The Augmented Van Gogh's: Augmented Reality Experiences for Museum Visitors

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ABSTRACT

To mark the completion of the restoration of Van Gogh's painting 'The Bedroom', and as part of the Friday Evening events organised by the Van Gogh Museum, the AR Lab was asked to develop three installations dedicated to the exhibition 'Paul Gauguin: The Breakthrough into Modernity'. With these installations we aimed to make it possible for visitors to discover paintings by Van Gogh in a playful and exciting way. One of the installations features the painting 'The Bedroom' which is shown on a large screen, and by using a digitally modified spray-can, visitors can reveal information about the painting normally not accessible, like x-ray, infrared and ultra violet images, or even the back of the painting.
We will describe and later discuss these experimental augmented reality installations, and reflect on the lessons learned in order to make interaction with cultural heritage more exciting.

KEYWORDS: Augmented Reality, Cultural Heritage, Innovative Visualization Techniques, Design, Interaction.

INDEX TERMS: D.0 General Software; D.m Miscellaneous; K.3.0 Computers and Education; K.3.m Miscellaneous; K.4 Computers and Society; K.4.m Miscellaneous

1   INTRODUCTION AND CONTEXT

To emphasis the 'modernity' in their exhibition '*Paul Gauguin, The Breakthrough into Modernity*' the Van Gogh Museum wanted to make use of augmented reality, identified by them as exciting new technology. Previous installations we developed for Dutch museums Museum Boijmans van Beuningen, Kröller-Müller Museum, and Escher in the Palace, taught us that modern interfaces lead to interaction and thus enhance the user experience.

Students of the Royal Academy of Art The Hague, where the AR Lab is based, were involved in these projects. As part of their elective programme, students could sign in to participate in this cultural heritage programme. Wim van Eck, who works at the AR Lab, supervised the projects. The students involved were Marieke Bijster, Joris van Dam, Martin Hoorweg, Hannah Mjolses, Matthijs Munnik, Alrik Stelling, Susanne Vruwink and Arjen Zuidgeest. After brainstorming, the students came up with a variety of interaction possibilities that involved augmented reality. Finally, we realized three of these ideas, which we will discuss in the following sections, after a short detour to explain some characteristics of the way we use augmented reality.

2   AUGMENTED REALITY INSTALLATIONS

The AR lab conducts artistic and experimental research on three types of AR: screen-based which is seen on a monitor, projector or mobile phone, spatial AR using head mounted displays, and on a small-scale projection based AR. We use screen-based AR both with fiducial markers and natural feature tracking.

2.1   Interactive Installation: The 1.5 Markers

To enhance interaction both between the visitors themselves as with the artwork of Van Gogh, students came up with the idea to separate fiducial markers into two pieces, printed on cardboard together with a complete marker (Fig.1). These halves can form various complete markers when held together with another card; in total there are 5 different cards.
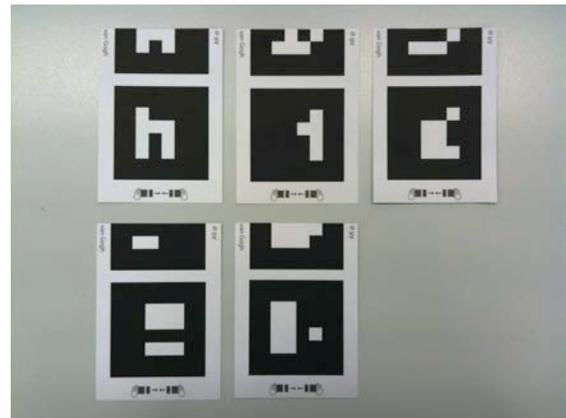

Figure 1. The 1.5 markers

When a visitor holds such a marker-card in front of the camera (which is positioned on top of a screen) (fig.2), a 3d object appears on top of the card on the screen. Depending on which of the five cards, this can be Van Gogh, Gauguin, the yellow house in Arles, Madame Ginoux, or the painting 'The Sunflowers'.

Figure 2. Interacting with the 1.5 markers

When two halves of these 1.5 cards are combined, a third 3d object appears in between the two before mentioned objects

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(fig.3). This extra object shows the relationship between the objects on each card. Visitors can try out the various combinations. If one would for example combine Gauguin and the yellow house in Arles, the painting 'Landscape with Carriage and Train in the Background' will appear.

Figure 3. Combining two cards

Other objects are for instance a chair from the painting 'The Bedroom', or a billiard table from the famous painting 'Night Café'. Some of the 3d objects were also animated: the AR 'Skull of a Skeleton with Burning Cigarette' is actually virtually smoking and the train from the 'Landscape with Carriage and Train in the Background' is moving and has steam coming out of its chimney.

2.2   Interactive Installation: Face Tracking – 'Wheat Fields With Crows'

Another project is making usage of face tracking: the eyes and nose of a person are captured by a camera and used as a triangular 'marker'. The setup consists of a computer monitor with a camera attached to its top. On the monitor a virtual environment (fig.4) is shown, based on Van Gogh's painting 'Wheat field with crows' (fig.5).

Figure 4. The virtual environment

Figure 5. The original 'Wheat Field with Crows', by Vincent van Gogh

When a visitor looks at the virtual environment, it is possible to navigate through this environment using movements of the head. By moving your head towards or away from the monitor you can move forwards or backwards into the painting. Rotating your head allows you to look around in the environment (fig.5). FaceAPI from Seeing Machines is used for the face tracking, Unity3d is used to render the virtual environment.

Figure 6. A visitor interacting with the virtual environment

2.3   Interactive Installation: The Bedroom

The most appealing installation however was 'The Bedroom' (fig.7), based on the painting Van Gogh painted in October 1888, when he was living in the Yellow House in Arles. Various types of captures have been made of this painting as part of a large-scale research by the Van Gogh Museum. This happened in close cooperation with the Netherlands Institute for Cultural Heritage (ICN), Shell Netherlands and more than 30 researchers from different disciplines in and outside the museum. These captures are made with professional, industrial and medical digital imaging equipment. The museum has x-ray, ultraviolet and infrared image modalities at its disposal as well as high-definition recordings illuminated from diverse angles (bottom, top, left and right). Many museums possess such spectacular captures of their treasures for archive and restoration purposes, but these are generally not accessible to the public. Our installation exposes such captures to the public using a playful interaction method.

Figure 7. Overview of the set up, including the Wiimote on the tripod

We created a digitally modified spray-can (fig.8) with which the visitor can 'spray' on the painting (which is displayed on a large screen), and by this temporally reveal the various modalities of 'The Bedroom'. The spray-can emits infrared light, which is bounced of the screen and captured by a Wii-controller which is pointing towards the screen (fig.9). The software 'Wiimote Whiteboard 1' enabled us to track the position of the spray-can relative to the screen. On the right side of the painting we positioned digital buttons that enables the user to choose between the various image captures (fig.9). The user can choose between infrared, ultraviolet, x-ray, the back of the painting, and illumination from the left, right, bottom, and top. Figure 7 shows not only the monitor with the digital paining, but also the tripod on which the Wii controller is anchored.

Figure 8. The digitally modified spray-can

Figure 9. A visitor selecting the ultraviolet capture

3   LESSONS LEARNED

Presenting these installations at the Van Gogh Museum gave us the opportunity to observe the responses of the visitors. The following sections describe the lessons we learned.

3.1   Lessons Learned: The 1.5 Markers

The majority of the visitors seemed to enjoy interacting with the augmented cards. We could see visitors recognizing 3D elements of the paintings of Van Gogh, other visitors seemed to be mostly fascinated by the augmented reality technology. The fact that two cards can be held together to reveal a third object was noted by few visitors.

We printed one thousand markers, providing information about our AR Lab on the back; this way the abundance of markers had a marketing aspect as well. Visitors, when entering the exhibition hall, spontaneously took one or more of our markers from a pile and brought them to the screen. However, after interacting with one of the three monitors we had available they did not take them away again which soon resulted in a table overfilled with markers. **Lesson learned**: with frugal availability of markers, the mini-stories could have been better understood because of their exclusiveness. Having three monitors on one table was stimulating and resulted in a lot of interaction between the visitors themselves.

3.2   Lessons Learned: Face Tracking – 'Wheat Fields With Crows'

The 'Wheat Field with Crows' installation can only be fully experienced by one person at a time, although other visitors can still have a glimpse of what is happening by looking at the relatively small screen. Unfortunately, the calibration of the tracking had to be adjusted many times due to a bug in the code. We also encountered another problem: the faces of people with glasses were tracked less accurate. **Lesson learned**: this technique is not yet solid enough for a crowded public place. Moreover, it will be more rewarding when other visitors can easily see what is happening on the screen as well. Hence, using an additional large external screen will give more visitors the chance to enjoy this installation.

3.3   Lessons Learned: The Bedroom

We showed this installation on two occasions: once as part of the Museums activities in the framework of the exhibition *'Paul Gauguin, The Breakthrough into Modernity'*, and once as part of the 'Uitmarkt', the national opening of the cultural season and the largest cultural festival in the Netherlands. For the presentation at

the 'Uitmarkt' we enhanced the performance of the "Bedroom" installation by adding more modalities of the painting, making the Wii tripod more solid, and we used a better constructed spray-can. In both setups the audience was very enthusiastic: many visitors wanted to use the spray-can; with over 500 visitors, supervising this is quite intensive.

People were thrilled that they could interact with the painting in this way and could reveal an x-ray image in which one could see the actual nails with which the canvas has been secured onto the frame. Also very exciting was the view of the back of the painting in which some handwriting of Vincent's brother Theo could be seen. This meant that we had to deal with many people assembling in front of the screen and blocking each other sights and more importantly, blocking the Wiimote, which is needed to track the position of the spray-can. Thus, a crowd of people can easily disrupt the stability of the system. This was the biggest problem we encountered. The small crowd in front of the screen could also unintentionally move the tripod on which the Wiimote was placed and thereby disturbing the calibration. This was the second biggest problem. Also the spray-can itself was fragile and had to be handled with care. The performance of the spray-can was best if one would hold it in front of the screen at a distance of roughly one centimeter, in a slight angle so the infrared beams would reflect better towards the Wiimote. With rushed visitors trying to see all museums of Amsterdam in one day, such distortions occurred regularly. Our last and fourth problem was 'unwanted interaction'; people started to touch the screen even though it was not a touch screen!

4   CONCLUSION

For us interaction proved to be a very effective method to enhance the experience with cultural heritage.. Augmented reality proved to be a very suitable although relatively new and hence unknown technique. For museums with many visitors, one has to prepare 'idiot-proof' installations, as due to unfamiliarity with the technique, visitors can easily disturb the performance. Based on our installations, we can conclude that when interactive experiences are offered with a Van Gogh painting, one has to deal with large crowds.

To secure optimal performance of our future AR installations (e.g. the *'Van Gogh's studio practice: Canvases re-used'*, June 2011-June 2012) it is essential curators, artists and technicians combine their knowledge, skills and inspiration.

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