The Eye of R.G.L.
Part One

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Abstract:

This paper reports the work done in the Advanced Computer Animation class (CS231). The work focuses on the creation, modeling and animation of an iris skeleton. This work does not focus on the looks of the iris but rather on its movement. The iris skeleton was created in Maya software and the modeling of the movement was done in C++ with OpenGl.

1-Introduction:

The iris has its name given from the ancient goddess Iris, daughter of Thaumas. She was the personification of the rainbow and a messenger between earth and heaven.

The human iris is the colored part of the eye and the only muscle that is exposed to eye-sight. Its function is to moderate the amount of light that enters into the pupil which is the black hole in the middle. Depending on the situation the iris will expand to make the pupil smaller or contract to do the opposite.

The iris has two muscles composing it. The sphincter which is the one ring surrounding the pupil and the dilator which goes from the sphincter to the sclera, the white part of the eye.

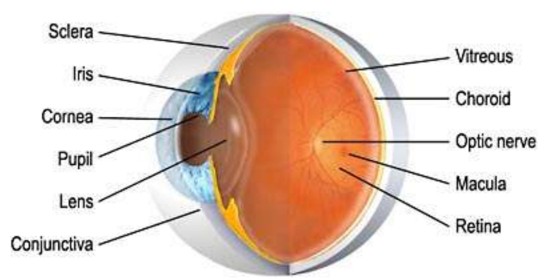
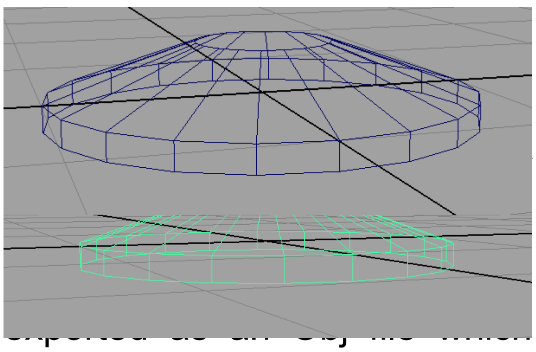


Fig1. Components of the Eye. Iris is the only exposed muscle of the human body.

2-Model:

The iris model was created using Maya software. It was then simplified to its most basic expression by getting rid of faces and springs not used. The outcome is a rigid body iris skeleton which will later be transformed into a spring-mesh particle system.



exported as an obj file which consists of its vertices, edges, normals, materials, etc.

3-Engine:

The engine behind this model is based on code for Breathing™ by Zordan et.al. This code is capable of reading in the obj file and create a spring mesh of it. In other words this program will convert the structure created in Maya into a spring-particle system.

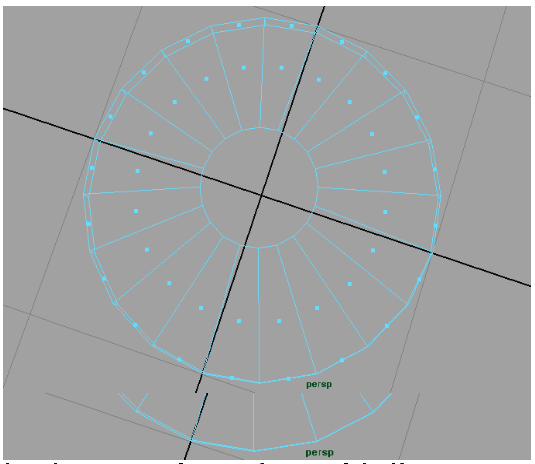
4-Some Challenges:

Once at this point the problem was to understand the given code to be able to modify it and adapt it correctly. One of the biggest problems with the code is that it was poorly documented, but the good side is that it did its job really well.

The next step was to differentiate between the springs that corresponded to the dilator, the sphincter and the base. The base is basically the outer ring of the iris. In a human eye it is the part that is attached to the sclera.

I then proceeded to categorize the springs by checking the height of the particles with respect to the Y axis. The particles in the top y's would have to correspond to the sphincter. If a spring had particles above and below the threshold then they would correspond to the dilator and finally the spring that have both ends below the threshold would have to belong to the base. This approach has to be improved as it clearly has problems when the model opens all the way and then everything becomes part of the base. In principle this should not happen given that the iris should not be able to open up beyond certain radius as it is a muscle and has limits in its contraction.

Materials where added to the model in Maya to accompany the differentiation of the muscles in the iris.



is the rest length multiplier.

This is calculated in the code and in order to achieve an animation we have to change the rest length of the spring so that the computation of the forces acting will move the spring. Basically the spring will always try to be at its rest position, when this one changes then it will move towards achieving this goal.

The first approach was to drastically cut the rest length and then compute the forces which will animate the iris. By doing this in the dilator springs we create a animation that goes too fast and that is not near the actual footage.

To smooth the transition between the initial and desired rest lengths we modified the calculation to cut the rest length in several steps as time passed. The actual implementation sums the initial and final rest lengths, divides in half and then updates initial rest length with the new rest length, doing this for several time steps until the difference between the actual rest length and the desired one is a very small amount compared with the original and final.

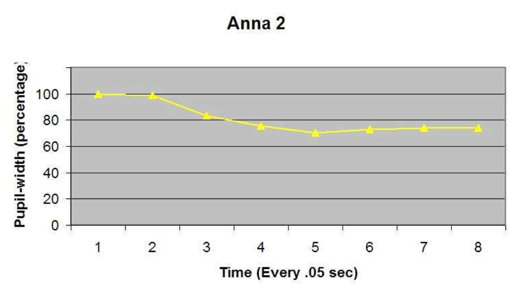


Fig4 Movement of iris in percentage Vs. time steps. We can see that the movement is smooth and not abrupt

6-Results:

The results where more pleasing. The iris was able to move from a fixed starting position to a desired final state in a smooth way. The calculations where done using the updating of the rest length in every time step and then recalculating the force. We also modified the K and b spring constants to achieve the desired effect. The actual animation was much closer to the real footage taken from real humans.

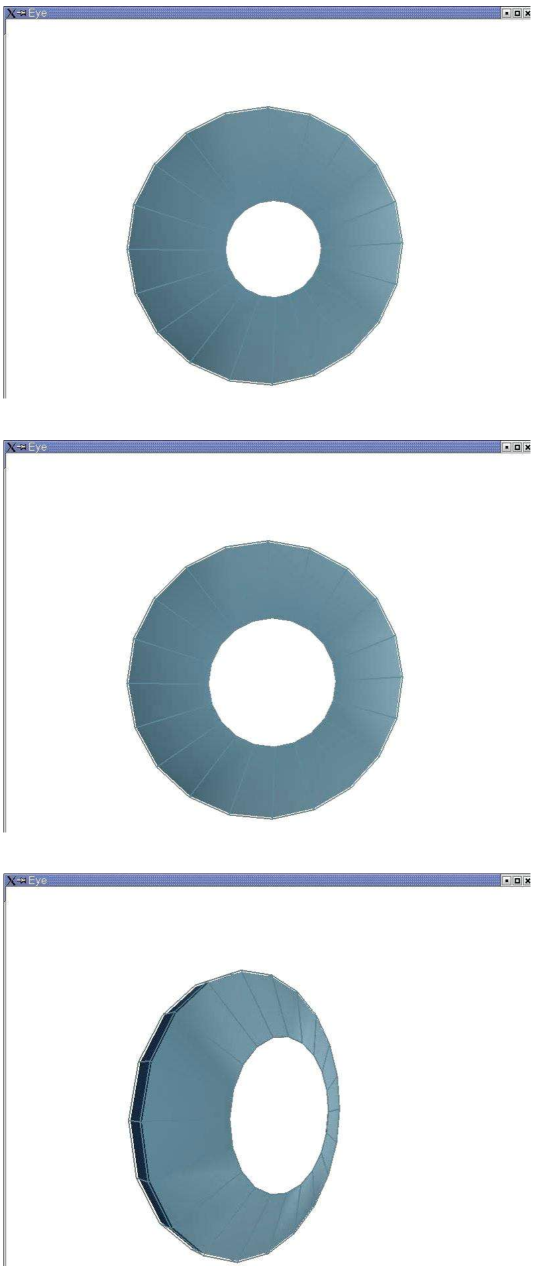


Fig5. The iris with colored parts in the dilator and base. Can be seen from initial to final position and with an angle.