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Idea and Inspiration

This project was based on the implementation of an orca whale that is an object in 3 dimensional space as viewed by a user on a 2 dimensional screen. The notion behind the whale's simulation is to construct an object that is able to follow the movement of the position of the mouse and is able to consequently update the whale's relevant position on the screen. However, in the process of doing so we were able to observe the different transformations being applied to the while during its travel from the previous position to the current position of the mouse. The idea was to be able to implement a 'realistic' change and transformation of the whale and in the process to be able to make all features of the orca whale prominent. Initially, we were of the view that all this could be achieved in 3 dimensional space **however we came to the realization after a conversation with Sir Murtaza Taj in the final week of the project due to which the project suffered to its core.** The whole point of the project was to build a successful implementation of an orca whale but according to Sir Murtaza Taj taking mouse coordinates on a 2 dimensional screen and converting that to a 3 dimensional world coordinate was in itself a project on its own due to which our 3 dimensional implementation had failed. A total of 3 weeks were spent on the 3 dimensional model and a total of 1 week was spent on the 2 dimensional model suggested by Sir Murtaza Taj. In this report, I will be talking about both models so as to explain the effort we have put in the first model and its implementation since there is a chance that the final product created for the 2 dimensional model might not appeal to you as much.

Research and Mathematical Insight

The construction of the whale in 3-D was done by amalgamating a series of cylinders and incrementing the values of the cylinders by a constant amount so that a linear change could be observed in the size of the whale along the cylinders. Initially, this linear approach did not give off a very 'smooth' feeling of the whale's body but then we found a solution that made this problem a lot simpler.

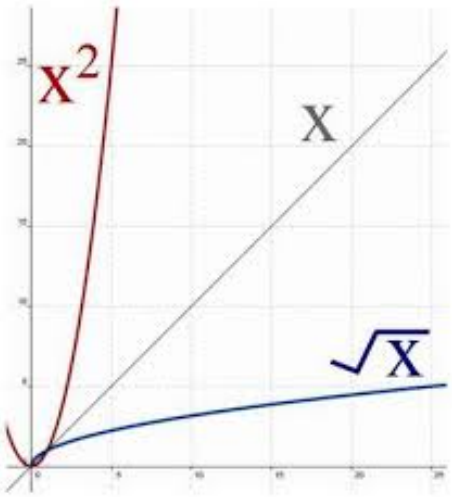

Figure 1.1: Comparison between the linear and square root of x functions for the body of the whale.

As you can see in the above picture, the initial approach we followed was along the y = x line where the radius of each cylinder would be along this line however, smoothing out the shaped of the whale's body would require a function like $f(x) = \sqrt{x}$ which allows us to get radii for the cylinders that would lie on this function. Implementing this approach, the body of the whale can be seen in the below figure.

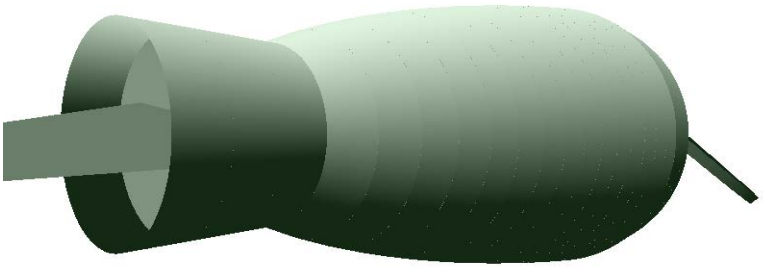

Figure 1.2

As you can see the surface of the whale's body is better than our previous approach that was shown in the mid project meeting.

One of the major implementation that we were successful with was the delay that had to be written for each of the individual disks of the whale so that a realistic feeling is given off by the whale's movement. The glutTimerFunction() was initially used to make this happened but the results were not very successful for multiple disks since every delay added up to the previous disk's current delay due to which after successive clicks the movement of the various disks went haywire. This problem was solved by introducing a dummy variable that was checked for each disk and incremented at each iteration the diplayfunction() after which each disk would move independently however in the same direction.

Misdirection and Independent research

This is the part to explain the hard work that went into making the 3D whale. The problem of taking the mouse input in 3 dimensions did not take seem like an issue that could render our project meaningless at the point. The notion behind taking a 2D mouse input and converting that into the 3D world starts when a ray is extended from the screen to the 3D world and the mouse click has to be adjusted accordingly. An independent project that utilizes this concept is given in the resources.

Challenges and Limitations

The challenges we faced in the first part as well as the second were abundant. In the first 3D part, we had many issues with the translation of the disks as well as the rotations of the fins in such a way that the positioning was accurate. The other issue in the first part was our attempt to use a Bezier spline to model the tail of the whale which we were able to do very much accurately.

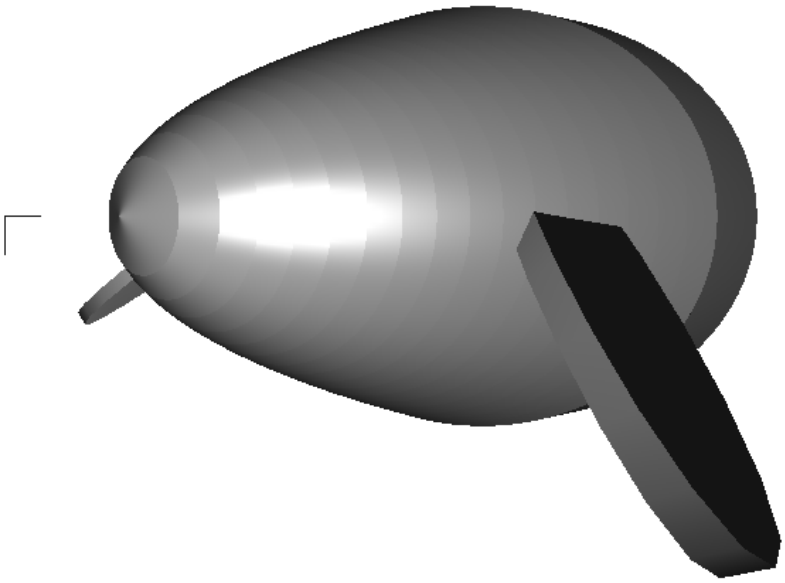

Fig 1.3: The orca whale after lighting effects and the square root implementation

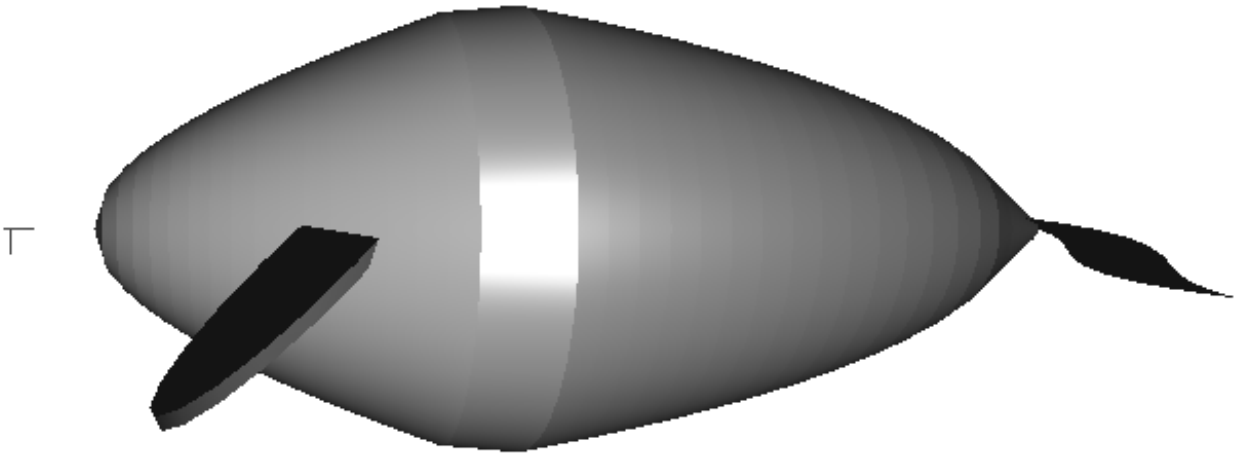

Fig 1.4: After the Bezier spline implementation.

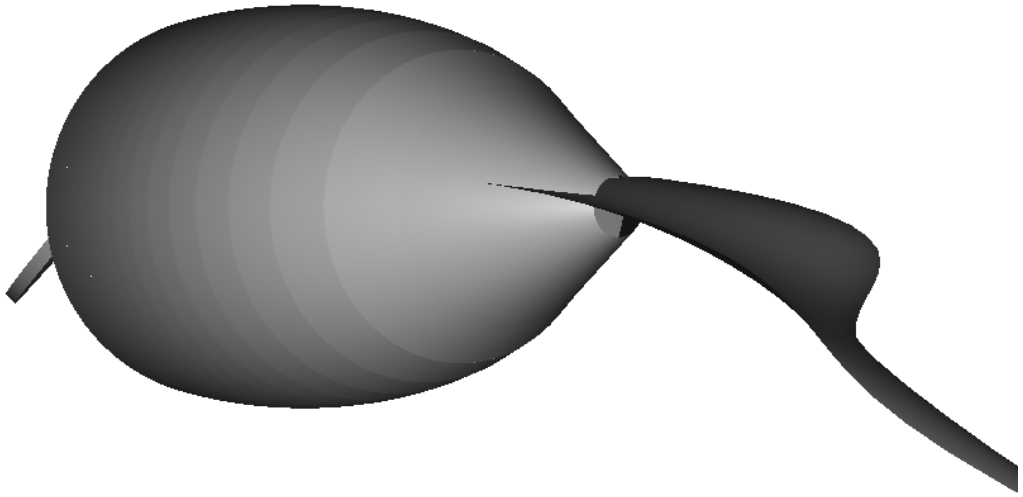

Fig 1.5: The Bezier curve with 2 parameters from another angle.

For the 2D implementation we considered making the disks so that the central one is the head of the whale and is being followed by the rest of the body.

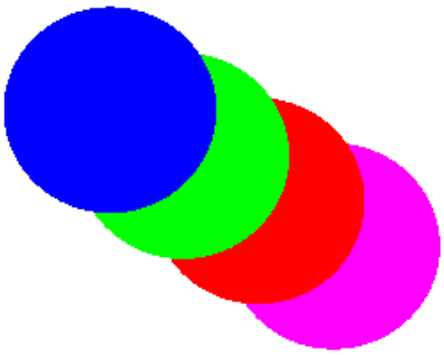

Fig 1.6: The circles following the central disk that is blue in color.

Fig 1.7: The whale and the 3 d effects as seen on the 2D screen. Sir Murtaza's hypothesis being proved to be very authentic in the above picture.

Final note

As hard as it may seem to consider this to be a final project we would like you to try to understand the amount of effort we put in the initial project and to try our best to make it happen. The final product that we have made might not appear to be very attractive to the normal person but we would like to consider the time we spent on this project in an attempt to try and implement something that could not be implemented in a period of 4 weeks (the 3D mouse problem). This project was prioritized by us over our other projects and it would be a shame if we were to lose marks over this even though we did try our very best to make ends meet. The project that we will be demonstrating in class tomorrow will be something

we worked on and produced in a span of 3 days which does not at all reflect our insight and hard work into this project. Once again, we thank you for your cooperation in this regard.

Submitted by

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Resources and References

- http://stackoverflow.com/questions/33997861/how-to-add-delay-between-the-movement-of-two-disks
- http://stackoverflow.com/questions/34194913/moving-a-3d-object-with-a-mouse-in-opengl
- http://stackoverflow.com/questions/785097/how-do-i-implement-a-b%C3%A9zier-curve-in-c
- https://www.opengl.org/discussion_boards/showthread.php/123078-best-way-to-draw-a-pyramid
- http://img0.liveinternet.ru/images/attach/c/5/3970/3970473_sprite198.swf
- http://www.codeproject.com/Articles/3097/Mouse-Selection-in-OpenGL-Scene