Freies Gymnasium Zürich

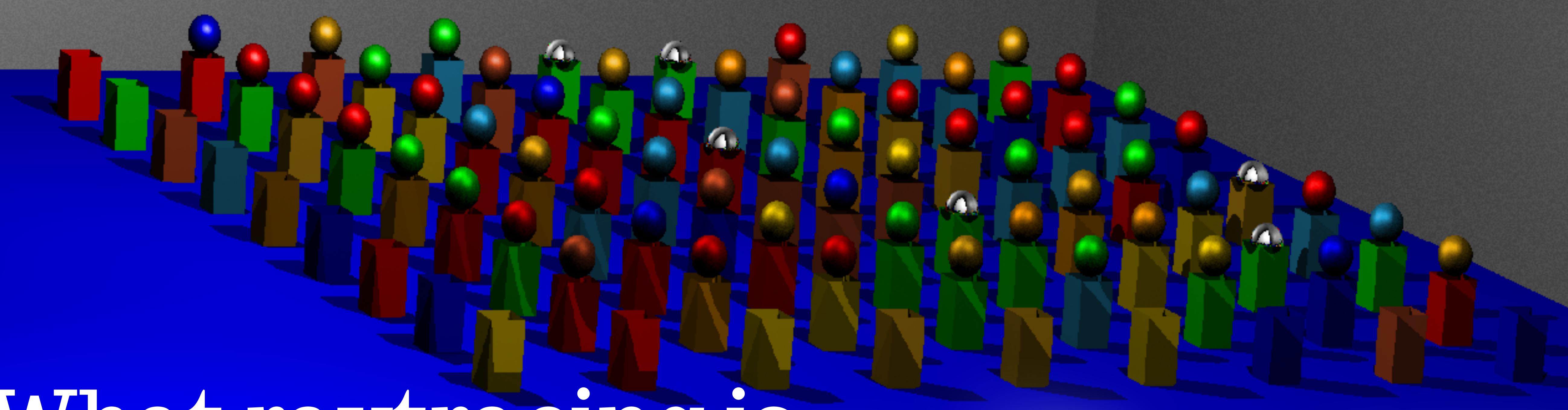
Lucas Dodgson

Light Source

Shadow Ray

Scene Object

Programming a ray tracer



What raytracing is

Camera Raytracing is a technique of generating realistic looking computer images. It does this by sending a ray through every pixel in the screen and then calculating different components of lighting at the point this ray intersects with the scene.

My

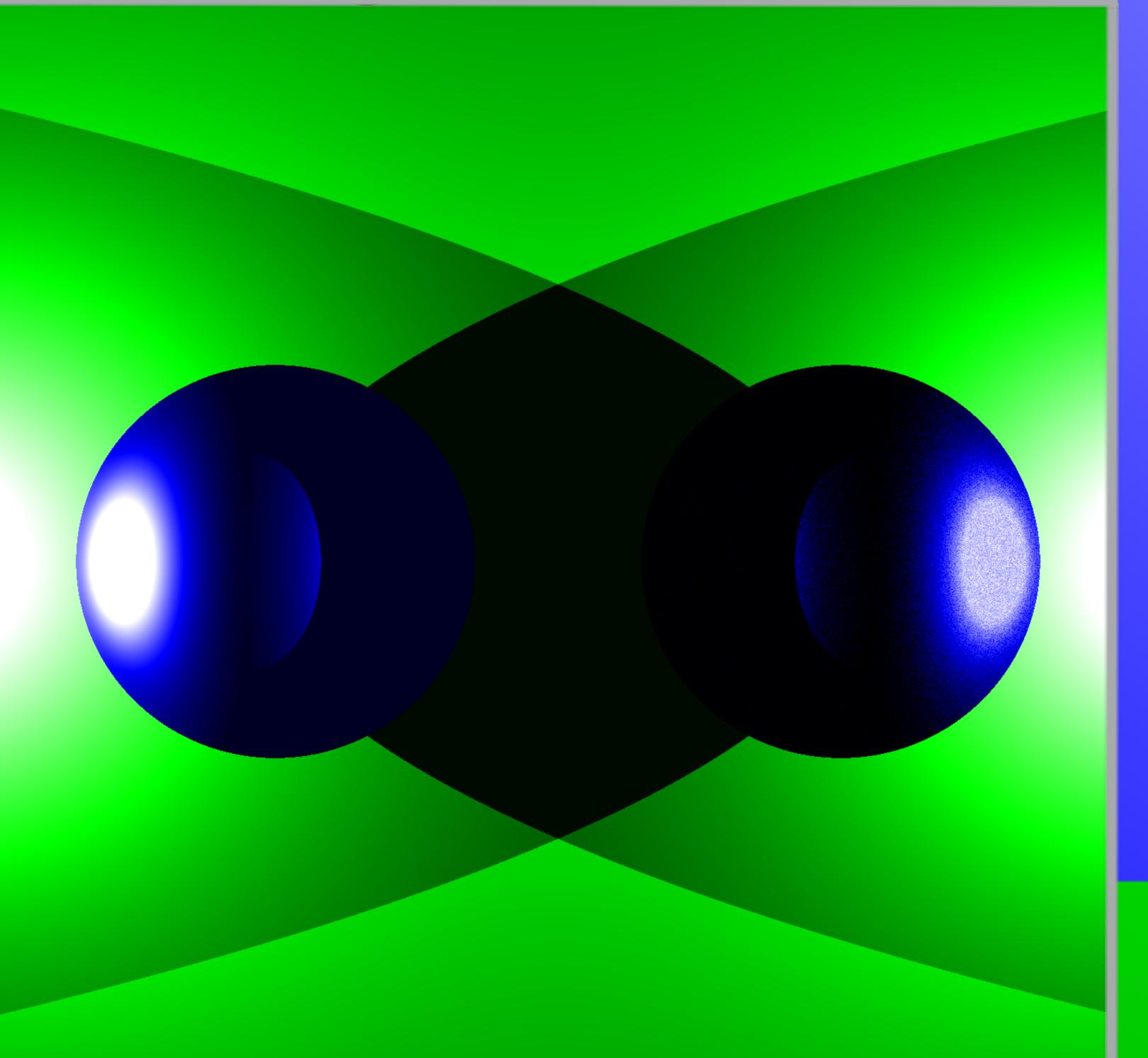
This paper examines how a ray tracer works and described the general and mathematical ideas behind one. It then also includes the realisation of all these ideas in the programming 2021: Includes the realist language python.

Method:

Before writing the code an idea was first explained generally and the mathematical calculations behind it were documented. It was then programmed and tested in various situations.

Here the thoughts behind two features are explained

Roughness:



To give an object a certain roughness, you want to create a random variation in the brightness. This will result in a bigger difference between neighbouring pixels. Here a random number between 0 and 0.3 is used. Every object has a constant roughness which is multiplied with this random number and then subtracted from the brightness. In this image, you can see the comparison between a smooth and a rough sphere.

Image

Mirrors:
An ideal mirror will reflect all the light that hits it. In this ray tracing algorithm, to turn an object into a mirror you need to treat it as a reflective object. We will treat mirrors as ideal. So the light will continue on with the same brightness as before but will be reflected along the plane of the mirror. So if you have a ray that is traced from the eye and reflected, you treat the reflected ray as the ray that needs to be traced to determine the colour of the pixel. You still draw the pixel at the same place with the resulting colour and brightness. In this image, you can see three spheres sitting on top of a mirror.

