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# Lab 5 Report: Transformations and Viewing

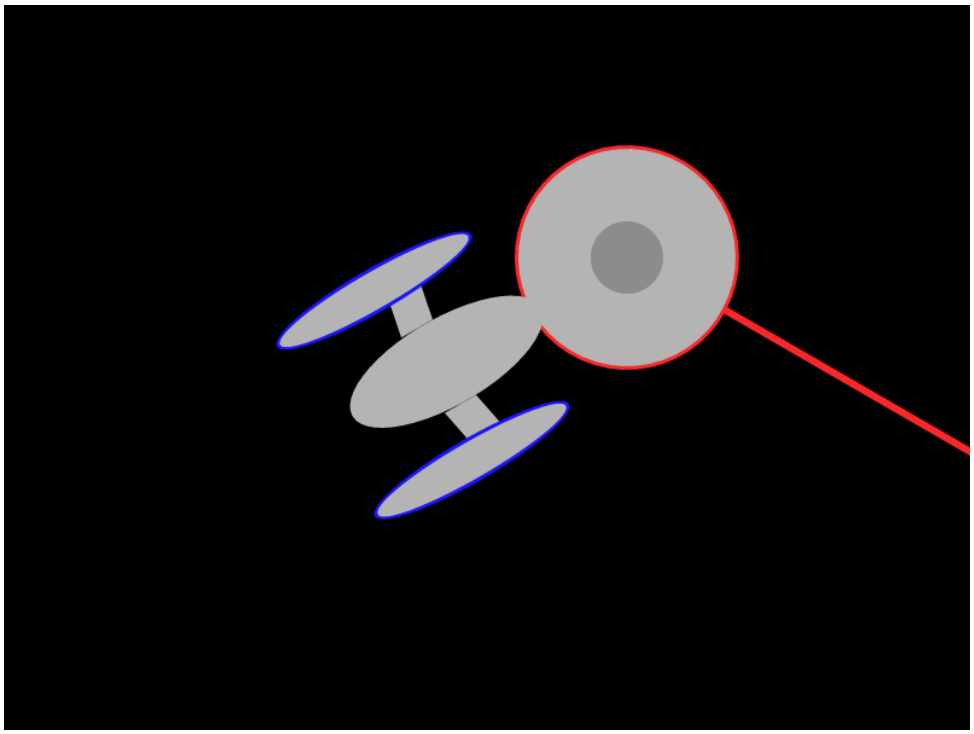
**Summary**

This project focused on implementing a library for 2D and 3D transformations and using this library to create an object and a simple imaging pipeline. The aim was to transform Cartesian coordinates into screen coordinates and visualize scenes with **panning, zooming, and viewpoint adjustments**. The library supports a variety of matrix and vector operations and is tested using a series of predefined and custom scenes. The final output includes animated GIFs showcasing the transformation capabilities of the library in both 2D and 3D contexts.

**Required Images**

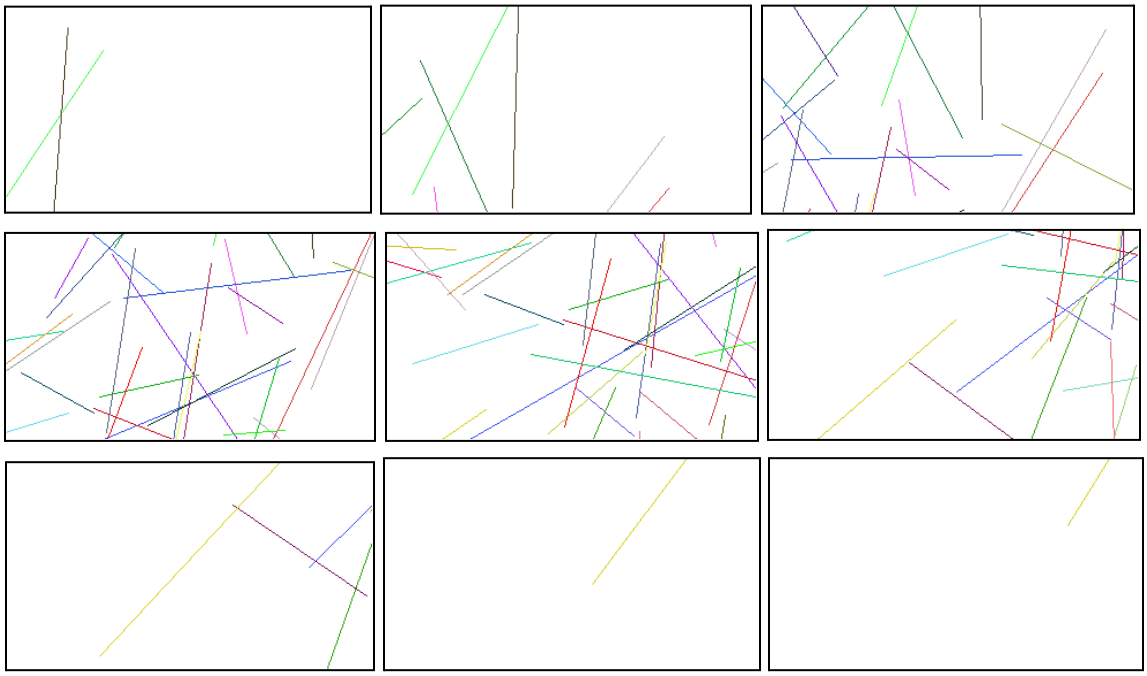
1. ***Test Image A***

   Description: This image was produced with ***test5a.c*** and validates the basic functionality of the matrix library, including transformations such as translation, scaling, and rotation. Notably, the picture captures components that extend beyond the image boundaries, showcasing the robustness of the transformations by portraying a starship firing lasers.



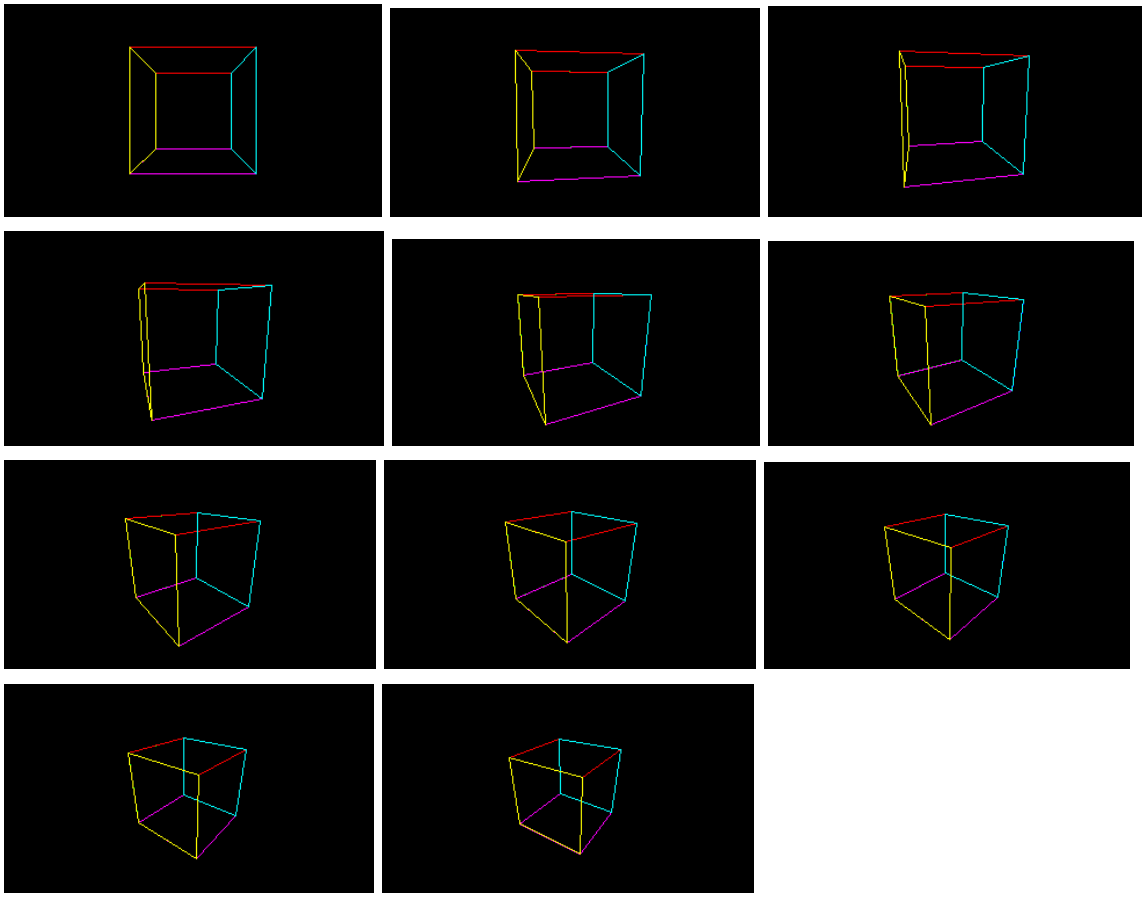
## 2. *Test Image B*

Description: Generated using ***test5b.c***, this series of images illustrates a 2D scene where the view matrix function ***matrix_setView2D*** is used to pan and zoom. The sequence consists of 10 frames, each displaying a slightly adjusted view of the scene, which helps in verifying the correct implementation of panning and zooming functionalities. These images, when animated, confirm that the transformation pipeline accurately converts Cartesian coordinates to screen coordinates while maintaining the correct aspect ratios and alignment.



### 3. *Test Image C*

Description: This GIF showcases the functionality of the 3D view matrix function ***matrix_setView3D***. It displays a sequence of frames where the viewpoint moves relative to a simple 3D scene, demonstrating the transformation of 3D Cartesian coordinates into screen coordinates. The animated cube rotates and shifts, verifying the handling of 3D transformations, including the view reference point (VRP) and view plane normal (VPN) adjustments.



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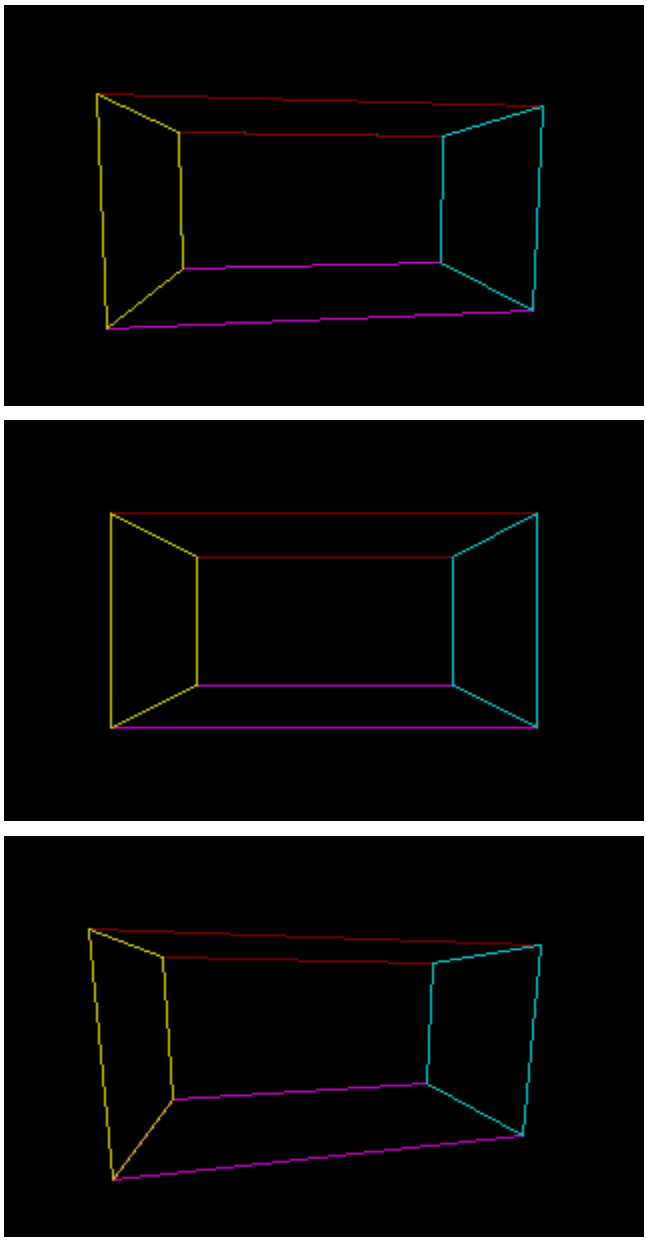
**Portfolio Images**

### *4. 3D Image*

Description: I made a 3D rendering of gif for a rectangular prism. It demonstrates how the coordinates can be modified to create unique images.



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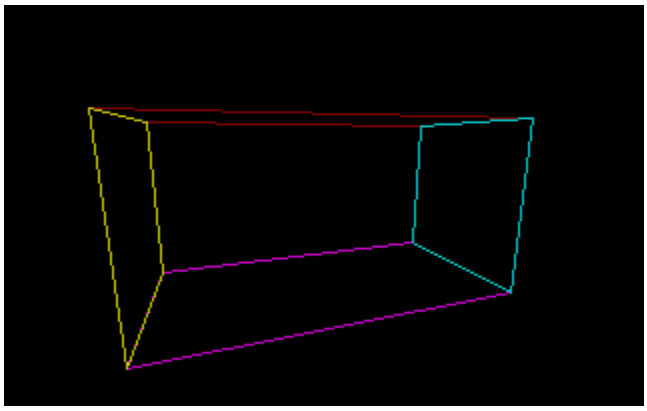

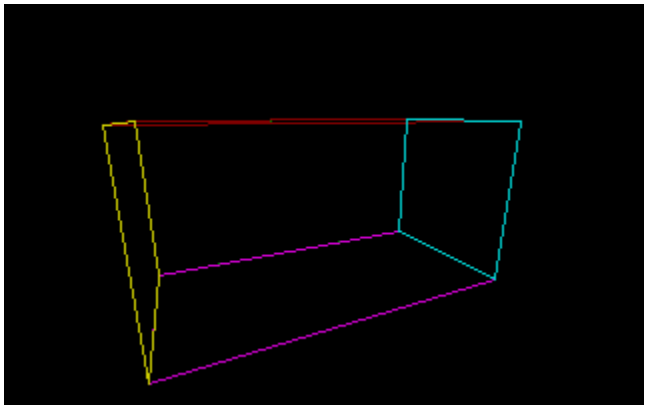

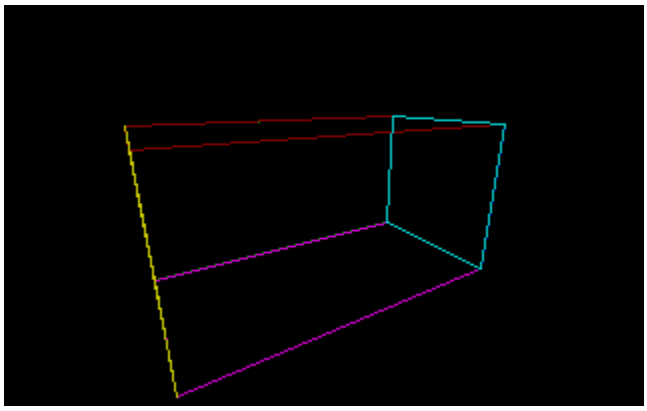

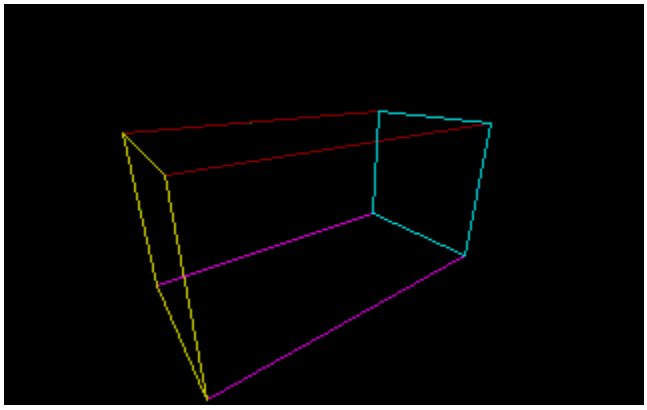

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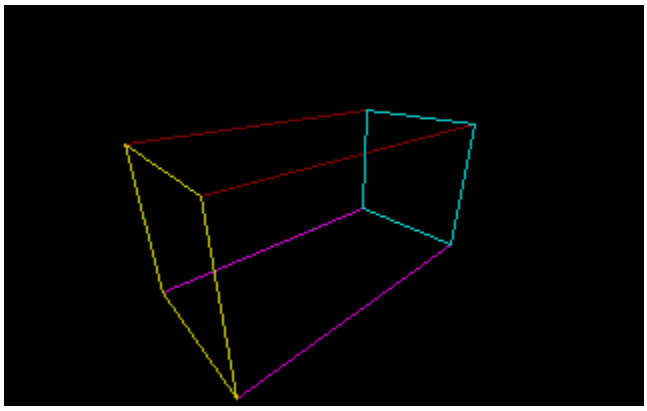

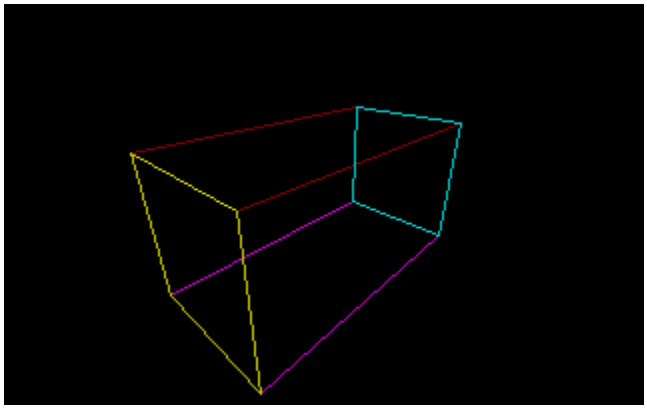

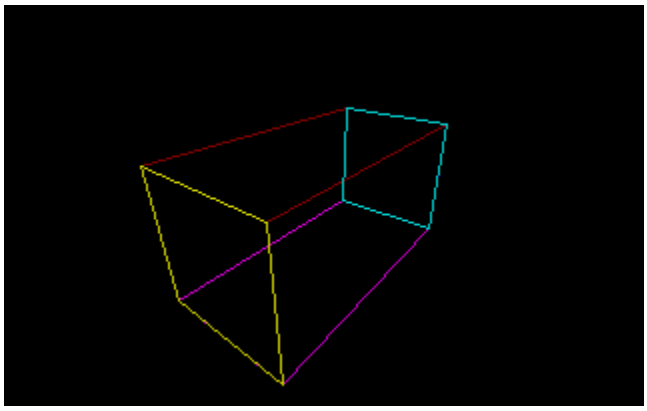

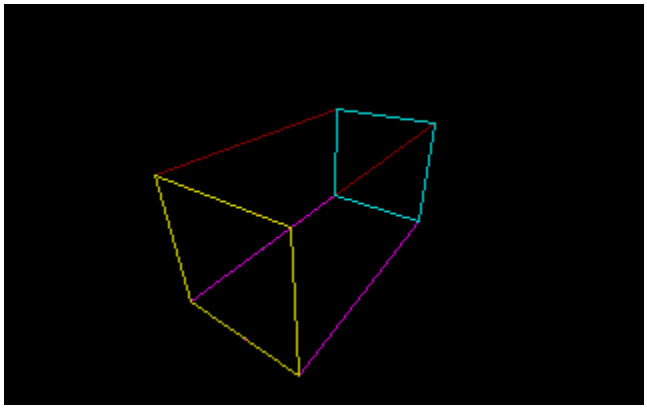

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## Reflection

This project provided significant insights into the mechanics of geometric transformations and their applications in computer graphics. The development of a matrix library for handling 2D and 3D transformations was challenging but rewarding, as it formed the foundation for various advanced graphics operations. Implementing the view matrix functions helped me understand the intricacies of converting world coordinates into screen coordinates. Additionally, creating animations and experimenting with extensions like shading and anti-aliasing improved my skills in visualizing and debugging graphics applications.

## Acknowledgements

I would like to recognize the following for helping me complete this assignment:

- **Instructor and Course Material:** Professor Maxwell's lecture notes and videos provided me with guidance and reference materials for implementing the algorithms.
- **Classmates:** N/A
- **Online Resources:** Various online tutorials and articles from sites like W3schools on scanline and barycentric algorithms contributed to my understanding of the concepts.