Josh Ebner
ebner040

HW1A Writeup

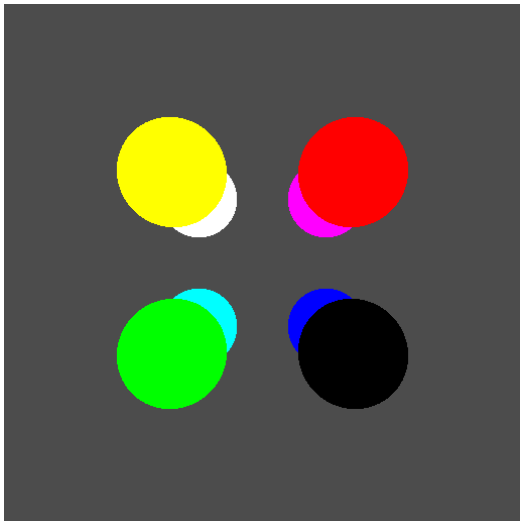

Figure 1. Base image with eye (0.0 0.0 -20.0), viewdir <0.0 0.0 1.0>, updir <0 1 0>, and vfov 60°. Spheres are located at the corners of a cube centered at (0 0 10).

The updir vector is used mainly to determine the rotation of the camera or how it tilts. For example, Figure 1 has an updir of <0 1 0>. This results in an image where the top of the camera is pointing straight "up" if we define up as the y-coordinate. If we change the updir to <1 1 0> (and normalize it), this will essentially tilt the camera a bit towards the x direction. In this case, that effectively means the camera tilts to the left. The resulting image can be seen in Figure 2. Updir does not control any "downward" tilt as the viewdir specifies what is considered forward. It's worth noting that updir and viewdir are always normalized in my program regardless of input.

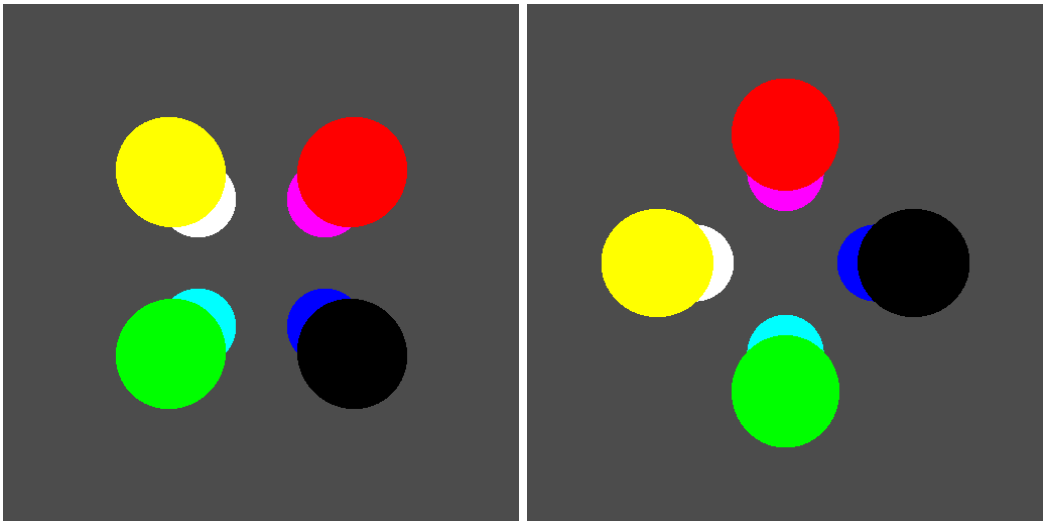

Figure 2. Updir <0 1 0> (left) compared to updir <1 1 0> normalized (right).

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Field of view settings affect how broad the image scope is. For example, the base image has a vertical field of view of 60°. Changing this to 30° shrinks the scope of the final image. This can be seen in Figure 3. It's akin to looking at the scene through a cone with a 60° angle compared to 30° angle. The larger the field of view, the more of the scene is captured in the resulting image.

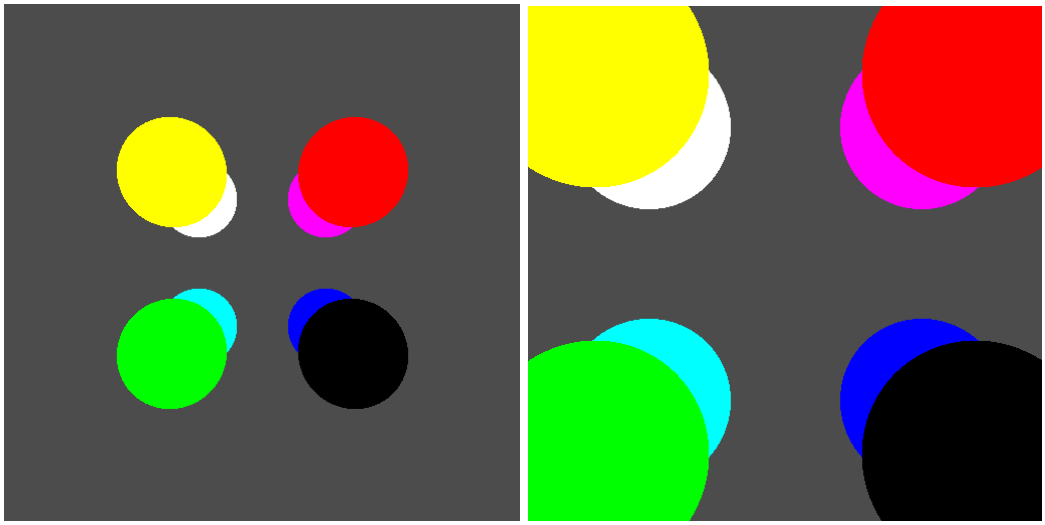

Figure 3. Vfov 60° (left) compared to vfov 30° (right).

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Perspective distortion seems to generally happen when the camera location is near an object with a field of view greater than 90°. This is because the rays shot out into the scene start shooting out closer to behind the viewing window, but many of those rays still hit the same object. Since each ray corresponds to a pixel, parts of an object that might be beyond typical peripheral vision are still in the image. This results in affected objects appearing stretched. This can be seen in Figure 4.

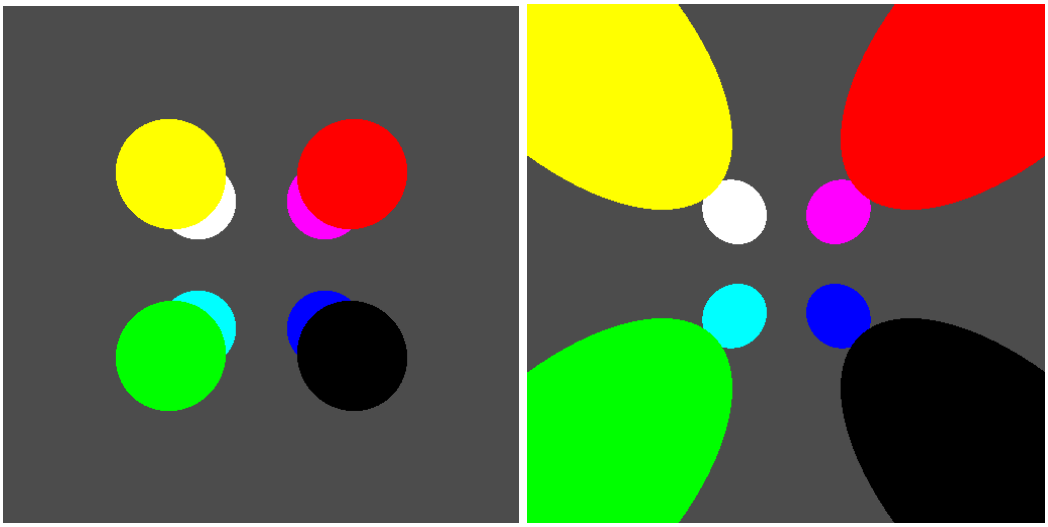

Figure 4. Eye (0 0 -20) vfov 60° (left) compared to eye (0 0 0) vfov 120° (right).