Virtual Reality
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Lecture – 6
Geometry of Virtual Worlds (eye transforms, cont'd)

Good to go; I can continue with the lecture.

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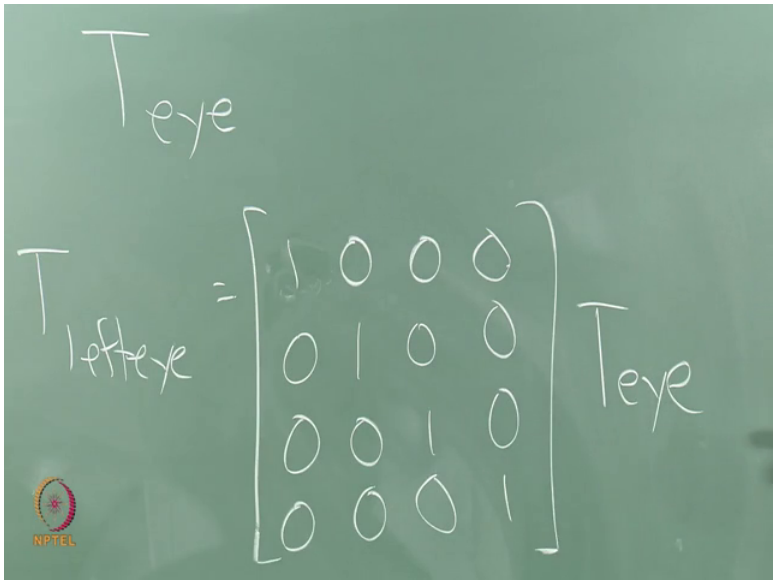

We just finished giving you the homogeneous transform for the cyclopean eye. One thing I like to add at this point is the pair of transformations that will make it stereo. So, I can give you right and left eyes. So, if you want to do that we get T let us say left eye which is equal to let me make an identity matrix first it is not a very good identity matrix see here, and then put T eye here and. So, I guess left eye is equal to T eye if I do this transformation because this is just the identity.

So, I just want to do a little fix. So, basically the horizontal direction from the coordinate system we set up is the x direction correct. So, I just want to take the x part here.

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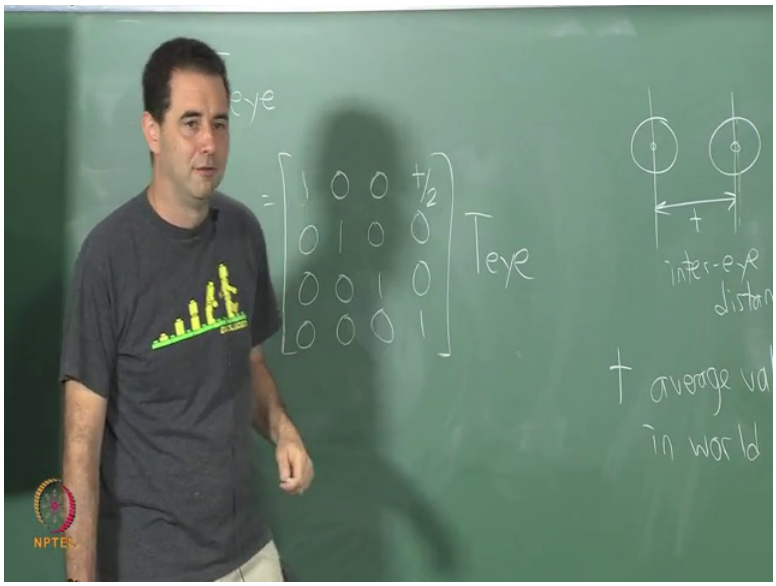

This is the x translation part and I want to put some shift in there, I will call it t over 2 or t I do not see here.

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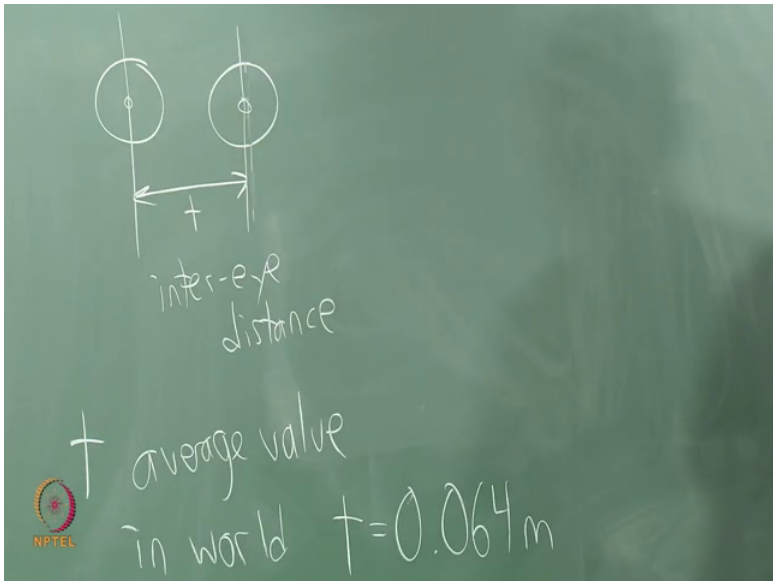

Is going be the inter eye distance in the virtual world. So, t is the inter eye distance in the world. And if you are curious about the real world the t average value in the world I mean in the real world in this case right like on the earth among humans, not among the monkeys running around on your campus, but among humans is equal to 0.064 meters or 64 millimeters.

So, that is just an average there is quite a bit of variation from person to person, and this is a nice example of when you define the world, it is good to use whatever system of units you use in your daily life. So, if you are using the metric system here, it is nice to set that all up. So, that your units in the world are meters. So, that then when you perform this shift here this makes appropriate sense because we are still using the coordinates of the world here for the eye, we have not done any strange distortions or rescaling yet right these are all rigid body transformations.

So, it is to use meter coordinates and for the left eye I do this transformation. So, is that does this need to be I guess one question need to ask here, just need to be minus or plus you think. So, let me think about this. So, I start off with a cyclopean view and then I want to figure out what the perspective should be for my left eye. So, if I all of the sudden move my eye to the left; that means, I should be shifting the world to the right which means that I am adding to the x coordinates. So, that is what I get that very easy to mess this up. In fact, and one of the very first oculus demos we were working on the right and left eyes were swapped and everybody in the company thought it was fine for a while, it was very difficult you had eventually look you had eventually look around the edge of some corner. So, that your left eye cannot see beyond the corner and your right eye can and you realize hey somethings not right here, and you have to learn to open one eye and close the other and try to resolve these things that gets into the perception parts again.

So, your brain cannot necessarily distinguish, when you make some of these mistakes. So, that is t left eye and for t right eye.

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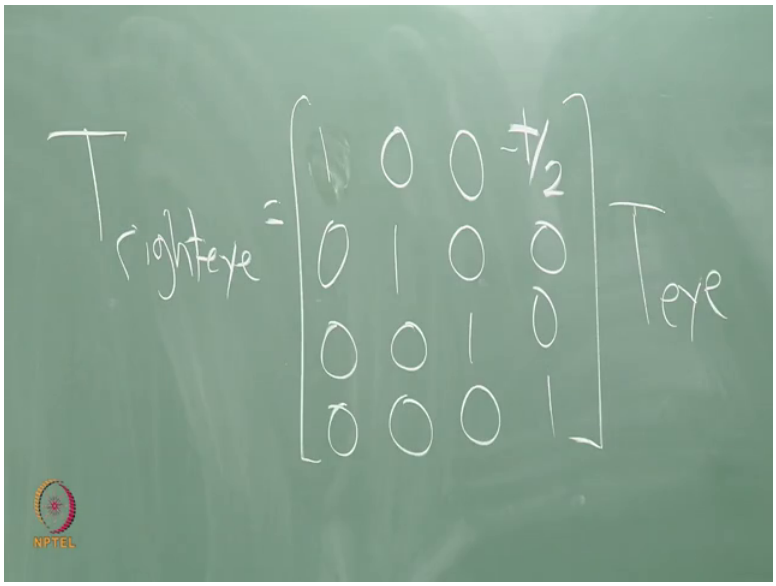

It is just the other way we just use the other sign, we just put minus t over 2 here and then fill in the oops sorry it is one we fill in the rest of the identity matrix and put T eye here. So, in that chain of transformations I gave you, if you want to go from cyclopean eye to binocular vision having left and right eyes then you just replace T eye with t right eye and t left eye and that will give you 2 different paths to go down for the rest of the chain to fix everything. You can try to do some hacks at the end where you just shift it all the way down on the pixel coordinates, but you may make mistakes.

So, it might look in some cases it may cause errors and others that are perceptible. So, this is the right way to fix it, even oh it might not be the most efficient way to fix it is correct and. So, there are other ways that may be more efficient, but their hacks and they may make mistakes we can talk about some of those kinds of things later in the in the question; questions about this yes.

Student: (Refer Time: 05:36).

The angle.

Student: Yeah.

Oh I see. So, for this is going to be this is still changing just the viewing I am still I see what you mean. So, you want to if they are both fixated on a single point in space right then you are right there will be some virgins, and that is something separate that we are

going to cover we are not going to we are not going to present images to the eyes, based exactly on which way they are oriented with respect to your head because we are not doing eye tracking. If we additionally add eye tracking then we would have to also consider the individual rotations of the eyes as they converge and our brains are considering that certainly in the real world and they are taking that part into account, but if we are just going to render onto a display it will be an assumption that the that the center views of the eyes are in fact, the same.

So, the eyes are in fact, looking off at infinity that is something infinitely far away and we are not taking the vergence into account well there is a very good question that is interesting. So, we are neglecting that part and it is here, but in some other system where you are taking eye tracking into account and you are presenting to the eyes exactly what the eyes are looking at considering that rotation this is called foliated rendering for example. It is more expensive to do that now and less clear how to solve all the engineering challenges, but it can be done and if that is done then you have to take that extra transformation into account other questions.