Rasterizer Project

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1. What is the rasterization?

Before jumping into this broad idea, let’s go back in the time.

Think about the time where people had no access to the internet, the computer and

the television, where the night was dark, and the morning was bright. Working in a

farm in the morning, pray and sleep with your family at night is all you can do.

One day, a man decided to open his Bible and saw

*“And God said, "Let there be light," and there was light.” Genesis 1:3*

The light, this is where all began.

1. The light

“**Light** is electromagnetic radiation within a certain portion of the electromagnetic spectrum. The word usually refers to **visible light**, which is visible to the human eye and is responsible for the sense of sight.”[1]

René Descartes is the one who started the modern concept of the light.

He said that the light is a mechanical property of the luminous body. Later, this idea

became the principle concept of the Particle theory. Isaac Newton believed that the

light was emitted in all directions from a source and the light was moving in a line

form, not in curve form.

This theory led the humanity to the concept of the camera.

1. Camera Obscura

“Camera obscura(pinhole image)  is the natural optical phenomenon that occurs when an image of a scene at the other side of a screen (or for instance a wall) is projected through a small hole in that screen as a reversed and inverted image (left to right and upside down) on a surface opposite to the opening.”[2]

This is the first camera which projected the light through a pinhole in the center and make the light draw the inverted image on a surface.

Ex.

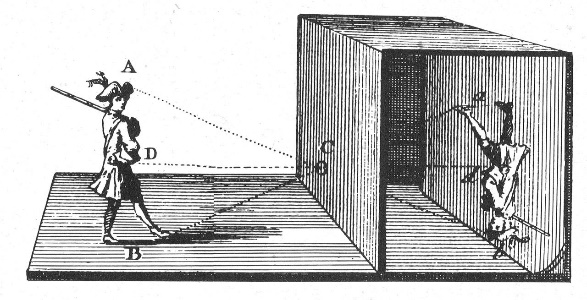
If we took this image of zebra with the pinhole image



The result is the image below.



For further explanation[2]



1. The screen

The concept of camera obscura is also used in the modern computer screen.

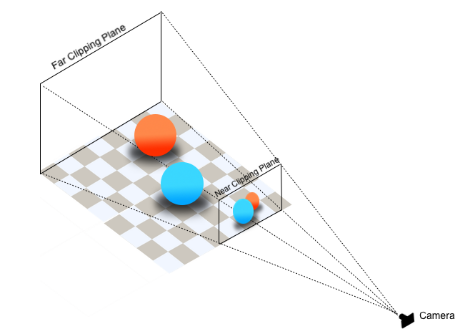
The side, the position and the angle of the object will depend on the position of the

Camera, the object and the screen.

If the image is closer to the screen, the image representation will also be bigger.

If the distance between the image and the camera is smaller than the distance

between the camera and the screen, the image won’t be projected to the screen.



Light traveling from the object will go through the screen and will reach the camera.

When the light reaches the screen, the position of the light will be the

The coordinate of the object in the screen.

1. Graphics pipeline

Until now, we saw the basic concept of the light and the camera.

Now, I must explain what the graphic pipeline is.

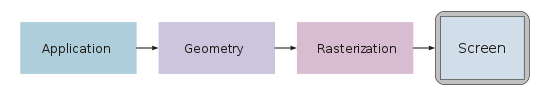
The graphics pipeline is the descriptions of what steps a graphics system needs

to perform to render a 3D scene to a 2D screen. We can easily calculate the

coordinates of a 3D object but showing it in a 2D screen is a problem.

Multiple steps are required to perform this, and it must be processed in the right

order.



1. Application

The application process is where everything is prepared by CPU.

Let’s say you want to draw a cube.

The cube is placed at the origin (0,0,0) and the length of a side is 1.

So logically, the coordinates should be

Point A at x = 0.5, y = 0.5, z = 0.5.

Point B at x = 0.5, y = -0.5, z = 0.5.

Point C at x = -0.5, y = -0.5, z = 0.5.

Point D at x = -0.5, y= -0.5, z = 0.5.

Which will make a square.

And rotate this square on the axe of y or x by 90 degrees to make 6 faces.

These point coordinates will be called the “Vertex” / “Vertices”.

The problem rises at this point: The CPU have no idea what to do with these

vertices.

So, you must specify how you want to draw those points.

In other words, you must sort in which order you want to draw the coordinates.

This order is called the “Primitives”.

With Vertices and Primitives, the CPU will draw the lines of the cube.

1. [CIE](https://en.wikipedia.org/wiki/International_Commission_on_Illumination) (1987). [*International Lighting Vocabulary*](http://www.cie.co.at/publ/abst/17-4-89.html). Number 17.4. CIE, 4th edition. [ISBN](https://en.wikipedia.org/wiki/International_Standard_Book_Number) [978-3-900734-07-7](https://en.wikipedia.org/wiki/Special:BookSources/978-3-900734-07-7).  
By the *International Lighting Vocabulary*, the definition of *light* is: “Any radiation capable of causing a visual sensation directly.”

2. https://en.wikipedia.org/wiki/Camera\_obscura