game. A notable example is when the player dies after falling into a pit (player's commands in lower case, and the program's reply in all-capitals).

In the developer's original version of the game, he created a maze of ten rooms, while each room described exactly the same. The layout of this "all alike" maze was fixed, so the player could determine the maze's architecture. One method entailed dropping virtual objects in the rooms to act as landmarks, enabling one to map the section on paper. Using this technique and others, players of Colossal Cave Adventure could reconstruct the map of the maze during play. From the concise and dry textual description emerged a complex architecture of narrative.

Nick Montfort in his book 'Twisty Little Passages: An Approach to Interactive Fiction' provided the most detailed account of the development of 'Colossal Cave Adventure'. Montfort compared the game experience to what Roland Barthes described in 'The Pleasure', as the text's ability to create an erotic reading experience. The text reveals itself in a sort of striptease, according to Barthes (1975), and the reader who skips boring passages resembles "*a spectator in a nightclub who climbs onto the stage and speeds up the dancer's striptease, tearing off her clothing, but in the same order*" as the author would have.[46] He thinks of games as mysteries slowly unraveling, revealing the narrative gradually and seductively.

Montfort tells the story of the invention of Colossal Cave Adventure, developed in 1975 and 1976 by one programmer and author, Will Crowther, who worked at Bolt, Beranek and Newman (BBN) in Cambridge, Massachusetts. With Crowther's permission the game was augmented by

[46] Montfort, *Twisty Little Passages* (MIT Press, 2005). 11.

another programmer and author, Don Woods, who used the SAIL computer at Stanford. The game was a program created originally enjoyment, as Crowther said, for "non-computer people". Adventure was influenced by Dungeons and Dragons and it is often referred to as a "version" of that game by Crowther himself. As told by Montfort, the inspiration came to Crowther from his own experience. Crowther was an accomplished caver who said he created Adventure to be "*a re-creation in fantasy of my caving, and also ... a game for the kids [his daughters], and perhaps [to have] some aspects of the Dungeons and Dragons I had been playing*" (Peterson 1983, 188). The locations bear the names and detailed descriptions of specific areas of the Flint Mammoth Cave System, near the Bedquilt Entrance, in Kentucky, and were not fictional, like most thought, inspired by The Lord of the Rings. The influence of Tolkien on Adventure is real but often overstated, argues Montfort.

Unlike Dungeons and Dragons, Colossal Cave Adventure is based on real space. 'Mammoth Cave' is a complex system of natural rock, difficult to capture in an image or in textual description. We can imagine the experience of "cave hunting", climbing and crawling inside the cave, as being highly *embodied*; this is a physical experience hardly mediated thorough visual representation. The challenge of mediating his own experience is what encouraged Crowther to seek for new means of expression – using the simulative power of the computer, identifying a new storytelling ability. The overlaying of the story on real space takes advantage of the spatiality. Crowther's cognitive map of the cave is similar to Swift's use of maps in his writing of 'Gulliver's Travel' (described in the previous section) where fictional narrative is poured into a real map. But unlike Swift, Crowther explores the possibility of creating three-dimensional space through text, evoking a cognitive architecture of mixed-reality. The use of computation allowed him to simulate his own embodied cognition, as an experienced cave-hunter. Although engaged simply with text, the game conjures-up a complex architectural layout in the player's mind.

*Figure 7: The Rotunda Room at Mammoth Cave, Kentucky. The inspiration for the architecture of 'Colossal Cave Adventure' game*

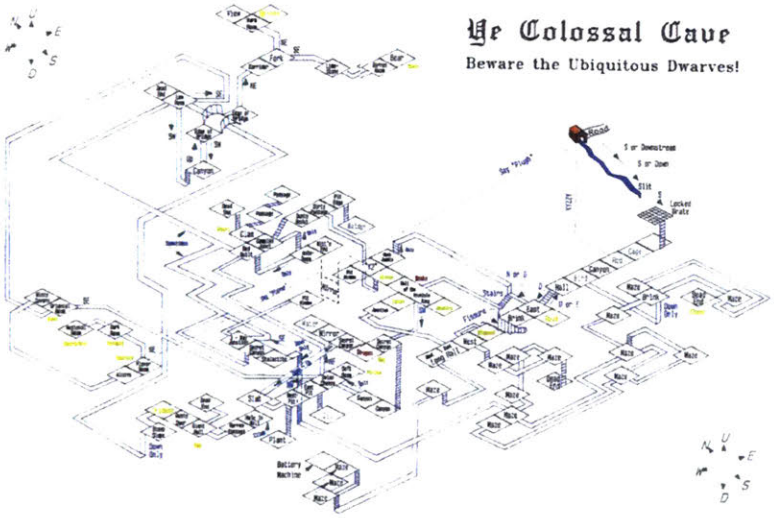


*Figure 8: Colossal Cave Adventure, game-map drawn by player.*

Another feature of Colossal Cave Adventure was its generation of multiple potential narratives, according to choices made during the game, in a kind of "choose your own adventure" scenario. This new possibility forking narratives was revolutionary to both computer science, which introduced narrative to an otherwise abstract field, and to literature, dismantling the linearity of the storyline. Crowther was not the only one experimenting with the computer's ability to generate

non-liner interactive literature. 'Hypertext'[47] and other developers of Interactive Fiction[48] experimented with these ideas in mid-twentieth-century, attempting to conceptualize non-linear narrative. The early years of non-linear interactive fiction (including hypertext and text-based games) intersected with computation and literary theory. In the introduction to her seminal book 'Hamlet on the Holodeck', Janet Murray posited the question *"Will the literature of Cyberspace be continuous with the literary traditions of the Beowulf poet, Shakespeare?".*[49] Murray's question suggested that narrative traditions do not arise out-of-the-blue, but are built on previous technologies of communication—the printing press, the movie camera, the radio – *"they all perhaps startled us when it first arrives on the scene, but the traditions of storytelling fed into one another both in content and in form".*[50] Murray saw the emergence of the computer games not as revolutionary form of art but as a continuation and elaboration of narrative-based forms of art. In the incunabular days of the narrative computer, one can see how twentieth-century novels, films, and plays have steadily pushing against the boundaries of linear storytelling. Murray asserts that dramatic and written narrative traditions have moved closer to the computer and that computer-based entertainments have become more story-like. At the same, she says, computer science itself have moved toward move towards domains that were previously the province of creative artists.

## 3.2. The affordances of computer games as spatiotemporal media

Colossal Cave Adventure pioneered a form of gaming that quickly became a huge industry. I will now extend my discussion of the important innovations that arose from computer games; in so doing, I will focus on three fundamental affordances of computer games that create new

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[47] Hypertext refers to text displayed on a computer display or other electronic devices with references (hyperlinks) to other text that the reader can immediately access, or where text can be revealed progressively at multiple levels of detail. In 1963, Ted Nelson coined the terms 'hypertext' and 'hypermedia' as part of a model he developed for creating and using linked content (first published reference 1965).

[48] Interactive fiction, often abbreviated IF, is software simulating environments in which players use text commands to control characters and influence the environment. Works in this form can be understood as literary narratives, either in the form of Interactive narratives or Interactive narrations. These works can also be understood as a form of video game, either in the form of an adventure game or role-playing game. For history of IF see: Montfort, Nick. *Twisty Little Passages: an approach to interactive fiction* (MIT Press, 2005).

[49] Janet Murray. *Hamlet on the holodeck: The future of narrative in cyberspace* (MIT press, 2017). 45.

[50] Ibid.47.

interactions with the surroundings and events: (1) ***Multiform*** in media and storytelling, (2) ***spatiality*** of games and (3) ***participation***. Some of these concepts were discussed in Janet Murrays 'Hamlet in the Holodeck', a book that by now has become the primary reference source of computer game theory and new media generally. While reiterating some of Murray's ideas, I want to shed new light on computer games' spatio-temporality. I will assert that abilities of computer games to integrate space and narrative is found in the three foregoing conceptual characteristics of computer games. I will intentionally not highlight other aspects of computer games that seem less relevant to the research's motivations, like their rule-based nature or that they are objective-driven media.

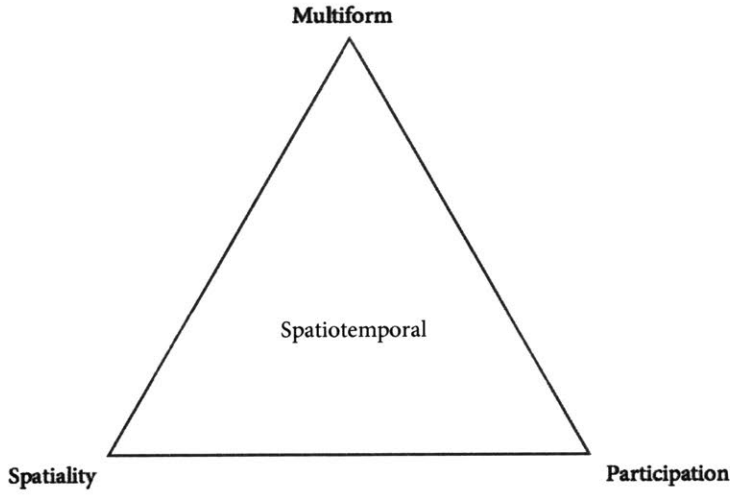


*Diagram 3: The affordances of computer-games*

### 3.2.1. Multiform

Multiform refers to computer game's ability to incorporate a variety of digital media: image, video, sound and 3D models, in conjunction with its ability to present a forking storyline, enabling a multiplicity of scenarios.

Technically the computer game space is a framework which can integrate multimedia: 3D modeling, 2D digital images, digital video, audio, and other form of digital information. 3D games are made today using a *game-engine*[51] that is a computational framework capable of doing basic game design operations like rendering, physics, and input. Engines offer loading, displaying, and animating models, collision detection among objects, physics, input, graphical user interfaces, and part of a game's artificial intelligence are all components that make up the engine. In contrast, the content of the game, specific models and textures, the meaning behind object collisions and input, and the way objects interact with the world, are the components that make the actual game. From this engine, the game can be exported to multiple graphic machines, including home desktop computers, portable computers, tablets and smartphones. This design freedom provided by multimedia of the game-engine facilitates new ways of digitally *collaging* various media in virtual space.

Multiform also impacts the way that narrative can be portrayed. Janet Murray defines multiform storytelling as *"a written or dramatic narrative that presents a single situation or plotline in multiple versions, versions that would be mutually exclusive in our ordinary experience."* [52] Multiform's multiple versions challenge the division between various forms of media, including the boundaries between games and stories, films, television and radio, books and podcasts, and even between the audience and the author. The quintessential multiform narrative, as defined by Janet Murray, is Jorge Luis Borges's "The Garden of Forking Paths" (1941). Borges tell the story of a German spy on the verge of getting captured, trying to find his way on a forking path. The story is a labyrinth because it is based on a radical re-conception of time:

> *"In all fiction, when a man is faced with alternatives he chooses one at the expense of the others. In the almost unfathomable Ts'ui Pên, he chooses—simultaneously—all of them. He thus creates various futures, various times which start others that will in their turn branch out and bifurcate in other times."*[53]

Time in the story-world is not an "absolute and uniform" line but an infinite "web" that embraces every possibility. Multiform stories often reflect different points of view of the same event. The

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[51] The most popular game-engines are currently Unity3D, Unreal, Godot, CryEngine, MonoGame. For my own prototype I used Unity3D.

[52] Janet Murray. *Hamlet on the holodeck: The future of narrative in cyberspace* (MIT press, 2017).

[53] Jorge Luis Borges, *The Garden of Forking Paths* (Penguin Books, Limited, 2018), 101.

classic example of this genre is 'Rashomon' (1950), Akira Kurosawa's film in which the same crime is narrated differently by four people: a rape victim; her husband who is murdered; the bandit who attacks them; and a bystander. Multiform narrative attempts to give a simultaneous form to different versions, allowing us to hold in our minds at the same time multiple contradictory perspectives. The fragmentation of the story structure reiterates patterns of historical fragmentation, and the patterns of readings echo the characters' efforts to reconstruct the past in order to restore a lost coherence. Kurosawa's film depicts events in changing times, in a single place. The spatiality of the scene becomes crucial as points of view are reconstructed.

*Figure 9: frame from Rashomon by Akira Kurosawa, 1950*

### 3.2.2. Spatiality

Space has been a central issue in the study of digital media since the introduction of cyberspace.[54] Various theorists recognize spatiality as a fundamental quality of computer games. Janet Murray argues that spatiality is one of the core features of digital media; Aspen Aarseth starts his discussion on Cybertexts with a discussion of labyrinths; Marie-Laure Ryan writes about narrative aspects of virtual spaces; von Borries, Walz, and Bottger wrote a large collection of short essays about spatiality in games and related issues; and other studies of

[54] From the early nineties, as the internet infrastructure spread, a spatial metaphor for the "space behind the screen" dispered. See: Michael Benedikt, *Cyberspace: First Steps* (MIT Press, 1992); Martin Dodge and Rob Kitchin, *Atlas of Cyberspace* (Addison-Wesley, 2001); Francis Hamit, *Virtual Reality and the Exploration of Cyberspace* (Sams Pub., 1993).

video games include often substantial chapters on space.[55] All of these writers refer to computer games as a spatial as well as structural medium that have similarities to architecture. Henry Jenkins, in his essay 'Game Design as Narrative',[56] argues that computer games produce a new *architecture* of spatiotemporality. He says that the central role of spatiality can also be seen in paper mazes and board-games. Jenkins claims that board games such as monopoly *"(...) may tell a narrative about how fortunes are won and lost (...) but ultimately, what we remember is the experience of moving around the board and landing on someone's real-estate."* He sees the same projection of space into *"the first text-based games, which were solely relaying on text to unfold the events in space, centered around enabling the players to moves around a wide variety of spaces".*

Computer games can evoke spatiality in various ways – some use the player's imagination like text-based games while others create elaborate photorealistic 3D environments. The relation between the "space of the game" and actual space varies along an axes from *spatialization of a game* to a *gamifying of space* – meaning from adding spatial elements to abstract games such chess, to gamifying already inherently spatial situations, such as game which occur *in* space. Most demanding for imagination are the games like 'Colossal Cave Adventure' that spatialize narrative only with the use of text, bearing similarities to literature. Other games offer a more contained literal world, such as in the game 'Civilization': a simulation game of history of mankind in which a player develops historical cities. The game is developed in space, as cities grow and diminish according to the player's moves. 3D models assist in facilitating perception change in a physical and engaging way, moving away from literature towards architecture, and city-planning.

Moving beyond a *closed* game-world, in Neil Young's 'Majestic' game, the story is no longer contained within a defined game software, but rather flows across multiple information channels. The player's activity consists of sorting through documents, deciphering codes, making sense of garbled transmissions, moving step-by-step towards a fuller understanding of

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[55] Janet Murray. *Hamlet on the holodeck: The future of narrative in cyberspace* (MIT press, 2017).; Espen J. Aarseth, *Cybertext: Perspectives on Ergodic Literature* (JHU Press, 1997); Marie-Laure Ryan, *Narrative as Virtual Reality 2: Revisiting Immersion and Interactivity in Literature and Electronic Media* (JHU Press, 2015); Borries, Walz, and Böttger, *Space Time Play*; Henry Jenkins, "Narrative Spaces," *Space Time Play*, 2007, 56–60.

[56] Jenkins, Henry.*Game design as narrative* (*Computer* 44, 2004). 53.

the conspiracy that is the game's primary narrative focus. The player follow links among web sites; getting information through webcasts, faxes, e-mails, and phone calls. This type of embedded narrative does not require a branching story structure but rather depends on scrambling the pieces of a linear story, allowing the player to reconstruct the plot through acts of detection, speculation, exploration, and decryption.[57]

Furthest from abstract text and closest to actual physical world are *pervasive games*. These are games taking place in urban environments whose spatial, temporal, social and interface-related characteristics are ambiguous. The artist's group Blast Theory 'Can you see me now?' is one of the first location based games. Online players compete against other players on the streets. Tracked by satellites, Blast Theory's runners appear online next to a player on a map of the city. On the streets, handheld computers showing the positions of online players guide the runners in tracking down the player. With up to 100 people playing online at a time, players can exchange tactics and send messages.[58] The ambiguity of a game's spatial boundaries require the development of a skill necessary to for playing the game; as players test out a game's boundaries, their perceptions of the city in which the game is played change. The city is the gamespace, and the game designer become an urban designer, exerting control over how people use the spaces they create or what kinds of scenes they stage there.

*Figure 10: Can You See Me Now? Blast Theory*

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[57] Von Borries, Friedrich, Steffen P. Walz, and Matthias Böttger. *Space time play. Computer Games, Architecture and Urbanism: The next Level* (2007). 276.

[58] https://www.blasttheory.co.uk/projects/can-you-see-me-now/

### 3.2.3. Participation

Gameplay, whether digital or not, entails participation of people among themselves, or people and machines, in the case of computer games. Without a participatory element there is no game. '*Homo Ludens*', written in 1938 by Dutch historian and cultural theorist Johan Huizinga, discusses the importance of the gameplay element in culture and society. Gameplay, writes Huizinga, "*is an act of direct participation and essential collaboration*".[59] In a chapter on ceremonies Huizinga suggests that games are a form of sacred performances: The rite (a religious ceremony or act) is a *dromenon*, "something acted," an act, action, a sort of drama represented on a stage. Thus the word "represention," fail to capture the exact meaning of the act of game. For Huizinga, "representation" is a mystic repetition or re-presentation of the event. The function of the ritual is far from being merely imitative; it causes the worshippers to participate in the sacred happening itself.[60] Representation is a question of figuratively re-showing an action for Huizinga, suggesting that play is an effect reproduced in the action. The ritual act, is thus helpful for understanding the third aspect of gameplay: diegetic participation.

This yields a transition from representation to an act - a simulation. Media historian William Uricchio's concept of participation, also sees simulation's move-away from representation– towards an active real-time and interactive depiction, as a crucial concept. Uricchio observes that the opportunities for mediation through play pose new and difficult questions about narrative authority and representation. "*What happens*," he asked, "*if we push the notion of mediation beyond language, to the domain of game, enactment, or simulation? Does this allow us to slip out of the well-critiqued trap of representation? And if so, where does it land us?*"[61]. From the mid fourteenth century until the mid-twentieth century, simulation was associated with meanings ranging from *"false pretense"* and *"deception"* to *"the tendency to assume a form resembling that of something else."* After World War II, the term finally evolved into the more familiar meaning *"technique of imitating the behavior of some situation or process by means of a suitably analogous situation or apparatus, especially for the purpose of study or personnel*

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[59] Johan Huizinga, *Homo Ludens: A Study of the Play-Element in Culture* (Beacon Press, 1971). 121.
[60] Alexander Galloway, *Gaming: Essays on algorithmic culture*. Vol. 18. (U of Minnesota Press, 2006). 66.
[61] William Uricchio, "Simulation, History, and Computer Games," in *Handbook of Computer Game Studies* 327 (2005): 338.

*training.*"[62] This significant shift in meaning, recounted by the Oxford English Dictionary in 1947, shows the historical move away from simulation both as willful misrepresentation and something akin to representation, to a modeling of behavior that is dynamic in nature, analogous in relationship, and pedagogical in goal. Unlike a representation, that is fixed in nature, a simulation is a dynamic process guided by principles. Simulation is capable of generating multiple encounters that may subsequently be fixed as representations, fixed, that is, as narrative or image or data set summations of a particular simulated encounter. However, representation does not necessarily generate or include within it simulation.

The notion of simulation is also distinct from immersive forms of representation such as cinema. Procedural environments such as scripted digital environments, are starkly different from cinema, not just because they exhibit rule-generated behavior but because an outside intervention induces the behavior. While the primary representational property of the movie camera and projector is the photographic rendering of action over time, computers are responsive to input. In distinction, the primary representational property of the computer is the codified rendering of responsive behaviors. This is what is most often meant when we say that computers are interactive. We mean they create an environment that is both procedural and participatory. Again, in 'Colossal Cave adventure', we see a game-world managed by decisions of a player, and by thus generate a form of action. As shown, this was a product of programmers celebrating their pleasure in the increasingly responsive computing environments at their disposal. Janet Murray, in a discussion on participatory media, reminds us that before the 1970s most complex programming was done by writing a set of commands on a piece of paper, transferring them to keypunch cards, and taking the stack of cards to a mainframe computer, from which, later, a cumbersome paper printout would emerge.[63] Only one person could use a machine at a time. In the mid-1960s research labs began developing the current computing environment based on a display device and a keyboard. They were also making wide use of programming languages that were interpreted rather than compiled. As such, 'Colossal Cave Adventure' was written with LISP (List Processing Language), that had been developed at MIT in the 1950s for artificial intelligence. Running LISP on a time-sharing system meant that its dynamic interpreted according to inputs, rather than preprogrammed codes that execute linear

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[62] Dictionary, Oxford English. "Oxford English Dictionary." *Simpson, JA & Weiner, ESC* (1947).

[63] Janet Murray. *Hamlet on the holodeck: The future of narrative in cyberspace* (MIT press, 2017). 88.

tasks. LISP, by using a real time interpreter, demands a real time input of information. This technical environment gave way to a collaborative medium.

This new interactivity coincided with the emergence of a new expressivity that revolves around the agency of the player, that could "lose sense of time and place" and become someone else. The player became an active agent in the narrative. This is most apparent in the specific gaming genre known as the first-person shooter (FPS), a genre perfected in the early 1990s with games like Wolfenstein 3D and Doom. In this context, there are several formal conventions that appear repeatedly. FPS games are played in the subjective, or first-person, perspective; they are the visual progeny of subjective camera techniques in the cinema. The camera position in many games is not restricted. The player is the one who controls the camera position, by looking, by moving, by scrolling, choosing angle. Jay Bolter and Richard Grusin put the matter quite clearly when they contrast a film camera convention with the game Myst:

> *Myst is an interactive detective film in which the player is cast in the role of detective. It is also a film "shot" entirely in the first person, in itself a remediation of the Hollywood style, where first-person point of view is used only sparingly—except in special cases, such as Strange Days recently and some film noir in the 1940s. . . . Like many of the other role-playing games, Myst is in effect claiming that it can succeed where film noir failed: that it can constitute the player as an active participant in the visual scene.*[64]

Here it should be noted that the montage technique perfected by the cinema, has diminished greatly in the aesthetic shift to the medium of gaming. The cinematic interludes that appear as cut scenes in many games do indeed incorporate montage, but gameplay itself is mostly edit free. Counterexamples include cutting between various visual modes: opening a game map; the point of view of a sniper rifle or night-vision goggles; cutting between different camera positions, as with looking in the rearview mirror in driving games. Abandoning montage creates the conditions necessary for first-person perspective in games. The lack of montage is necessary for the commercial first-person games. While film montage is fractured and discontinuous, the gameplay needs to be is continuous.

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[64] Jay David Bolter, "Digital Media and Cinematic Point of View," *Heinz Heise, Hannover*, 1997.

# 4. Historical simulation games

As shown in the previous section, computer games have qualities which distinguish them from other forms of media, in particular that they enable a player to participate in the unfolding of space and narrative. In this section I discuss computer games that simulate historical sites and events, recreating real scenarios from the past, set in accurately reconstructed spaces. With historical simulation games, we see again movement between the fictional and the real; in some cases the historical locations are the background, and in others history and historical reconstruction is in the foreground.

There is not a large body of writing on the use of computer games for depicting history.[65] An in-depth discussion of history and gaming can be found in the edited volume 'Towards a Theory of Good History Through Gaming.' This volume identifies serious engagements with game studies by historians and the use of games as teaching tools.[66] In another edited volume, Erik Champion - 'Playing with the Past', gives a comprehensive analysis of the use simulation for the advancement of history studies. Champion argues that *"historical computer games allow for an in-depth understanding not just of facts, dates, people, or events, but also of the complex discourse of contingency, conditions, and circumstances, which underpin a genuine understanding of history"*. [67]

As part of my research, I have examined historical simulation games. This leads me to suggest a typology that emphasizes distinctive aspects of games that focus one way or another on history. These include commercial popular historically-set games, historical-educational games, virtual environments for archaeology and history. The different types capture changing emphasis on historical accuracy and framings.

1. **Commercial historically-set games:**

   Popular history-based video games offer "period" studies, set in a deified historical era. Ubisoft's historical fiction series the Assassin's Creed series (2007 –2018), includes the

[65] Among the work done on games for historical education: Kevin Kee et al., "Towards a Theory of Good History through Gaming," in *Canadian Historical Review* 90, no. 2 (2009): 303–326; Erik Champion, *Critical Gaming: Interactive History and Virtual Heritage* (Routledge, 2016).
[66] Kevin Kee, et al. "Towards a theory of good history through gaming." in *Canadian Historical Review* 90.2 (2009): 303-326.
[67] Erik Champion, "Playing with the Past," in *Playing with the Past* (Springer, 2010), 129–155.

Crusades, the Renaissance, the American and French revolutions, and a pirate-occupied Caribbean. Each is an open-world, action-adventure games using diegesis historical reconstruction of landscapes to weave tales of historically based fiction with real-time historical events. The main character is usually presented in the third person, and is allowed a free run of historical settings. The location itself and the details such as the art, architecture, and the more basic aspects of life such as indoor lighting, furniture and utensils put the player into a fully imagined historical moment. Since the first Assassin Creed (2007) (which reconstructs historic Jerusalem), these games provide players with a glimpse of life during a given time, with rich historical details about cultures, economies, and societies, from the most basic attributes, such as clothing and weapons, to more complex attributes, such as political, and social dynamics. Viewing the street one sees the culture of the society at the respective time, how people interacted in public space, and commerce that occurred in public spaces. This action-adventure genre immerses the player in the historical environment providing a sandbox for historical exploration. In another of the game's versions, Ubisoft consulted and relied on historians of the Civil War to reconstruct Boston during that time, including building which were destroyed since then.[68] The game generated an uncanny realistic image of Boston's streets at the time, which the player can interact with. Nonetheless, the game is not designed for historical scholarship or even accurate storytelling; the player roams the streets shooting enemy AI characters in bloody Hollywood-style scenes.

[68] Real locations depicted in Assassin Creed game series: https://www.nbcnews.com/tech/tech-news/visit-five-real-historic-locations-assassins-creed-3-flna1B6743842

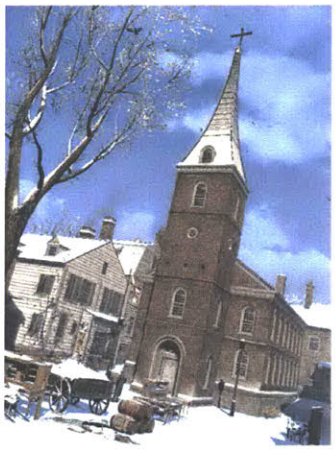

*Figure 11: Boston Old South Meeting House, 'Assassin Creed III '*

*Figure 12: Built in 1729 as a place for Puritan worship, this building became that starting point for the Boston Tea Party come 1773. It was on Dec. 16 of that year that thousands of colonists gathered at this building, all fired up about the British tendency toward taxation without representation.*

Another example of historical reconstruction in a game environment that enables the player to *become* the protagonist, but which is less aimed at commercial success, is the computer game 'Walden' (2015). Developed by Tracy Fullerton, the game explores the experiences of Henry David Thoreau during his time at Walden Pond between 1845 and 1847, as depicted in his famous travel journal 'Walden, Or, Life in the Woods'. This game expands the use of aesthetics and narrative in game play, using survival experiences as game mechanics. The player lives as Thoreau did, attempting to live on meager amenities and at the same time immerses himself in aesthetic appreciation and contemplation. The activities of daily life become the mechanics of game play. Once players masters survival, they can concentrate on aesthetic and contemplative aspects of life. The game tracks and awards the player's actions with increasingly more vibrant colors as the observing time progresses. 'Walden' shows a possibility of daily life during essentially any historical period be translated into a scholarly game.

*Figure 13: Thoreau's cabin, screenshot from game*

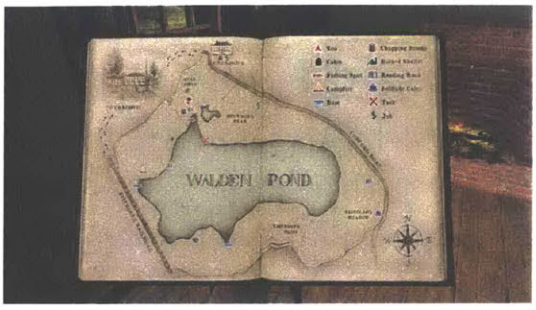


*Figure 14: game map of Walden. The a tribute to the book form inside the game*

The goal of Assassin Creed and Walden is similar in that both aim at a reviving an historical event within its setting. They attempt to reconstruct realistic and persuasive virtual environments. As forms of simulation, these games attest to the definition of simulation as a *"technique of imitating the behavior of some situation"*. This is done through the game's ability of allowing the player to experience the place in as if she was there.

In another type of game, **open-ended world-building simulation**, offer a more robust depiction of historical-political conditions of a given time. They rely less on reconstructing events as they occurred, giving the player freedom to construct events that *might* have occurred. Open-ended historical simulations are centered at the vantage point of a "god-like" all powerful being, from above and not from a person's perspective. These games' designers did not intend to achieve an immersive subjective environment, but a realistic set of parameters that can determine history. This kind of simulation is often used for military games, being less impressionist and more instrumental in investigating historical narratives.

A classic example of this kind of game is *Civilization III*. Here the entire world is incorporated into the game. The player prime objective is bringing an entire civilization from 4000 BC to the present, managing the civilization's natural resources, finances and trade, scientific research, cultural orientation, political policies and military. Kurt Squire asserted that the game *Civilization III* succeeds as a special tool for studying world history, in that it allows students to examine relationships among geography, politics,

economics, and history over thousands of years and from multiple perspectives.[69] Although the architecture is schematic, the game integrates a web of parameters – from technologies of past times, religious, cultural and civic infrastructures, all according to historical knowledge of the time. The history and geography are more concerted presented here than in games such as Assassin Creed, because information is explicitly transmitted by the game's interface – mainly through texts and narration. and some would say better perceive the events. Some would say that the events are understood better in this game, because it has better tools for putting the player "back in time" to the relevant historical period.

Media historian William Uricchio, whom I have already referred to, argues that board games, role playing games and re-enactments, have all contributed to the formation of historical computer games. Among the various genres, war games arguably have had the most influence on historical computer games, particularly because they tend to be most event-oriented and most historically specific in their references. In the 'Wargames Handbook', written by James Dunnigan, a military-political analyst and a games designer, he wrote the following:

> *"A wargame is an attempt to get a jump on the future by obtaining a better understanding of the past. A wargame is a combination of "game," history and science. It is a paper time-machine... A wargame usually combines a map, playing pieces representing historical personages or military units and a set of rules telling you what you can or cannot do with them. Many are now available on personal computers. The object of any wargame (historical or otherwise) is to enable the player to recreate a specific event and, more importantly, to be able to explore what might have been if the player decides to do things differently."*[70]

With a game, the historian can engage in research questions, incorporate primary and secondary source evidence, explore historical themes, present a thesis and make historical arguments. With an open-ended historical game such as Civilization, the historian can simulate the social, political and economic scenarios of the past.

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[69] Adam Chapman, *Digital Games as History: How Videogames Represent the Past and Offer Access to Historical Practice* (Routledge, 2016).

[70] James F. Dunnigan, *Wargames Handbook: How to Play and Design Commercial and Professional Wargames* (iUniverse, 2000).

Moreover, exploring history through such a game environment allows to simulate historical paths untaken, to explore a "what if" history. This method of historiography is a deterministic model, based on facts, statistics and strategy.


*Figure 15: Civilization III, depicting the Roman Empire and its infrastructure. Screenshot from game.*

## 2. Historical educational games:

"Serious games" or applied games are games designed for a purpose other than pure entertainment. The "serious" adjective is generally used to refer to computer games for education and scholarship, but also for industries like defense, health care, engineering, and politics. Kepell and Elliot show that serious games research typically uses modified computer games as virtual learning environments. Unlike commercial games, writes Champion, games for:

> *"virtual heritage projects typically aim to provide three-dimensional interactive digital environments that aid the understanding of new cultures and languages rather than merely transfer learning terms and strategies from static prescriptive media such as books. As an intersection between the two fields, game-based historical learning aims to provide ways in which the technology, interactivity or cultural conventions of computer gaming can help afford the cultural understanding of the self, of the past or of others with mindsets quite different from our own.*[71]

[71] Erik Champion, *Playing with the Past*. (Springer, London, 2010). 129-155.

These types of games move closer to producing what could be considered scholarship. In 'The Art of Game Design', Jesse Schell's instruction manual about how to design historical educational games defines key elements of a successful educational games. Schell identifies "t*wo simple steps to using a historical theme to strengthen the power of your game's experience,*" determining the theme and using "*every means possible to reinforce that theme*".[72] In the case of the scholarly games, the game designer should have a clear thesis and historical argument ensuring as much as possible that all aspects of the game reinforce the theme. The designers must consider how historians will accept or refute their argument, and how well their thesis holds up. As with other types of games, the player ultimately must remain at the center, whether the game is designed for other historians, students, or a public audience. In designing the scholarly game, the historian must assess the relevant primary source material and determine how to make it most engaging. "*The job of a game*", Schnell argues "*is to give pleasure*" and the designer must determine "*the kinds of pleasure your game does and does not provide*".[73] The designer should ask '*What experience do I want the player to have?*' '*What is essential to that experience?*' and '*How can my game capture that essence?*'.

In 'Playing with the Past', Champion describes his recreation of temples of the Mayan site called Palenque, in a game environment. Champion used computer game technology to depict the Mayan city at Palenque in Chiapas, Mexico in order to "*re-create a sense of place, a feeling that the place was uniquely and specifically viewed and used for a particular purpose, by people with a specific outlook*".[74] Palenque is well documented as the site where the Mayan language was first decoded by archaeologists, and is set in a spectacular landscape. Champion decided to re-create the city site complex "*because models alone did not create a sense of place*", claiming that there was no way of accurately gauging the apparent scale or the spatial relationships of the buildings or even their apparent mass. 3D models, he said, tend to float in space and do not convey a sense of embodiment. In the game environment, people can navigate with a joystick; their task is to find the Mayan version of the underworld.

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[72] Jesse Schell, *The Art of Game Design: A Book of Lenses, Second Edition* (CRC Press, 2015).40.
[73] Ibid.52.
[74] Erik Champion. *Critical Gaming: Interactive History and Virtual Heritage*. Routledge, 2016. 44.

In spite of its success in reconstruction, there is a problematic aspect in Champion's game. The re-construction of the Mayan temples has, in my view, over-compensated for the lack of certain information – the coloring and texture, perspectives and simulation of Mayan structures and Mayan priests. The over simplified version of a past culture seems to be too illustrative to evoke curiosity about what is lost.

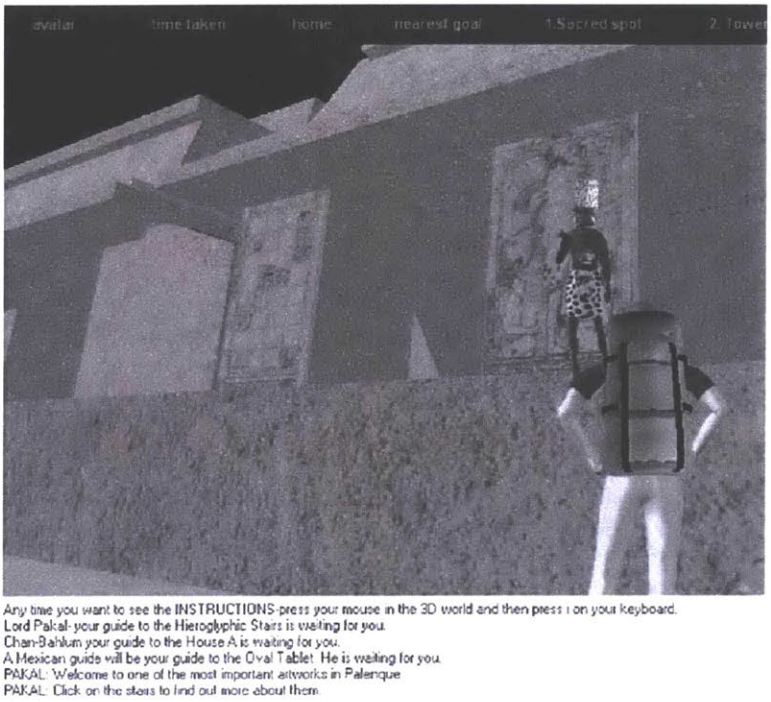


*Figure 16: Palenque Game (Erik Champion); A Tourist Leaving a Conversation with King Pakal at the Palace*

### 3. Digital heritage platforms:

The goals of virtual environments which are not explicitly *games*, is primarily archival. These platforms are dedicated to transcending bias in the historical process, allowing the evidence to speak for itself.

Archaeologists have traditionally been early adopters and developers of new technologies, from photographs to remote sensing, for surveying and annotating their fields of study. For example, Favro and Johanson are among those studying the ancient

past who are experimenting with new technologies.[75] They regard digital modeling as particularly well suited to getting at the ineffable dimensions of the city—*"its sights, movement, sounds, and smells,"* all of which are integral dimensions of the politics of pageantry, and broader practices of government—that are hard to capture in a sketch, drawing, or physical model. Within the field of cultural heritage, archaeologists have used GIS and computer animations to reconstruct the Roman Forum, for example, creating three-dimensional vision that allows users to walk through buildings that no longer exist, except as ruins. The user can experience these spaces at various times of the day and seasons of the year. The user perceives more clearly a structure's mass and how it clustered with other forms to mold a dense urban space. In this virtual environment, the user gains an immediate, intuitive feel for proximity and power. The developers of the virtual Roman Forum, explain their project as *"a constructed memory of a lost space helps recapture a sense of place that informs and enriches our understanding of ancient Rome."*[76] Another similar project uses laser-scanning technology (LiDAR—light detection and ranging) to create three-dimensional models of major heritage sites and allows scholars and others to roam this virtual environment at will.

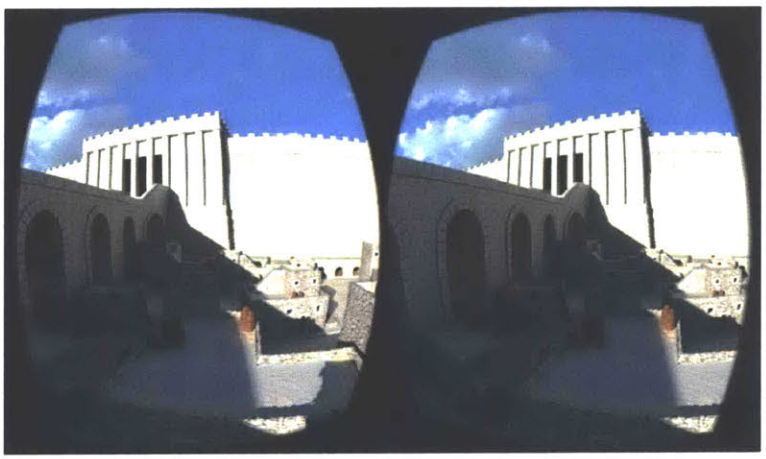

*Figure 17: Virtual-Reality of reconstructed historical Jerusalem, Lithodomus*

I consider the use of digital environments, Virtual Reality, GIS and other forms of interactive visualization of history and archaeology as *gamified* in the sense that they utilize affordances of digital media, such as participation in spatial media. When

[75] See their RomeLab at the UCLA Experiential Technologies Center: http://etc.ucla.edu/research/projects/romelab/.

[76] Digital Roman Forum Project, http://dlib.etc.ucla.edu/projects/Forum/ (October 27, 2013).

comparing a Virtual Reality reconstruction of ancient Jerusalem based on historical documents (apparently mostly textual descriptions from the bible) with the reconstruction of Boston during the Civil War, there appears a tension between entertainment and scholarly immersion. The question remains - how to design a game environment which takes from both extremities? on the one hand, building on simulation's ability to *imitate* or even *deceive* in its depiction of place (such as in Assassin Creed), and on the other, simulation's pedagogical nature of explaining historical sites in detail (such as in the Roman Forum archaeological platform).

# 5. Case Study: **Simulating the discovery of Machu Picchu by Hiram Bingham**

In this section I discuss my case study in order to present a conceptual model generally, and in particular for simulating the historical site of Machu Picchu. My work is based on the constituting narrative of its discovery provided by Hiram Bingham in 1911. The suggested prototype explores the way in which computer games can be used to create a simulation of Machu Picchu, through historical events as captured by Bingham himself. This site has rich spatial and narrative qualities, reflected in various media, within a confined timeframe and historical context, and is thus a perfect site for experimentation in method development. Before discussing the design and construction of the prototype, I start by explaining the circumstances and background to the discovery of Machu Picchu. I also focus on the technologies of documentation used by Hiram Bingham, which I refer to also as *perspectives*.

Although Machu Picchu was partly inhabited by indigenous Peruvian farmers when Bingham found the ruined city, the finding was considered a discovery, and is viewed today by Peruvian authorities as major historical moment. This was the moment in history when Machu Picchu was shown to the scientific community in the US and Europe and it became a major world historical site, a monument for the Inca empire of the mid fifteenth-century and a national park.

Since its discovery in 1911, growing numbers of tourists have visited the site each year, including 1,411,279 in 2017.[77] In 1981 the Peruvian Government declared Machu Picchu a Historical Sanctuary, and this was quickly followed by UNESCO who declared the area a World Heritage Site in 1983. More recently (2007), Machu Picchu was voted as one of the New Seven Wonders of the World. Today the site is managed by the Peruvian government, and provides the country's main source of income. The management closely and carefully controls the daily routine of the site the movements of crowds in it. A number of tour routes are offered, and groups are usually escorted by local tour-guides. An iron-cast plaque mentioning Hiram Bingham as the discoverer of Machu Picchu has been placed at the entrance to the site. Although Bingham was an American explorer, and according to some accounts an invader or

[77] Peru Ministry of Culture website: http://www.cultura.gob.pe/en/tags/ministry-culture

even a grave-robber[78], he is still distinguished as the "rescuer" of the site and it's culture. Accordingly, the site's guides tell the story of Hiram Bingham, many times embellishing with historical anecdotes they themselves have concocted.


*Figure 18: A bronze plaque in the entrance to Machu Picchu dedicated to Hiram Bingham who "discovered Machu Picchu in 1911".*

## 5.1. Hiram Bingham's production of Machu Picchu

Although popular myth refers to Hiram Bingham as an archeologist, Bingham was actually trained as an historian. What was practiced on Yale Peruvian expedition is better characterized as a late antiquarianism-inspired collecting spree – or less generously, strategic "grave robbing".[79] It was during Bingham's career as a lecturer on South American history at Yale that he re-discovered Machu Picchu. In 1908 he had served as delegate to the First Pan American Scientific Congress at Santiago, Chile. On his way home via Peru, a local prefect convinced him

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[78] Beth Gruber, *National Geographic Investigates Ancient Inca: Archaeology Unlocks the Secrets of the Inca's Past* (National Geographic Books, 2006). P.56.

[79] Amy Elizabeth Hall Cox. *Framing Machu Picchu: Science, photography and the making of heritage*. (University of Florida, 2010).

to visit the pre-Columbian city Choquequirao.[80] Bingham published an account of this trip in *Across South America; An account of a journey from Buenos Aires to Lima by way of Potosí, with notes on Brazil, Argentina, Bolivia, Chile, and Peru.*[81]

Bingham was thrilled by the prospect of unexplored Inca cities, and organized the 1911 Yale Peruvian Expedition[82] with one of its objectives being to search for the last capital of the Incas. Guided by locals, Bingham rediscovered and correctly identified both Vitcos (then called Rosaspata) and Vilcabamba (then called Espíritu Pampa), the latter of which he named "Eromboni Pampa".[83] However, he did not correctly recognize Vilcabamba as the last capital, instead continuing onward and misidentifying Machu Picchu as the "Lost City of the Incas", as his book titled it.

On July 24, 1911, Bingham's Peruvian guide Melchor Arteaga led him to Machu Picchu. This site had been largely forgotten except by the small number of people living in the immediate valley. Bingham was probably not the first to "discover" Machu Picchu; the Cusco explorers Enrique Palma, Gabino Sanchez and Agustín Lizarraga are said to have arrived at the site in 1901.

Upon arrival Bingham's team cleared fields, extracted human remains from graves, and collected objects. Collectibles included not only conventional archaeological artifacts excavated from the earth such as bones, pots, jewelry, and household goods, but also exotic animals and species previously unknown to science. The expedition also purchased artifacts, books, and manuscripts in antiquity shops and from private collectors. The way the members of the exhibition worked help mythologize Machu Picchu into a lost city. The team's collecting practices and the frame of science, as well as the types of artifacts collected, had a strong impact on how Machu Picchu came to be viewed, as both a vestige of the Inca race and a scientific discovery. The collecting practices combined prospecting with the notion that science had an unconditional claim on the objects found, for the purpose of advancing scientific knowledge.

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[80] Hiram Bingham, *The Story of Machu Picchu: The Peruvian Expeditions of the National Geographic Society and Yale University.* (National Geographic Society, 1915).
[81] Hiram Bingham, *Across South America: An Account of a Journey from Buenos Aires to Lima by Way of Potosí, with Notes on Brazil, Argentina, Bolivia, Chile, and Peru* (Houghton Mifflin Company, 1911).
[82] Amy Elizabeth Hall Cox. *Framing Machu Picchu: Science, photography and the making of heritage*. (University of Florida, 2010).

[83] Fellman, Bruce (December 2002). "Rediscovering Machu Picchu". *Yale Alumni Magazine*. Retrieved 7 April 2016.

In the first book-length account of his exploration of the Urabamba Canyon, Bingham recalled being inspired by Rudyard Kipling's poem "The Explorer": "*Something hidden. Go and find it. Go and look behind the ranges / something lost behind the ranges. Lost and ready for you. Go!*". Bingham was motivated by the idea of finding something hidden and revealing it for the world to see. As shown by his collection of skeletal remains, his drive involved more than geographic discovery. His interest, as demonstrated in practice, centered on the study of the pre-Columbian man. Collecting skeletal remains, Bingham could demonstrate that he had gone behind the mountain ranges and found something. "Salvage ethnography" was in vogue in the nineteenth and early twentieth centuries. Scholars argued that the cultural and evolutionary knowledge embodied in material objects had to be rescued for science before a particular "culture" or "tribe" "vanished".[84]

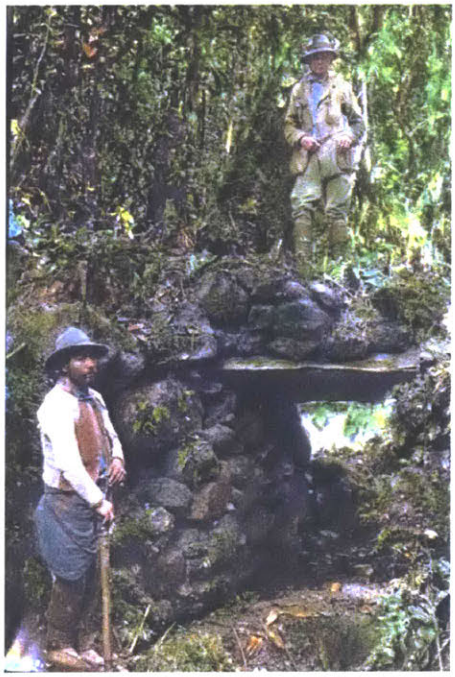

*Figure 19: View of Hiram Bingham III standing atop a jungle bridge at Espiritu Pampa in Peru. Hand-colored glass slide, 1911.*

[84] Amy Elizabeth Hall Cox. *Framing Machu Picchu: Science, photography and the making of heritage*. (University of Florida, 2010). 15.

### 5.1.1. Photography

For the 1911 expedition Eastman Kodak provided the Yale Peru Expedition with a No 3A Special Kodak with portrait attachment and wide angle lens as well as two 3A folding pocket cameras. Technology was critical for Bingham's philosophy of vision. The 3A was fitted with a wide angle lens that was useful for highlighting details at shorter focal lengths (the rocky walls of the monument). Kodak's camera technology permitted Bingham to collect views and materialize his own imagining of Machu Picchu. Technology was the first step in the visualization of Machu Picchu as a "lost city". The second step was the reproduction of those imaginings in National Geographic.

More than any other research method, photography served Bingham as a collection instrument. Amy Cox Hall in her book 'Framing Machu Picchu', wrote that photography, like collecting, was considered a primary scientific practice for conducting the expeditions and preserving the findings. The frame of science facilitated his expeditions, validated his practices, and legitimized his findings. Bingham's most powerful scientific expeditionary tool, the camera, concretized and made factual the imagined discovery of a lost city in the clouds. Through the camera, landscapes were constructed and scenes framed, creating compelling and popular narratives about Bingham, Yale's discovery, Peru, its Inca past, and its indigenous present. As a general matter, photography was considered invaluable to early twentieth century scientific and anthropological fieldwork. Photographic images constituted critical evidence for legitimizing the anthropological discipline as a whole as well as the findings of scientific explorations.[85] Photography was thought to capture what words could not, offering a form of mechanical objectivity.[86] As a mechanism for collecting and materializing evidence on the Yale Peruvian Expeditions, photography was a powerful tool for establishing facts about Peru, since it claimed to produce an objective reality. Bingham and the other expedition members also used photography to tell a story. In a passage from the Bingham journal, describing his discovery of the 'Sacred Plaza' in Machu Picchu, he writes: *"Would anyone believe what I have found? Fortunately, (...) I had a camera and the sun was shining."*

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[85] Amy Elizabeth Hall Cox. *Framing Machu Picchu: Science, photography and the making of heritage.* (University of Florida, 2010). 26.

Cox-Hall claims that photographic technology played a central role in the Yale Peru Expedition and acted as both the technology for the collection of scientific evidence and produced the collected object itself. In the printing and reproduction of photographic images, Bingham's view was materialized or commoditized. Ideas were registered in the frame of the photograph. Like maps, Yale Peru Expedition photographs relied on their insertion in texts to establish meaning. The photograph as scientific object was, like all texts, subject to interpretation and reinterpretation as it circulated and rematerialized in text.

The hired laborers were occasionally included in the detailed photographs of the monument's stairwells, walls and niches. Presumably they were included to act as markers for perspective and indicators for size or perhaps to add interest to an otherwise mundane image. They are not the subjects of the image, but rather incidentals to the subject, such as the impressive stone construction of the ancient city.

The aerial and long-distance panoramic views sacrificed detail for the fantasy of conquering the unknown. Overgrown brush conjured up for the viewer heroic sacrifice and hidden lands. The site was cleaned-up and the photographs as printed in National Geographic demonstrated the physical achievement of the expedition through breathtaking vistas and bridge crossings. The aesthetic of discovery translated in National Geographic made Machu Picchu safe and consumable, presenting it in distant, spectacular and inviting images. The reader of the photographic travel narrative could participate in the expedition, witnessing the unveiling of the "lost city" in its pages.

*Figure 20: Harry Foote (Bingham's Naturalist) at the 'Sacred Rock' in Machu Picchu, next to him is a boy farmer. (National Geographic)*

### 5.1.2. Journal writing

Bingham carried with him a travel journal, a long-established literary tradition of travelers, a record of experiences, written during the course of the journey and later edited for publication.[87] In his writing it is evident that Bingham imagined a public reading his journal. In some paragraphs he even seems to mix a scientific tone with that of adventure novelist. It is hardly surprising that while he wrote about actual journey he has undertaken, he is also in some way influenced by fictitious writing, and indeed the boundaries between fact and fiction in what we shall call the genre of travel writing are often hard to discern. Hiram Bingham, wrote his impressions and projected meaning onto his findings, many times overreaching by presuming the existence of mummies and collective graves, which in fact were nowhere to be found.

But Hiram Bingham, along with the rest of the Yale Expedition members of 1911, did in fact have the good fortune of finding the three most important Inca ruins that eluded the Spaniards. In his journal he described the towering cliffs, with water cascades and bromeliads the led to Machu Picchu. After a morning's weary climbing, Bingham wrote;

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[87] The journal written by Bingham during his travels was later edited into a book; Hiram Bingham, *Lost City of the Incas* (Orion Publishing Group, 2010).

> *"suddenly I found myself confronted with the walls of ruined houses built of the finest quality of Inca stone work. It was hard to see them for they were partly covered with trees and moss, the growth of centuries, but in the dense shadow, hiding in bamboo thickets and tangled vines, appeared here and there walls of white granite ashlars carefully cut and exquisitely fitted together."* [88]

Bingham had the incomparable thrill of stumbling across ruin after ruin buried in dense tropical forest, documented in some of the most exciting passages in the annals of archaeology.

For Hiram Bingham, his travel journal was an instrument for presentation of Machu Picchu – for portraying the enormous physical effort involved in locating Machu Picchu, sharing his own experience in the first person. He already knew that the National Geographic Society would publish his edited journal, so he wrote for a tangible reader. Bingham's photographs and writings in National Geographic magazine put Machu Picchu in the laps of readers around the world, who could then perform their own imaginative travels and discover the "lost city." National Geographic Society (NGS) became a major sponsor for the 1912 and 1914/15 expeditions to Peru, providing Bingham $30,000 for his research expeditions. In turn, Bingham published three articles about the expeditions in the magazine: "In the Wonderland of Peru" (1913b); "The Story of Machu Picchu" (1915b); and "Further Explorations in the Land of the Incas" (1916).[89]

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[88] Aviezer Tucker, *A Companion to the Philosophy of History and Historiography*, vol. 107 (John Wiley & Sons, 2011); Leonard Krieger, "Ranke the Meaning of History," 1977. 155.

[89] Hiram Bingham, *In the Wonderland of Peru: The Work Accomplished by the Peruvian Expedition of 1912, under the Auspices of Yale University and the National Geographic Society* (National Geographic Society, 1913).

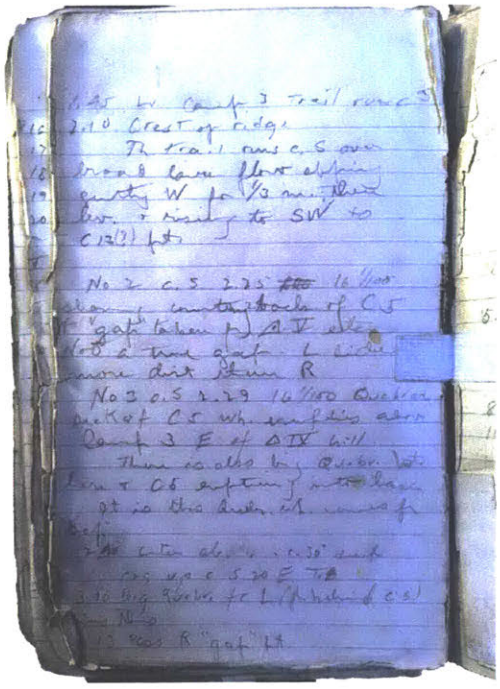

*Figure 11: The original journal of Hiram Bingham, Yale Archives, scan*

## 5.2. Prototype: Constructing Perspectives of Machu Picchu

Using multiple perspectives all depicting one segment of Machu Picchu, I have reconstructed a portion of Hiram Bingham's experience using a game-engine. This required importing historical documents into a Unity3D program and designing the interaction with the materials. In this way, I developed a workflow that does not amount to a game, in which there are clear objectives, rules, winners and losers, or particular tasks, in a game-environment, with interactions between a player and its virtual environment.

The prototype is also a hybrid mapping environment and game-engine, allowing the precision of geographic platforms in locating objects in space, using global coordinates of latitude and longitude, combined with interactivity inside a three-dimensional model.

The historical simulation developed here is meant to be a scholarly historical platform, intended

for use by historians, archaeologists or others interested in the historiography of the discovery of Machu Picchu by Hiram Bingham. The game environment is designed to function as an historical archive, to be used and further developed by scholars. Accordingly, all the materials are taken from primary sources, either from Hiram Bingham's archive, or captured by me. The platform functions to compare various times as well as different media of representation – textual, photography, drawings and 3D models.

### 5.2.1. On-site work

The work on-site consisted of the following techniques:

- **Photogrammetry capturing**

  **During 2017 I had the opportunity to join a collaborative research project undertake by the Peruvian Regional Culture Directorate and Prof. Takehiko Nagakura at MIT Architecture Department**[90], dedicated to the 3D-scanning of the historical site of Machu Picchu using photogrammetry.[91] The main purpose of the collaborative project was to capture Machu Picchu in 3D modeling using a photogrammetry technique. Photogrammetry is technique for making measurements from photographs, especially for recovering the exact positions of surface points. It is used for topographic mapping, architecture, engineering, as well as manufacturing, forensics, and geology. Archaeologists use photogrammetry to quickly produce plans of large or complex sites, and meteorologists use it to determine the wind speed of tornados when objective weather data cannot be obtained.

  We conducted *aerial* photogrammetry, using a camera-mounted drone, while pointing the camera towards the structures in various angles. Multiple overlapping photos were taken as the drone flies above the site.[92]

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[90] The photogrammetry project produced by: Takehiko Nagakura and Paloma Gonzalez, In collaboration with: Universidad de San Antonio de Abad in Cusco and Peru Regional Culture Directorate; Funded by: MIT MISTI-Peru program and MIT SUTD IDC Research Fund.

[91] Photogrammetry 3D scanning entails taking multiple photographs of the site from various points of view, including aerial photos using drones. The photographs are them processes to construct a 3d model of the site using Agisoft Photoscan.

[92] http://www.photogrammetry.com/

In close-range photogrammetry, we located the camera on the ground, using it hand held, on tripod or pole mounted. Usually this type of photogrammetry is non-topographic - that is, the output is not topographic images such as terrain models or topographic maps, but instead 3D models, measurements, or point clouds.
During our two expeditions to Machu Picchu we took thousands of photographs, from air and from the ground. In the lab at MIT the photographs were then processed using Agisoft Photoscan[93], which cross-references photographs to produce 3D mesh geometric models, with high resolution texturing and pointclouds.

- **360 video and audio capture**

Additionally, using photogrammetry, I made 360 videos (using Nikon KeyMission) of various locations at the site, along with multichannel audio (using Zoom H2N). I used 360-video to capture locations which are "hot spots" for the site's tour-guides; places where groups stop to hear explanations. These locations are interesting since they reveal the multiple versions of stories told describing and explaining the historical site, by various guides, in different languages. Many of the stories told are embellished or fictional imaginations, through which guides alter stories of the Inca city and Hiram Bingham's exploration. The guides often tell anecdotes about mummies, treasures and human sacrifice that are at least partially fictions of their imagination. Listening to the guides' various versions, Machu Picchu can be seen as a three-dimensional canvas used for imagining various renditions of the Inca story.

The 360 video's lack of directional lens or conventional frame, was useful for two reasons: 1) The camera is not "aimed" at any clear target, since it captures spherically all its surroundings. This facilitated capturing tourists' natural responses to the site, while they listened to the guides' stories. Not knowing the direction, the camera is pointed, visitors ignore camera and behave freely. 2) The spherical video can be integrated into a game-engine, surrounding the player.

[93] The model processing and generating of 3D mesh models were done at Prof. Takehiko Nagakura's lab at the MIT Architecture Departemetn, by Xu Zhang.

### 5.2.2. Importing geo-referenced photogrammetry models into Unity3D game-engine

Importing 3D photogrammetry models into a unified program requires processing the models. For this I followed the instructions in a guide published by Unity3D, the software company behind the game-engine with the same name.[94]

After processing the thousands of photographs using Agisoft Photoscan[95], a geo-referenced 3D mesh model is extracted and can be imported into a game-engine (Unity3D). To create a geo-referenced model inside Unity3D game-engine I used MapNav[96] add-on which translated the metric units into Latitude and Longitude.

### 5.2.3. Collecting historical documents

My prototype is based on primary materials only, captured by Hiram Bingham himself during the Yale Peru Expedition of 1911. As I explained, Bingham's account of his journey consists of his travel journal, photographs he took during his travels, and drawings – maps and sketches. The variety of materials produces varying perceptions of the place and events. **Each technique yields a different spatiotemporal framing.**

- **Travel Journal:** ***first-person perspective, narrative-based framing***

  Access to the text from the journal is straightforward because it was published in the book 'Lost City of the Incas'.[97] One chapter of the book was published in a raw version of the journal, in which Bingham wrote in first-person describing the day of his discovery. This text is integrated into my prototype. The chosen fragment of the journal was read by a professional actor recorded and can be heard in the game-space I constructed.

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[94] https://unity3d.com/files/solutions/photogrammetry/Unity-Photogrammetry-Workflow_2017-07_v2.pdf
[95] The model processing and generating of 3D mesh models were done at Prof. Takehiko Nagakura's lab at the MIT Architecture Department, by Xu Zhang.
[96] https://recursivearts.com/mapnav/home.html
[97] Bingham, Hiram. *Lost city of the Incas*. Hachette UK, 2010.

- **Photographs:** ***Singular point-of-view (of the lens), singular moment***

A limited number of photographs were published in National Geographic issue of April 1913 captioned 'Into the wonderland of Peru'. The remainder of the photographs, hundreds of frames taken by Bingham in Machu Picchu, were difficult to locate. I found some of them in the Yale Sterling Memorial Library where the journal is archived. Other photographs I found in various sources in Peru during our visits there.

- **Maps and drawings**

Going through boxes of letters and papers from the Yale Peruvian Expedition of 1911, I also found Bingham's original journal, with drawings as well hand-written paragraphs of text and other scribbles. Occasionally, the drawings were detailed and show architectural plans, sections and close-ups of the structures. These offer a more scientific *perception*, entailing representation of architecture using conventional projective view, starkly different from the subjective perspective of the journal or the photographs.

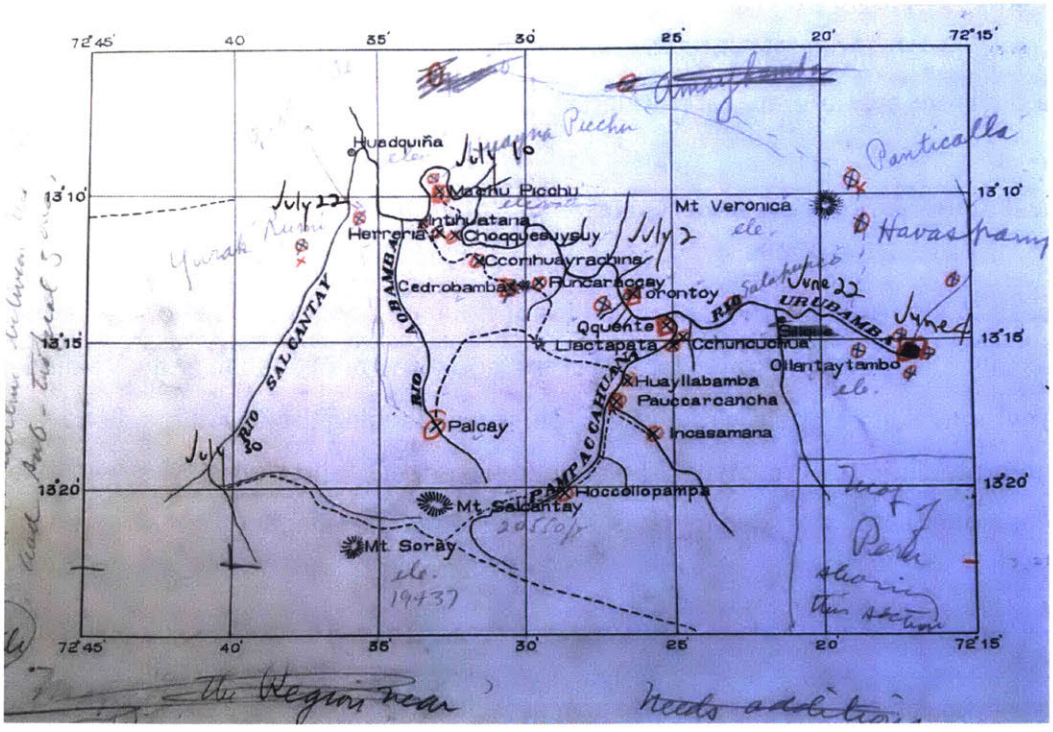



*Figure 22: Map drawn by Hiram Bingham, 1911*

### 5.2.4. Composing simulation space

The prototype consists of the photogrammetry models, 360 videos and historical documents arranged inside a 3D virtual space of the game-engine. The composition of the materials is meant to emphasis their varying spatiotemporal qualities; textual depiction (including their narration), photographs and drawings. The materials are geo-located inside the game-space, which consists mostly of the photogrammetry model, shown in fairly low-resolution. The text is segmented according its spatial reference, photographs are geo-located and given the exact coordinates of the locations where they were taken, and drawing are placed in above or perpendicular to 3D models, to show spatial reference.
The overall composition thus reconstructs, in a forensic process, the events and their place of occurrences. A small segment of Hiram Bingham's journey, but probably the most significant reproduces the moments of discovery.

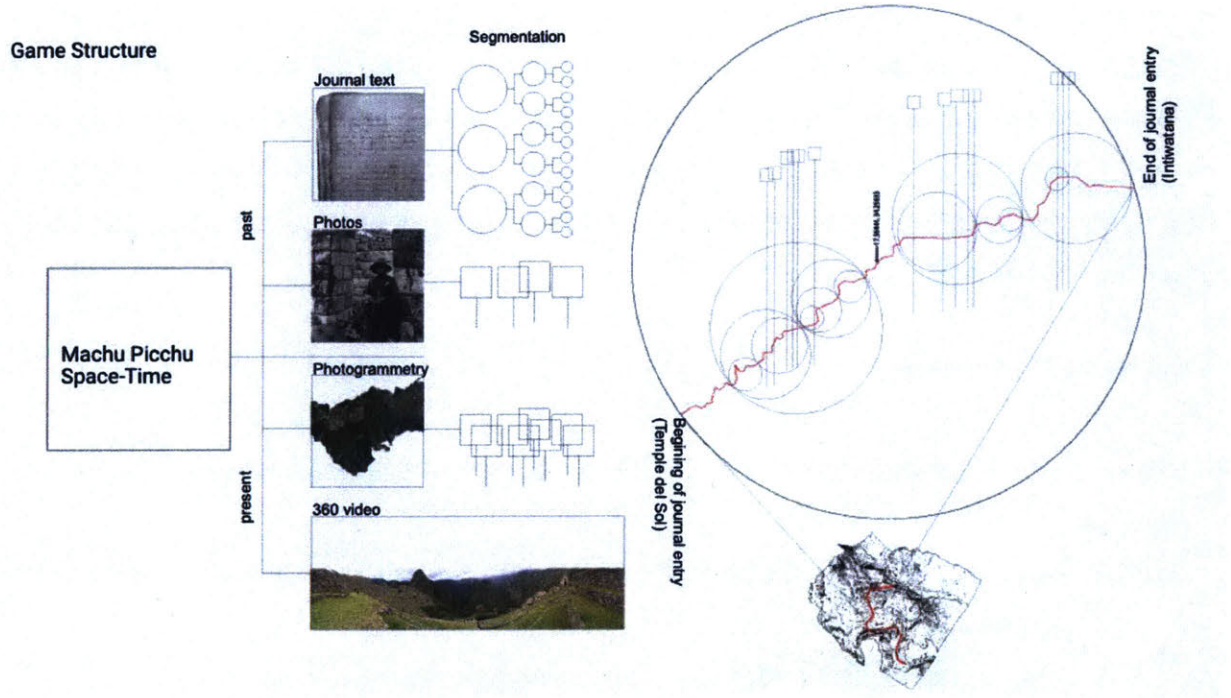



*Figure 23: Bingham's route (right) is segmented to textual 'areas' and photographic 'points'*

- **Navigation**

  Navigation is the key element that moves the 3D environment from an interactive model to a game space. The player can control the walking movement of a character – an abstract portrayal of Bingham, using a keyboard, and can roam the 3D environment freely. With the mouse the player can zoom-in or out and examine the landscape from up close or get a wider frame of the site.
  The character, seen from above, can be walked to the various locations. When the character walks through an area described by Bingham in his journal, the text appears on screen and a narration voice is heard. When the character engages with a green sphere, representing the location of an historical photograph, the point of view changes, becoming a first-person perspective, simulating Bingham's point took while taking the photograph.

- **Interface**

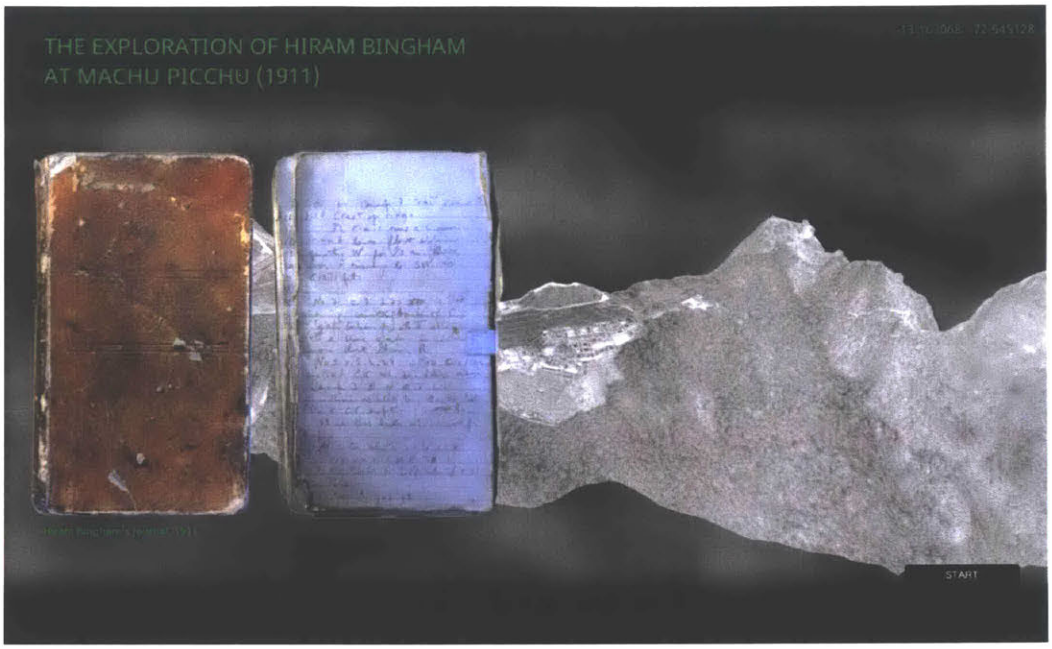
  The default interface shows the character from above, as it walks through the 3D photogrammetry model. A menu on the right side of the screen shows the various available layers of information at each location, as the character moves through the game-space. As the character enters an area documented by Bingham through one his media - writing, photography, or drawing - the layer is li-up to indicate its functioning. The player can then click on the layer to turn it on/off.

- **Layering of documents**

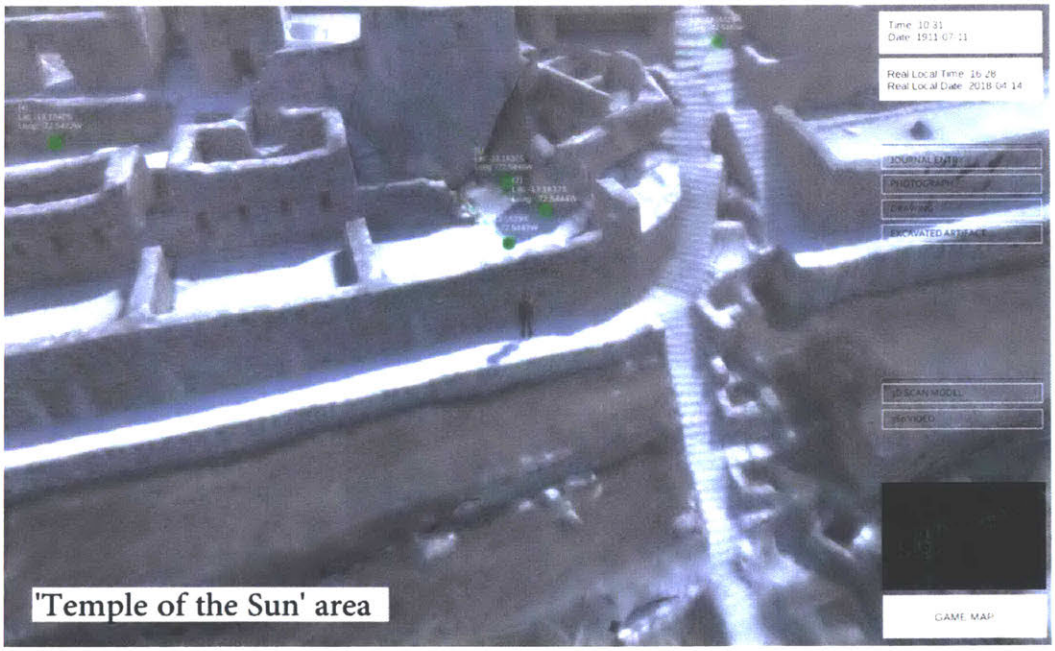
  Layering of documents allows for multiple perspectives of the same scene. Similar to GIS interface, a user can switch and mix various views.
    - **Journal – text and narration** (screenshot 9): Journal text was located and overlaid onto landscape.
    - **Photographs** (screenshot 4/6/11/14)**:** as seen in historical photographs are situated according to an estimation of the location of the camera based on the framing of the photograph. Each photographs then gets a Latitude and Longitude, as well as field of view.

- **Drawings** (screenshot 17/27)**:** Drawings made by Hiram Bingham are integrated at certain locations. The drawings are accessed through the layers menu on the right-side of the screen. When
- **High-res model** (screenshot 5/26)**:**
- **360Video and sound** (screenshot 12/23)**:**

***A recorded screen-capture of gameplay, can be accessed here:***
https://www.vimeo.com/271485212
Password to access video: *mit*

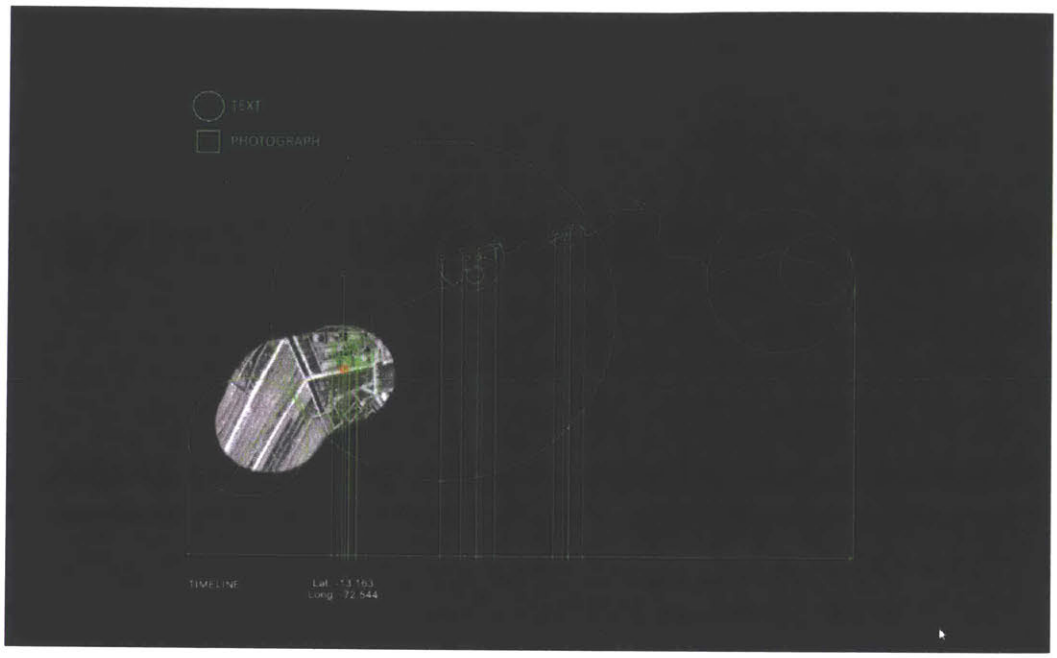



*Screenshot 1.* ***Introduction to platform****, narration from a section of Bingham's journal giving an overview of the journey up until the members of expedition walk into the site.*




*Screenshot 2.* ***Main interface*** *showing 3d model of the site (photogrammetry 3d scanning), the player can roam the model through character (using keyboard arrows), zoom-in and out, rotate model using mouse.* ***On the right****: menu showing (1) diegetic time and date and real time and date; (2) layers of documents: upper layers showing original documents from Hiram Bingham's Yale Expedition; lower layers showing visual documents from the present. Bottom right corner button opening game map.*

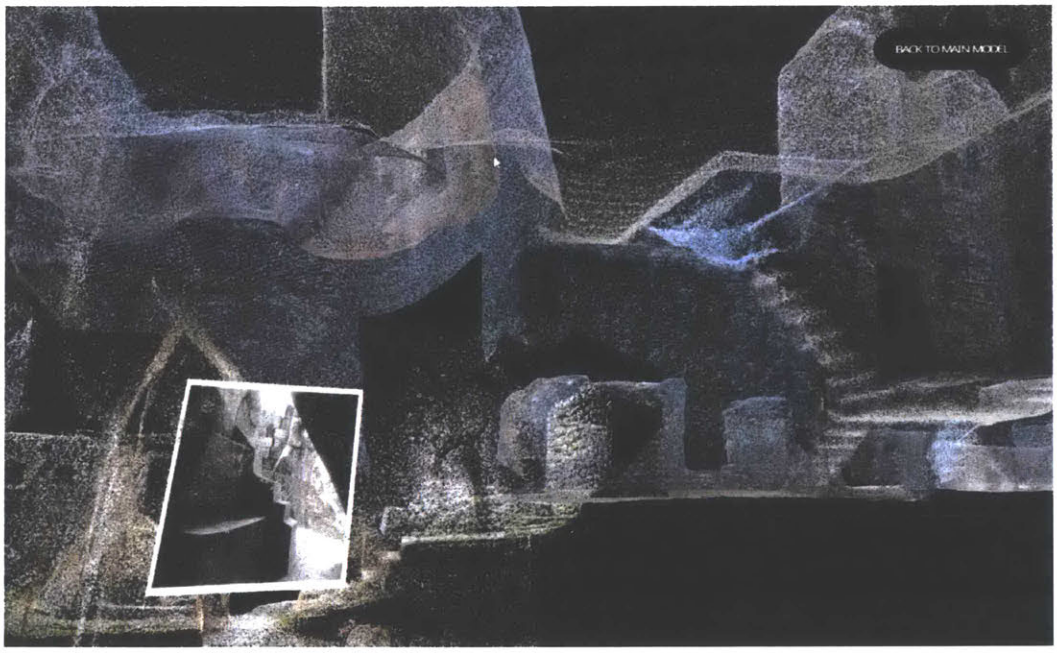
*This first scene if of the 'Temple of the Sun'. As you (the character) walk, a narrated version of the journal is played in the background, according to your position in the site.*




*Screenshot 3. Clicking on the 'game map' button on the bottom-right part of the screen, the view is changed to show the* ***game map****. The map is gradually exposed as the character moves across the landscape.*

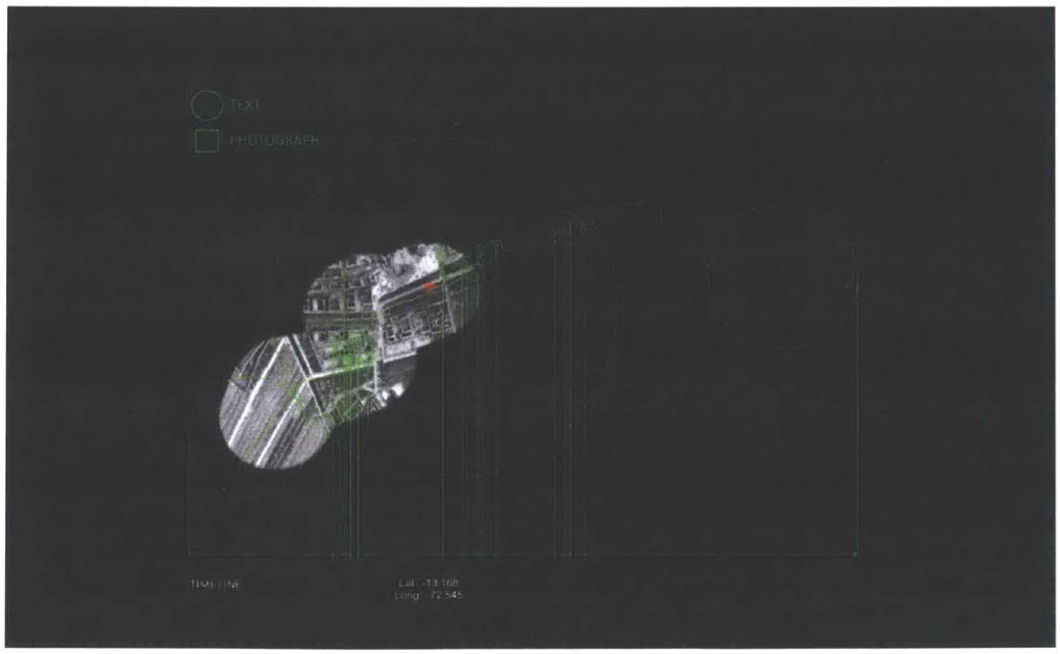

*Screenshot 4. Photograph of the cave shown to Bingham by a boy. Once you (the game character) engage with a green sphere, the view switches in the "****photosphere****", from a first person perspective, from the position and angle of the camera, as it was. Inside the photosphere you can continue to walk around.*


*Screenshot 5. Photosphere view, photograph layer turned-off, 3D Scan layer turned-on*




*Screenshot 6. Photosphere. Photograph within the cave, seen in point cloud mode.*


*Screenshot 7. Another area on the route is the' Sacred Plaza'. This is the main plaza of Machu Picchu and accordingly was most heavily photographed by Bingham. As he walked into the Sacred Plaza his tone of writing also changes as he becomes overwhelmed by his finding.*




*Screenshot 8. Switching the a "map view", we see the current position of the character within the site's map, along with the locations of text/narrations and photographs.*


*Screenshot 9.* ***The Sacred Plaza****, with the various locations from which photographs were taken (green spheres). Again, each original photograph is located back in the site. The relevant segment from journal is seen in the upper-left corner of the screen (and narration is heard).*

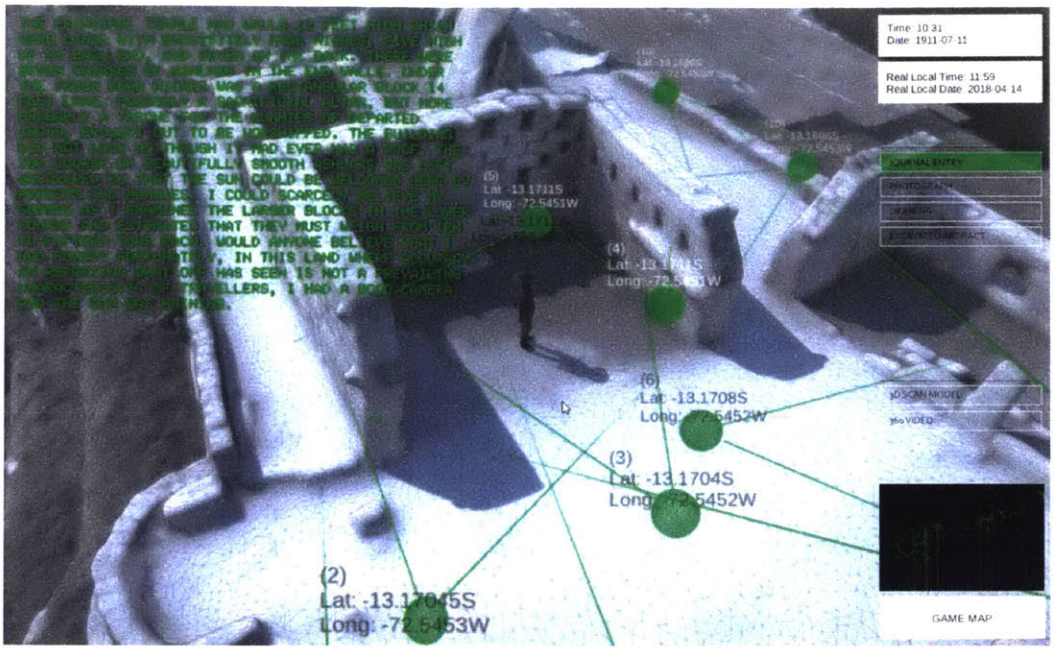

*Screenshot 10. Once the character is in a zone where there is a photograph, or other perspectives depicting the place, the relevant layer lights-up.*


*Screenshot 11. The 'Sacred Plaza' photosphere (after going into the green sphere)*

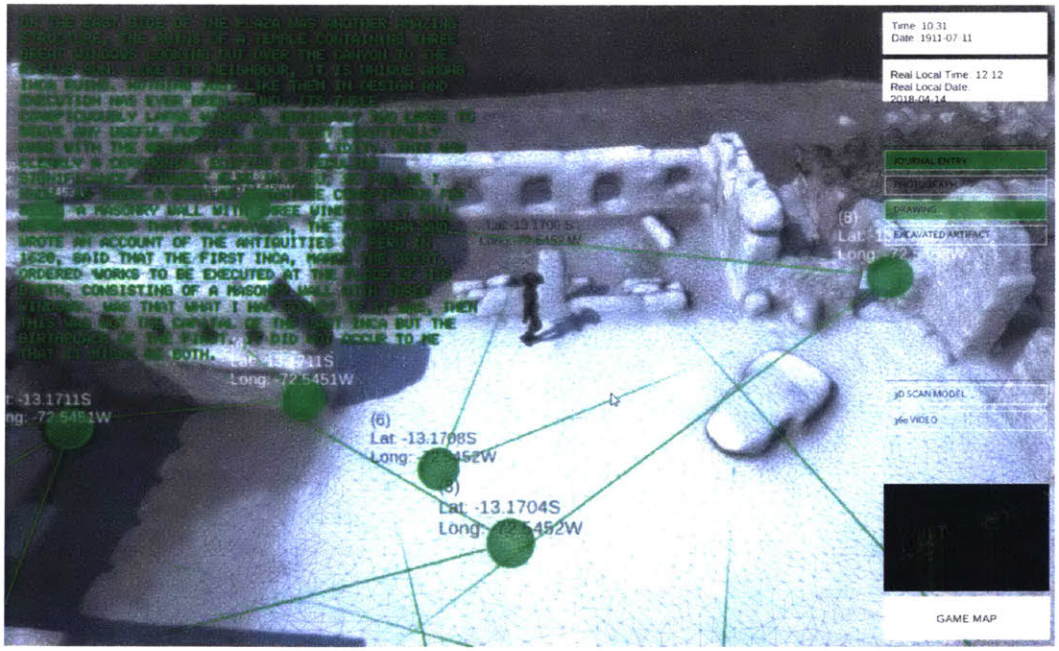

*Screenshot 12. Switching-on the **'360 Video' layer**, active in this section, is a video showing the same spot today as overlaid. In the screenshot the 'Photograph' layer is also on.*


*Screenshot 13. Turning the 'Photograph' layer off*

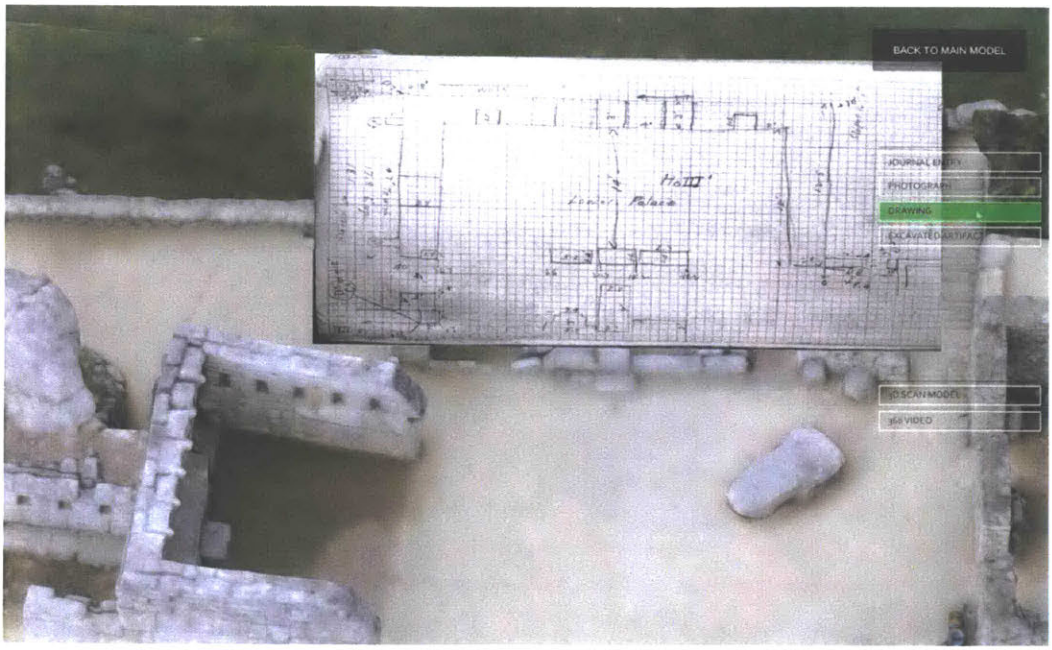

*Screenshot 14. After turning the '360 Video' layer off, and 'Photograph' layer back on, you find yourself back in the Sacred Plaza photosphere.*




*Screenshot 15. Walking into the journal-area describing the main temple.*




*Screenshot 16. Walking into the journal-area describing the famous three-window temple. On the right layer-menu we see the **'Drawing' layer** lit-up; this means that the viewer has stepped into an area described also by a drawing.*

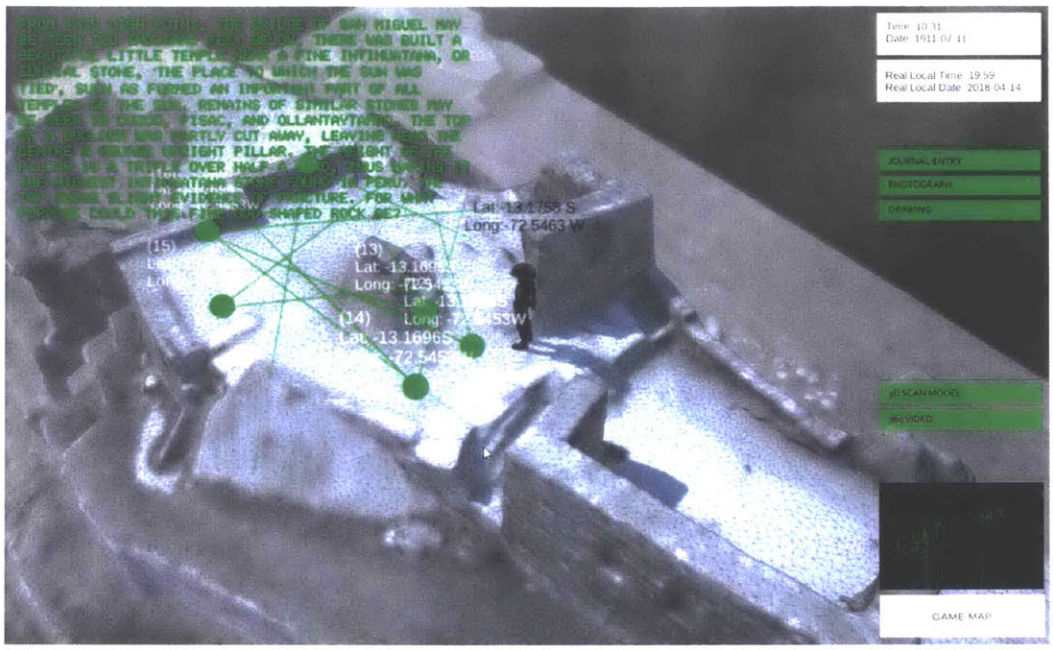



*Screenshot 17. In the drawing layer, the document is seen in correspondence to a details 3D scan in orthographic view, simulating the non-perspectival representation.*

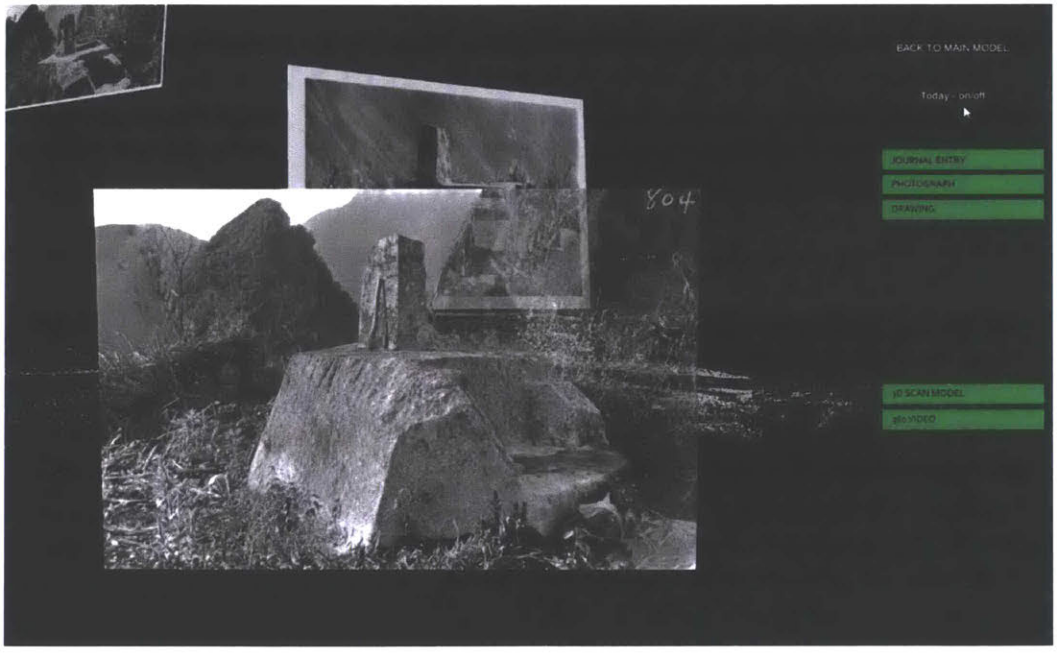

*Screenshot 18. 'Drawing layer' off.*


*Screenshot 19. Moving up along the hill, the 'Sacred Plaza' is see below. This section depicts the* ***Intiwatana – 'The Sacred Rock'***


*Screenshot 20. Again, once walking-into the green sphere, a photograph from that same point of view takes over the screen.*




*Screenshot 21. Around and above the Intiwatana Rock, Bingham has taken multiple photographs from various points-of-view. Here, on the right layer-menu, we see that there are different layers of historical documents active.*

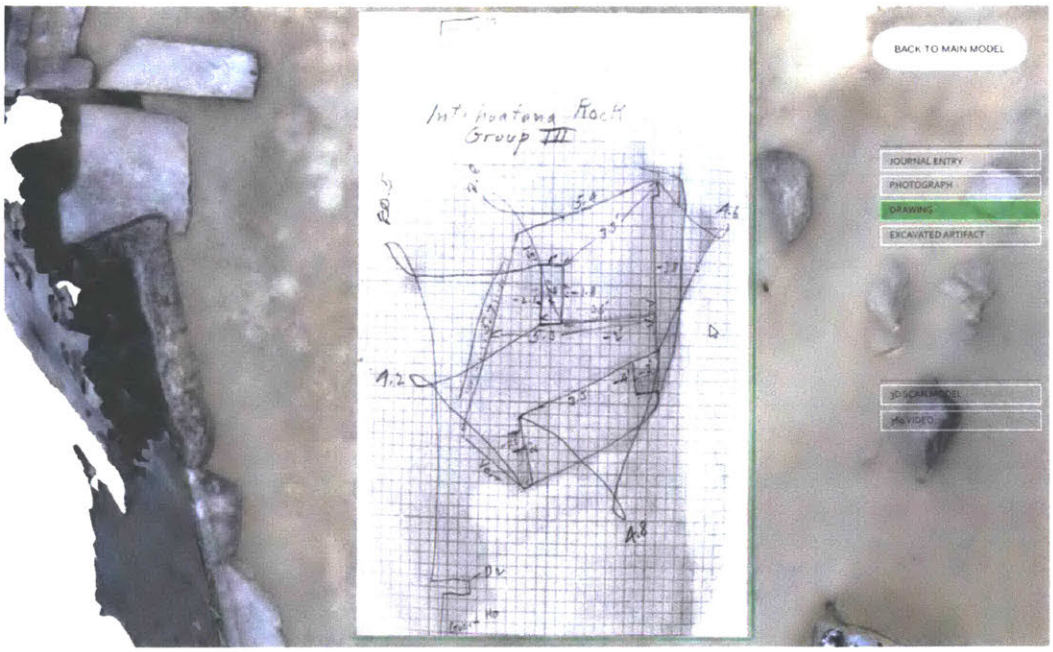



*Screenshot 22. The Intiwatana Rock photosphere, showing the various photographs taken. On the bottom-right corner of the screen we see the '360 Video' layer is again lit-up, indicating that it is possible to turn-on the layer and view the video...*


*Screenshot 23. '360 Video' layer turned-on. The scene depicts tourists as they come-up to the rock to view it, some trying to touch it, to enjoy its supposedly mystical powers. In the center of the screen, where the rock surfaces above ground, we see the original photographs overlaid. In this scene there is an argument between a tourist and the guard over touching the rock too much.*


*Screenshot 24. Hiram Bingham's axe, used for clearing the vegetation, is seen leaning on the edge of the rock.*


*Screenshot 26.* ***3D scan*** *layer turned on.*




*Screenshot 27.* ***Drawing*** *layer turned on.*


*Screenshot 28.* ***3D scan*** *layer turned on.*


*Screenshot 29. Inside the photosphere, around the Sacred Rock.*


*Screenshot 30. Inside the photosphere, around the Sacred Rock.*


*Screenshot 31. Inside the photosphere, around the Sacred Rock. Point-cloud layer only is active.*

# 6. Conclusion:

## 6.1. Simulating history through computer games

My initial hypothesis was that computer game concepts and technologies can be used to represent historical sites and events, and that a method based on computer game technology could challenge conventional spatial representations through a multilayered view of place. I suggested further that such a method entails a movement from *representation* to *simulation,* and has the advantage of allowing for the active participation of the user in the unfolding of a site's history. In my research, I have shown that these results can be obtained due to three aspects of computer games distinguishing them from other forms of media: *spatiality, multiform* and *participation* (section 3.2). I have focused on these characteristics, using examples of games depicting historical sites and events, to demonstrate the great power of computer game technology and concepts in producing historical simulations (section 4). I my research I applied computer games concepts to create a *game environment* for simulating Machu Picchu, using the multiple historical documents produced by Hiram Bingham (section 5). In so doing, I developed a method to integrate the documents in a game environment intended to function as a reconstructed experience. This method allows one to navigate among different perceptual mechanisms inside a game space, and can be used generally to simulate historical sites in a variety of settings. The materials used are all primary sources, that is, historical documents and information collected from the site, and were left intentionally raw, with minimum attempt to fuse them together. Through this method I attempted to explicitly show the complexity of reconstructing a story from vastly different media.

By overlaying space and narrative, I have emphasized the wide range of possibilities for depiction of place, while maintaining accuracy by using coordinate systems (section 2). Moving from literary descriptions of elaborate landscapes using abstract maps, to overlaying information on real landscapes, to virtual reality reconstruction of lost worlds, we see in the history of spatiotemporal representation varying attempts to close the gap between narrative and space. With the advent of narrative-based computer games (section 3.1.), there emerged new possibilities for depiction of place based on interaction between player and machine in a game environment, while creating a new participatory medium. Through interaction, the space of the computer game unfolds in real-time, evoking a sense of performance – a reenactment of

events in an increasingly realistic simulation technology. This form of simulation of historical events raises critical questions regarding historiography, in respect to the instruments and conceptual base for storytelling of the past. While the affordances and advantages of computer games as tools for spatial storytelling are persuasive and inviting, one has to asked whether and how an interactive game-like environment for simulation of past events in space, as captured at the time, impacts on history's interest in objectivity. Is the notion of simulation productive for historical scholarship, or is there a higher value in leaving the artifacts and document untouched? If we do use computer gaming technology, what is the rhetoric and style of simulation that should be used?

My prototype seeks to validate the use of computer gaming technology for simulation of history, while striving to maintain factual integrity, through the assembling of primary resources with minimum alteration of the historical documents. In searching for, discovering and making sense of the archival information, I attempted to let the historical material express itself, to construct the mass of evidence into a coherent spatial narrative without filling-in the gaps. I sought to leave the assembling technique apparent, following the methods of historians who use similar techniques to describe, contextualize, and explain events and circumstances of the past. The simulation seeks to represent the complex activities and events of the past, to explain and interpret significant outcomes based on evidence available in the present that bears upon understanding the past. However, as with other methods, the historical image remains partial, limited by its sources, and grounded in the present point of view. We by now know that we are always limited by our own points-of-view. It is today a philosophical truism that no imaginable set of "historical" representations can do justice to the fullness of "history" as past. Although tacitly acknowledged by most historical practitioners, the limits and inherent subjectivity of history as written tend to be bracketed off from discussion, allowing historians to get on with their jobs.

In thinking about the integrity of game-based simulation as history, I want to refer to two major themes in the methodology and assumptions about the work of historians. For the sake of putting game based simulation history in perspective, I will use the heuristic device of dichotomy, dividing the schools of history into two fundamentally different positions: one asserts that responsible research efforts have the potential **for providing an accruing and ever-more accurate understanding of the past**, and that somehow, with enough effort, the space between history as past and history as interpretive text can be minimized. In this historical

*positivism,* the historians immerse themselves in the period studied, striving to get as close as possible to what has been lost.[98] A main proponent of this historical paradigm was the nineteenth century historian Leopold von Ranke. Ranke's asserted that history should embrace the principle of "how things actually were". This notion of history was taken by many historians as their guiding principle, and can be generally referred to as positivistic. A positivist historical simulation game would recreate the historical scene in the utmost accuracy, attempting to recreate history as it were.

While Ranke's positivistic methods remain influential in the practice of history, his broader ideas of historiography and empiricism are regarded by many as outdated and no longer credible. In mid-20th century, his ideas were challenged by historians such as E. H. Carr, Fernand Braudel and Walter Benjamin. Carr opposed Ranke's ideas of empiricism as naive, boring and outmoded, saying that historians did not merely report facts, but chose the facts.[99] Braudel's approach was based on the *histoire problème*, criticizing the legacy of Ranke's dictum that historians should represent the past "as it actually happened".[100] Walter Benjamin scathingly wrote that the positivist notion of history represented "*the strongest narcotic of the [nineteenth] century*".[101] These latter historians all assumed an unbridgeable gap between the events of the past and the ever-shifting representational efforts of an ever-changing present. They are often called post-structualists, and they argued essentially that the present, and the position of the subject within it, impact strongly on the construction of the understanding of the past. The poststructuralists made their mark by embracing precisely this long suppressed representational uncertainty.[102] In a double move, they challenged the established master narratives that dominated the field, and at the same time asserted the need for boldly and articulately partial histories.[103]

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[98] Leonard Krieger, "Ranke the Meaning of History," 1977; Aviezer Tucker, *A Companion to the Philosophy of History and Historiography*, vol. 107 (John Wiley & Sons, 2011).
[99] David Carr, "Place and Time: On the Interplay of Historical Points of View," in *History and Theory* 40, no. 4 (2001): 153–167.
[100] Aviezer Tucker, *A Companion to the Philosophy of History and Historiography*, vol. 107 (John Wiley & Sons, 2011). P.223.
[101] Vanessa R. Schwartz, "Walter Benjamin for Historians," in *The American Historical Review* 106, no. 5 (2001): 1721–1743.
[102] See among others, Hayden White, The Content of the Form: Narrative Discourse and Historical Representation (Baltimore: Johns Hopkins, 1990); Michel de Certeau, The Writing of History (New York: Columbia University Press, 1992); Keith Jenkins, ed., The Post-Modern History Reader (New York: Routledge, 1997); Keith Jenkins, Rethinking History (New York: Routledge, 2003).
[103] William Uricchio, "Simulation, History, and Computer Games," in *Handbook of Computer Game Studies* 327 (2005): 338.

Poststructuralism, consistent with the broader cultural turn of which it was a part, also posed the challenging question of what are the instruments by which history is written? If one of the major moves in poststructuralist thought has been to displace the controlling metaphor of historical evidence from reflection to mediation (that is, a shift from the notion that texts and documents transparently reflect past realities, as positivism believed, to one in which the past is captured in the mediated form preserved for us in language), then we need to think carefully about how we understand mediation and how that understanding affects the practice of simulation.

Simulation games and virtual environments that aim at simulating history move between those two historical paradigms: historical positivism and poststructuralist history. What is important to note here is that computer games' affordances, when considered as history storytelling instruments, can support positivistic or poststructuralist paradigms of historiography. In examples seen in blockbuster games such 'Assassin Creed', as well as in recent attempts to recreate historical sites realistically using Virtual Reality, we find a desire for *seamless* reconstruction of the past. In contrast, a poststructuralist historical paradigm would move away from a claim to realistic simulation of historical places and events, and seek to expose the seams of historiography, as in my study of Machu Picchu in which I emphasize the existence of multiple perspectives.

## 6.2. Towards exposing the *seams* of historiography

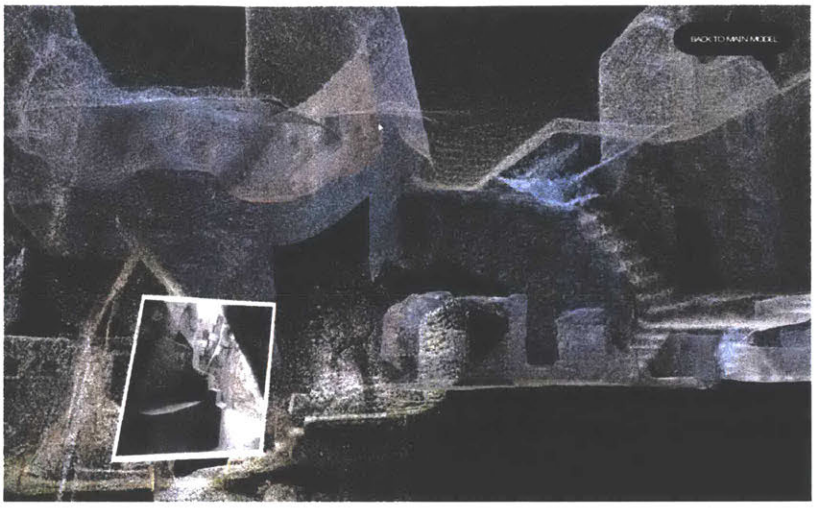

*Figure 24: Screenshot from prototype. The 3D environment is created out of multiple perspectives consolidated, yet still separate*

Recent examples of 3D interactive environments, Virtual Reality and Augmented Reality applications reveal a tendency to simulate past places seamlessly. These platforms impliedly assume that simulation and gaming technologies can imitate ineffable historical occurrences. They assume that through digital simulation we might "actually" reconstruct lost cities and "actually" reenact events within them. While computer games allow an ever growing captivating subjective experiences depicting past places, I suggest moving away from an aspiration for realistic simulation and towards collaging of historical materials: constructing assemblages of evidence from multiple sources, written memories, commentaries and snapshots without attempting to fit them together in one unified representation. Stitching perspectives together inside three-dimensional space of the game-engine, without making them a seamless material, takes advantage of the *"deceptive"* aspects in simulation. This amounts to a playable archive consisting of fragments, allowing the flatness of documents to become immersive experiences. Exposing the seams of the archive entails reproducing an image while allowing a certain autonomy of its components, creating a hybrid form of archive-computer game, a presentation of fragmented history, while enjoying play.

This design strategy includes mechanisms of historiography as integral to the narrative. Here I seek to follow Walter Benjamin, in his '*Thesis on the Philosophy of History*', in which he explores

the theoretical limits of the usefully recoverable past. Benjamin saw the work of the historiographer as reconstructing memories. Unlike Ranke's positivism, which supposed an access to the past, Benjamin proposed an alternative process of laying a claim to historical truth: "*To articulate the past historically does not mean to recognize it 'the way it really was' (Ranke). It means to seize hold of a memory as it flashes up at a moment of danger.*" Benjamin asserted that there was high-stakes struggle to remember the past with the collective memory of the likely victims and that this was a last-ditch tactic of resistance against the "scientific" rewriting of history by the apparent victors. He wrote "*Only that historian will have the gift of fanning the spark of hope in the past who is firmly convinced that even the dead will not be safe from the enemy if he wins.*"[104] Writing on the background of World War II, Benjamin argued that the task of the historian is to piece together evidence of a lost object that could never be fully recovered.

As an historian, explorer, storyteller, and would-be archaeologist, Hiram Bingham collected fragments, hoping he would be able to piece together his experience at home in distant New England. In a journal entry from the day of his discovery he wrote: "*Would anyone believe what I have found?,*" expressing his fear of missing-out on an opportunity to tell a dramatic story, as if he was witnessing a momentary event – a rare natural phenomenon, while struggling to capture every detail. Bingham knew that although the ruins were not going anywhere, his finding was a history in the making. In this vein of thinking, Mike Pearson and Michael Shanks write about the complex network of time and space, and the urgency of capturing a momentary fleeting sense of time. In their writing they extend Benjamin's concept, going so far as to compare an historical site to a crime scene. They ask "*(...) What has happened? The temporality of (archaeological) spaces is one of aftermath—the traces left behind. Time is fractured as present appearances are haunted by indeterminate pasts, events now gone and evident only in their alienated traces. Here the alienated trace is the precondition of meaning.*"[105]
Proposing a strategy of interpretation, Pearson and Shanks refer to the need for a "forensic archaeology," emphasizing the argumentative and rhetorical dimension of probative work in history. They maintain that apprehending meaning from a "crime scene" requires a leap of interpretation. Interpretation, in turn, requires as detailed as possible an understanding of the relationship between events and their spatial contexts. They continue by saying "*There is no*

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[104] Walter Benjamin, "Theses on the Philosophy of History," 1989. 255.
[105] Michael Shanks, *Theatre/Archaeology* (Taylor & Francis, 2001). 18.

*reason to assume the innocence of the archive: to select is to tamper*". For these reasons forensic investigation favors a certain suspicion in which the narrative sleights of hand, of the stories told, no less than the motives of the storytellers themselves, must be scrutinized.

The fractured time evoked by Pearson and Shanks, and Benjamin's invitation to "*seize hold of a memory*" suggests a fractured simulation of history, that allows the past and present to coexist. It suggests that we aim at a simulation model that focuses on multiple media sources for capturing historical events, rather than fostering seamless experience of the events. A "*seamful*" design method means using the affordances of computer games to emphasis the stitching of perspectives. Recreating a spatial and narrative-based experience, not by directing the observer towards a curated experience, such as is cinema. The simulation should facilitate a new self-consciousness of multiplicity of interpretation.

## 6.3. Further Development

**Testing and Validation**

An important next step for the research should be testing and validating the prototype. For that I would encourage historians and educators to use simulation platforms for teaching purposes. This would provide feedback on the prototype as a storytelling instrument based on multiple source access to historical materials.

This step forward will demands uploading the prototype to a web server that allows streaming of high-resolution 3D models. This requires the development of a web-based iteration of the platform.

**Uploading materials**

Once uploaded to the web, an additional step should be to open the platform to other forms of spatial perceptions. This means developing a web-based platform using a geographic database, allowing storage and management of materials uploaded by multiple users. An open platform would enable the game-space to incorporate a growing archive of materials. I imagine the editing process similar to that in Wikipedia, in which there are designated editors for maintaining online archive accuracy and integrity.

In a case of an open platform game environment, the question of authorship would demand defining the scope of the historical simulation. Since the method requires a framing of defined events in history – a route taken, a crime committed, an occurrence of an historical meeting, the platform's administrators would have to define the historical boundaries of the archive.

**Using the method in other sites**

A new site for testing the prototype will ideally be a location that can be scanned from above using drone photogrammetry, and that allows for constructing layers of narratives and times in history. The new site would then become "a virtual archaeological excavation site." Executing the test would probably require cooperation from authorities and perhaps local inhabitants.

**Composing a narrative**

Narrative is another crucial component of my method. Literary work describing a place, or describing a scene which occurs in a place lies at the heart of the prototype. While almost all sites have been identified and described in some form of literature, the depth of the simulation will depend partially on the degree in of multiplicity of sources, including literary narrative sources, contain multiple points-of-view, captured by multiple media. A richly historical location would reveal in its sources layers of times, not only of materials.

**3D Scanning and the production of Pointclouds**

While the prototype I propose is open for a wide variety of media - visual, audio, and text-based, it demands a three-dimensional model that functions as a base-layer, serving as the ground for situating other materials. The 3D scanning of the site yields 3D model that becomes the "playground" and container, crucial for the development and arrangement of multiple sources. In the case of my prototype in this research, the 3D models were acquired by using photogrammetry that collects vast number of photographs by drones or from the ground. When approaching future sites, I would continue to use photogrammetry for large scale models due to its relative affordability.

For higher-resolution models I would experiment with implementing ***laser scanning (Lidar)*** to create exceedingly accurate pointcoluds of structures. As I have shown, pointclouds became a crucial component of the prototype, since they allow presentation of structures and topography

accurately as well as abstractly. In my prototype I produced pointclouds from photogrammetry models, although this technique is not ideal for these kinds of models. Using laser scanning would produce more dense and efficient poointcloud.[106]

[106] An example of pointclouds produced by Lidar Scanning can be seen in the work of London-based ScanLab; https://scanlabprojects.co.uk/

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