Poster

The Spectare device for experiencing stereoscopic photographs

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Abstract

Stereoscopic photography was one of the main forms of visual communication in the second half of the 19th century, leaving even today an important impact on our visual culture. In this work, we have re-imagined the classical stereoscope in order to take advantage of smartphone-VR technological capabilities, while still trying to maintain a viewing experience close to the original. This poster describes the design and operation of the Spectare device for experiencing stereoscopic photographs.

CCS Concepts
• Human-centered computing → Virtual reality; Displays and imagers;

1. Introduction

Stereoscopic photography was invented virtually at the same time as conventional photography and, in fact, became one of the most influential forms of visual culture in the entire second half of the 19th century [Gre18]. Viewing these photographs requires a stereoscope and perhaps the most well-known model is the Holmes stereoscope (Fig. 1a). Our motivation is to create a viewing experience for Cultural Heritage (CH) content that resembles the original viewing experience of stereoscopes, with current smartphone-based VR technology. By recreating aspects of the original stereoscope usage experience to view digital Virtual Environments (VEs) we hope to provide a more engaging and memorable CH experience. We have developed the Spectare device, which keeps essential elements of the stereoscope such as the physical action of placing/removing the stereo cards, adjusting their position on the arm of the device, and the physical act of bringing the device close to the eyes. The experienced content, however, is not limited to stereo photographs and can include any digital VE. It should be stressed out that, although Spectare is similar to a Google Cardboard, it provides a very different user experience. On the one hand, the experience is very similar to the one provided by a Holmes stereoscope, which was what we were trying to emulate. On the other hand, it effectively constitutes a tangible interface where the physical stereocards represent digital content and a simple way to interact with

that content. This poster describes the design concept, and implementation details of the Spectare device for CH exploration.

2. Related Work

Custom Virtual Reality (VR) viewers inspired by stereoscopes have been applied to CH fruition in previous studies. Petrelli [Pet19] developed the "Steampunk viewer" – a device similar to the Brewster stereoscope – in the context of a visit to the Dr. Jenner's House Museum and the Trajan Museum. Content is triggered by Bluetooth beacons spread throughout the museum. In Spectare, we wanted a deeper connection to the original experience of using a stereoscope: the content displayed is associated with a "stereo card" that users manually place in the device. Ciolfi et al. [CPG*13] developed "Binoculars", an augmented reality display with a form factor that resembles binoculars. The device allows users to insert a smartphone that displays augmented reality information during visits to the Sheffield General Cemetery. The device itself is simply an enclosure for the smartphone, providing a different way to hold the smartphone as if one is looking through binoculars. It shares the purpose of the "Spectare" device: to enhance the user's experience by providing a custom tangible device that fits better into a given context.

3. Design of Spectare

The main goal of the Spectare device is to recreate, and re-imagine, the experience of viewing stereoscopic photo cards using a smartphone-based viewer. Operating the device is reminiscent of the form and operation of a late 19th-century stereoscope. However, it allows viewing richer digital content such as 360º images, audio, or even 3D models.
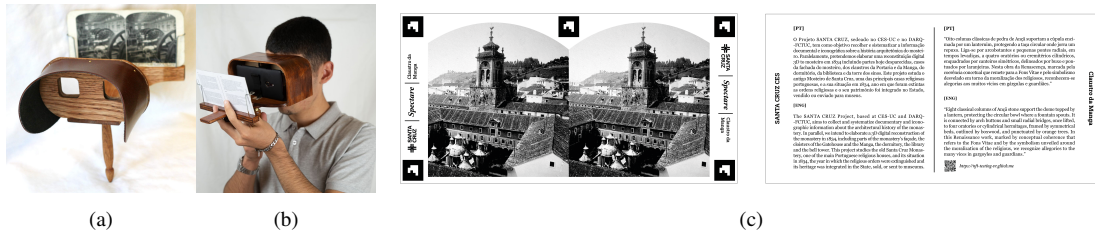
Figure 1: *a) Holmes stereoscope (photo by Davepape on en.wikipedia); b) Spectare device; c) Stereo card.*

3.1. Prototyping and Physical Construction

Several prototypes were created before the final physical construction solution was reached.

Some of these prototypes were made to test specific elements of the device such as the lenses' adjustment and smartphone locking system. Initial prototypes were made using paper (Fig. 2a), but
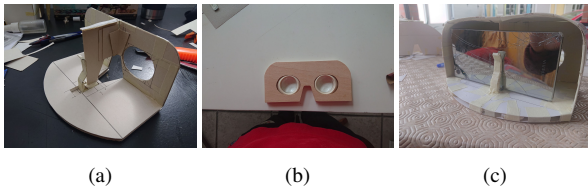

Figure 2: *a) Cardboard prototype; b) Final lens mechanism; c) Smartphone gripping mechanism.*

with an internal structure similar to a honeycomb to provide rigidity. These allowed to test: the overall size of the face, the size of the aperture for the nose, the distance between the holes for the lenses, the size of the posterior arm that holds the stereo cards, the sizing of the case for holding the smartphone. Other prototypes were built to test specific mechanisms such as the distance adjustment between the lenses (Fig. 2b). Still other prototypes were made to test the smartphone clip mechanism (Fig. 2c). The final device is made almost entirely of wood (Fig. 1b).

4. Experiencing Coimbra Demo

We designed a stereocard with five barcodes to support a variety of smartphones with different camera placements (Fig. 1c). The software that runs on the smartphone is a web page implemented using the A-Frame VR framework (https://aframe.io). This allows users to simply load a web page in their smartphone's browser (or scan a QR code available in the back of the stereo cards) and then place the smartphone inside the Spectare device to start the experience. Although there is no limitation to the type of content that can be displayed, we are currently focusing on experiences that display stereo or mono photographs or digital images, 360° photos or videos, soundscapes. We have also implemented the possibility of calculating the distance between the smartphone and the stereo card and use this as an additional degree of freedom. We have developed a demonstration, based on locations in Coimbra, Portugal. The experience uses four cards. The first card displays a stereo photo of the historic center of Coimbra, from start of the
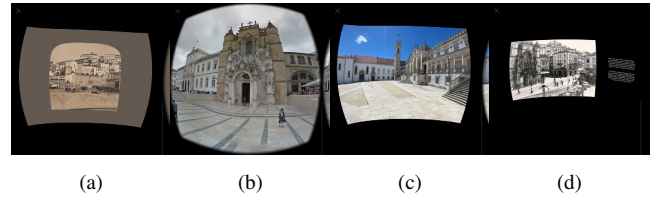

Figure 3: *Contents of the demonstration Spectare experience. a) Stereoscopic photo of the historic center of Coimbra; b) Praça 8 de Maio in 360°; c) University Palace; d) Soundscape.*

20th century. The second card displays a current 360° photo of the "Praça 8 de Maio", where the town hall is located. The third card displays a photograph of the University Palace, now occupied by the Rectory. In this card, moving the card holder to the front or to the back of the arm will display a photo from the early 20th century or a contemporary photo of the University Palace. The fourth card will display a recreated soundscape of the "Praça 8 de Maio" in the 1950s as well as an accompanying photo from the same time.

5. Conclusions and Future Work

We have designed and implemented the Spectare device inspired by the Holmes stereoscope for experiencing digital content through a smartphone device. The goal is to recreate the original viewing experience and develop a device that "fits" into the experience of exploring 19th-century cultural heritage. This device updates the original experience, allowing users to see stereoscopic images but also 360° images or videos and hear the associated soundscapes. We are currently conceiving a tour of the digital reconstruction of the Monastery of Santa Cruz in Coimbra as it was in 1834 using the Spectare device.

References

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