Virtual Reality
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Lecture - 20-1
Interfaces (social interaction)

Alright, so, let us all I want to say about system control. I want to get to the final of these 4 categories remember had another category, but I am not going to go into specifics on, I am just trying to cover the generic categories.

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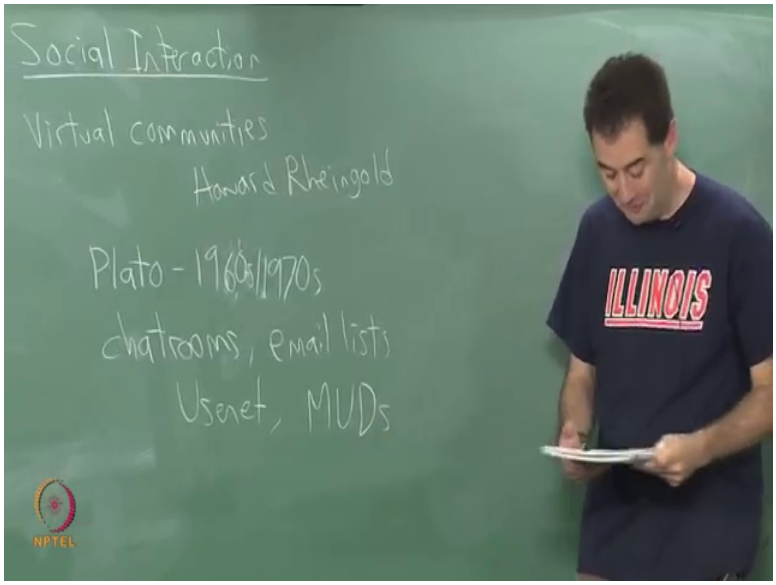

So, interfaces for social interaction. So, many years ago the idea of virtual communities was developed. This can be we considered as a part of sociology. And how do we, how do we interact and socialize build societies together? The term virtual communities came out of a book by Howard Rheingold. It is a long history of virtual communities. So, one of them is called Plato which is from the 1970, while see 60s and 70s which came from the University of Illinois and was a system for doing for education and.

So, in that time there were forums appearing. So, I was no worth computers brought together and people were interacting in the context of classes now a forum like the on the forum we have for the class the online forum seems very natural this is developing a kind of community for learning, right. So, you do not have to have a completely immersive

virtual reality experience to develop a community of people who have some kind of common goals or interests. So, I just want to point that out.

So, in addition there are chat rooms, then after a long time email lists, perhaps not as interactive, but we tend to use email lists all the time with threads going and discussions Usenet, Multi User Dungeons been around for many years. So, this idea of virtual communities has developed for quite a while and it is quite an independent thread of virtual reality right. You do not need virtual reality to build virtual communities and have some kind of social interaction right; human beings will do this in many other formats or many other kinds of media.

So, we have it is already been established that they do not have to be physically present in the same physical space to form a community correct, alright. So, a special case of that is through the some kind of virtual the some kind of virtual worlds.

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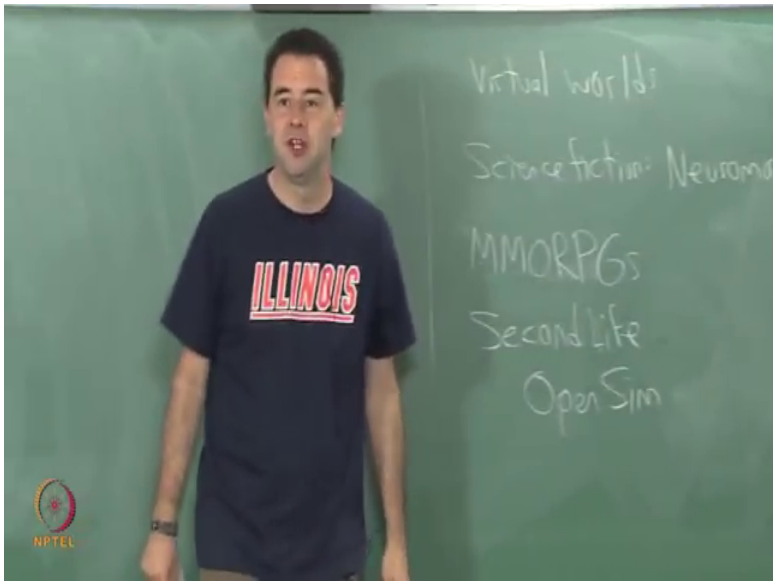

We have seen this idea all over in science fiction tell me just kind of when you list a few books that have inspired a lot of people in this space usually, they involve some kind of dystopian future society or people connected together through virtual reality um.

So, you can look these up if you have not seen them before Neuromancer from the 80s snow crash, from the 90 and ready player one from a few years ago. If you want to read

about all of the things that might happened to us one day if we immerse ourselves and virtual reality almost all the time or all the time.

Coming back to the real world MMORPGs is worth looking up if you are not familiar with that Massively Multiplayer Online Role Playing Games right, any of you involved in those, all right.

So, you have heard of this before it. So, it just depends on the on the audience, and these online games they involve some kind of teamwork and interaction perhaps with a bunch of strangers right, all around the world. So, it is fascinating I would say just corresponds to some kind of virtual worlds with social interaction occurring.

And second life this platform started around 2003 grew to have many users 10s of 1000s were connected together at the same time, building some kind of virtual worlds for interaction. The real people who are interacting through avatars so we have cartoon like representations of themselves, they are wearing clothes, they go to the shopping mall, and buy other buy outfits they socialize in virtual of pubs. They started buying real estate there became a currency called Linden dollars that was actually exchangeable for real currencies like you could exchange it for US dollars there is an exchange rate for that.

This is one of the earlier examples of a kind of independent currency. You see bit coin today very often. So, this was a that the currency that evolved in here was a precursor to that. All you need is some kind of social interaction community and people will start exchanging money that becomes effectively real money at least as real as the money we use that are backed by governments. Eventually it got into a lot of trouble in a lot of ways because there is no government inside of here really. And so it became hard to enforce rules and laws and theft and other kinds of things became a problem people would start to trick others out of money and its actually changeable for real money. So, it is a fascinating what happened inside of here.

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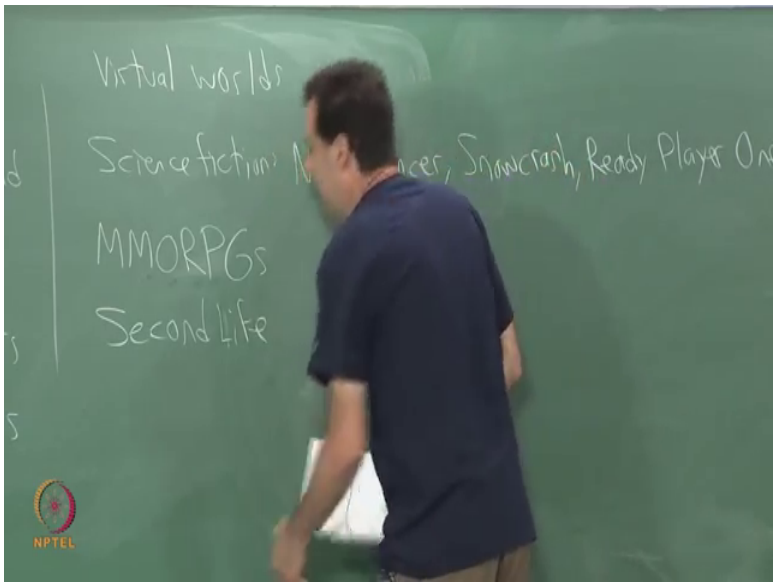

So, the creators of second life are were big fans of virtual reality they just did the best they could using the technology of the time which means do it all on a screen do not worry about the problems of head tracking and immersion and simulator sickness. They have worried about the social interaction part and so the people who the creators of second life are continuing to be involved in the virtual reality community and want to see it brought to the next level, where you feel like you are completely inhabiting these worlds, alright.

So, virtual reality is increasing the amount of immersion this feeling of being present together is that important for social interaction or not. I do not know which we started let us say a long time ago with telephones for talking to each other, and then we carry around these things we call smart phones how often are we phoning each other versus I am sending text messages, all right. So, which what is more immersive and why give you more of a feeling of presence? When you are talking to someone on the phone or when your text messaging them? I would think the phone feels a little more immersive.

In fact, I will go the other direction I will add video to that, wow now I have a video conference going with my friend How often do you do that versus just sending a text message all right. So, it is very interesting right.

So, you feel like you get pretty good interactional text. So, I do not think its always very clear you know it is not necessarily the case that more immersion more feeling of

presence somehow improves the interaction, right. You would like to just roll out of bed and start sending text messages and not really worry about how you look for example, right maybe that is an issue. So, something to pay attention to.

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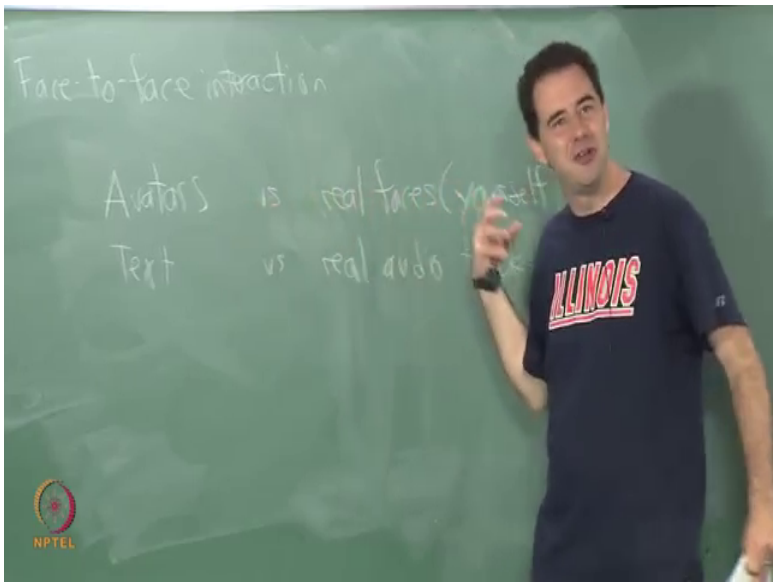

On the subject of face to face interaction which again might not be necessary at all [FL] maybe we put on our virtual reality headsets and then we just read text messages from each other right. Why would you do that? I do not know.

But if you are spending all of your time inside of virtual reality you might still be texting with your friends then right. And in second life all the interaction was done by texting. And I asked people who are who are who are in that very active in that community there is also an open source of version then I encourage you to try called open sim or open simulator. So, if you are all especially if you are on Linux platforms you may find that very interesting and hopefully people are running servers on that.

So, I asked them why do not you just transmit the voice and they care a lot about the anonymity of it they like to be someone else. You know they become their avatar, and so the texting part let us them communicable with each other and they would walk around in these virtual worlds. And only when they get closed enough within what would be normal hearing distance then you can see the texts of each other. So, the texting replace that.

If you wanted to do an audio track version you may need something like a voice disguise to listen right, because they are already running around with avatars that disguise their appearance. So, you would need to disguise the voice to have it will be comparable, right. So, that that could work you could make a real time voice warbler or some kind of distortion transform to the to the voice, but texting works just finer.

So, when we get to face to face to face interaction we have on the one hand avatars which is some graphical representation of oneself. If you want to look like a monkey it is up to you can be anything you like, you could look like a xs piece of fruit it does not matter really, but so you decide to have some kind of other representation. Probably something that animates itself now a piece of fruit put in you know you can trying to give you extremes versus real faces.

In other words yourself captured as well as you possibly you can capture it. Maybe just capture with a video camera and transmit, maybe you do something more sophisticated to provide 3 dimensional information. And for the audio part maybe you have text versus the real audio, all right. So, that is the visual part in the first line on the hearing part in the second line.

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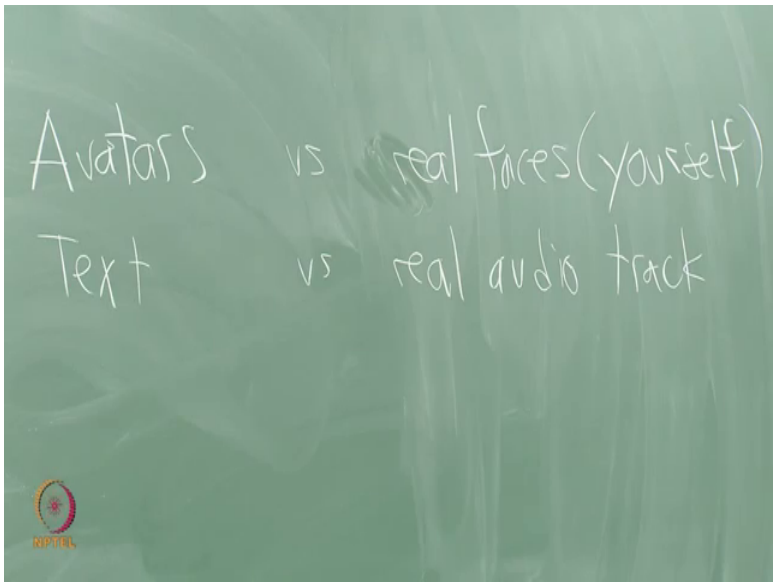

So, on this side you are approaching realism you are trying to match the physical world experience, on this side you are approaching fantasy right. You having a chance to escape the real world yet still have some kind of interesting social interaction. So, these are both

the interesting and useful extremes. Think about your task think about the experience you are trying to make.

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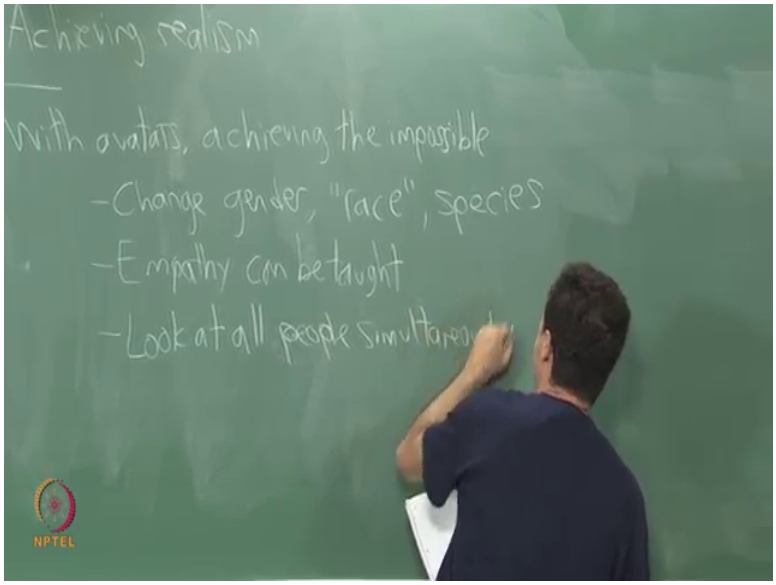

So, regarding achieving realism how might I do that, right. So, maybe I just placed in the environment like in this classroom today I just put an how many directional camera, all right.

So, using multiple cameras that are synchronized, using lenses, optical techniques, for a wide field of view; however, you want to put it together build a coherent panoramic video and then transmit that. And someone we can look around and feel like they are here that should be very realistic may be better to capture all of the information in stereo or capture the entire light filled somehow. So, they can move their head around, get parallax, get everything working just right that would be an extreme level of realism.

And you know maybe not too difficult if you just want to do a monoscopic, panorama and transmit the live video. You could replace your face to face on a screen video conferencing with full live panorama, all right. So, that is not too bad.

One problem is that if each of you is wearing a head mounted display then in the panorama you will be wearing a head mounted display. So, then I cannot see your eyes, all right. So, we have a great conversation, but every time we meet we have black bricks on our faces right. So, it is kind of unfortunate, but that is one of the outcomes all right.

So, what do you want to do about that? You can put little cameras inside. So, I could at least try to capture the part of your face that is being obscured by the headset. But I still have to reconstruct the rim parts that I cannot see any way you know it is a max number how you do it? So what exactly you are you going to reconstruct?

Another interesting problem is that what if I would like to extract the person out of the real world and put them into a virtual world. Maybe I would like to move if you and I are interacting maybe I would like to move us to some virtual world or perhaps we would like to be standing in Paris talking together right, make it appear like that. Now, you have to do a lot of difficult work to extract some representation of our bodies and move us to that location right the moving parts not too hard once you have a good representation of the entire person.

So, it is a lot of work and it is going to be very challenging to get that accurate without having access to your own private motion capture studio or you can put markers all over the body and try to completely and perfectly extract representation of the person. So, that is a very difficult problem. So, it was very easy if we all stay in the same place and we just captured with omnidirectional video becomes very challenging if we want to extract just the body maybe put a blue screen behind and extract the body and move it somewhere else. So, make sense and always take into account problems of delays if we want to move ourselves to another location on the earth for example, or some other virtual world there may be problems with synchronization. And if you see my lips moving, it might not be synchronized perfectly with the audio. So, another issue maybe it is better to delay them both just, so that they are synchronized, all right.

So, that is some comments about achieving realism. Let us think about with avatars, with avatars we can achieve the impossible, right. So, you can achieve some things that are not possible in the real world.

So, some kind of transformed social interaction right beyond what even normally seems possible. For example, you can change, you can change your gender and see what happens as you interact with people right. You can change your race whatever that means, you could change your species, all right.

It could be some kind of fictitious alien or creature of some kind you could be running around like a virtual Godzilla and see how people interact all right. Do your friends

respect you more when you when you run around like that? You can change just very simple characteristics like maybe you just change your height all right. Change your eye colour, your weight and just see how people interact. It is very interesting because this gives you an opportunity to maybe experience empathy all right, to put yourself in someone else is place right. Very often when people complain of a racial issues, gender bias things like this why do not you try it yourself and see how people treat you, all right. So, you can put yourself in their perspective.

So, working with an avatar gives you an excellent and an unusual opportunity to experience what it is like from someone else is perspective rather than just form an opinion quickly without really have having experienced it yourself. So that means, that empathy can be taught.

For example, perhaps in police training videos, you may be able to have the police enter certain situations, but they get to be different characters in the scenario. And everyone can look at it, and learn evaluate, and it is everyone being treated fairly you know they may get a feeling of what it is like to be the one being arrested right and why are they being arrested perhaps they feel like they are being discriminated against. So, there is a lot of interesting opportunities there.

Along the same line of achieving the impossible you may be able to look at all people simultaneously.

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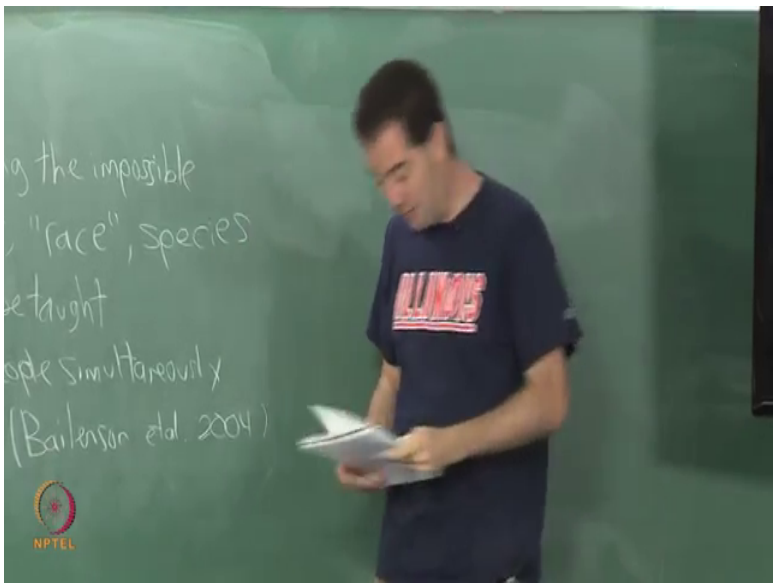

This comes from a paper by a Jeremy Balanson at all from Stanford in a 2004, and Jeremy Balanson has done a lot of research on social interaction and virtual reality. So, there is just one example is a lot of interesting papers from his lab.

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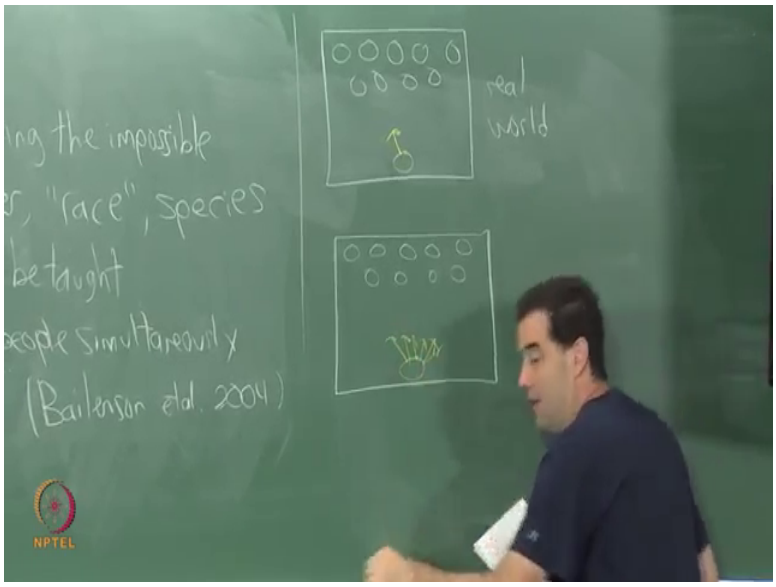

So, for example, in today's classroom there are bunch of students I will just draw you as circles if you do not mind. So, the bunch of students sitting in the classroom and there is one lecturer me and I look in some direction at a given time. So, I can only look in one place.

So, this is the real world and it is been a lot of studies that show that the learning outcome is enhanced by live presence, right. So, I am doing a live performance today and that that increases your learning capabilities, your learning abilities. And so if I am recorded then I believe it goes down quite a bit all right. Part of it I think is just maybe a little bit of the fear that I might look around and see if one of you is not really paying attention, maybe you look like you are sleeping, doing something else I can look around at you and watch when I am giving this lecture.

But if you, but if I do not pay attention to you for a long period of time then you might start to fade away right, or what if you have the fear that I might call on you and ask you a question all right. You know it is safe for the recording well in virtual reality I could make a transformed classroom where people are all sitting there and I could be looking at

all of you at the same time because when you are wearing the virtual reality headset I am looking at you, all right.

So, I can be looking at all of you at the same time and give you this feeling and maybe I am not paying attention at all, maybe I am recorded, maybe I am not, maybe once in a while a real person appears and is in fact, looking at you and is going to ask you a question. So, you will get a little bit of that fear that maybe someone is paying attention to you. But maybe 50 percent of the time or less there is no one there at all and no one even looking at you it is just completely recording, right.

So, there is all kinds of interesting possibilities to help you stay more focused and pay attention me out of this fear that a human being might care and that human being might assign a grade to you at the end of the course right. So, things like that.

So, I think that is a great example of how you can achieve the impossible. Something that is not even possible in the real world, but it still leverages your real world experiences and expectations. Questions about that?

So, suppose we have an avatar and I still want to bring some realism back, so I am kind of going the other way now. I started off with a realism over two avatars I want to go back. And I should say before I go back the avatar representation could be very simple. How much do we need right? We just need some simple lines, and some very simple expressions that indicate our emotions maybe that is enough right.

We know about emoticons, and the power of those in texting is there going to be something similar like avatar visual virtual reality emoticons that just give us an idea of the emotion of our of our friends. Or people are interacting was or just an emoticon or something like that it gives us an idea of whether or not they are paying attention right, so how much do we need. So, that is one extreme we get a very simple representations or you could try bringing realism into the avatar.

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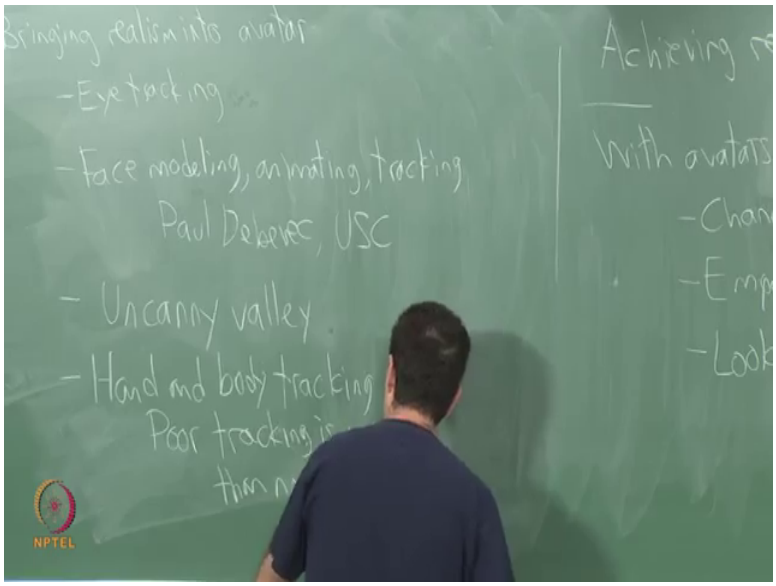

So, if that is the case well maybe I can do some eye tracking, all right. So, maybe every time I blink my eyes in the real world my avatar blinks as well maybe I can wink I can close one eye, all right. So, I can do some simple gesturing if you like to call that with my eyes you could also figure out where people are looking if you track the eyes, right. So, when that it can be kind of creepy you have this cartoon like representation, but the eyes of the cartoon like representation to correspond to exactly where the physical real person is looking. So, it is not, so you could bring that information back.

You could go even further and you face modelling and I should go back for the eye tracking I mentioned foliated rendering before and said that you had there were very high performance demands for that. For simple social interaction the eye tracking demands are much less, you know maybe just generally you know where is the person looking some latency maybe is not too much of a problem. So, there is no point that this is much more feasible at let us say a low cost which was the minimal kind of engineering requirements. But if you want to do something like foliated rendering as we have talked about before then the performance demands are higher. So, this is called as basic eye tracking.

Face modelling, so what if I would like to do modelling and animating and tracking of my face? So, while I am making different gestures here there is a avatar face that I have that moving along with me capturing as many of my emotions as possible. So, you may

make a model of the kinematics and dynamics the muscles of the face try to match everything up as well as possible.

If you would like to see some work on that I suggest looking at the work by Paul De Bewick who is at the university of Southern California he is done a lot of facial modelling and animating and tracking for the motion picture industry. And so you get very realistic looking faces.

Now, one problem you have when you go down his path is what is called the uncanny valley. So, whether it is in motion pictures where there are synthetically generated actors and facial expressions, it is also the same in robotics for humanoid robots as you start to approach human realism people do not like it. And then finally, there is some threshold that is crossed when you come out of the valley and then it is considered acceptable it has to be really good and very close to reality for people to accept it.

Otherwise there is this uncanny region where I do not it feels like maybe a dead person talking or something. It just does not seem right something is just not quite captured correctly. And so that is what you risk when you go down the path of very realistic face modelling is Jesus seems like my friend, but they look more like a kind of dead puppet or something that is that is moving along and it is very creepy and uncomfortable. So, that is something to be aware of.

And of course, you can go down the path of hand and full body tracking. How important is that? Well, I can get gestures, if we are just sitting in chairs talking it might not be very important, if we are walking around together maybe it is important if we are playing a sport together. If you want to play a virtual tennis and then maybe that would be very nice to have everything captured. For playing virtual of tennis that would be difficult to require a lot of space if you want to move around completely and play just like in the real world and you have the haptic force feedback interaction part was the tennis racket, so that would be difficult.

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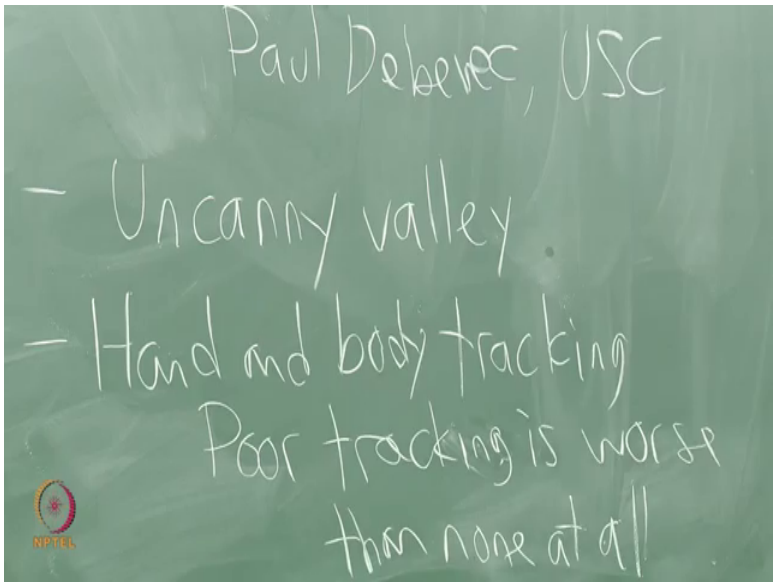

Nevertheless you can do this one morning I want to give you though is that poor tracking, poor tracking is worse than none at all right. If I have a tracking algorithm I am moving my arm around, imagine you are visualizing your friend, they are moving all of a sudden looks like their elbows and then broken in their arms popped in the other direction oh then it pops back again, so very disturbing, very uncomfortable, annoying..

So, a lot of tracking systems even if you see a great demo you may watch a video online looks great if you go try it yourself you will see a lot of flaws they usually show you the best cases not the worst cases. Usually they are not even showing you the typical cases. So, lot of interest in tracking more and more of the body, but it is not very reliable and accurate, it is better in many cases to not do it at all. Think about what you are trying to do for your task determine what you need how accurate does not need to be is it really required to match the physical world or not.

For basic social interaction probably not you get a lot of social interaction as I said just from text messaging. So, what exactly do you need here? Think about it very careful. Any questions on that?

If you would like some more reading that is related to these topics. One thing I suggest is I am I mentioned this, I believe last time 3D user interfaces.

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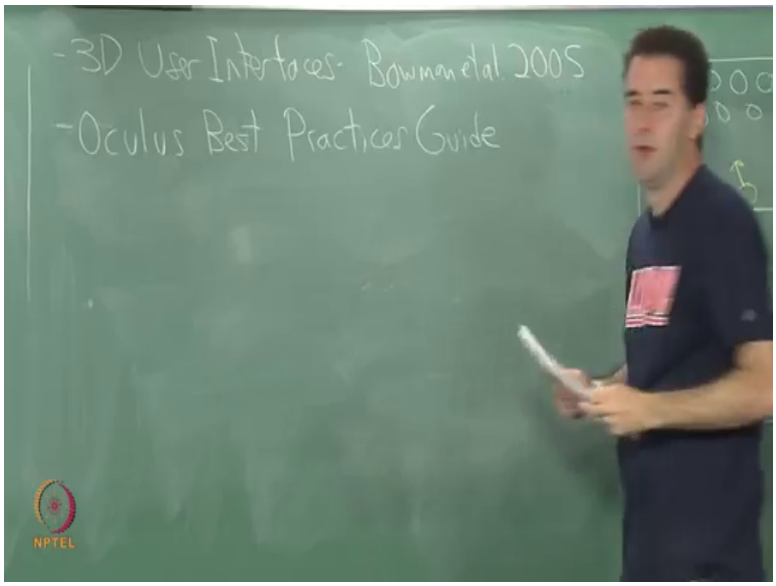

Although it is not particular to head mounted displays is more general for virtual reality, augmented reality and a few other examples in that general area. Both are 3D user interfaces by Bowman et al believe it is 2005. So, lot of the technology examples in that book are significantly dated.

But it does give you a lot of the general principles and also strongly suggest that you look at the oculus best practices guide which you can download online for free. This was written by a coming together of experienced video game developers and perceptual psychologist. So, its science and game development and experience merged together. And it provides a lot of recommendations some of these things about like where to place menus gives you guides for that, very simple recommendations like never turn off the head tracking.

So, as an example one of these apps that you might use in the labs that allows you to to experience panoramas that were captured by for Google street view. If it is loading and other panorama it tends to turn off the head tracking, that is the most nauseating part of that experience it turns out. It is a head tracking all the sudden freezes well load something else and you are in trouble. So, do not starve of the tracking thread you have to keep the tracking going.

So, examples of recommendations like a very practical advice and it is based on lot of the scientific aspects that I have covered in this in this class from a perspective of perceptual psychology and human physiology, all right.

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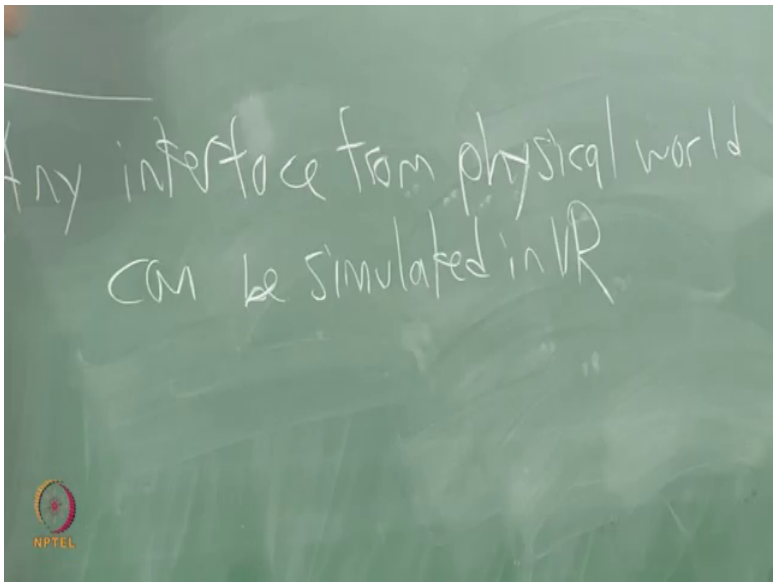

One final comment on interfaces: So, I said this before any interface from the real world or the physical world can be simulated in VR. So that means, that any VR interface can be simulated in VR right, well no it does not mean that does not, but I will does not extension it does this is we being a generalization of this.

So, if I start simulating interfaces in VR from the physical world, I can then stimulate VR interfaces I guess that in VR I can put on a VR headset and I guess keep doing that and definitely, right. So, lot of weird things you can do I will give you something bizarre to think about so. So, you can have more and more levels I suppose. So, take anything in the physical world simulated in VR, but then even putting on a VR headset can be simulated, so very strange right. Questions about interfaces?

I have one final part which is advice on a evaluation of virtual reality systems. So, that is only go to that part, yes.

Student: Sir, would putting on a VR headset in VR that use (Refer Time: 29:35) simulator sickness by any degree?

Student: Suppose the person is like he knows that you guys simulator sickness by using (Refer Time: 29:43).

No, I do not know what happens. I guess once you put on the simulated VR headset in VR if it is assuming there is no additional latency and head tracking because it is not real anyway, then I suppose your brain is convinced that there was just one level of virtual reality right. So, reminds me of the movie Inception where you have all these different levels of dreams and you keep going further and further down so, except there is no time scaling distortion.

So, I assume it is just you have the same problems again because it really ultimately is built. The problems of simulator sickness are only based on the physical layer which is what are the visual stimuli that are being presented to your to your eyes.