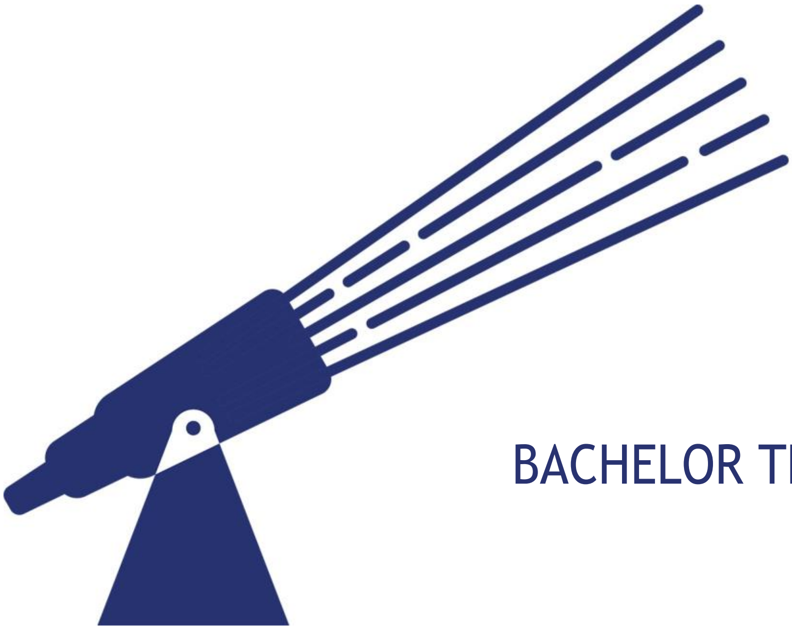
Two Page Summary



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The thesis covered several improvements in AR viewers. More specifically, it outlined the issues with a current model of the FATscope, which is an augmented reality viewer made by the Dutch creative agency, 100%FAT. 100%FAT (Fusion of Art and Technology) is the producer of custom interactive installations that combine hardware, software, and content to produce interactive experiences for knowledge institutions such as museums, expositions, and universities. Their latest venture, the FATscope, allows the user to see live images of the surrounding area with information and animations overlayed by a computer in real-time. The FATscope is intended to be placed in the A'DAM Tower in Amsterdam, across the river from the central station (figures 1 and 2).

In total there were four separate projects that each focused on different elements. The first project focuses on trying to solve the problem that sunlight creates when being focused onto the screens inside the viewer. Lenses are used in the viewer to create a larger field of view for the user when looking at the screen. However, the lenses also work in reverse, meaning that direct and indirect sunlight is allowed to focus onto the screens, and in some cases, allowed to create burn marks. The project was done in the format of a two-week design sprint in order to still be able to implement the design changes into version one of the FATscope before its installation at the A'DAM Tower.

At the start of the project, two solutions were discussed in meetings with 100%FAT. One solution was a set of flaps with a motor beside the viewer to rotate a small axle on which flaps were mounted (figures 3 and 4). The motor would rotate to the upwards position and back down again through the use of a sensor. The other option was to place two polarization filters in front of each lens. Using one gear in the middle of the two innermost filters of both lenses, a motor could drive the filters to a 90° position from the first filter (figures 5 and 6). Pitching these ideas at a meeting with 100%FAT, it was concluded that for further iterations of the FATscope, the flaps concept would be more ideal.

The final design included a photoresistor and a stepper motor. The stepper motor was triggered to by the resistance in the photoresistor which opened the flaps up and allowed the user to see inside.

The second and third projects were research projects. The first of which was to try and find out why some users seem not to like how it feels to look through the viewer. This was done by creating a set of 5 viewers, each with the same core element, the only difference being lenses. This made the test repeatable and reliable. The viewers ranged from a long focal length with shallow field of view, to a shorter focal length with large field of view. The test was to compare the different lenses with each other and ask participants whether round or square edges on the inside of the viewer were more preferable. In the end it was concluded that a longer focal length lens with a rounded border is the best solution for a telescope-like design (figure 7).

The third project was to determine the best way to make the FATscope more intuitive. The current model of the FATscope has to make use of stickers that show the user what the button functions are while other consumer electronic devices do not have to employ similar stickers. This realisation prompted three separate button configurations that were tested for intuitiveness. The first was a viewer with a set of four buttons modelled after camcorders and SLR cameras. The second was closely modelled after modern videogame controllers and the final design was inspired by the turning motion required on binoculars and cameras to focus or zoom with them. The conclusion was that a select button in a very similar position to a camera shutter was the most intuitive, along with a dial for zooming in and out (figure 8).

The final project began as an idea to improve the resolution of the FATscope. This resulted in a recommendation for an entirely new viewer concept. The project became an attempt to break the FATscope free of the standard VR viewer mould and instead rely on older telescope designs to increase the realism of the image inside FATscope. As it turns out, image projection can be just as bright as modern LCD displays, which makes a reflector telescope with its characteristically wide aperture, the perfect device to project an image onto the back of a translucent display. This would effectively increase the resolution of the FATscope by an infinite amount. Only the AR component would have to be digitalized, meaning that the AR component would be the only thing bound by the resolution cap in the screen. Instead of having a camera relay the image to the screen as well, the user would experience the real world as he normally would. This mere proof of principle could be the basis for a newer generation of AR viewers with more realistic resolution.

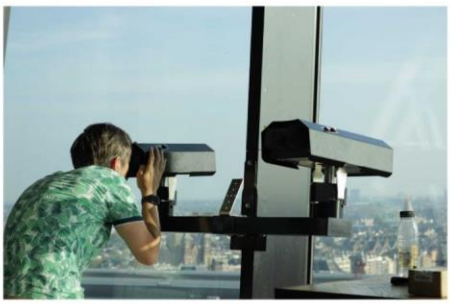

Figure 1. FATscopes A'DAM Tower

Figure 2. FATscopes A'DAM Tower

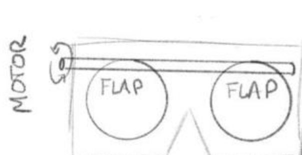

Figure 3. Flaps design sketch

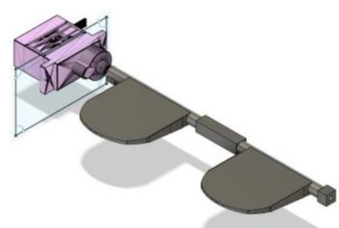

Figure 4. Flaps initial CAD design

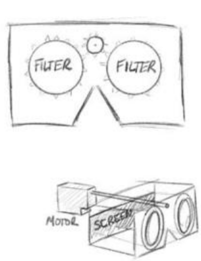

Figure 5. Polarization design sketch

Figure 6. Polarization prrof of concept[1]

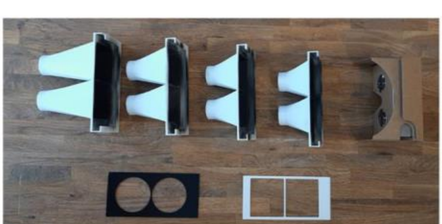

Figure 7. Project 2 Lens test setup

Figure 8. Project 3 interaction test setup

Figure 9. Telescope proof of principle

Figure 10. Telescope proof of principle

Figure 11. Telescope proof of principle

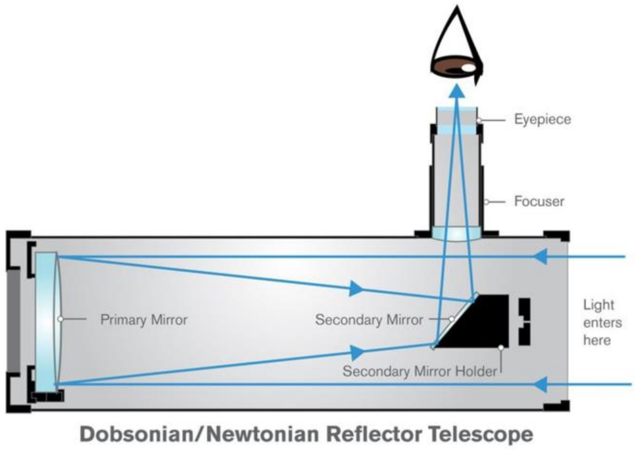

Figure 12. Newtonian telescope diagram[2]

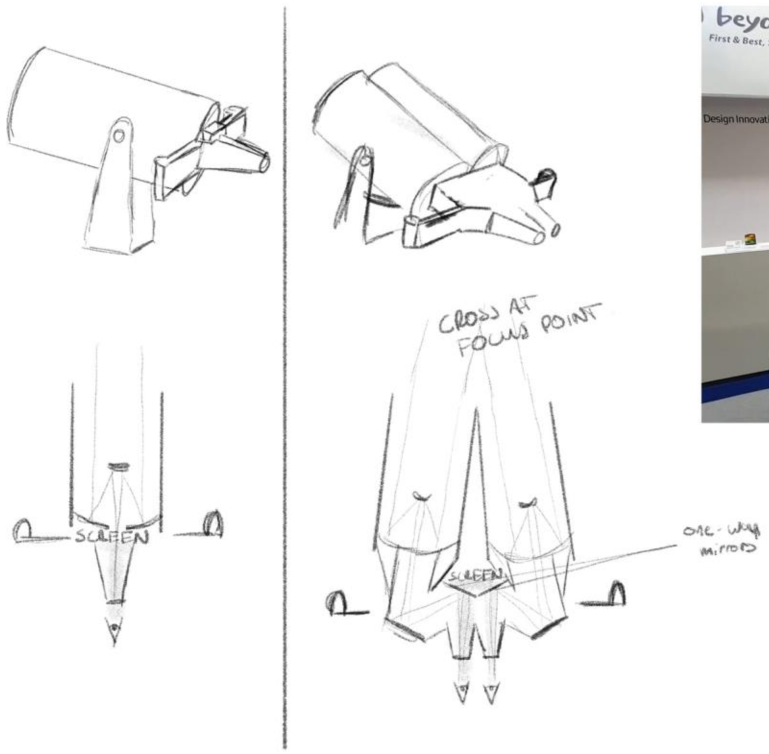

Figure 14. Transparent AMOLED display[3]

Figure 13. Final Concept sketches

Sources

1. Minutephysics, 3Blue1Brown. Bell's Theorem: The Quantum Venn Diagram Paradox [Internet]. YouTube. YouTube; 2017 [cited 2021Jul16]. Available from: https://www.youtube.com/watch?v=zcqZHYo7ONs&t=62s
2. The Ultimate Guide to Celestron Optical Tubes [Internet]. Celestron. 2020 [cited 2021Jul17]. Available from: https://www.celestron.com/blogs/knowledgebase/the-ultimate-guide-to-celestron-optical-tubes
3. 2K Transparent OLED Display for Windows [Internet]. YouTube. YouTube; 2021 [cited 2021Jul17]. Available from: https://www.youtube. com/watch?v=wudfkWy5Fk8