
ARtLens: Enhancing Museum Visitors' Engagement with African Art

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DIS'18 Companion, June 9–13, 2018, , Hong Kong
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ACM ISBN 978-1-4503-5631-2/18/06.
<https://doi.org/10.1145/3197391.3205435>

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Abstract

We present ARtLens, an Augmented Reality application for the Microsoft HoloLens, which allows museum visitors to actively interact with and learn about artifacts. We designed ARtLens to enhance learning and engagement with museum collections while keeping the focus on the original artifact. ARtLens provides context for an artifact by supplying audio and visual information, and guides visitors in exploring the original artifact. It also allows users to directly manipulate, using gesture-based interactions, holographic representations of related artifacts next to original artifacts in the gallery. We intend to study the impact of ARtLens on object-based learning and engagement of museum visitors in an African Art gallery.

Author Keywords

Augmented Reality; museums; gesture-based interaction; education.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

Introduction

Augmented Reality (AR) technology provides museums with exciting opportunities to enhance visitors'



Figure 1: A directional arrow that directs users to the next artifact



Figure 2: Photo of the supplementary images next to the artifact



Figure 3: Photo of the contextual video played next to the artifact

engagement and experiences by 'bringing objects to life.' Indeed, many museums are currently experimenting with integrating AR into their traditional exhibit spaces. Examples include "The Story of the Forest" exhibit at the National Museum of Singapore [16], the "Skin and Bones" exhibit at the Smithsonian National Museum of Natural History [21], and the "Heroes and Legends" at the Kennedy Space Center in Florida [11]. However, current AR applications mostly utilize hand-held devices (e.g. tablets or phones), which distract from the artifacts displayed by requiring visitors to look away from the artifacts onto their device screens [15] or to examine the artifact by using their device as a window into the artifact. In addition, hand-held screen-based applications do not allow for direct manipulation and exploration of the 3D artifacts. Instead, they offer limited interactions on the screen.

The increasing availability of head-worn AR devices [13] offers new opportunities to augment traditional gallery spaces and create immersive and engaging experiences that retain visitor attention on the original artifact. Using audio, video, movement, and air-gestures, visitors can be guided through a museum exhibit, choose which supplementary information they receive, and view this information either adjacent to or superimposed on the original artifact. They can also manipulate 3D model representations of artifacts in ways otherwise not possible, such as scaling, rotating, and removing the object's texture.

In this abstract, we present the first prototype of ARTLens, an AR application for engaging and exploring African art in a museum setting using the HoloLens device. ARTLens is a collaborative project with the Davis Museum, an academic fine arts museum on the

Wellesley College campus, which has three permanent galleries dedicated to African art. We intend to deploy ARTLens in the Davis Museum and study its impact on learning and visitor engagement with African Art. Our goal is to investigate how to design museum applications for head-worn AR, which promote engagement with original artifacts while helping visitors to experience and understand important aspects of artifacts' original cultural contexts.

Related Work

Engagement with objects in the museum setting has been shown to increase visitor understanding and enjoyment [9]. Actively engaging with artifacts allows for visual and verbal vocabulary expansion, which enhances the visitor experience [9]. AR applications can improve museum navigation and make it more deliberate and informative [14]. As mobile AR technology has been rapidly increasing, web-based artifact libraries, such as Sketchfab, have been releasing their own AR platforms [20]. With this rapid expansion of mobile AR technology, many museums have been incorporating mobile AR applications and guides into their exhibits. For example, an early European survey from 2003 shows that around 35% of museums started working with AR or VR [18]. Here, we discuss AR or mobile applications that share our goal of increasing user engagement with artifacts in museums.

ArteMuse [17] is a mobile application developed for an academic museum that demonstrated increased engagement when visitors interact with works of art. ArtLinks [5, 6] and Imprints [12] are mobile applications aimed to increase engagement through social interaction by sharing personalized tags for artifacts in the museum while exploring the exhibit

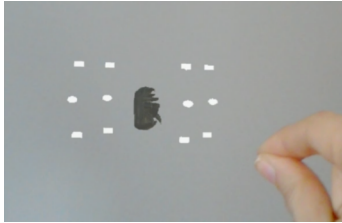


Figure 4: Photo of a user rotating a holographic 3D scanned version of the actual artifact using air-gestures



Figure 5: A user interacting with the ARtLens application in the museum by clicking on the artifact hotspots (as seen in Figure 6) using air-gestures

spaces. "Lumin" at the Detroit Institute of Arts (DIA), is an AR tablet application that allows visitors to engage in depth with the DIA's collection, including providing overlay x-ray scans of objects [7]. Other AR applications, such as "A Gift for Athena," [22] aim to promote exploration through AR tablet-based games. Museum AR applications are not always initiated by the museums themselves. Several state-funded projects encourage cultural heritage spaces to use mixed reality to encourage visitor learning and augment visitor experiences [3, 10, 22]. There have also been attempts to understand how mobile augmented reality tours can transform museum visits [1].

Few wearable AR headset applications have been evaluated in the context of art or archeological artifacts. Examples include HoloMuse [4], Archeoguide [23], ARtSense [2], and The Museum Wearable [8]. However, there is little research on how wearable AR museum applications impact user engagement, learning, and enjoyment. The development and deployment of ARtLens allows us to further investigate these questions.

ARtLens for African Art

The Davis Museum African art collection is composed primarily of West and Central African artworks from the nineteenth and twentieth centuries. None of these objects were made with the intention of museum display. Through deliberate exhibition design and didactic text, curators at the Davis Museum encourage close looking in the gallery and give information about how the objects were previously used and displayed. ARtLens aims to enhance both of these goals. This is especially challenging for artworks like masks, which were intended to be viewed as part of elaborate

costumes in dance, accompanied by live musicians and an interactive audience. Such context is lost in the quiet museum gallery, where objects are displayed in isolation within glass cases. While museums often present interpretative information on labels or on a side screen, it is difficult to convey the immersive effect of an African masquerade.

ARtLens intends to serve as a bridge between the objects on display and their original cultural contexts. Once a visitor approaches a particular artwork (the application detects the visitor location - no markers are needed), the application provides audio, visual, and textual information adjacent to or superimposed on the object (see Figures 2-3). Users can navigate through these materials, choosing which materials they want to view, by using voice commands, such as "next" and "yes." The application also superimposes annotations on the original object in the form of hotspots (see Figure 6), which the user can select using air-taps to hear more about the specific part of the object. It also allows users to explore holograms of related objects not currently in the gallery (e.g. in storage or displayed in another museum), and to manipulate them (e.g. scale and rotate) using their gaze and HoloLens-specific air gestures (see Figure 4). Augmenting the original artifact with adjacent or superimposed digital information maintains the focus on the physical artifact, while providing supplementary information. Visitors are guided through the museum by directional arrows (see Figure 1) to navigate from object to object. ARtLens allows the original artifacts and the digital information to exist within the same mixed reality gallery space.

The current version of ARtLens guides users through the permanent African art galleries at the Davis



Figure 6: The colored dots are annotations on the artifact that a user can air-tap to find out more about that specific area, as a user is doing in Figure 5.

Museum in a tour of four West African masks from the late nineteenth and early twentieth centuries. It includes objects from the Mende, Bete, We, Bamana, Baule, and Yoruba cultures.

Our goal is to promote active engagement and learning with authentic museum artifacts. Leveraging headset AR technology allows us to offer new ways to interact with artifacts and information in the gallery. We intend to utilize ARTLens to further investigate open questions about visitor learning and engagement, social acceptability, and effective design of mixed-reality exhibits.

Design Process

The current prototype of ARTLens is a result of an iterative user-centered design process. Our multidisciplinary team consists of interaction designers and researchers, computer scientists, art historians, and the exhibit's curator. We worked closely with museum professionals to explore the integration of wearable AR into the museum setting. We went through multiple rounds of testing with our team in the gallery, examining different aspects of the application and interaction design including, navigating mixed-reality space, and displaying location-based content. We conducted a preliminary evaluation of the current prototype in the museum.

Preliminary Evaluation

We conducted a preliminary evaluation for assessing usability and engagement with the current version of ARTLens. Three participants used the application at the Davis Museum, each interacting with the application for about 15 minutes to explore four African masks on display. In general, users were able to navigate

through the gallery space and explore the chosen artifacts further by going through the additional information provided without significant problems. The users noted enjoying the application and learning more about the particular artifacts. We observed some difficulties speaking loudly and clearly to the HoloLens and making HoloLens specific air gestures when needed. We intend to resolve this issue with a brief HoloLens training.

Implementation

ARTLens is implemented using HoloLens for Unity 5.6.1f1-HTP (Unity HoloLens Technical Preview), Visual Studio 2015 (Version 14.0.25431.01 Update 3) with Microsoft .NET Framework (Version 4.7.02053), and Windows 10 SDK (10.0.10586) installed. To present related objects, artifacts were scanned using Artec Spider, modeled using Artec Studio 10 and 11, and reduced using Maya 2015.

Conclusion and Future Work

We present ARTLens, an AR application on the Microsoft HoloLens that augments an African Art exhibit using gaze, air-tap gestures, and whole body interaction (i.e. walking). We designed ARTLens to increase engagement and facilitate learning of the African mask collection, without detracting from visiting the exhibit in-person and viewing the original artifacts. We plan to evaluate the visitor engagement and learning outcomes of ARTLens by deploying it in the Davis Museum at Wellesley College.

Acknowledgements

We thank Jordan Tynes and LTS, the Davis interns, Davis staff, especially Mark Beeman, Craig Uram, and Julia Bregeron.

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