# [DEMO] Augmented Reality Storytelling Application for Riot 1831 Exhibition

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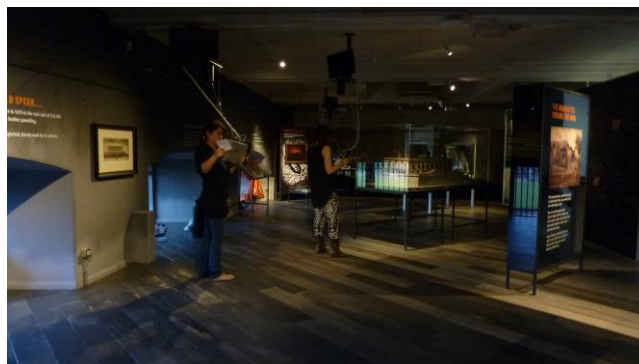Nottingham
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Riot 1831@Nottingham Castle is an exhibition that uses an augmented reality mobile application (ARMA) to tell the story of one of the most significant events in Nottingham Castle's History. In October 1831 the building was set alight by rioters protesting against the Reform Bill. That night left a legacy, a unique combination of diverse first-hand witness accounts and museum objects that our ARMA brings to life.

The exhibition presents a range of different museum objects taken from this era and uses them to trigger the augmentations. The ARMA uses object tracking technology to superimpose; 3D real-time computer environments, animated first-person performances and sounds onto and around the live objects. This allows the visitors to simultaneously interact with and experience the events of the 1831 Riots at the exhibition (see Figure 1). Visitors can explore the exhibition using their personal mobile device in a range of different ways, providing a unique range of interactive experiences.
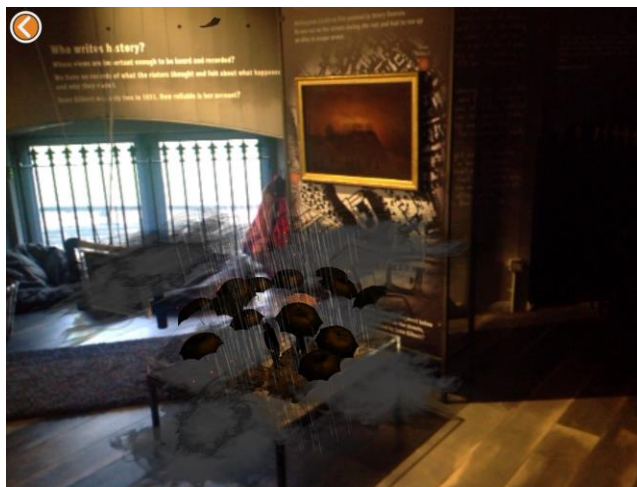
Figure 1. Screenshot taken from Riot1831 application.

Like many heritage sites the existing "history offer" is passive, word-based and it can be challenging for visitors to relate the collection on display to the history of the heritage site. An integrated digital approach will encourage a deeper engagement with the collection. The curatorial relationship between the digital and physical displays are carefully considered. iPads are dispersed throughout the space, positioned in front of paintings and objects in display cabinets making the ARMA accessible to all visitors (see Figure 2). In addition free Wi-Fi is provided in the gallery space for visitors who wish to use their own mobile devices.

Figure 2. View of Riot1831@Nottingham Castle Exhibition

The workflow pipeline includes - Autodesk 3dsMax for low polygon model creation, application of materials, character rigging, animation of characters and creation of scenarios. Unity is the authoring tool used to combine 'device ready' 3D model assets and animation for export and authoring of AR compliant scenes - Metaio SDK is used to track real world objects and images for the ARMA.

This augmented reality research project places storytelling at its heart by integrating traditional theatrical and cinematic narrative techniques and aims to develop new ways to use this technology for storytelling, learning and audience engagement. The project has collected data about the audience and their engagement with this exhibition. The project uses mobile eye tracking technology to record the visitor's eye focus alongside ethnographic studies of their movements and behavior. Qualitative and statistical data was collected using focus groups, questionnaires and interviews. Data regarding the Application use such as new users and session dwell time was also collected using Google Analytics.

Our ongoing research aims to evaluate how effective this technology is for providing creative and engaging experiences within a range of contexts where storytelling is key. The information at present suggests that the technology is readily accepted by a broad demographic because its use excites them and it can be used in a number of ways to help them engage.

Each object offers the visitor a different kind of interactive experience making use of touch screen interactions, motion accelerators and gyroscopes. These different interactions create an experience which is performative in nature with the audience exploring the space to find animations and hear sounds using a range of gestures, putting them at the center of the action as they move the device, up, down and around the scene (see Figure 3).

Figure 3. Visitors explore animations and sounds above them

Using this technology for public display was a challenge. The application had to be usable for a wide range of smartphones and tablets and techniques were adjusted so that they worked with as wide a range of hardware as possible. While smart phones have the processing power equivalent to a standard games console, this task is processor heavy. The camera runs in the background looking for 3D objects and recognising them, even before processing the augmentations to screen and running the interactive application. Therefore producing the content became a case of carefully balancing the number and size of tasks that the device had to perform simultaneously for example by faking animated effects and reducing the polygon count of 3D objects.

Stress tests were used to assess the optimum use of polygons for rendering these objects at thirty frames per second. This helped us to streamline the demand on the processor and avoid overloading its capacity (see Figure 4).

Figure 4. Stress tests used to help design

19th Century Artists, didn't paint with augmented reality in mind and some objects were more difficult to use as a trigger than others, particularly the ones which we were not able to fully light due to their delicate nature. This was compounded by the museum context where artefacts are protected behind glass. In some cases we had to choose a different object or rearrange the display design.

Some of the biggest difficulties were with the management of battery power. In addition to the power demands of the processor you have the Wi-Fi and bright screen display draining the battery of the mobile device. The installation and use of permanent iPad devices in a public space was significantly more challenging than anticipated because of this as it had an impact on the management of charging the devices, turning them off at night, and then on in the morning early enough to fully charge.

Since the exhibition has been launched in early July several hundred visitors have used the exhibition, including 170 who have downloaded the app to use on their own devices and to date no crashes have been reported. The installation is currently undergoing some final improvements, in response to user feedback and observations collected during this time.

The flexibility of mobile technologies gives museums the possibility to tell stories in innovative ways, to share and create a living history experience for their visitors. Digital storytelling can bridge the gap between explicit information and implicit knowledge that museums and heritage sites often struggle with balancing. In this case augmentations allow us to strip the objects of the written labels and plaques and reveal their historical relevance in a more memorable way.

This demonstration will provide the opportunity to experience some of the AR stories developed for the exhibition by using the tablets provided or by downloading the free application onto personal mobile devices. Visitors to the demonstration will be able to use the Riot1831 application to trigger augmentations using copies of the trigger images from the exhibition. Video showing examples of the exhibition in use, visualizations of the eye tracking study and project presentations will be on display and access to the project website and YouTube Channel will be provided.