1.1 i) Only render part of the digitally displayed object. The parts that should not be ~~seen~~ visible by person shouldn't be rendered. You will need to be able to get depth, position, shape, etc. Basically you need to sense structures that exist in real world. You could use stereo camera, light, IR/depth cameras etc. Potentially make a depth map. Potentially in the future, we can use something like deep learning w/ CNNs to get a model to produce the depth given some image or video.

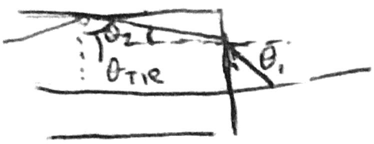
You could also create a mask of the object that should appear in real life and place it on top of the AR object? Must be same size, shape, color, etc.

ii) Since virtual objects appear in front of real world counterparts, might not be as big of an issue. You still need relative sizes/distances of real + virtual objects to determine scaling. Perhaps obtain perspective of space and map it to objects space/vice versa.

1)

1.2 $n_{guide} = n_2 = \sqrt{2}$

$n_{air} = n_1 = 1$



i) $\theta_{crit} = \sin^{-1}\left(\frac{n_1}{n_2}\right) = \sin^{-1}\left(\frac{1}{\sqrt{2}}\right) = 45°$ //

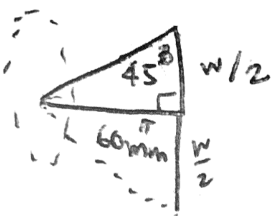
ii) $\theta_{TIR} = 60° \Rightarrow \theta_2 = 90° - 60° = 30°$

$n_1 \sin(\theta_1) = n_2 \sin(\theta_2)$

$\theta_1 = \sin^{-1}\left(\frac{n_2 \sin(30)}{\cancel{n_1} 1}\right) = \sin^{-1}\left(\frac{\sqrt{2}}{2}\right) = 45°$ //

iii) $f = 60mm$

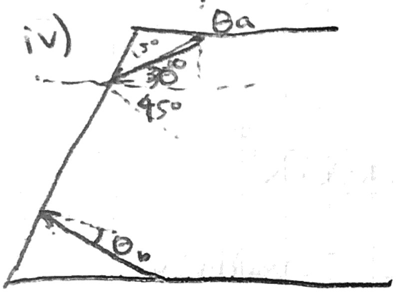
width of microdisplay? o display 60mm from lens.



$\tan(45)^{1} = \frac{60mm}{w/2} \Rightarrow 1\left(\frac{w}{2}\right) = 60mm$

$\boxed{w = 120mm}$

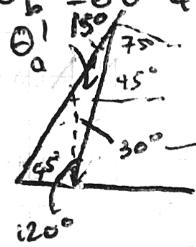
iv)



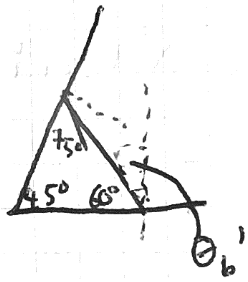
$\theta_a = 30 + 45 = 75°$
$\theta_b = 60 - 45 = 15°$ } relative to normal of slanted mirror.

$90 - 60 = 30$

$\theta_b' = 30°$



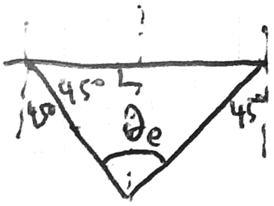
$\theta_a' = 30°$



$\theta_a' = \theta_b' = \theta'$

$n_1 \sin(\theta_1') = n_2 \sin(\theta')$

$\theta_1' = \sin^{-1}\left(\frac{n_2 \sin\theta'}{\cancel{n_1}}\right) = \sin^{-1}\left(\sqrt{2} \cdot \frac{1}{2}\right) = \boxed{45°}$



$\theta_e = (90 - 45) \cdot 2 = 45 \times 2 = \boxed{90°}$

v) $\theta_e = 120° \Rightarrow \theta_1' = 60°,\ \theta' = 30°$

$n_1 \sin(\theta_1') = n_2' \sin(\theta')$

$n_2' = \frac{\cancel{n_1} \sin(\theta_1')}{\sin(\theta')} = \frac{\sin(60)}{\sin(30)} = \boxed{\sqrt{3}} = n_2' \approx 1.73$

Flint glass ~1.69 is quite close Also sapphire/sapphire glass ~1.76 (Al_2O_3)

Maybe even crown glass (but n is lower).

2.1.3

(i) Smaller ipd values tended to make be dizzy after awhile. I think I ended up crossing my eyes for some of them and was able to get the desired 3D image (ex. when I tested ipd = 40mm). Pots not centered and shift to right in left eye and shif left in right eye.
Higher ipd didn't make me as dizzy but you could see >4 pots so results weren't super great. Center region was a mix of green + white (a bit turqoise-y almost).

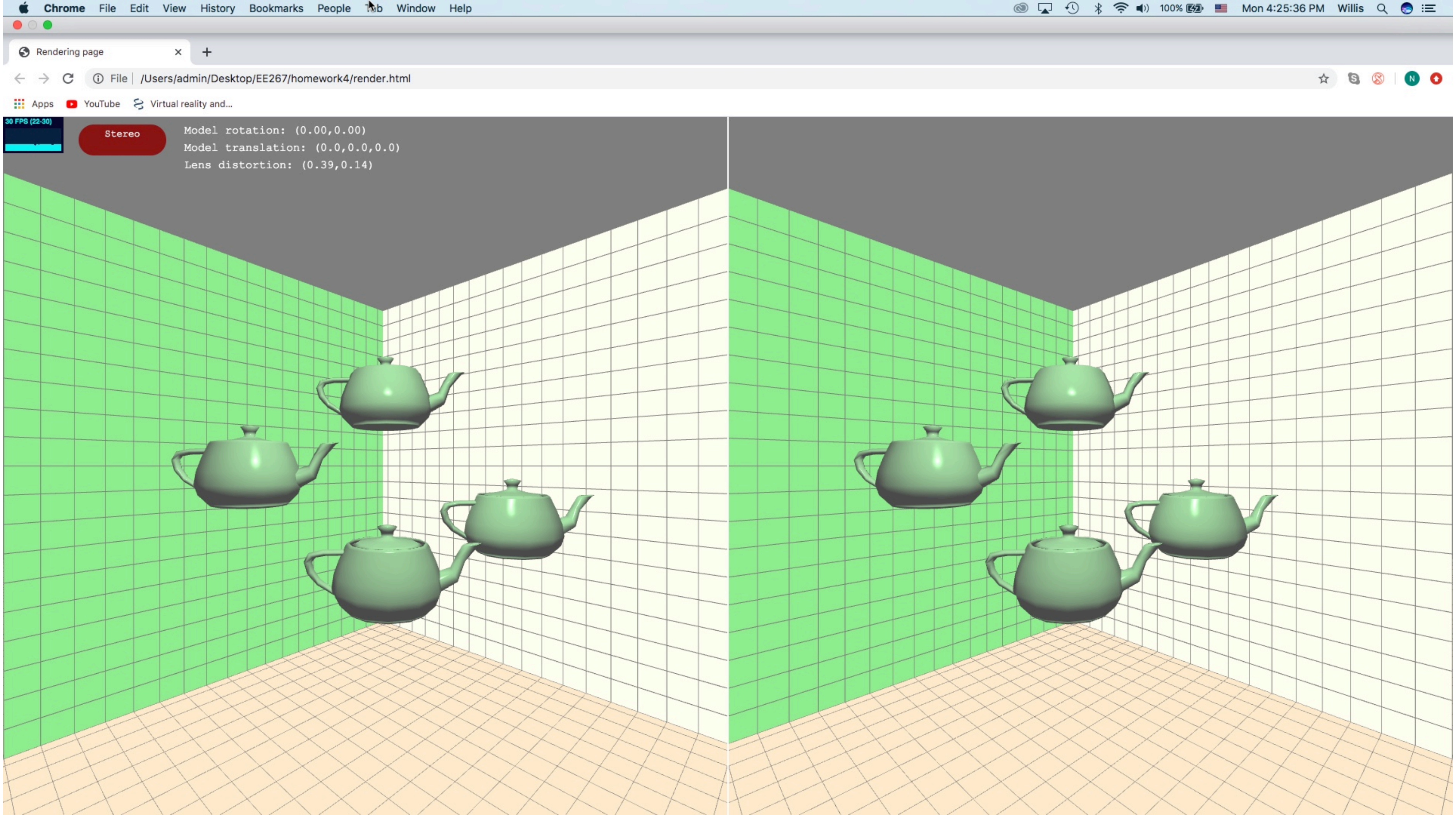
(ii) Honestly very hard for me to tell without my glasses on bc my eyesight is really bad and all the pots are very blurry to begin with (glasses don't fit in the HMD so).

519 & -280 ?

~~[2] Otherwise we can round up to the nearest integer with introducing a slight approximation.~~

2.2.3

We found that k_1 0.39 k_2 0.14 were pretty good values in terms of correcting the distortions (probably possible to find smaller k_1, k_2 values though).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YouTube
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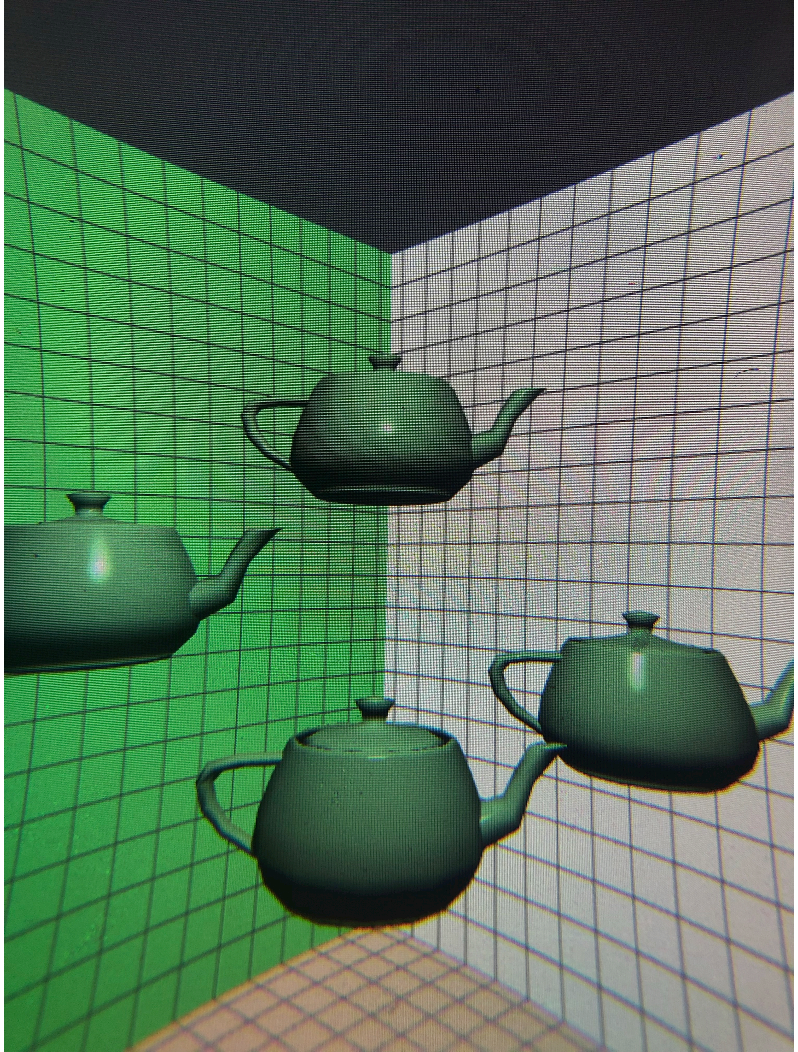
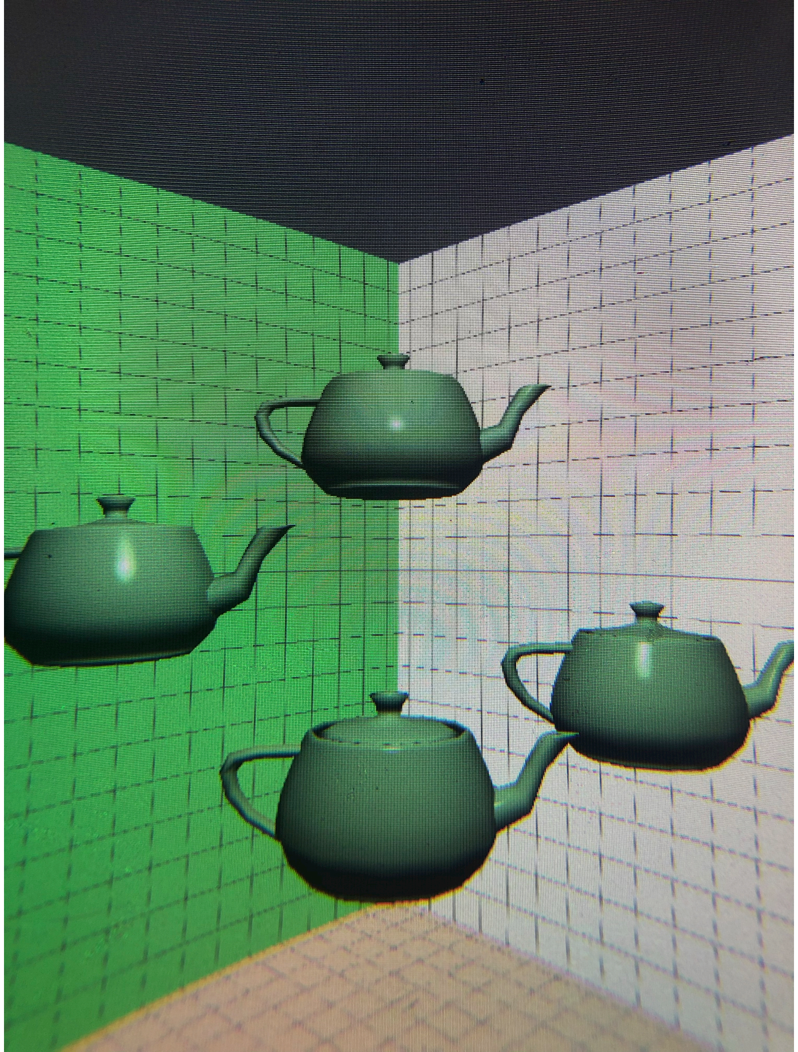
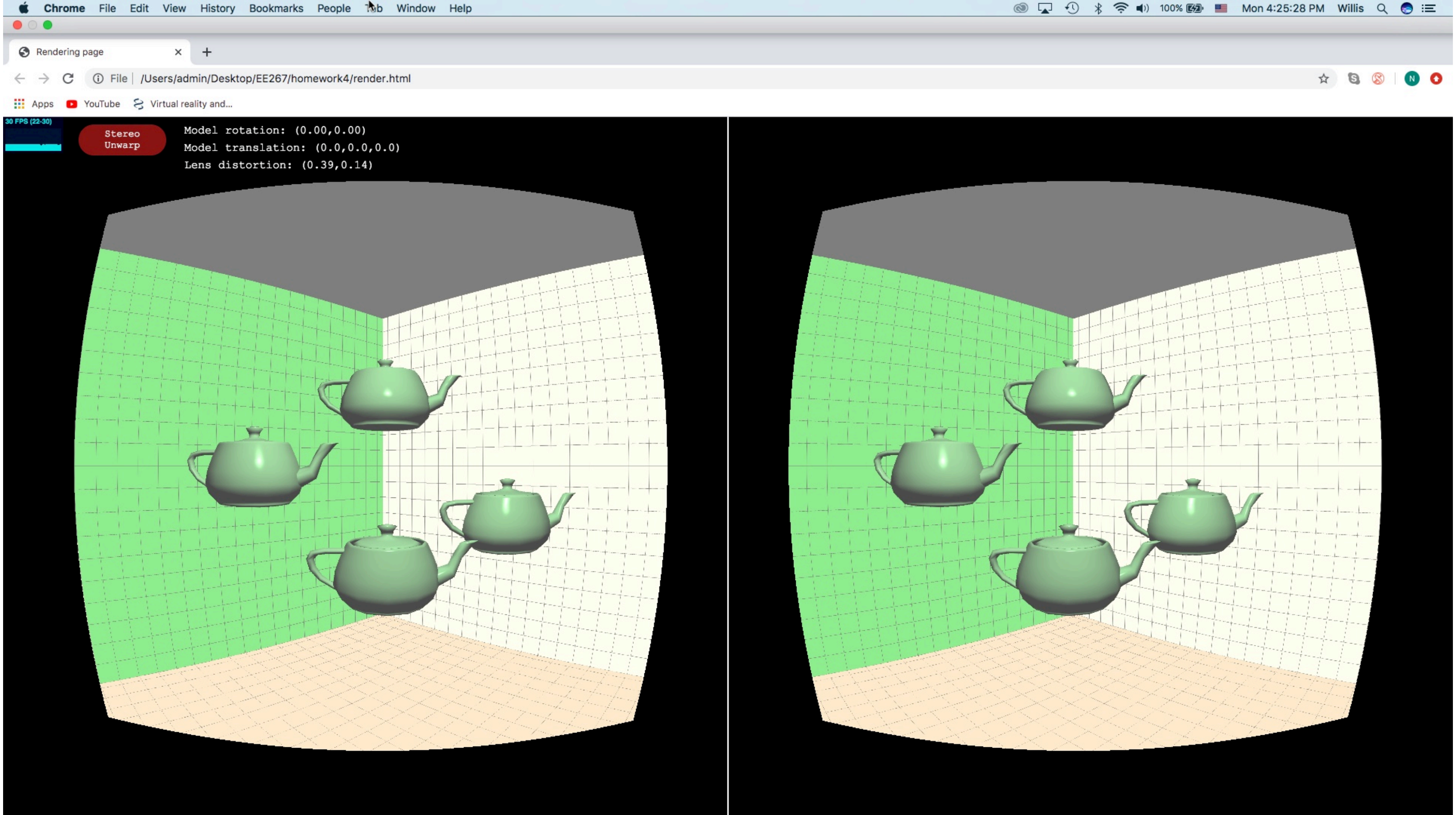
Stereo
Model rotation: (0.00,0.00)
Model translation: (0.0,0.0,0.0)
Lens distortion: (0.39,0.14)



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Stereo Unwarp
Model rotation: (0.00,0.00)
Model translation: (0.0,0.0,0.0)
Lens distortion: (0.39,0.14)