



International Journal of Heritage Studies

ISSN: 1352-7258 (Print) 1470-3610 (Online) Journal homepage: www.tandfonline.com/journals/rjhs20

New Philadelphia: using augmented reality to interpret slavery and reconstruction era historical sites

Jonathan Amakawa & Jonathan Westin

To cite this article: Jonathan Amakawa & Jonathan Westin (2018) New Philadelphia: using augmented reality to interpret slavery and reconstruction era historical sites, International Journal of Heritage Studies, 24:3, 315-331, DOI: 10.1080/13527258.2017.1378909

To link to this article: https://doi.org/10.1080/13527258.2017.1378909



Published online: 17 Nov 2017.



🕼 Submit your article to this journal 🗗



Article views: 1679



View related articles



View Crossmark data 🗹

Citing articles: 10 View citing articles



Check for updates

New Philadelphia: using augmented reality to interpret slavery and reconstruction era historical sites

Jonathan Amakawa^a and Jonathan Westin^b 🕩

^aCommunications Media, Fitchburg State University, Fitchburg, MA, USA; ^bDepartment of Conservation, University of Gothenburg, Gothenburg, SE, USA

ABSTRACT

Does a historical site lose its significance or become less worthy of interpretation if there are no surviving buildings? Can technology help present the stories of disadvantaged and disenfranchised groups whose heritage lacks well-preserved architecture or material culture? The emerging technology of augmented reality (AR) offers new ways of designing and shaping the public's experience when visiting landmarks by enabling an unprecedented means to combine 3D historical visualization with historical landmarks. This especially applies to underrepresented groups whose heritages have not been well served by traditional modes of preservation and interpretation due to a variety of factors. These range from disadvantages relating to material culture to a greater emphasis on intangible heritage which have placed them outside the bounds of what archaeologist Laurajane Smith calls authorised heritage discourse. A project at the New Philadelphia National Historic Landmark, located in Pike County Illinois, seeks to address these issues through AR. The technology, while offering opportunities for historical interpretation, poses challenges in terms of designing AR systems that coordinate content presentation with specific locations as well as developing virtual historical content with varying levels of source materials.

ARTICLE HISTORY

Received 9 February 2017 Accepted 31 July 2017

KEYWORDS

Augmented reality; historical interpretation; African American history; slavery; mobile

Introduction

By following the process and conclusions of building an augmented reality application for public interpretation of New Philadelphia, this article explores the challenges faced in communicating a heritage site that due to a scarcity of material remains falls outside the bounds of what Smith (2006) calls the *authorised heritage discourse*. The article contests that a historical site loses its significance or becomes less worthy of interpretation if there are no surviving monuments. By applying a critical perspective to the meaning making process of reconstruction, it explores augmented reality as a technology through which to (re-)associate a meaning with a site lacking material remains. Hence, the processes of reconstructing and staging New Philadelphia through augmented reality are approached as parallel processes of interpretation where place is at centre. This approach serves both to connect the stories of a disenfranchised group to a physical site, and to lend a site meaning.

CONTACT Jonathan Amakawa 🖾 jamakawa@fitchburgstate.edu

© 2017 Jonathan Amakawa and Jonathan Westin. Published with licence by Informa UK Limited, trading as Taylor & Francis Group

316 🕒 J. AMAKAWA AND J. WESTIN

The project discussed, carried out at the New Philadelphia National Historic Landmark, located in Pike County Illinois, involves a collaboration with the United States National Park Service's Network to Freedom Programme, the Illinois State Museum, the New Philadelphia Association and descendants of Free Frank McWorter.¹ This collaboration resulted in the creation of a mobile application, *The New Philadelphia AR Tour*, which seeks to give meaning to a now bare landscape and thus *challenge* our notion of which locations have historical value. The application allows visitors to walk through the site of New Philadelphia, view digitally reconstructed historical buildings placed in their original locations, and learn about the history of the vanished nineteenth Century American frontier community.

The primary goal of the first phase of the project was to map the original block layout of New Philadelphia onto the landscape and design a system of AR signage. When visitors view a sign through their mobile device, the application overlays virtual reconstructions of the now lost built environment onto the current landscape (Figure 1). The historical buildings and artefacts at New Philadelphia were reconstructed in collaboration with Claire Martin, an historian and archaeologists from the Illinois State Museum. This collaboration utilised archaeological evidence, drawings created by a past resident, and representations of similar nineteenth century American buildings in order to create an informed yet hypothetical representation of how several buildings may have appeared in New Philadelphia.

However, while a digital reconstruction of the built environment constitutes knowledge acquisition by itself, and is, as such, also an important research result by itself (Forte 2014; Murteira et al. 2017), the purpose of the reconstructed structures of New Philadelphia is to eventually serve as a backdrop for less tangible aspects of the town. While cultural heritage could be described as a set of values and understandings, not merely places, old monuments and artefacts (see Smith 2006), there is an equally important communicative aspect of heritage where these tangible and intangible concepts are given form and purpose through narration. By giving a site meaning, or, vice versa, giving meaning a site, both place and story are strengthened. As Smith (2006, 44) writes, heritage is 'a cultural process that engages with acts of remembering that work to create ways to understand and engage with the present'. This sentiment is echoed in much of the contemporary heritage practice that has shifted from a strong focus on material artefacts, a Western conservation theory, to a more inclusive Contemporary conservation theory with a focus on subjects, narratives, and socio-cultural contexts (Muñoz Viñaz 2005; Malpas 2008; Edgren 2016). However, as Barile (2004) writes, historical context is still often a



Figure 1. Screenshot from mobile device during New Philadelphia AR Tour application testing.

secondary consideration in the evaluation of a site when cultural resource management becomes synonymous with archaeology rather than historical investigation. A failure in giving proper recognition to context leads to a devaluation of African American sites (2004, 98).

Background

The story of New Philadelphia and its founder Free Frank McWorter is powerful in its narrative as it encompasses major themes in North American history including slavery, the Underground Railroad, the American frontier and settlement of the West. Furthermore, New Philadelphia is historically significant as the first town in the United States to be founded, planned out and registered by an African American (Shackel 2011, 38). As such it is challenging popular perceptions of African Americans' participation in the settling of America's western frontier and founding of new communities in nineteenth century America. The founder, Free Frank McWorter, was a slave who purchased his own freedom through money he had earned on days off and after hours while operating a saltpetre mining business (Shackel 2011, 28-29). McWorter, moved west from Kentucky into Illinois and purchased land which he then surveyed and sold as lots, in the process founding the town of New Philadelphia in 1835. Using the proceeds from selling his saltpetre business in Kentucky and the lots in Illinois he successively purchased the freedom of his wife and his children (Shackel 2011, 28–29). Over the course of the mid-nineteenth century, New Philadelphia grew modestly in size as a multi-racial community of whites and blacks peaking around 1865, with a population of around 160 (Shackel 2011, 44). Hence, New Philadelphia was at its height in the beginning of the Reconstruction Era (1865-1877), a period lacking major National Historic sites and landmarks and which has been called 'one of the most complicated, poorly understood, and significant periods in American history' (National Park Service 2016). Through the remaining years of the nineteenth century, however, the town's population declined for reasons, some research suggests, may have had to do with a racially motivated decision by the Hannibal and Naples Railroad to bypass the town (Fennell 2011, 142-150). By the early twentieth century New Philadelphia had reverted to farmland (Shackel 2011, 18) and has since then not seen any major development (Figure 2).

In terms of presenting the story of New Philadelphia to the public, the town has been the subject of books such as Free Frank: A Black Pioneer on the Antebellum Frontier by Juliet Walker (1983), New Philadelphia: An Archaeology of Race in the Heartland by Paul Shackel (2011) and an episode in the PBS Documentary series Time Team America (2009). However, until recently, there has been little to see for visitors interested in visiting the site itself. The challenge today for historians and educators is how to interpret a site for visitors with little visibly remaining besides the landscape. Much of what we know about New Philadelphia and its inhabitants has been passed down through oral history, or exists in historical records, newspaper articles and artefacts, and findings uncovered by archaeologists. In many ways the past is disembodied from the present physical location creating challenges for presenting and interpreting the site to visitors. This is in fact a challenge not just for New Philadelphia but also for interpreting a number of other nineteenth Century African American sites that are associated with slavery and the post-Civil War Reconstruction Era as well as the heritage of other underrepresented groups (see Pocock, Collett, and Baulch 2015). Beyond New Philadelphia, memory institutions, particularly in Western countries, are increasingly grappling with ways in which to represent and engage the heritage of underrepresented and disenfranchised groups in a meaningful way (Smith, Shackel, and Campbell 2011), as these groups have often lacked the resources or agency to leave lasting physical marks in the landscape (see Holmberg 2014). This can be seen in the concept of 'intangible heritage' and its recognition by the UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage which was drafted in 2003 (Smith, Shackel, and Campbell 2011, 8).



Figure 2. New Philadelphia in June 2014. Source: Photo by Jonathan Amakawa.

Augmented reality and heritage sites

Augmented reality (hereafter AR) technologies for mobile devices offer promising new opportunities for interpreting and presenting culturally complex sites like New Philadelphia. There are a growing number of examples of AR usage in the field of cultural heritage (see Gottlieb 2015; Younes et al. 2017). At the New Acropolis Museum in Athens, AR is used to bring colour and interactivity to white washed statues, thus applying research results and interpretations right on top of the museum artefacts (Keil et al. 2013). At the Natural History Museum in London, AR is used to present evolutionary history to their visitors (Debenham, Thomas, and Trout 2011; Barry et al. 2012). To let visitors access X-ray, infrared and ultra violet documentation, the Van Gogh Museum in Amsterdam has experimented with AR as an interface through which to explore their paintings (Kolstee and van Eck 2011).

There are many forms of AR, with varying grades of sophistication. Situated Simulations, for instance, closely related to Indirect AR (Wither, Tsai, and Azuma 2011), makes use of AR to serve up a place-specific pre-annotated panorama image or a real time rendered 3D scene of the surroundings (see Liestøl 2011; Liestøl and Morrison 2013; Madsen and Madsen 2017). While Situated Simulations fill the screen with a reconstruction, AR can also be presented as a forensics tool through which a visitor of a museum or site can gain additional information of a specific part of an artefact perfectly mapped on top of the real world camera view (Westin, Almevik, and Thomas 2017).

Hence, in the context of heritage studies, AR technology can be defined as that which supplements the way a person experiences an object or a place in the real world with information that may be in the form of sound, text or graphics (Santos 2012; Govilkar and Amin 2015). The key feature of AR is that it allows information to be accessed and presented in a specific context and relevant location in the real world. This necessitates having a means in which to determine the location of a person holding

the device, or the orientation of the device itself and its relation to objects in the physical world, and a means of accessing information pertaining to that context.

The use of AR in a nonvisual format in fact predates the arrival of smartphones: audio tours of the kind that allow museum goers to navigate exhibits while listening to information, for instance, may be considered an early form of AR in that it allowed users to access information specific to an artefact or location (Proctor 2011, 7). Location-specific information for these kinds of audio tours is often accessed by inputting a unique code number into a device at different points during the tour.

Audience studies within educational sciences suggest that AR helps both in conceptual learning and interpretation of information, as well as improving engagement (Damala et al. 2008; Yoon et al. 2012). Primarily, this is an effect of the connection between the physical world and the information layers that AR facilitates, but, as Szymanski et al. (2008) found, the technology also encourages interaction between members of an audience leading to discussions about what they see and how they perceive it. Newer forms of AR, however, are enabling developers to incorporate visual information in immersive new ways. This is because AR is benefitting from a convergence of ever improving smartphones and mobile devices, with their abilities to utilise GPS and location specific data, and the vastly improved graphics capabilities of mobile devices (see Martínez et al. 2015; Canciani et al. 2016; Kasapakis, Gavalas, and Galatis 2016). Virtual 3D models, with their own three-dimensional coordinates and illusion of perspective, can be convincingly overlaid in real-time onto the physical world in ways that blend the real with the virtual and seamlessly combine the two. This allows for the possibility for people to look at a real world landscape with their mobile device and see reconstructed virtual 3D buildings, artefacts, and people positioned in that same landscape. Landmarks with buildings that no longer exist, or that have significantly changed can be recreated and presented in a past form in their original location.

Because these virtual objects are rendered in 3D, it is also possible to allow people to walk around these objects and view them from different points of view as if one were walking around something that existed in the physical world, thus adding an embodied aspect to the visualisation. This further differentiates it from a solely virtual presentation as it includes the body of the spectator, where the visitor has to perform the necessary movements in the physical world to navigate the virtual reconstruction. This shift in the representational medium of the town, from a map or model on a screen into a place where scale becomes apparent through the physical exhaustion of having to move one's body to navigate, creates a multi-sensuous connection between representation and place (see Michon and Antably 2013).

In addition to this, the objects can be made interactive and serve up other media, such as digitised archive material otherwise not readily accessible in physical form. As Were writes, digitisation constitutes a significant shift towards a new kind of heritage experience, 'one that is marked by heightened mobility, on-demand availability and virtuality' (Were 2014, 153), something AR has the potential to be the access point for. All of this, of course, is mediated through the camera lens and viewfinder of a mobile device.

The challenges of interpreting African American landmarks and cultural heritage

While AR presents opportunities for interpreting any historical location that no longer exists or appears dramatically different than in the past, the platform may be particularly useful for presenting the history of underrepresented groups such as African Americans during the eras of Slavery and Reconstruction. This is especially relevant now given that there have been increasing efforts in recent years, by the US National Park Service and scholars, to designate and interpret historic sites relating to the era of Reconstruction (1865–1877), an era that began when New Philadelphia was at it's peak, but that coincided with the decline of the town. The problem of communication is due to several of the challenges involved in interpreting and presenting African American landmarks.

For one, African Americans in the nineteenth Century often lacked the resources to build housing that could survive over multiple generations, relying on the creation of simple wooden cabins, that

at times lacked foundations. Historians believe that New Philadelphia only contained one two-story building which was the house of Louisa McWorter, in all probability the town's most highly valued tax property (New Philadelphia Association, 4). Most structures on the other hand were erected quickly and could easily be moved to other land parcels when necessary.² Research on land ownership in New Philadelphia during the nineteenth century shows that individual lots changed ownership multiple times and witnessed the construction and dismantling of dwellings over short periods of time. For example, in 1845, lot 1 in block 4 was owned by John Bixler and records indicate that there was a building located on the south part of the lot (Pike County Collectors Book 1845). In 1861, that same lot is recorded as having a building on the north part owned by Staten Brown and on the south part of words by Spaulding Burdick (Pike County Collectors Book 1861). By 1864, there is no longer any building on the south part of the lot, however the north part of the lot appears to contain a building owned by Augusta Sidener that extends into adjacent lot 2 (Pike County Collectors Book 1864). This is just one example of the fluidity of property ownership in New Philadelphia. By the late twentieth century, there was almost nothing visibly remaining of the former town.

Similarly, the property of Jameson Jenkins, another site within the National Park Service's *Network to Freedom* programme, now a part of the Abraham Lincoln National Historic Site in Springfield, is preserved as an empty lot within Lincoln's restored mid-nineteenth century neighbourhood. Jenkins was an African American neighbour of Abraham Lincoln in Springfield, a conductor on the Underground Railroad and was believed to have driven Lincoln to the rail depot after he was elected president of the United States. While a number of houses in addition to Lincoln's were restored to their nineteenth century state, Jenkins' modest, small, one-floor wooden house was demolished or moved soon after Jenkins moved away in 1865 (Hart 2014, 74).

One reason for the challenge in interpreting and presenting African American historical sites associated with the Underground Railroad has to do with the clandestine nature of the activity. African American sites associated with the Underground Railroad were secret stops or conveyances to freedom in the North and were intentionally concealed. While they are significant landmarks in American history, they do not lend themselves well to the traditional notion of a national monument or an authorised heritage discourse, 'which privileges grand, old, aesthetically pleasing sites' (Smith 2009, 1). A good example of this is the Harriet Tubman Underground Railroad National Monument in Maryland, one of the newest additions to the US National Park system and a member of the Network to Freedom programme. Tubman is one of the most important and well-known figures associated with the Underground Railroad and the fight for freedom during the era of slavery. She is currently slated by the US Treasury Department to replace President Andrew Jackson on the face of the twenty-dollar bill (Timiraos 2016). The Tubman park site consists of 11,750-acres of mostly wilderness on Maryland's Eastern Shore where she was born and through which Tubman led many African Americans to freedom (Obama 2013). There are few buildings or man-made objects for present-day visitors to see. Instead the historical monument is embodied by the terrain that is traversed, the experiences of Tubman and the freedom seekers in negotiating the plant and wildlife in order to survive and perhaps the songs and stories that they carried with them. Smith, Shackel, and Campbell (2011, 9) apply describe these things as 'intangible heritage':

One of the things that the concept of 'intangible heritage' has offered to debates in critical heritage is about lived experiences that are not always adequately represented by the material forms that have been the focus of traditional heritage preservation and conservation concerns.

The legacy of African Americans is at times richest in its intangible forms that are manifested in cultural areas such as craft making, music, food, and language. These things also lie outside the focus of the authorised heritage discourse, which privileges physical monumentality and the cultural expressions and experiences of an elite class. The Mitchelville Freedom Park, a US National Park Service's *Network to Freedom* site in Hilton Head represents a similar challenge and opportunity. The site is historically significant as the first self-governing community of freed slaves, also known as the Port Royal Experiment. In November 1861, after seizing a coastal enclave deep inside Confederate territory, Union forces allowed freed slaves and contraband to build a self-governing community amidst the military base and fortifications. The community was a precursor to Reconstruction and a test case for African American economic, political and social self-determination outside of the bonds of slavery. At one point the population grew to 1500 (Jackson 2012).

Similar to New Philadelphia and the Jenkins lot, the site was largely abandoned and little remains of the settlement. The difference here, however, is that many of the descendants continue to live in nearby areas of the island and carry on the traditions of the unique African American Sea Island culture of the South-Eastern US known as Gullah Geechee. Today Hilton Head is a major vacation destination drawing visitors to its beaches and golf courses. Interest in Gullah folk traditions, music and cuisine such as Lowcountry boil or Frogmore Stew are also a draw. However, the lack of surviving physical structures and artefacts has challenged the culture's relationship to important events and themes of the past. Because of this, the site necessitates an alternative means for presenting its intangible cultural heritage such as through AR.

Reconstructing New Philadelphia through AR

A digital reconstruction is a contextualisation that visualises an interpretation. By consulting and adhering to available sources when making the reconstruction, what Favro (2006) calls a 'knowledge model' is created. Therefore, the reconstruction is not a visual representation of an original structure, but instead a visualisation of our knowledge of the structure – a product of our interpretations of the available sources - and is as such as much a construction as a re-construction, as meaning is always inscribed through the process (Westin 2014). Moreover, a reconstruction often lacks transparency and may for the recipient cement interpretations later hard to challenge (see Spicer 1988; Shapiro and McDonald 1995; Klynne 1998). The emerging photorealistic digital representations of the last three decades have brought new problems; through their use of realistic looking shadows, textures and perspective, the photorealistic representations lend the interpretation a convincing physical materiality that may convey a deceiving feeling of certainty and kinship to the material remains. This has necessitated studies into the visual communication of digital models, where different approaches to communicating the uncertainty, rather than the certainty, of a reconstruction have been explored. The methods have ranged from a system for computing reliability through fuzzy logic (Hermon and Niccolucci 2010), to visual cues incorporated in the model such as the use of conflicting interpretations (Westin and Eriksson 2010), and colour grading (Landeschi et al. 2015).

Working with reconstructions demands a responsibility on behalf of museums and scholars to actively think about the way they present the past in their communication, since an unchallenged interpretation, incorporated into a large body of knowledge drawn upon by others, risks becoming a fact (Westin 2012). As argued by Smiles and Moser (2005), representational practices have an impact on how we perceive both history and culture. This is no less true when other sensors are engaged: through the *New Philadelphia AR Tour* visitors hear audio narration and sound effects, which serve to enhance the existing landscape. A schoolhouse, for instance, echoes with the sound of children playing.

Currently the app does not include a means for communicating certainty in regard to aspects of the town's virtual reconstruction. This is because the first phase of the project, with the exception of the reconstructed Louisa McWorter House and the town's schoolhouse, focuses less on reconstructions requiring informed speculation and instead on mapping the original block layout onto the landscape and designing a system of AR signage – things which will lay the ground work, in later phases, for adding reconstructed buildings and animations depicting the town during the nineteenth century. In future phases, there are plans to enable users to select specific buildings and animations in order to learn about the sources and reasoning behind specific reconstructions, thereby allowing them to peek behind the scenes and discern the degrees of conjecture (Figure 3).

Like a number of African American historical landmarks, New Philadelphia is challenged by the absence of visible remnants of the past and is a good candidate for utilising AR technology to situate reconstructions into the landscape, or resituate digitised material. Prior to the creation and release



Figure 3. 1872 Plat Map of New Philadelphia showing streets, blocks and lots.

of the *New Philadelphia AR Tour* application, visitors to New Philadelphia used a printed brochure containing a self-guided tour, created by the New Philadelphia Association in 2013, that enabled them to tour what was once the centre of town and follow along the path of its former streets. The tour consisted of thirteen stops marked by small numbered signs that corresponded with numbered passages in the brochure. The passages described buildings and events in the history of New Philadelphia from its birth to its eventual demise. At each stop along the path, visitors were prompted to look out on the present day fields and imagine the historical scene being described in the brochure. Early on, the New Philadelphia Association conceived of the application as a way of updating the existing self-guided tour and supplementing the information and current landscape with reconstructions of the houses of the town presented through AR. The New Philadelphia Association in consultation with Illinois State Museum Historian Claire Martin selected five stops on the self-guided tour to recreate for the AR application with the idea that the application would eventually be expanded to cover the other eight stops in a later phase.

Upon deciding to use AR to recreate and present parts of New Philadelphia, the main challenge was in how to display the architecture and other content so that visitors, when using the app, could see these things mapped to scale in their original locations. Many AR platforms, such as Layar and Vuforia, currently use one of two methods for mapping content to a place. Both have advantages and disadvantages. One method is to use GPS to identify a location and enable content to be displayed at that location. This works well for displaying contextual information or 3D AR content that do not need to be precisely displayed within a range of ten metres. The other method is to use image recognition to display the content over a predetermined target image or sign (Govilkar and Amin 2015). Variations of this, such as systems using visual-inertial odometry, sidesteps the use of target images by creating a large amount of tracking points in 3D space. These are then continuously tracked and compared with motion detecting data. However, while this allows for well-anchored and immersive AR content to be displayed, it is not place-specific the way traditional target-based solutions are. For place-specific target-less content, AR can make use of camera- or radio based systems, which relies on external sensors or transmitters – such as Microsoft Kinect or iBeacons – to track the movement of the device.

However, as systems relying on external sensors come with both deployment and maintenance costs, a target-based solution was selected for the *New Philadelphia AR Tour* application. Target-based AR is optimal in scenarios where the device through which the AR overlay is projected is either fixed at a certain distance and angle, or allowed to circle the target and present an object from the outside. By using a target image as the reference for scale and position, this method allows for precise placement and scaling of AR content in relation to a real world environment. One disadvantage to using image recognition, however, is that the target image needs to be kept in view of the mobile device's camera in order to correctly display AR content. Despite this disadvantage, it was decided that image recognition was the best option and Qualcomm Vuforia was selected in conjunction with the Unity game engine.

In collaboration with Boston-based software developer Ben Buchwald, a system was designed for displaying AR content at the site of New Philadelphia using a series of five target image signs placed at precise locations along the visitor's walking path. Each sign displayed a unique target image that could be recognised by the application and that would display AR content pertaining to the sign. The signs were 10×10 inches in dimension and positioned four feet off of the ground. Using the scale and position of each sign as a point of reference, we were able to virtually recreate and position the AR buildings and historical content around a virtual representation of the sign within the 3D development environment in the Unity game engine.

Correct display of AR content relied on creating an accurate virtual map of the New Philadelphia landmark that displayed streets, blocks, lots and building footprints. To do this, a virtual 3D map was assembled within the application development environment by combining information from a present day Google map, a Google satellite image, the original plat map created by Free Frank McWorter and an archaeological survey map for excavations conducted on the site of the Louisa McWorter house. As a result, alignment of AR content in relation to the original street and block layout of New Philadelphia is as precise as the technology allows. This can be evinced in the application when one views the sign titled Guidepost 1 and observes an AR animation of a horse drawn carriage moving away from the viewer and towards the horizon on what was once North street (Figure 4). Viewers will notice that the movement of the virtual carriage closely follows the path of the present day (real world) gravel road as would be expected given that it follows the original path of North Street.

While AR display of the layout of the streets, blocks and lots of New Philadelphia are relatively accurate and help to convey a sense of the density of settlement and numbers of buildings, the reliance on conjecture for AR recreations of individual buildings within the lots varied and were dependent on the available information such as archaeological survey maps and historical research on land ownership in the town.

Availability of historical resources was in fact a key determinant in the decision to select the Louisa McWorter house and the schoolhouse for more detailed recreations for the AR tour. The Louisa McWorter house is the only building in New Philadelphia for which there is an image of any kind for



Figure 4. A horse drawn carriage visualised on what was once North street.

guidance on its exterior appearance. This exists in the form of a drawing by Lorraine 'Larry' Burdick, a resident of New Philadelphia in the 1920s and 30s, who created a rough sketch of the house from memory (Illinois State Museum 2012, 7). The sketch, while simple, provides information that there were two floors, a portico over the front door as well as the number of windows on the front of the house (Figure 5). In terms of other details not conveyed in the sketch – such as whether the house was brick or had wooden shingles for siding – the site historian recommended images of similar houses from the same time period and region in order to fill in gaps of knowledge. In the case of the AR recreation of the Louisa McWorter house, the location of the structure is accurate given that it is based on archaeological surveys conducted in 2005 and 2010, which confirmed the location of the house in block 13, lot 4. The AR representation of the house's exact dimensions and its appearance, on the other hand, is less certain given that there are no known surviving blueprints or photos of the building.

The appearance, location and placement of the schoolhouse in the AR scene had to be reconstructed from even fewer sources. Records indicate that the school board purchased a lot and that Reverend Luce and McWorter built a schoolhouse in 1848. In addition, later resident Larry Burdick recalled that the town had a black and white schoolhouse and created a sketch of a structure that was similar to other wood frame schoolhouses of the period (Agbe-Davies 2008; Agbe-Davies and Martin 2013). However, archaeologists searching for the schoolhouse during excavations in 2005 and 2008 were unable to definitively locate it despite finding slate board and pencils that might have been used at the schoolhouse. They also uncovered a single stone pier that they believe might have supported the base of a building (Shackel 2011, 131). This suggested an ephemeral building foundation and informed the decision to recreate the schoolhouse as one standing on stone piers. In consultation with Illinois State Museum historian Claire Martin, the decision was made to position the schoolhouse in block 8, lot 1. While we could not pinpoint the location of the schoolhouse, we could argue that it might have been located somewhere within the lot. In addition, except for Burdick's sketch, the schoolhouse lacked visual references such as photos, or written descriptions. In order to recreate the schoolhouse, Martin recommended images of American frontier one-room schoolhouses from the same time period as they often followed a similar layout (Fuller 1994).



Figure 5. Sketch of the Louisa McWorter house by Lorraine 'Larry' Burdick in the 1930s. Source: Courtesy of the Pike County Historical Society.

Presenting more than just architecture

While the New Philadelphia AR Tour application project demonstrates how historical landmarks can leverage AR mobile technology to present the past, it also shows the challenges faced in virtually recreating a physical environment when dealing with gaps in knowledge and information about the landmark. The virtual model of New Philadelphia is not just an interpretation with varying degrees of certainty but also a representation of the running dialogue between historians and archaeologists. However the application's use of AR is intended to recreate and interpret more than just the appearance of the town and its buildings. If this were the case, the application would be little more than an historical snapshot of the process of reconstructing the built environment of New Philadelphia. Instead, the objective of the application is to attempt to present the important story of African American agency in the struggle for freedom during the era of slavery and their lesser-known participation in the settlement of the frontier. Virtually embedding the story of McWorter's purchasing, settlement and planning of the land into the physical space where it all took place achieves this. Visitors to New Philadelphia, while using the mobile application, can view McWorter's original 1836 plat map and learn about his plans for building a school and his active engagement in founding a frontier settlement – one that eventually drew white settlers as well, creating a multiracial community (Fennell 2011, 140). These themes as well as less tangible artefacts such as the culture and daily life of the town's inhabitants are the more significant kinds of information that the application presents revealing an understanding of the American frontier that is unknown to many Americans. While AR can be a platform to recontextualize and anchor the lost physical space in the current environment, it can also recontextualize this intangible heritage. This is why AR has the potential to play an important role in interpreting



Figure 6. New Philadelphia Association Board members and Free Frank descendant Gerald McWorter field testing the app.

and presenting the past for underrepresented and disenfranchised communities. For many of these people, it is the less tangible artefacts that have survived to the present.

As an example, when a visitor using the application views the schoolhouse at guidepost 4, they encounter an animated scene that shows two men in a heated discussion. The scene reimagines the dispute between Free Frank McWorter and Reverend Christopher Sanborn Luce over Luce's failure to build a seminary. Luce was a shoemaker by trade and also a Free Will Baptist preacher. He and Free Frank built a schoolhouse, but Luce had also promised to build a seminary (New Philadelphia Association n.d., 4). This animated scene is meant to serve as point of entry into a presentation of the barriers faced by African Americans in obtaining an education in the mid-nineteenth Century and the efforts made on their own behalf toward building schools (Agbe-Davies 2008). Furthermore, from the position of guidepost 11, visitors using the application can see an animation showing a locomotive billowing smoke while travelling along what was the Hannibal and Naples railway. The animation is accompanied by voiceover dialogue explaining that the railroad bypassed New Philadelphia and contributed to its decline. Seeing the proximity of the passing train, yet absence of a station at New Philadelphia, visitors are invited to reflect on the impact that this had on the town. This approach of dramatisation is to be expanded upon in a planned second phase of development, where emphasis will be placed on showing daily life in New Philadelphia; Rev. Luce acting as postmaster, Alexander Clark and Squire McWorter Jr working as blacksmiths, and Spaulding Burdick making shoes.

While the use of drama to convey interpretations of a place may inadvertently lead to an oversimplification of the matter at hand and may therefore be seen as problematic in a museum context, the traditional museum display could also be questioned on those grounds as ideology and imagination are often instrumental in the construction of historical truths (Chittenden 2010, 177). As Rickly-Boyd notes, 'it is the very selective nature of the heritage process that makes it a particularly contested political endeavour, even when executed in the most subtle of ways' (2015, 889). Still, the representation of McWorter and Luce is no less problematic than any of the other reconstructions. More so, since the way in which ethnicity and class is represented may inadvertently lead to what Chan (2005, 28) calls a 'fetishization of race', where conventions are embraced rather than problematized. While we know that there was a dispute between McWorter and Luce over the seminary thanks to legal records, we cannot know exactly how this dispute played out in real life, or, due to the absence of any known contemporary images, what either man looked like at the time. In consultation with Martin, it was decided to depict the dispute in a simple and direct manner by animating a scene with a middle-aged and older African American gentleman arguing face to face. The animated model of McWorter is based on a 2008 bronze bust sculpture, created by his fifth-generation descendant Shirley McWorter Moss (Gay 2008), depicting him as an older African American man wearing a bow tie and coat.

The application also presents the site's less visible historical residue of archaeological artefacts (many of which now reside at the Illinois State Museum in Springfield) buried or recently uncovered in excavations. Visitors can encounter virtual artefacts in the locations that they were found. These artefacts include a metal trivet, most likely created by one of the community's blacksmiths, a William Jennings Bryan campaign button, fragments of school slate boards and pencils, broken dolls and many other items.

In some cases, particularly those involving frontier settlement, the loss or absence of remaining buildings such as in New Philadelphia can itself convey historical understanding and meaning for present-day visitors. This absence of physical structures is contrasted, and thus emphasised, by the AR reconstruction of the town. Nowadays visitors to New Philadelphia are confronted with an uninhabited landscape just as the community's first settler McWorter. In many ways they are able to experience the site like him and imagine how they might build a new community.

Conclusion

As Malpas (2008, 204) argues, places bear meaning, a 'sense of place' as he puts it, and this meaning is diminished when we through digital media disassociate our understanding of a place, such as New Philadelphia, from the place itself. While the tourism industry makes use of historic settings as a means of experiencing the past (Ashworth 1994; Brett 1996), the place must be interpreted to incite an emotional response in the observer 'related to a deeper cultural meaning' (Rickly-Boyd 2015, 891). The *New Philadelphia AR Tour* application is an example of a new generation of AR technology enabling an unprecedented means to combine 3D historical visualisation with historical landmarks. AR technology affords those who interpret and present historical and cultural heritage new ways of designing and shaping the public's experience when visiting landmarks. It also allows historically significant landmarks that have traditionally fallen outside of the notion of authorised heritage discourse – but which are no less important – to be brought into the fold of public consciousness through a new means of experiencing the past. This especially applies to underrepresented groups whose heritages have not been well served by traditional modes of preservation and interpretation due to a variety of factors. These range from disadvantages relating to material culture to a greater emphasis on intangible heritage.

Development of AR-based exhibits and applications that accurately overlay historical recreations on top of present day locations requires new location-centric methods of interpreting historical information for the purpose of visualising interpretations of the past. The method for how the *New Philadelphia AR Tour* application utilised image targets and mapped and recreated the street, block and lot layout of New Philadelphia showed one way of doing this. The technology is still new and evolving – particularly in regard to tracking a person's location and pinpointing locations for placing virtual objects. This means that new methods for mapping and displaying AR content in relation to place will likely emerge. At the time of writing, however, image recognition is arguably the best option.

While all the issues of reconstruction practices remains, and perhaps even more acutely so as AR blends the virtual and the physical space in a manner that might lend the interpretations even more credence in the eye of the beholder, the technology opens up for approaches that takes place and context seriously; not only as a research tool, but also as a means through which to reclaim the right to a place and open it up for different narrations to coexist. Moreover, AR can have an important impact on interpreting and presenting the heritage of disenfranchised and underrepresented groups and in

328 🕒 J. AMAKAWA AND J. WESTIN

particular that of African Americans. The frequent absence of visible architecture and relics at African American-related sites, due to socioeconomic reasons and the requirements of survival in the age of slavery, call out for alternative ways of presenting heritage. While sites such as New Philadelphia may be challenging to interpret for visitors because of the marginalised status and limited resources of their past residents, this belies their importance to understanding American history. For historically underrepresented groups, recognition of their heritage is not just about rectifying omissions of their past but asserting their present 'social being' (Smith, Shackel, and Campbell 2011, 12). Moreover, as Smith, Shackel and Campbell write (2011, 9), heritage is 'concerned with "a certain way of knowing" the past and of mediating that past so that it can do "work" in the present'. As was noted at a field test of the application by Gerald McWorter, a Professor of African American Studies at the University of Illinois at Urbana–Champaign and a direct descendant of Free Frank McWorter, the history of New Philadelphia can serve as a beacon of hope for both African-Americans and Whites in its experience of peaceful coexistence and acceptance (Figure 6).

Notes

- 1. Other collaborators at the site of New Philadelphia include University of Illinois, University of Maryland, and University of North Carolina.
- 2. Personal communication with Claire Martin (2014).

Acknowledgements

The authors would like to thank Claire Martin and Terrance Martin from the Illinois State Museum, Christopher Fennell and Gerald McWorter from the University of Illinois and Urbana-Champaign, Diane Miller and Deanda Johnson from the National Park Service and the National Underground Railroad Network to Freedom program, and Phil Bradshaw from the New Philadelphia Foundation. We would also like to extend our gratitude to our anonymous peer reviewers who offered many insightful and constructive comments on our original manuscript, which helped us refine our arguments.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Jon Amakawa is an assistant professor in Communications Media and the Game Design program at Fitchburg State University in Massachusetts. His research and professional work focuses on interpreting cultural heritage and historical landmarks through augmented reality, video game technology and animation. He has created some of the first augmented reality mobile apps for the United States National Park Service through his work on the Jenkins Lot AR Tour for the Lincoln Home National Historic Site in Springfield, Illinois and the New Phil AR Tour for the New Philadelphia National Historic Landmark in Pike County Illinois. Amakawa was educated in Pittsburgh, Pennsylvania (MDes, Carnegie Mellon University) and in Poughkeepsie, New York (BA in History, Vassar College). In addition to his work with the United States National Park Service, he has also worked on projects with Disney Research, the West Virginia Symphony Orchestra and the Smithsonian affiliated Senator John Heinz History Center in Pittsburgh, Pennsylvania.

Jonathan Westin is a research fellow and co-director of the Heritage Visualisation Laboratory at the Department of Conservation at the University of Gothenburg in Sweden. In his research he studies how we form our perception of the past through representations, and how these representations become part of our cultural heritage. By focusing on the communicative aspects of heritage management, he approaches the creation of visual representations as a negotiation process between new research and established images. In his current projects: he researches how archives can be activated through augmented and virtual reality, as well as the performative aspects of archaeological simulations. Jonathan was educated in Gothenburg, Sweden (PhD in Conservation and MA in Ancient Archaeology, GU).

ORCID

Jonathan Westin D http://orcid.org/0000-0003-3901-2650

INTERNATIONAL JOURNAL OF HERITAGE STUDIES 😓 329

References

- Agbe-Davies, A. 2008. "Block 8, Lots 1-2: Searching for the African-American School House." In 2008 Archaeology Report, edited by C. Fennel. http://faculty.las.illinois.edu/cfennell/NP/2008ReportMenu.html.
- Agbe-Davies, Anna S., and Claire Fuller Martin. 2013. "Demanding a Share of Public Regard': African American Education at New Philadelphia, Illinois." *Transforming Anthropology* 21 (2): 103–121.
- Ashworth, G. J. 1994. "From History to Heritage: From Heritage to Identity: in Search of Concepts and Models." In Building a New Heritage: Tourism, Culture and Identity in the New Europe, edited by G. J. Ashworth and P. J. Larkham, 13–24. London: Routledge.
- Barile, K. S. 2004. "Race, the National Register, and Cultural Resource Management: Creating an Historic Context for Postbellum Sites." *Historical Archaeology* 38 (1): 90–100.
- Barry, A., Graham Thomas, P. Debenham, and Jonathan Trout. 2012. "Augmented Reality in a Public Space: The Natural History Museum, London." *Computer* 45 (7): 42–47.
- Brett, D. 1996. The Construction of Heritage. Cork: Cork University Press.
- Canciani, M., E. Conigliaro, M. Del Grasso, P. Papalini, and M. Saccone. 2016. "3D Survey and Augmented Reality for Cultural Heritage. The Case Study of Aurelian Wall at Castra Praetoria in Rome." ISPRS – International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences XLI-B5: 931–937.
- Chan, D. 2005. "Playing with Race: the Ethics of Racialized Representations in E-Games." International Review of Information Ethics 4: 24-30.
- Chittenden, T. 2010. "Rousing the Reggia: The Use of Cinematic Language and Video Projection in Peter Greenaway's Peopling the Palaces as a Way of Returning Life to a Seventeenth-century Italian Royal Palace." *International Journal of Heritage Studies* 16 (3): 173–186.
- Damala, A., P. Cubaud, A. Bationo, P. Houlier, and I. Marchal. 2008. "Bridging the Gap Between the Digital and the Physical: Design and Evaluation of a Mobile Augmented Reality Guide for the Museum Visit." In 3rd ACM International Conference on Digital and Interactive Media in Entertainment and Arts, 120–128. New York: ACM Press.
- Debenham, P., G. Thomas, and J. Trout. 2011. "Evolutionary Augmented Reality at the Natural History Museum." Presented at the 2011 IEEE International Symposium on Mixed and Augmented Reality, Basel.
- Edgren, L. 2016. "Contemporary Conservation Theory for Sustainable Development of Cultural Heritage Objects." *The International Journal of the Inclusive Museum* 9 (1): 1–8.
- Favro, D., 2006. "In the Eyes of the Beholder: Virtual Reality Re-creations and Academia". In: L. Haselberger and J. Humphrey (eds.) Imaging Ancient Rome: Documentation, Visualization, Imagination. Journal of Roman Archaeology Suppl. Series, 61. Portsmouth: Journal of Roman Archaeology, 321–334.
- Fennell, C. 2011. "Damaging Detours: Routes, Racism and New Philadelphia." Historical Archaeology 44 (1): 142-150.
- Forte, M. 2014. "Virtual Reality, Cyberarchaeology, Teleimmersive Archaeology." In *3D Recording and Modelling in Archaeology and Cultural Heritage: Theory and best practices*, edited by F. Remondino and S. Campana, 113–127. Oxford: Archaeopress.
- Fuller, W. E. 1994. One-Room Schools of the Middle West. Lawrence: University Press of Kansas.
- Gay, M. 2008. "An New life in New Philadelphia." American Archaeology 12: 3. http://faculty.las.illinois.edu/cfennell/ np/AmnArchMagArticle.pdf.
- Gottlieb, O. 2015. *Mobile, Location-based Game Design for Teaching Jewish History: A Design-Based Research Study.* New York: New York University Press.
- Govilkar, S., and D. Amin. 2015. "Comparative Study Of Augmented Reality Sdk's." International Journal on Computational Sciences & Applications (IJCSA) 5 (1): 1–16.
- Hart, R. 2014. Lincoln's Springfield, Jameson Jenkins and James Blanks: African American Neighbors of Abraham Lincoln. Springfield: R.E. Hart.
- Holmberg, I. M., ed. 2014. Vägskälens Kulturarv Kulturarv vid Vägskäl: Om att Skapa Plats för Romer och Resande i Kulturarvet [Heritage of Crossroads – Crossroads of Heritage: Creating a Place for Romani and Travellers in Cultural Heritage]. Malmö: Makadam.
- Illinois State Museum. 2012. The Living Museum 73: 4-13.
- Jackson, R. 2012. Mitchelville: The Hidden Town at Dawn of Freedom. http://www.bbc.com/news/magazine-16754502
- Kasapakis, V., D. Gavalas, and P. Galatis. 2016. "Augmented Reality in Cultural Heritage: Field of View Awareness in an Archaeological Site Mobile Guide." *Journal of Ambient Intelligence and Smart Environments* 8 (5): 501–514.
- Keil, J., L. Pujol, M. Roussou, T. Engelke, M. Schmitt, U. Bockholt, and S. Eleftheratou. 2013. "A Digital Look at Physical Museum exhibits: Designing Personalized Stories with Handheld Augmented Reality in Museums." Presented at the 2013 Digital Heritage International Congress (DigitalHeritage), IEEE. doi:10.1109/DigitalHeritage.2013.6744836.
- Klynne, A. 1998. "Reconstruction of Knossos: Artists' Impressions, Archaeological Evidence and Wishful Thinking." Journal of Mediterranean Archaeology 11 (2): 206–229.
- Kolstee, Y., and W. van Eck. 2011. "The Augmented Van Gogh's: Augmented Reality Experiences for Museum vVsitors." Paper presented at the 2011 IEEE International Symposium on Mixed and Augmented Reality – Arts, Media, and Humanities (ISMAR-AMH), IEEE. doi:10.1109/ISMAR-AMH.2011.6093656.

- Liestøl, G. 2011. "Situated Simulations Between Virtual Reality and Mobile Augmented Reality: Designing a Narrative Space." In *Handbook of Augmented Reality*, edited by B. Furht, 309–319. New York: Springer.
- Landeschi, G., N. Dell'Unto and D. Ferdani 2015. "Enhanced 3D-GIS: Documenting Insula V 1 in Pompeii". Proceedings of the 42nd Annual Conference on Computer Applications and Quantitative Methods in Archaeology In CAA2014 21st Century Archaeology, Paris, 349–360.
- Liestøl, G., and A. Morrison. 2013. "Views, Alignment and Incongruity in Indirect Augmented Reality." Proceedings of ISMAR 2013, IEEE International Symposium on Mixed and Augmented Reality – Arts, Media and Humanities, 23–28.
- Madsen, J. B., and C. B. Madsen. 2017. "An Interactive Visualization of the Past Using a Situated Simulation Approach." Presented at the 2013 Digital Heritage International Congress (DigitalHeritage), IEEE, 307–314.
- Malpas, J. 2008. "New Media, Cultural Heritage and the Sense of Place: Mapping the Conceptual Ground." *International Journal of Heritage Studies* 14 (3): 197–209.
- Martínez, J. L., S. Álvarez, J. Finat-Saez, F. Delgado, and J. Finat. 2015. "Augmented Reality to Preserve Hidden Vestiges in Historical Cities. A Case Study." ISPRS – International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences XL-5/W4: 61–67.
- Michon, D., and A. E. Antably. 2013. "It's Hard to be Down When You're Up: Interpreting Cultural Heritage Through Alternative Media." *International Journal of Heritage Studies* 19 (1): 16–40.
- Muñoz Viñas, S., 2005. Contemporary Theory of Conservation. Oxford: Butterworth-Heinemann.
- Murteira, H., A. Gago da Câmara, P. Simões Rodrigues, and L. Seueira. 2017. "Lost Cities as Virtual Experience: The Example of Pre-Earthquake Lisbon." In *Memories of a City*, edited by J. Westin and I. Martins Holmberg, 57–88. Gothenburg: University of Gothenburg.
- National Park Service. 2016. National Park Service Handbook Offers Insight into Complex History of Reconstruction. https://www.nps.gov/aboutus/news/release.htm?id=1793.
- New Philadelphia Association. n.d. A Walk Through New Philadelphia, Self-guided Tour.
- "New Philadelphia, Illinois." Time Team America. PBS. July 22, 2009. Television.
- Nicolucci, F., and S. Hermon. 2010. "A Fuzzy Logic Approach to Reliability in Archaeological Virtual Reconstruction." In *Beyond the Artifact. Digital Interpretation of the Past*, edited by F. Nicolucci and S. Hermon, 28–35. Budapest: Archaeolingua.
- Obama, B. 2013. Presidential Proclamation Harriet Tubman Underground Railroad National Monument. www. whitehouse.gov/the-press-office/2013/03/25/presidential-proclamation-harriet-tubman-underground-railroad-national-m.
- Pike County Collectors Book. 1845. 1845 Pike County Collectors Book. Document. Pittsfield, IL: Pike County Courthouse. Pike County Collectors Book. 1861. 1861 Pike County Collectors Book. Document. Pittsfield, IL: Pike County Courthouse.
- Pike County Collectors Book. 1864. 1864 Pike County Collectors Book. Document. Pittsfield, IL: Pike County Courthouse.
- Pocock, C., D. Collett, and L. Baulch. 2015. "Assessing Stories Before Sites: Identifying the Tangible from the Intangible." International Journal of Heritage Studies 21 (10): 962–982.
- Proctor, N. 2011. Mobile Apps for Museums: The AAM Guide to Planning and Strategy. Washington, DC: AAM Press.
- Rickly-Boyd, J. M. 2015. "It's supposed to be 1863, but it's really not': Inside the Representation and Communication of Heritage at a Pioneer Village." *International Journal of Heritage Studies* 21 (9): 889–904.
- Santos, A. 2012. Creating an Interactive Past: Digital Technologies for Public Representation of Archaeological Sites and Artifacts. Sarasota: University of Florida.
- Shackel, P. 2011. New Philadelphia: An Archaeology of Race in the Heartland. Berkeley: University of California Press.
- Shapiro, M. A., and D. G. McDonald. 1995. "I'm Not a Real Doctor, But I Play One in Virtual Reality: Implications of Virtual Reality for Judgements About Reality." In *Communication in the Age of Virtual Reality*, edited by F. Biocca and M. R. Levy, 2323–2323. Hove: Routledge.
- Smiles, S., and S. Moser, eds. 2005. Envisioning the Past: Archaeology and the Image. Oxford: Blackwell.
- Smith, L. 2006. Uses of Heritage. London: Routledge.
- Smith, L. 2009. Class, Heritage and the Negotiation of Place. https://www.academia.edu/348666/Class_heritage_and_ the_negotiation_of_place.
- Smith, L., P. Shackel, and G. Campbell. 2011. "Introduction: Class Still Matters." In *Heritage, Labour and the Working Classes*, edited by L. Smith, P. Shackel, and G. Campbell, 4-9. New York: Routledge.
- Spicer, D. 1988. "Computer Graphics and the Perception of Archaeological Information: Lies, Damned Statistics and... Graphics." Computer Applications and Quantitative Methods in archaeology 1988: 187–200.
- Szymanski, M., P. Aoki, R. Grinter, A. Hurst, J. Thornton and A. Woodruff. 2008. Sotto Voce: Facilitating Social Learning in a Historic House. *Computer Supported Cooperative Work*, 17(1), 5–34.
- Timiraos, N. 2016. Harriet Tubman to Be Added to \$20 Bill. http://www.wsj.com/articles/harriet-tubman-to-be-added-to-20-bill-1461170454.
- Walker, J. 1983. Free Frank: A Black Pioneer on the Antebellum Frontier. Lexington: University Press of Kentucky.
- Were, G. 2014. "Digital Heritage in a Melanesian context: Authenticity, Integrity and Ancestrality From the Other Side of the Digital Divide." *International Journal of Heritage Studies* 21 (2): 153–165.
- Westin, J. 2012. Negotiating 'Culture', Assembling a Past. Gothenburg: Acta Universitatis Gothoburgensis.
- Westin, J. 2014. "Inking a Past; Visualization as a Shedding of Uncertainty." Visual Anthropology Review 30 (2): 139-150.

Westin, J., G. Almevik, and J. Thomas. 2017. "Anchoring the Archive – Physical Space as a Digital Access Point to Research Documentation." Poster presented at the 3rd International Conference on Science and Engineering in Arts, Heritage, and Archaeology (SEAHA) at the University of Brighton, Brighton, June 19–20.

Westin, J., and T. Eriksson. 2010. "Imaging the Sanctuary of Hercules Victor." Archeomatica 2: 58-62.

Wither, J., Y. Tsai, and R. Azuma. 2011. "Indirect Augmented Reality." Computers & Graphics 35: 810-822.

- Yoon, S. A., K. Elinich, J. Wang, and J. G. Van Schooneveld. 2012. "Augmented Reality in the Science Museum: Lessons Learned in Scaffolding for Conceptual and Cognitive Learning." IADIS International Conference on Cognition and Exploratory Learning in Digital Age, 205–212. http://files.eric.ed.gov/fulltext/ED542780.pdf.
- Younes, G., D. Asmar, I. Elhajj, and H. Al-Harithy. 2017. "Pose Tracking for Augmented Reality Applications in Outdoor Archaeological Sites." Journal of Electronic Imaging 26 (1),1–12. doi:10.1117/1.JEI.26.1.011004.