Interactive Simulation WS 15/16
Project Proposal

EYES - Exchange Your Vision Simulator

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1. INTRODUCTION/MOTIVATION

- Give people the opportunity to experience different symptoms of eye disease, to know what they are and how to fight them for example nightblindness can caused by a wrong diet $\Longrightarrow$ so help people to eat the right food.
- Supposedly there is already a real-time simulator for eye diseases for Android, although we were not able to find it on Google Play Store for our phones [15].

2. CONCEPT

- Fulfill everyday tasks with impaired vision
- Possible boni:
  - Get rid of disease by performing the right actions e.g. take medication on the way or make a doctors appointment...
  - Preventive measures during the task to not get disease in next lvl
- Target platform: Android & Google Cardboard to address many people

2.1 User Experience

User should be able to experience different types of eye diseases, including their early as well as the severe stages, in order to understand when to consult a doctor and why. Hopefully this gives people better judgement on when to visit a doctor as well as the courage to do so, if they experience the symptoms of a particular disease.

3. PROJECT REQUIREMENTS

Vinnikov *et. al.* [VAS08] developed a Gaze-Contingent Display in order to evaluate the users eye direction and adept the displayed images in real-time. That way they were able to create realistic results because the effects of eye diseases are mostly following the eye movement since the eye itself is affected. Thus tracking the eye direction and using that information to adjust the generated

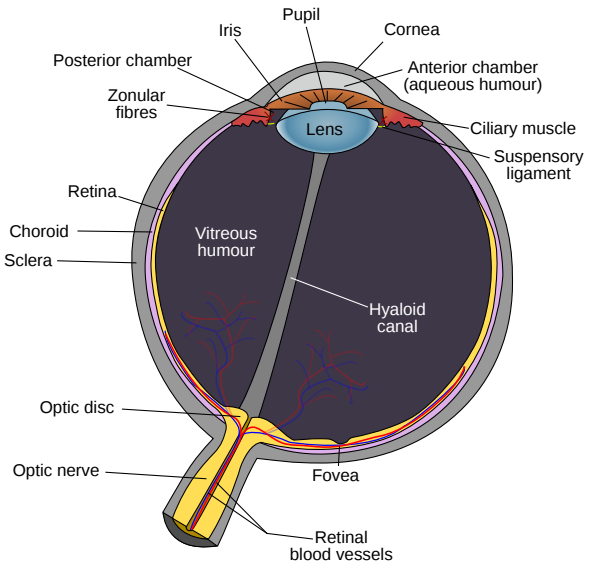

Figure 1: Scheme of the human eye.

image accordingly presumably yields better results on VR devices than displaying fixed images.

Contemporary mobile phones usually have two cameras, one at the back side and one on the side of the dislay. The latter one can be used for video calls or selfies. Yet, in this project it could be useful for acquiring the gaze direction of the eyes when using the Cardboard. Since the screen of the phone is lighting the eyes, they should be well visible. Two other problems are that the processing power of mobile phones is limited and the there might be no way of accessing the phones camera directly from a Unity3D program. The latter could be addressed by a seperate app which acts as a gaze-direction server with which the simulation is communicating via some inter process communication mechanism. The other problem of the limited processing power is subject to further research ;).

The gaze-direction would also be useful to accurately simulate the depth-of-field for some diseases like cataract.

Glaucoma

Cataracts Blurred vision especially in the center region.

Diabetic Retinopathy Black spots in the view

Color blindness Some colours appear undistinguishable.

Achromatopsia (Almost) No color sensitivity at all.

Myopia/Hyperopia Commonly known as nearsightness and farsightness respectively.

Kreatoconus Cornea shape converges to cone
Multiple ghost images! (chaotic pattern), blurry vision, visual acuity at all distances, poor night vision photophobia, eye strain
No to little pain
Differently strong in both eyes

Nyctalopia/Hermalopia High difficulty to see in relatively low and bright light respectively.

Retinal detachment/Posterior viterous detachment Flashes of light, very brief in the extreme peripheral region.
Sudden increase in the amount of floaters.
Slight feeling of heaviness in the eye.

4. TIMELINE

References

[15] *Leading Eye Diseases*. Braille Institute of America. 2015. URL: http://www.brailleinstitute.org/sight-loss-blog/398-leading-eye-diseases.html (visited on 10/27/2015).

[VAS08] Margarita Vinnikov, Robert S. Allison, and Dominik Swierad. "Real-time Simulation of Visual Defects with Gaze-contingent Display". In: *Proceedings of the 2008 Symposium on Eye Tracking Research & Applications*. ETRA '08. Savannah, Georgia: ACM, 2008, pp. 127–130. ISBN: 978-1-59593-982-1. DOI: 10.1145/1344471.1344504. URL: http://doi.acm.org/10.1145/1344471.1344504.