

COMS30020 - Computer Graphics

Week 4 Briefing

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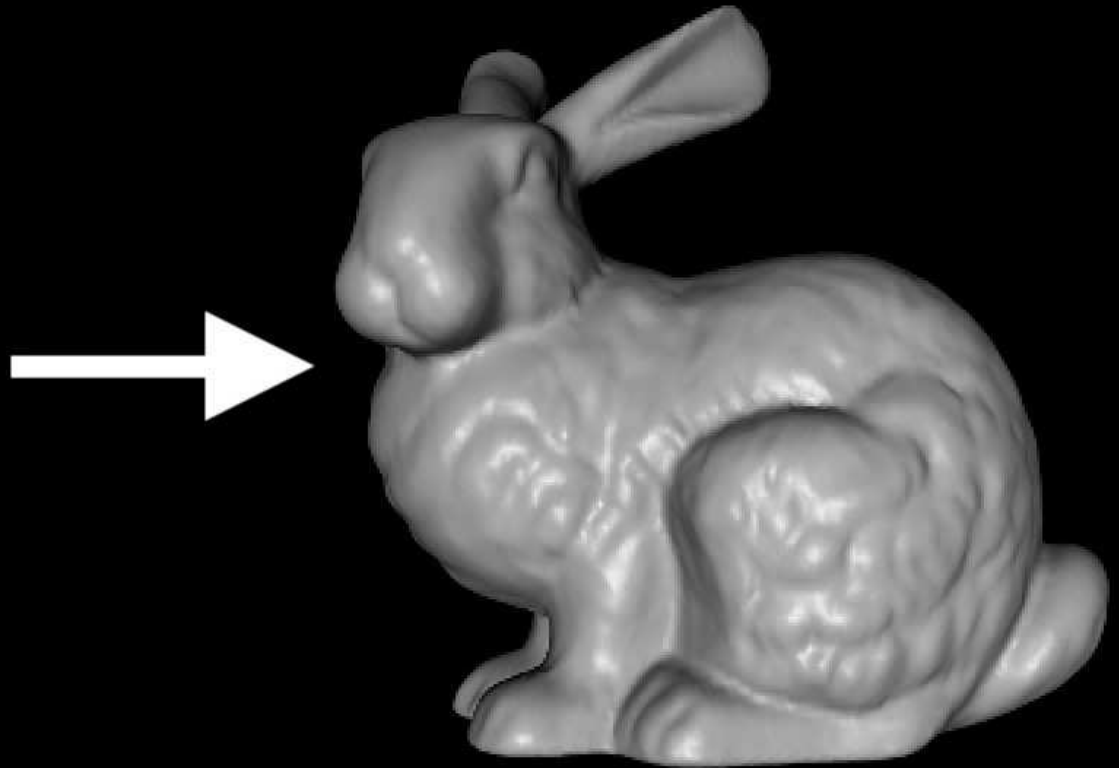
And now, the moment we've all been waiting for...

TIME TO START WORKING IN 3D !!!

2D functions already written will still be useful !

Our Objective is Simple (to Explain ;o)

```
stanford-bunny.obj
v -0.037830 0.127940 0.004475
v -0.044779 0.128887 0.001905
v -0.068010 0.151244 0.037195
v -0.002287 0.130150 0.023220
v -0.022605 0.126675 0.007156
v -0.025108 0.125921 0.006242
v -0.037121 0.127449 0.001796
v 0.033213 0.112692 0.027686
v 0.038043 0.109755 0.016169
v -0.025508 0.112568 0.036677
v -0.024531 0.112636 0.037347
v 0.027403 0.121560 0.021221
v -0.062896 0.158419 -0.017587
v 0.040081 0.104202 0.022168
v 0.045153 0.093197 0.011160
v -0.032497 0.174231 -0.002390
```

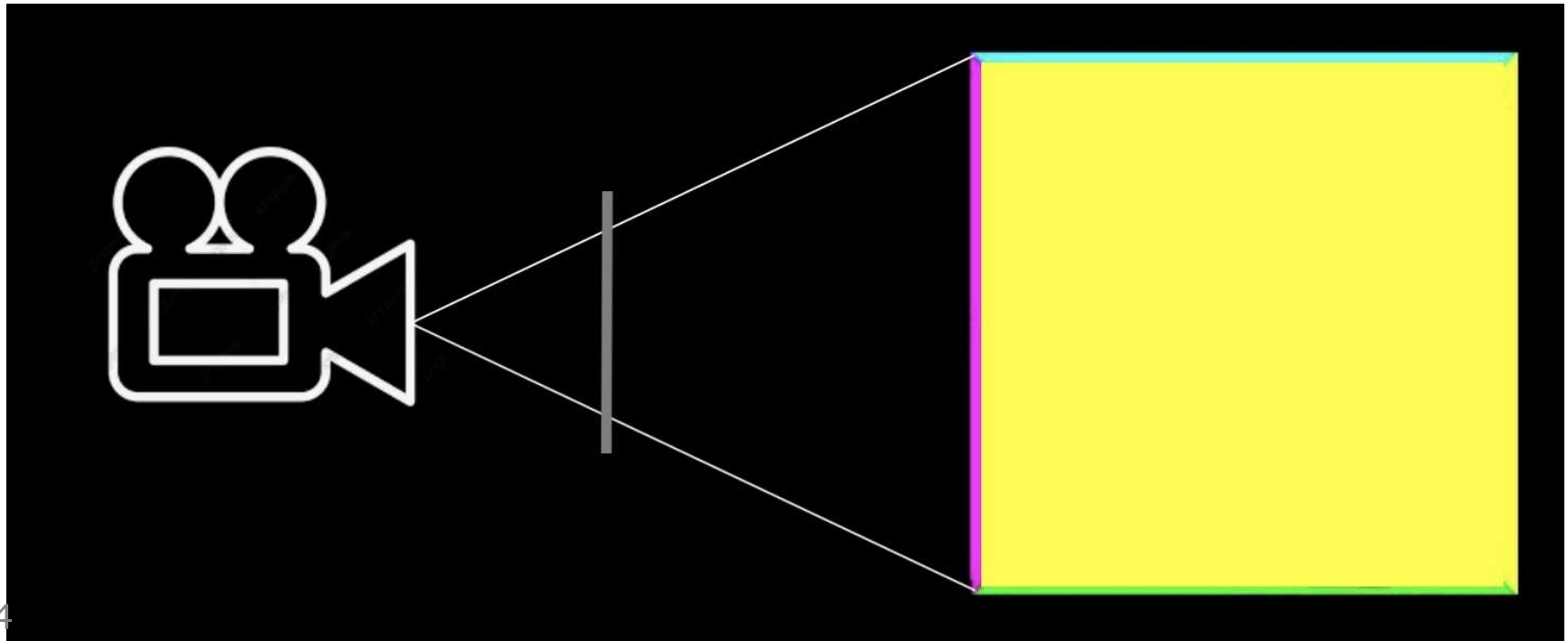


The general setup for the rest of the unit

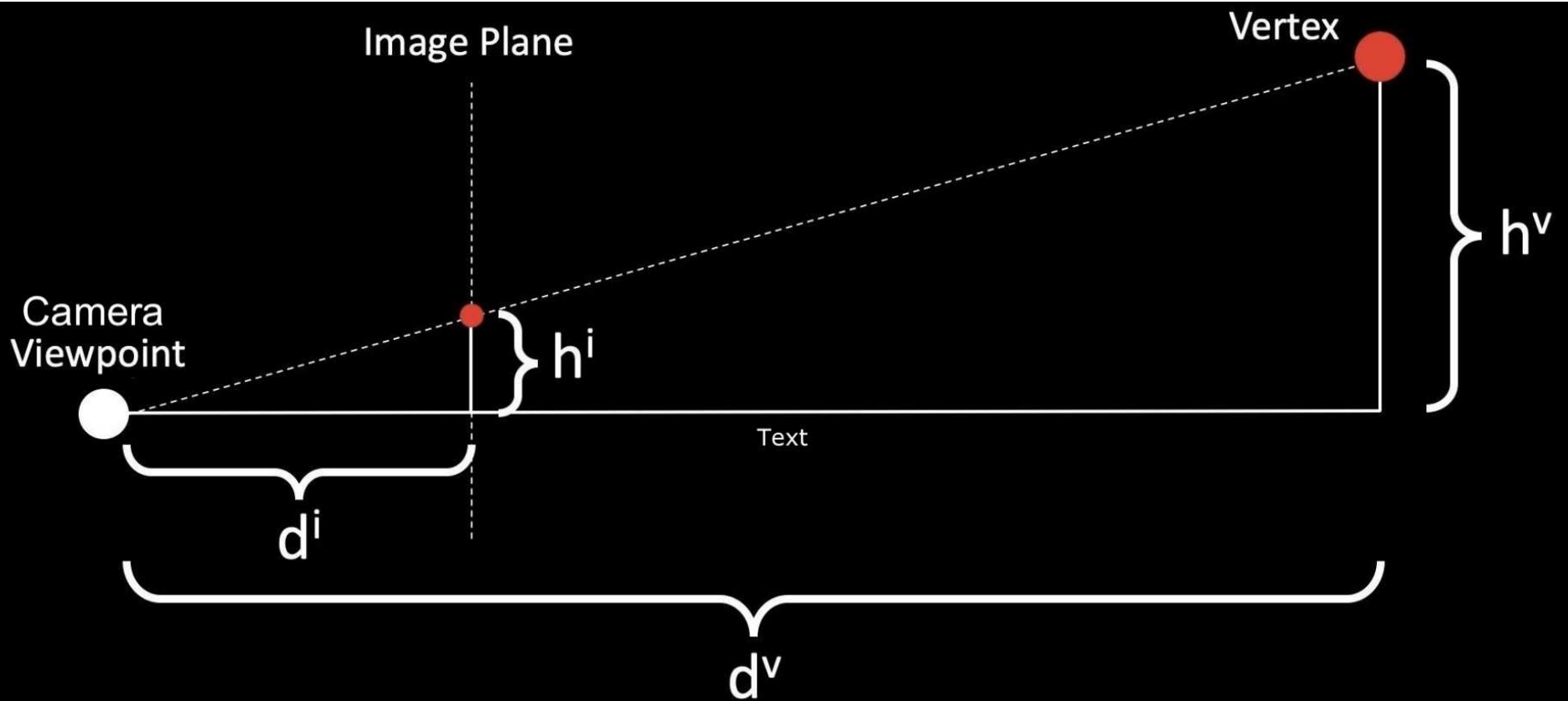
model - a scene in three dimensional space

camera - our chosen viewpoint on the scene

image plane - canvas onto which we draw scene

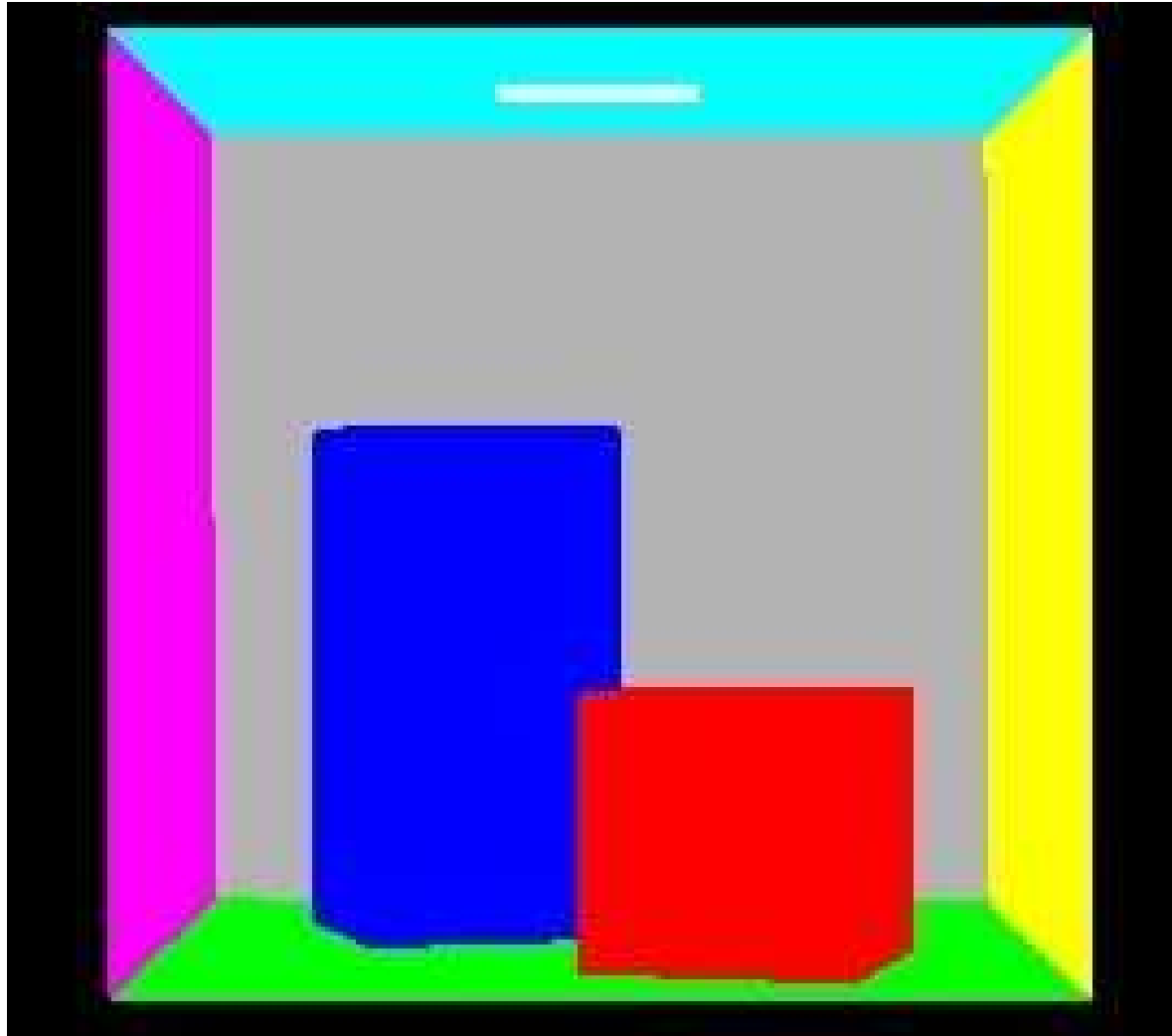


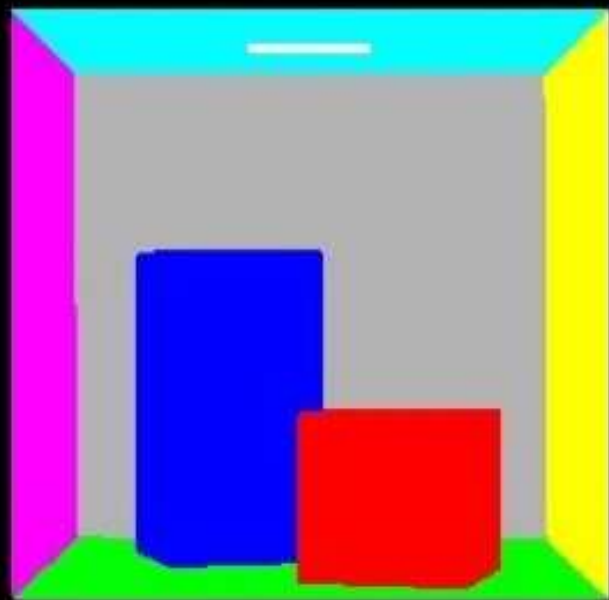
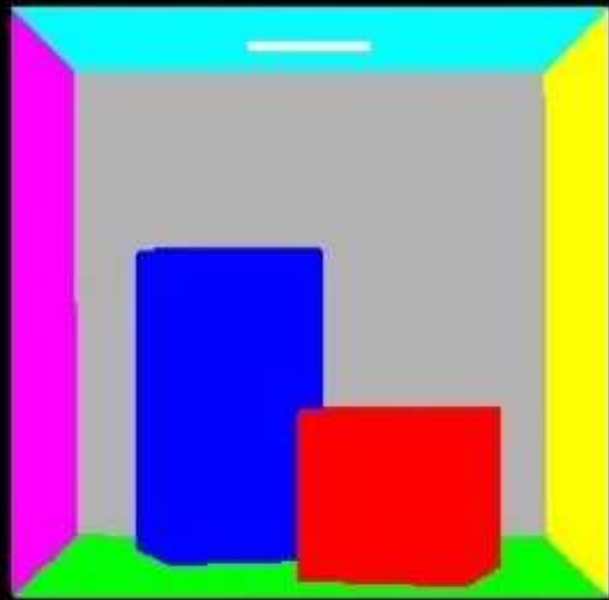
Approach is based on "Similar Triangles"



$$h^v / d^v = h^i / d^i$$

Your model for the next 4 weeks





In order to render this you'll need to...

- Load in some geometry (points in 3D space)
- Load in some colours ("materials")
- Take a "point of view" on the model (camera pos)
- Set the position of image plane ("focal length")
- Do a "bit of maths" (to "project" vertices into 2D)
- Draw model triangles onto canvas ("image plane")

Identical Rendering ?

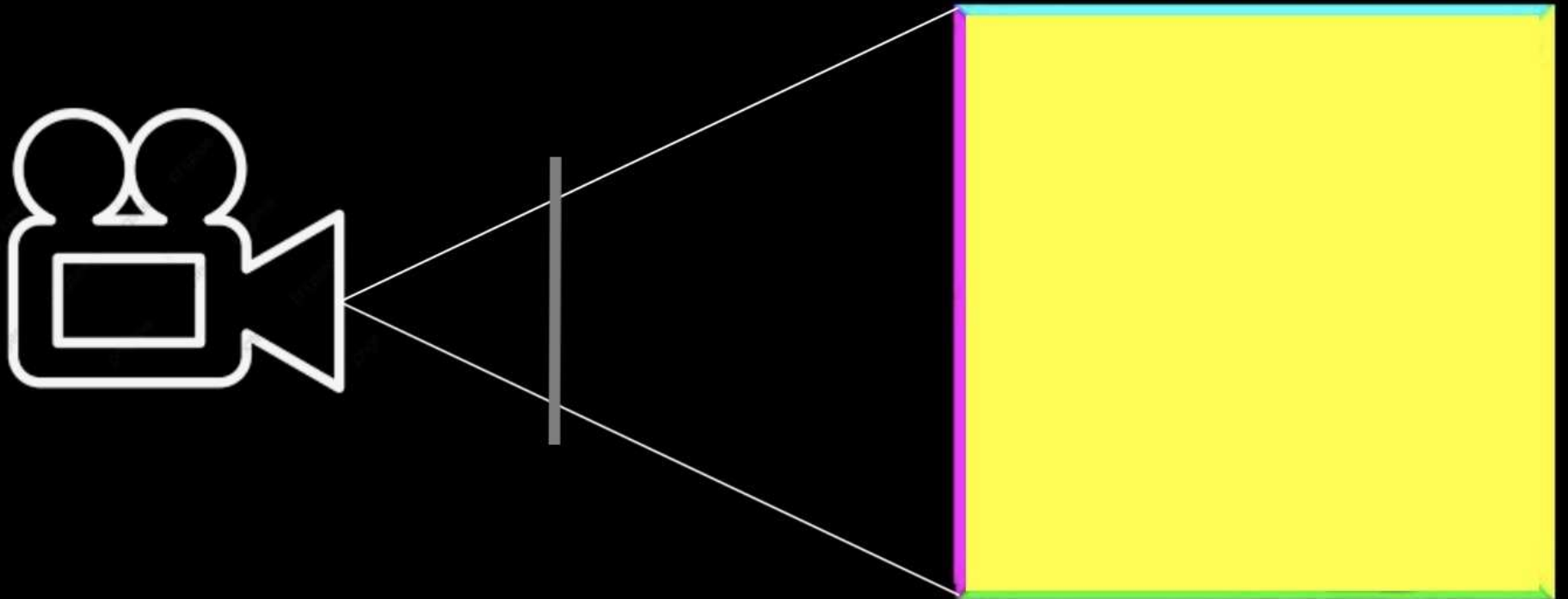
From this point on, achieving results *identical* to samples shown in workbooks becomes much harder

This is because the render you produce of a scene
Will depend on parameters you use in your renderer:

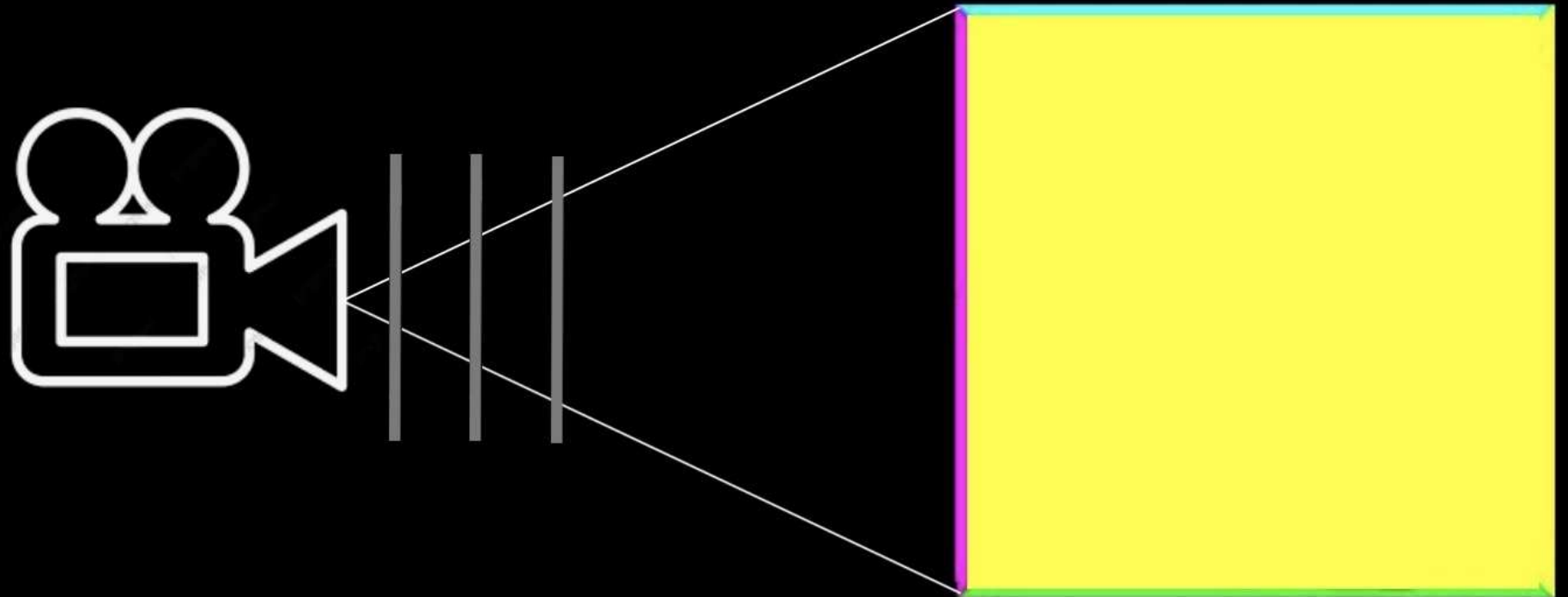
- Model scaling (when you load in vertices)
- Model position (relative to world origin)
- Camera position (relative to world origin)
- Image plane position ("focal length")
- Image plane scaling (used to fill the window)

Let's take a look at some of the variations...

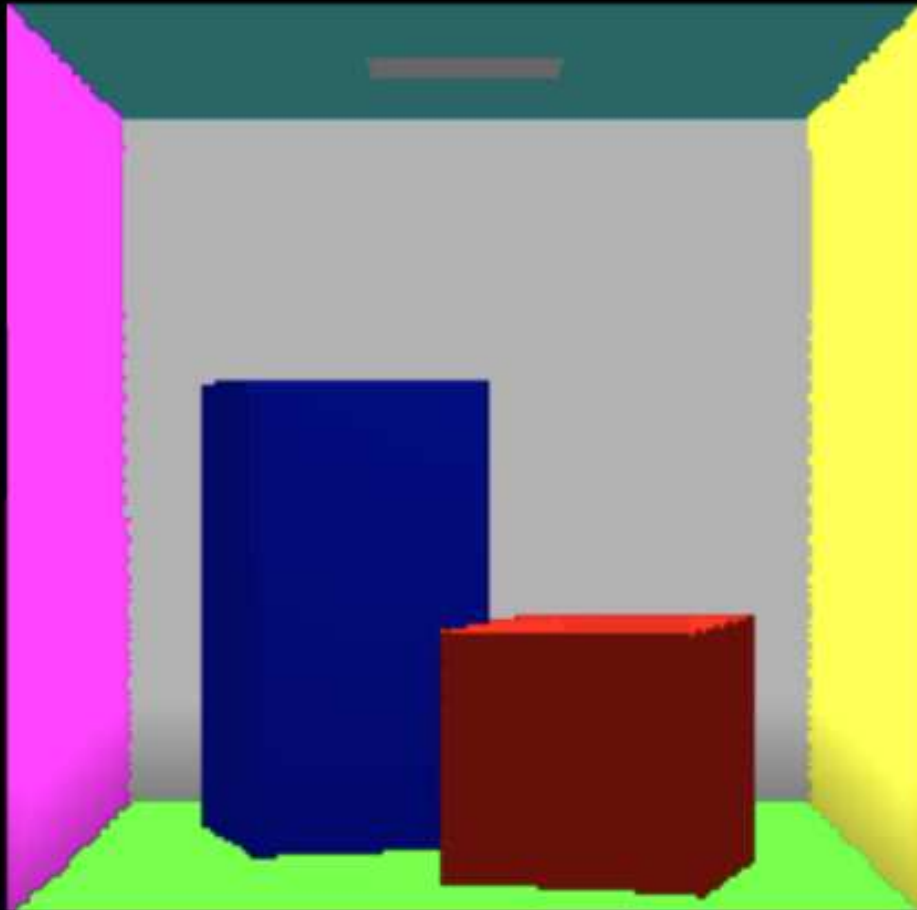
Sight lines allow us to imagine how render will appear
What if we move the position of the image plane ?



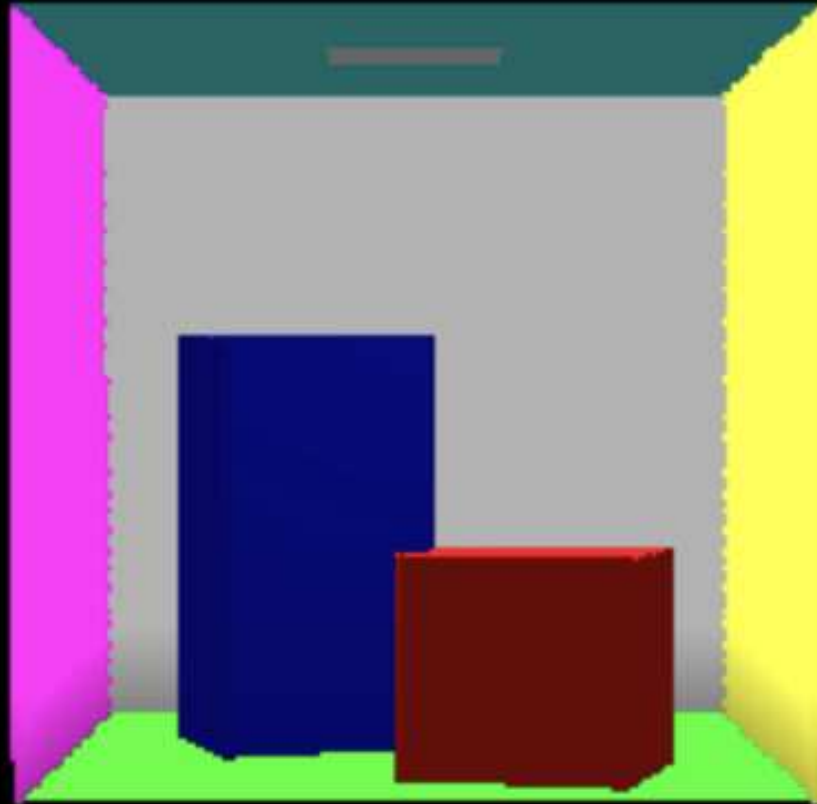
Our perspective (sight lines) on the scene stays same
But the size of the image on the image plane changes



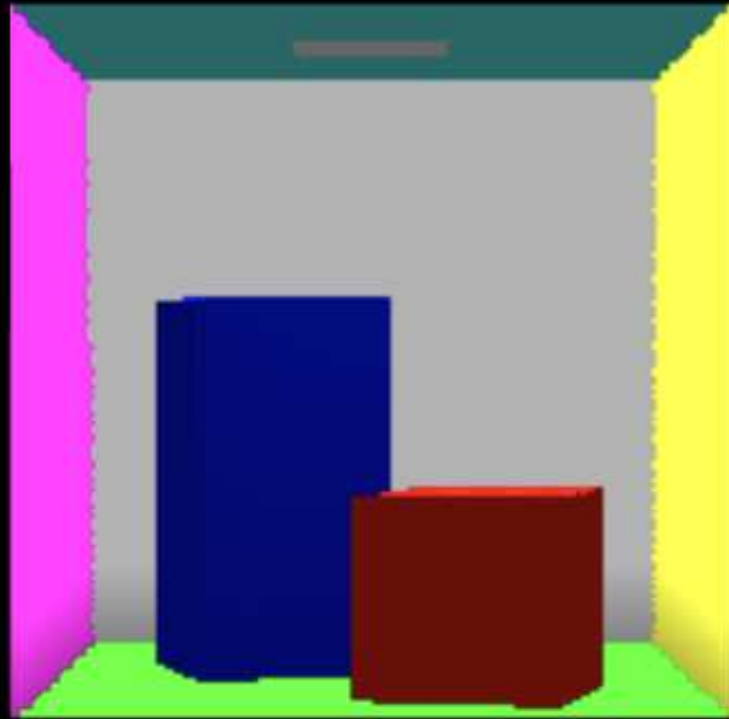
Focal Length of 4



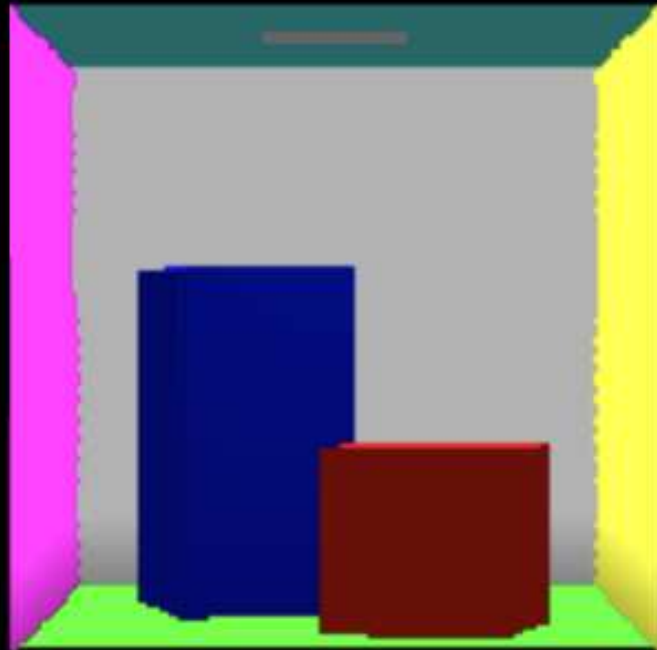
Focal Length of 3



Focal Length of 2

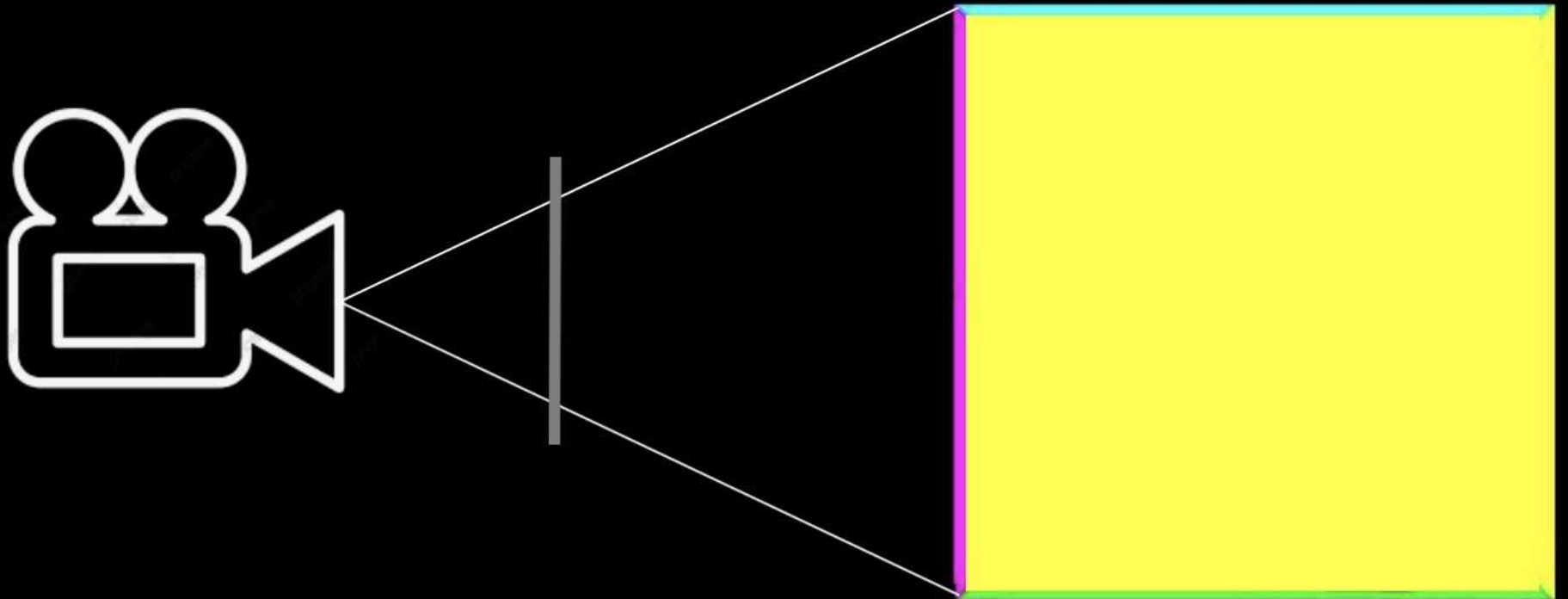


Focal Length of 1

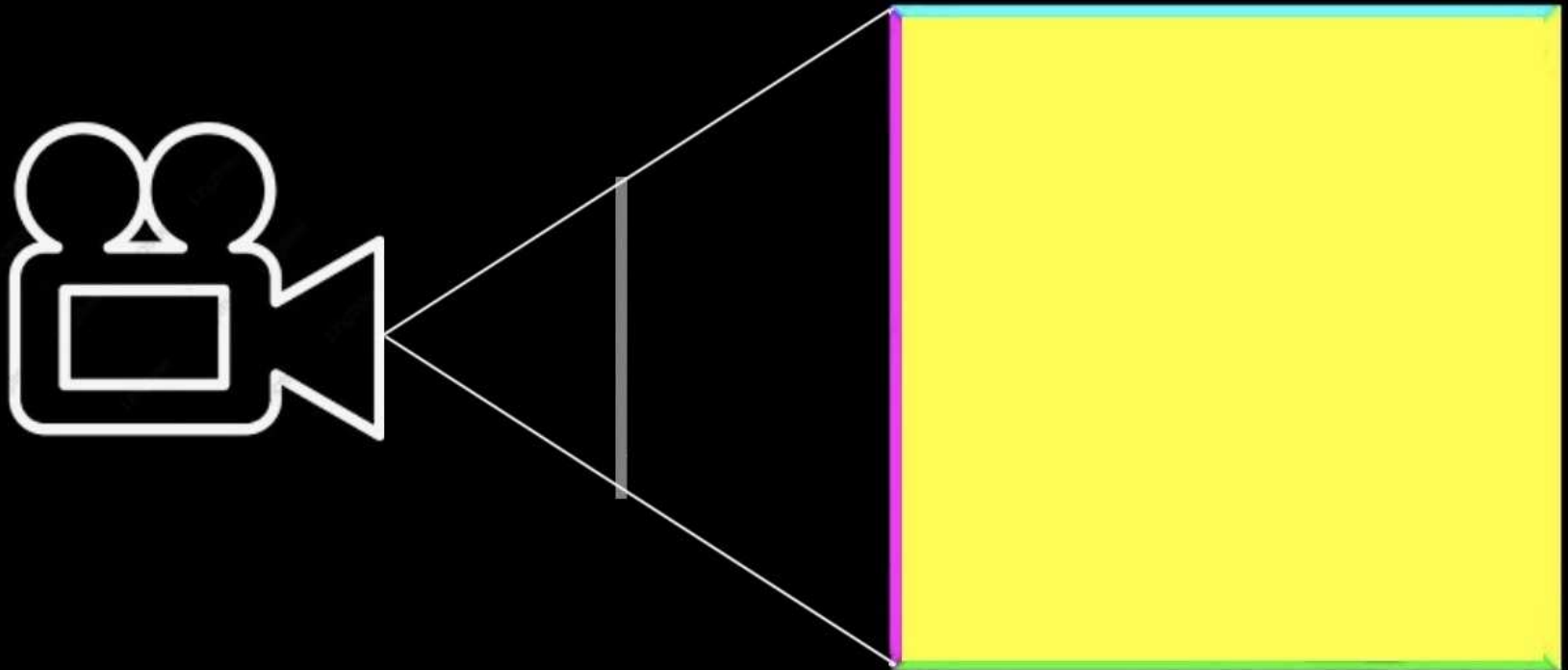




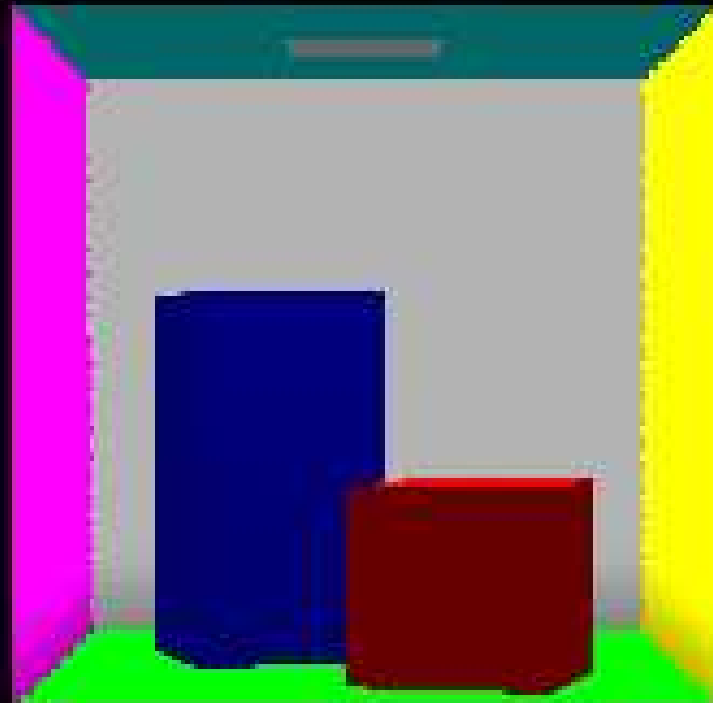
What if we move the POSITION of the camera ?
(without changing the focal length)



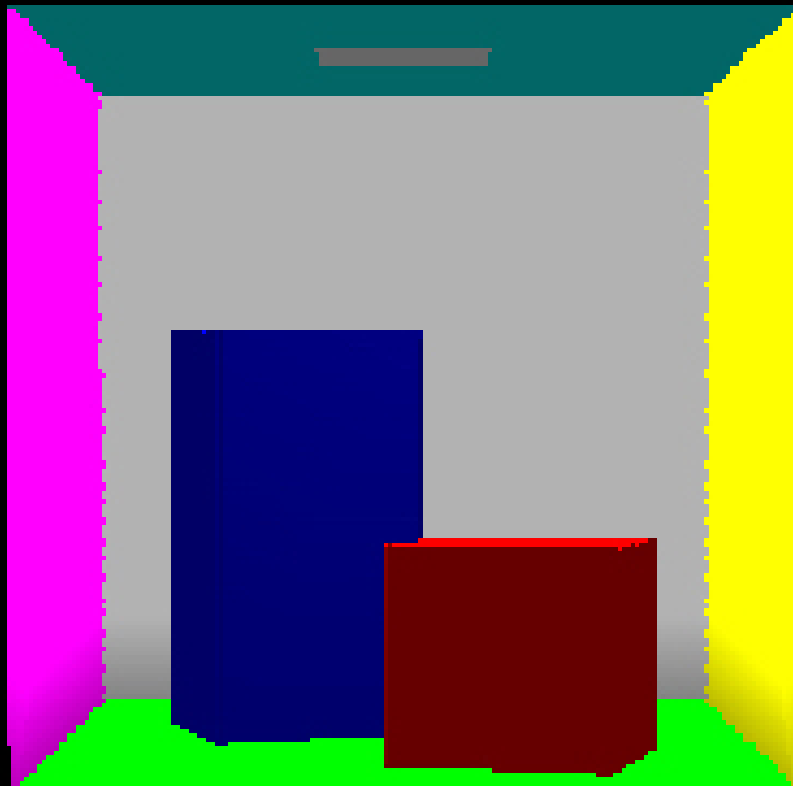
Again, the size of image on image plane will change
But ALSO so will our *perspective* on the scene !



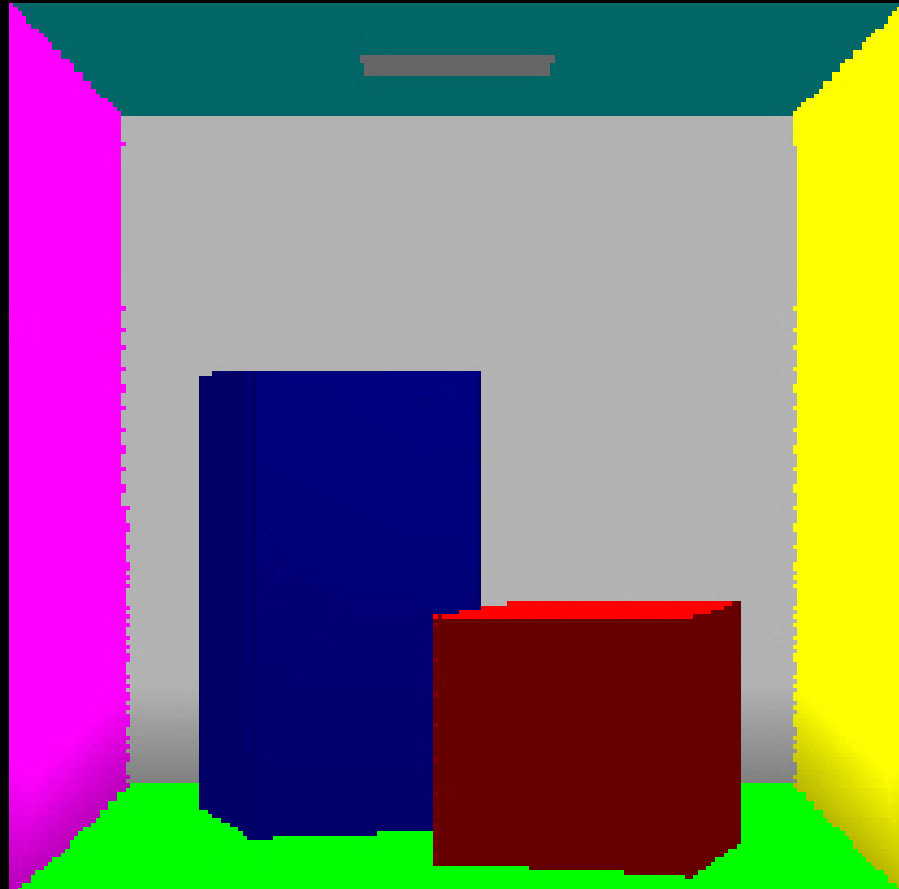
Camera Position #1



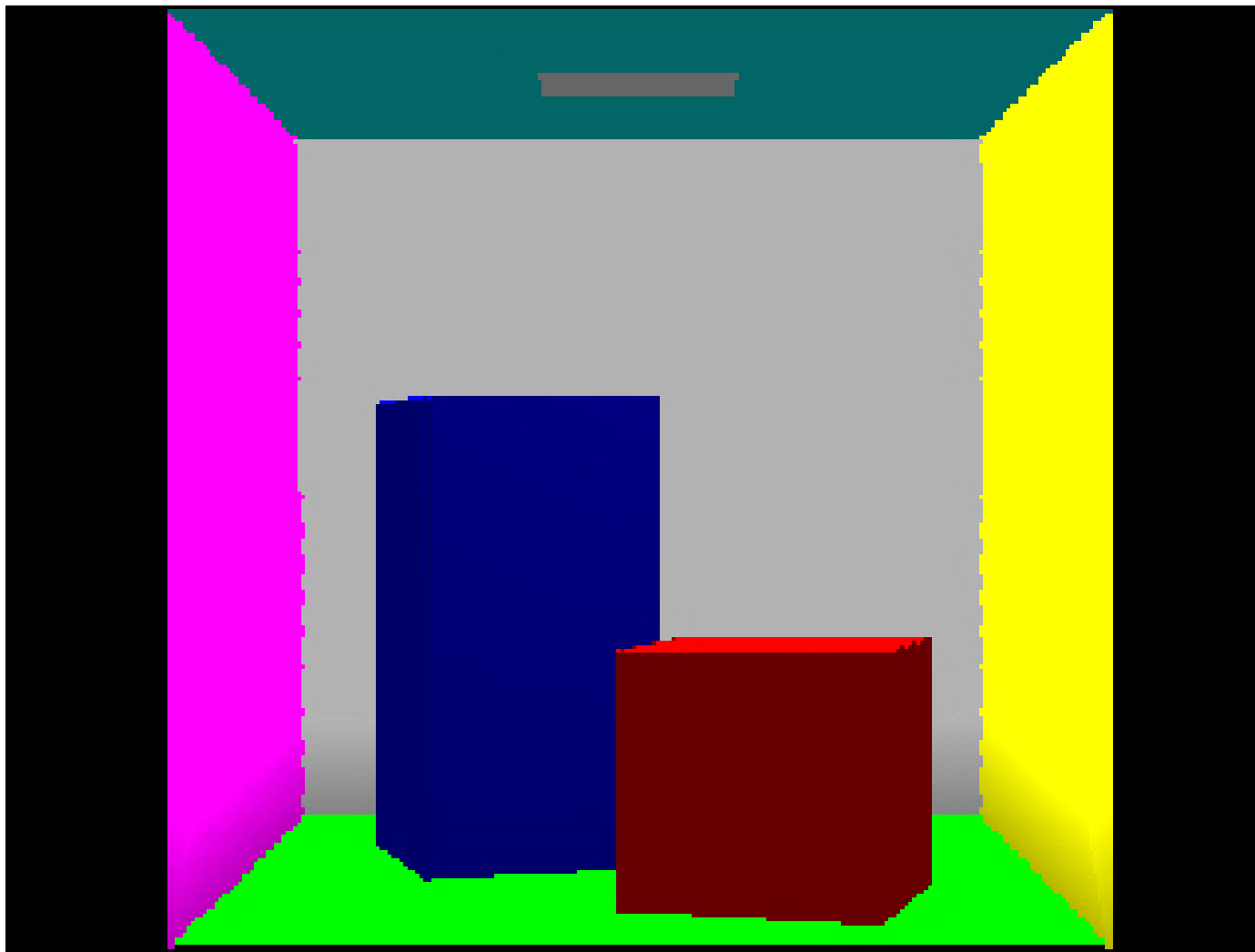
Camera Position #2



Camera Position #3



Camera Position #4



The change in perspective is hard to see
Because the size of the room is also changing

however...

If we do BOTH at the same time
(Move camera position AND shift the image plane)

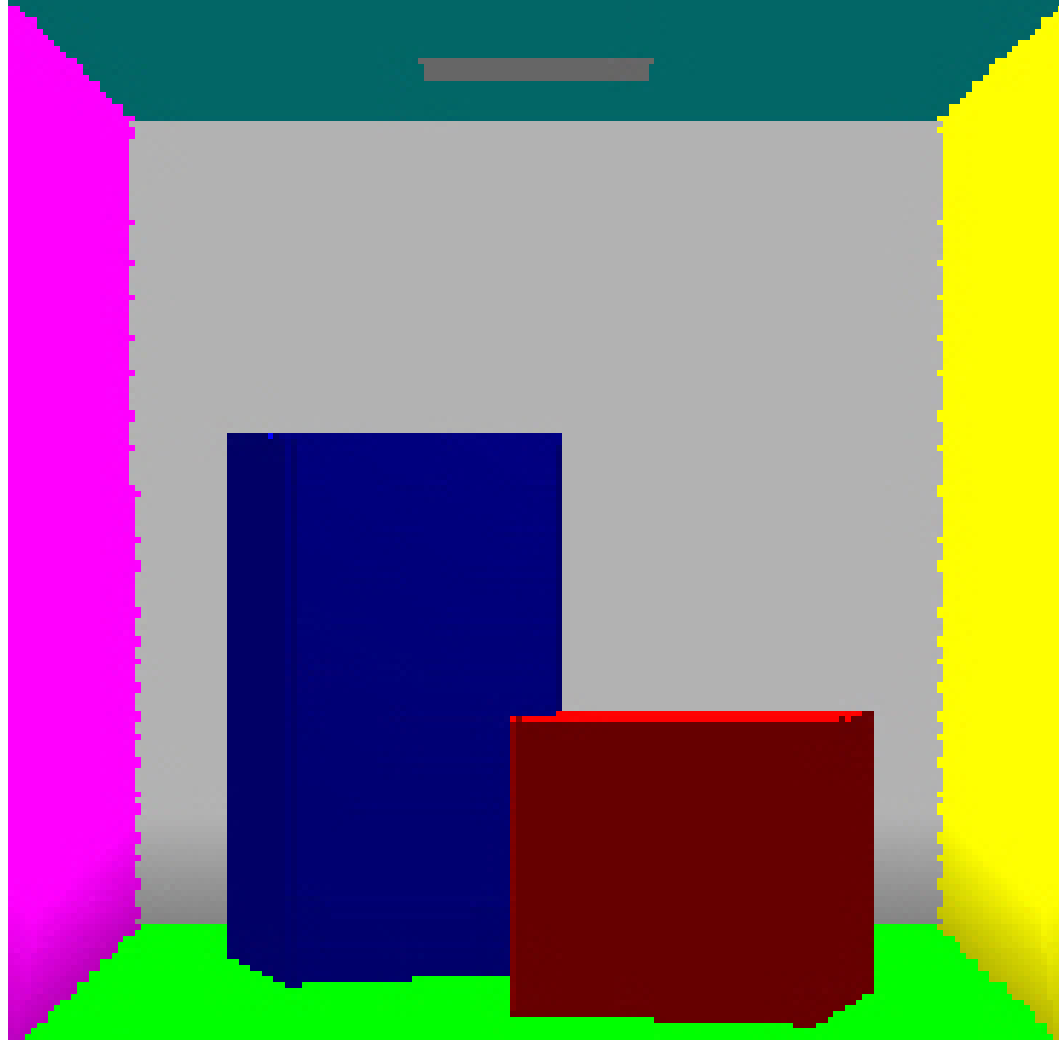
We can CANCEL OUT the two zoom effects
(if we move/shift by appropriate distances !)

This will leave us with JUST change of perspective...

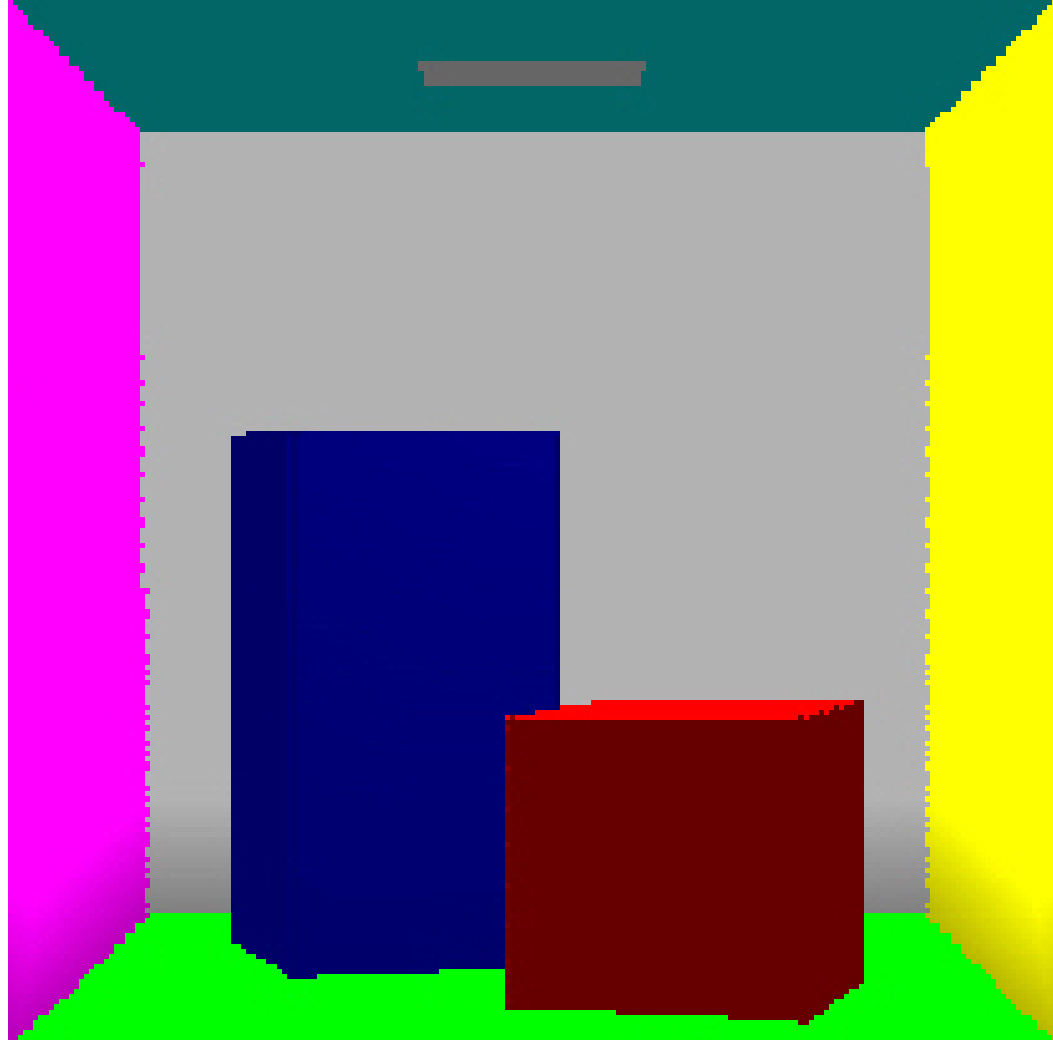
Change in perspective 1



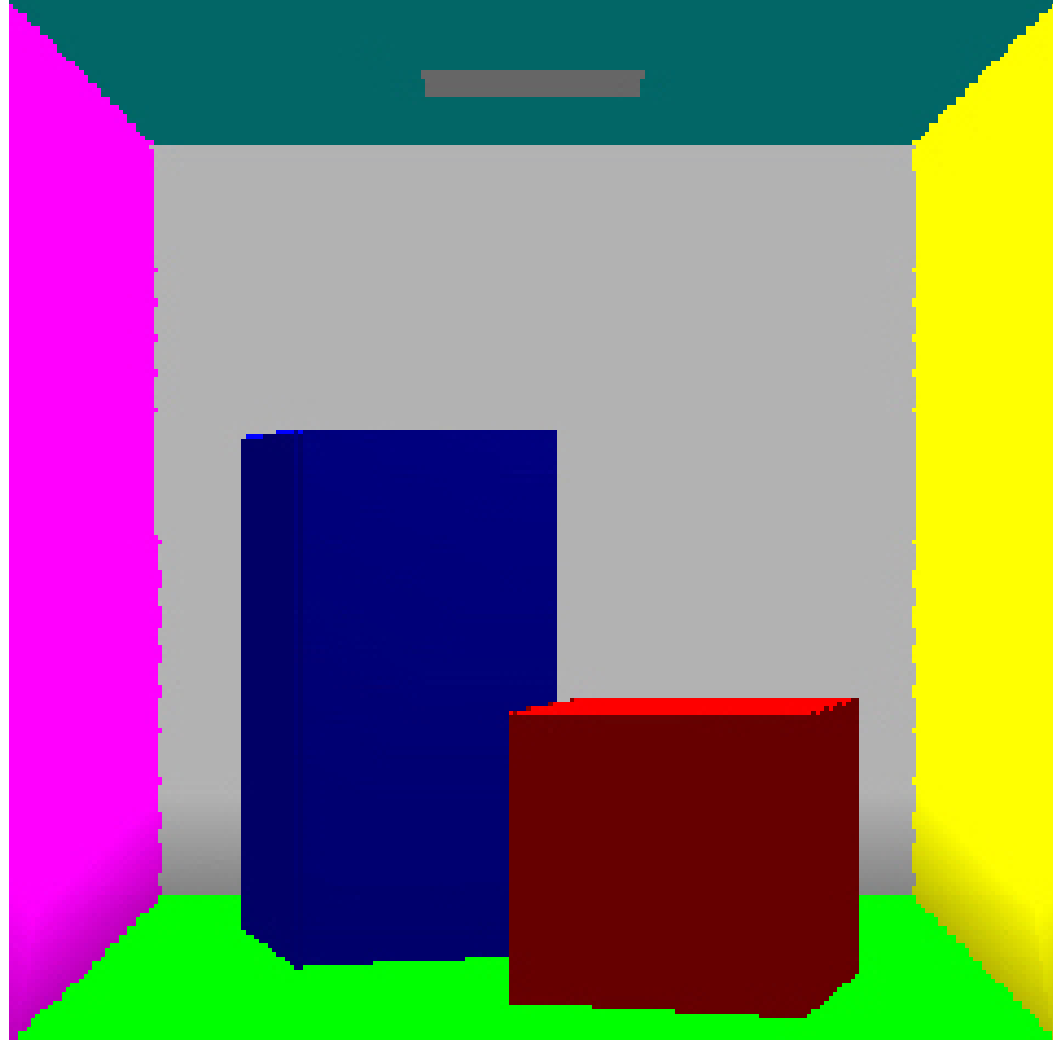
Change in perspective 2



Change in perspective 3



Change in perspective 4



Strangely familiar ?

Does this "deepening" effect look familiar ?

You will have seen it many times in film & cinema

For example in the 1970s horror classic:

jaws

<https://www.youtube.com/watch?v=NB4bikrNzMk>

Dolly Zoom 1



Dolly Zoom 2



Dolly Zoom 3



Dolly Zoom 4

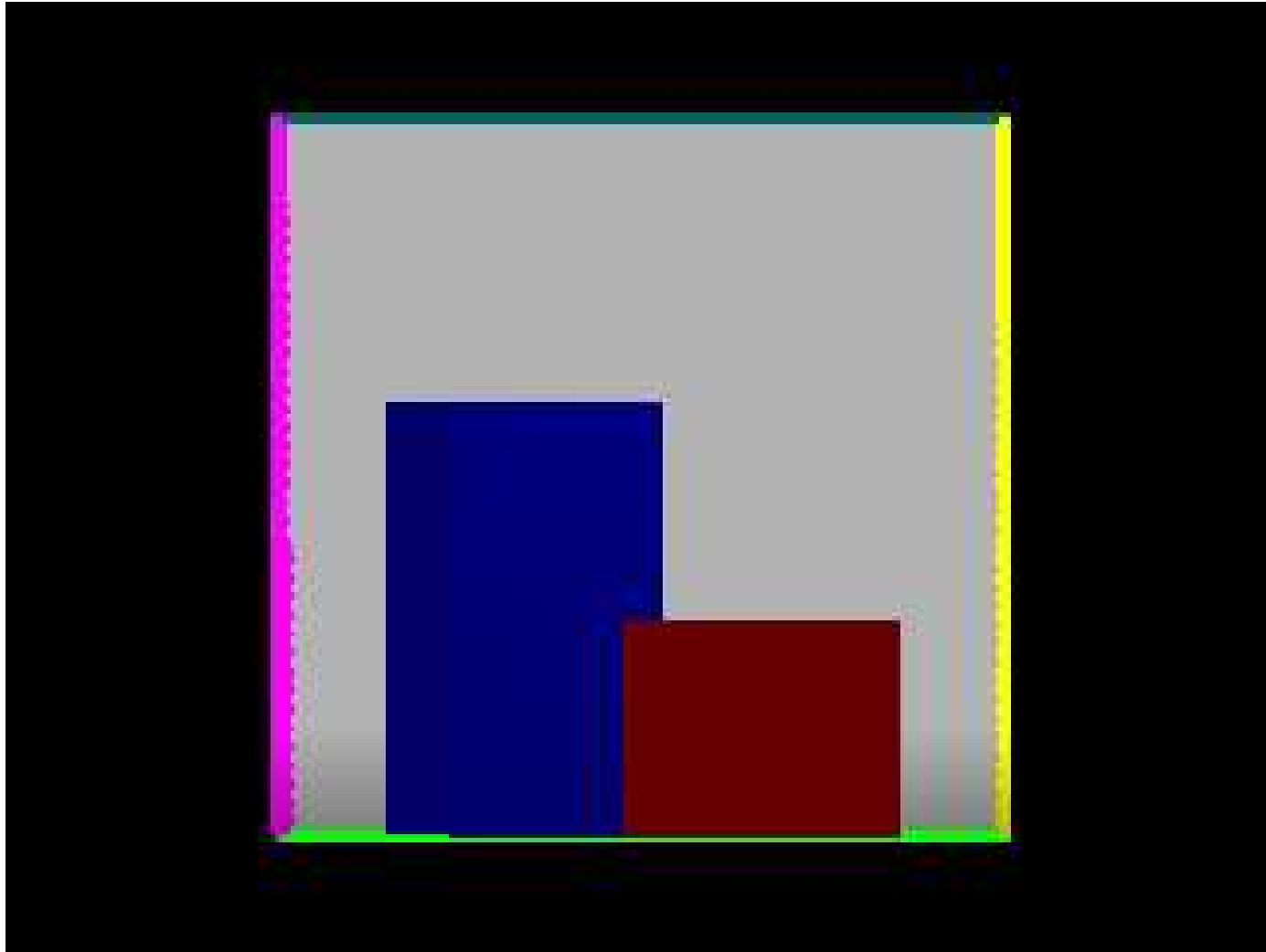


Extremes of Perspective

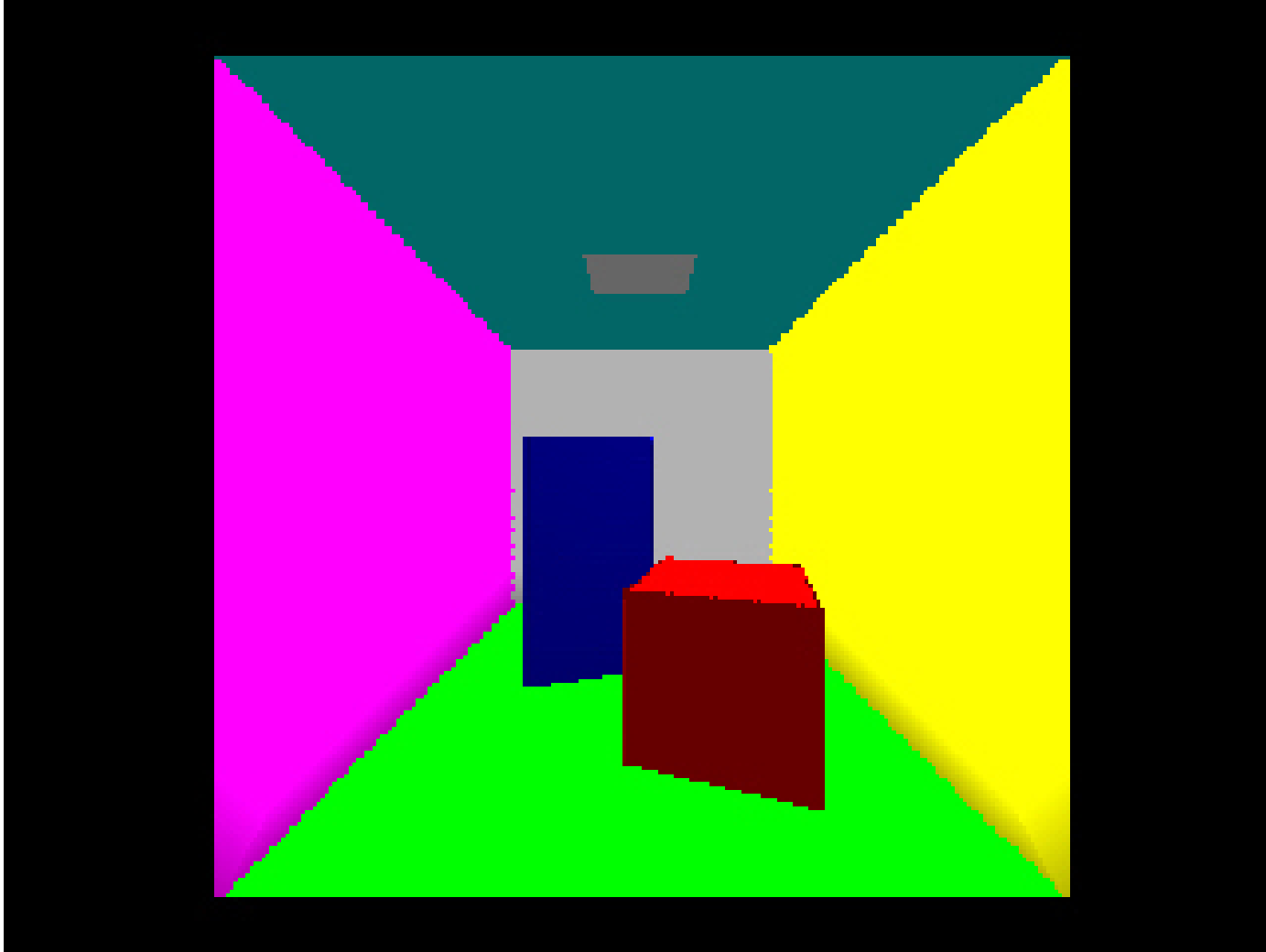
- or -

"How WRONG it can look"
(but still be RIGHT)

Extremes of Perspective - Far from Scene

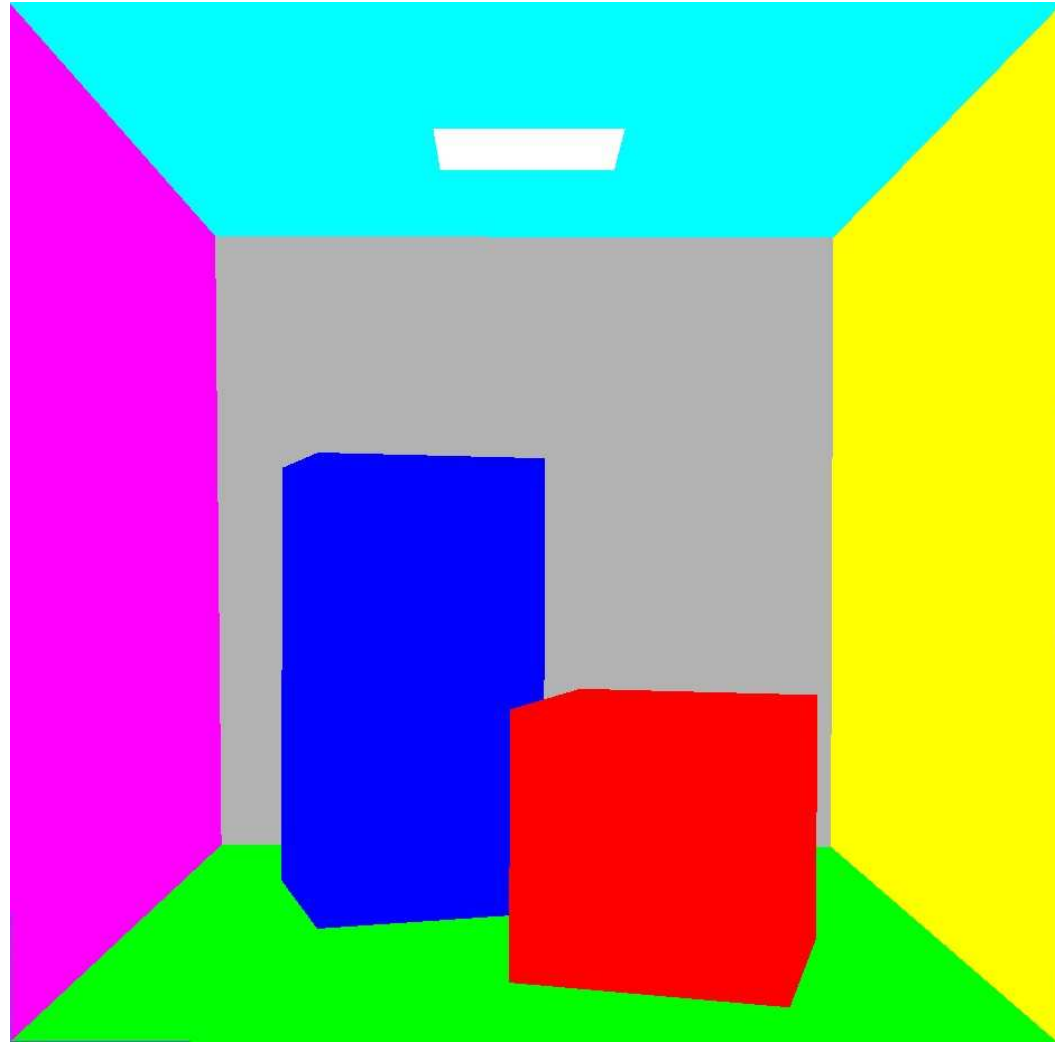


Extremes of Perspective - Close to Scene



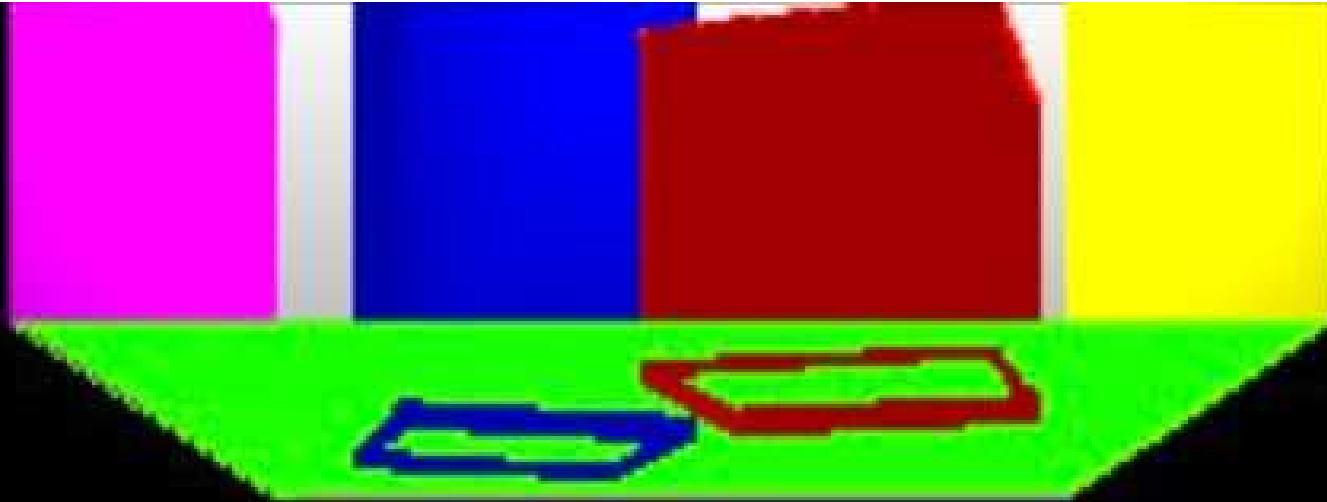
Different students - different perspectives !

Oh noz ! My ceiling is broken !!!



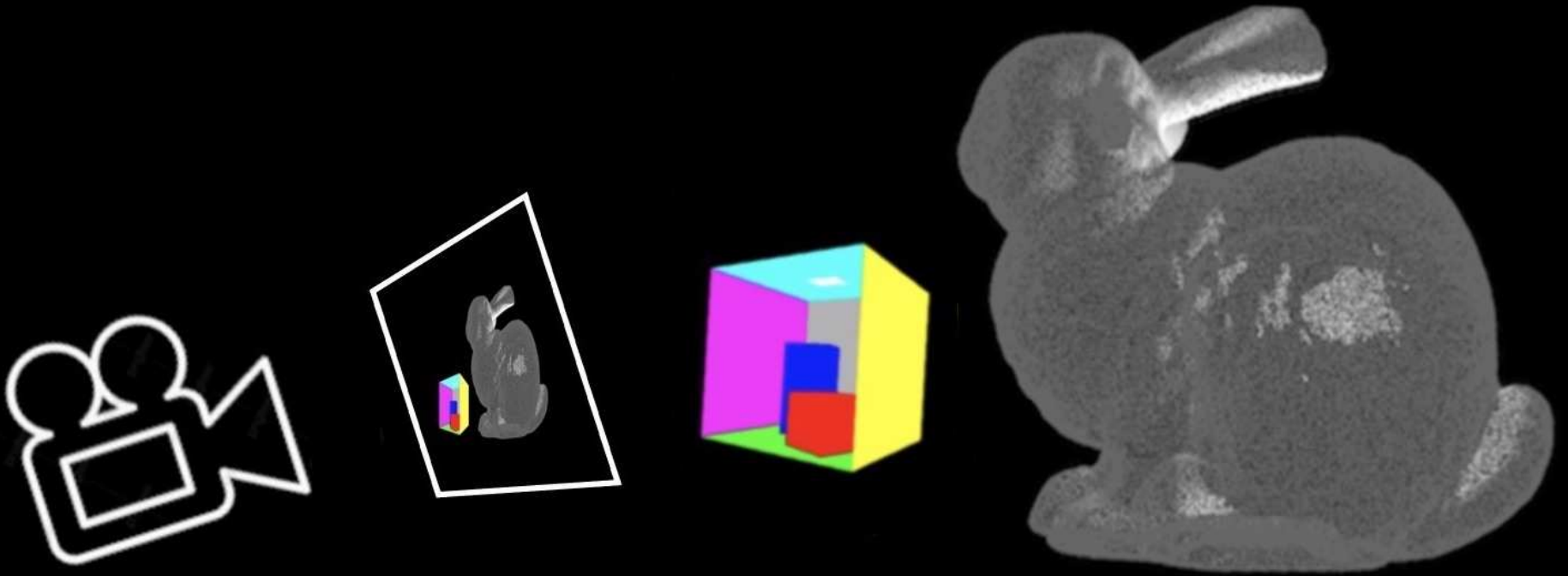
Oh noz ! My floor is broken !!!

yes it is



Time for a quick game !

Let's play "spot the origin" !



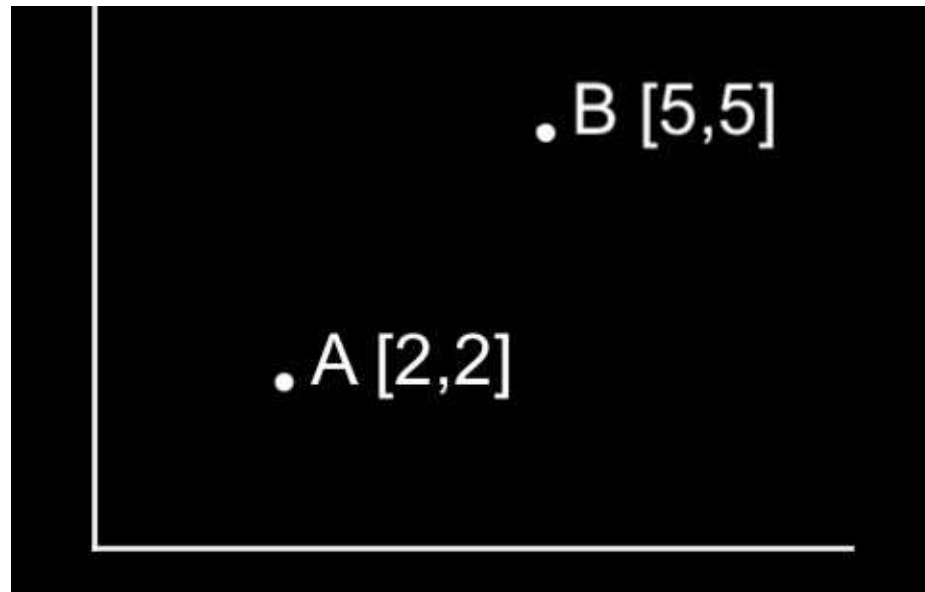
Transposition

For many rendering features we will explore...

We must shift positions between coordinate systems

Locate a certain point RELATIVE to a specific origin

Helpful trivial example: Where is B relative to A ?



And finally...

TheIncredibleShrinkingBuilding

Have a think about what causes this !