Audio for Virtual Reality
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Crosstalk Cancelation

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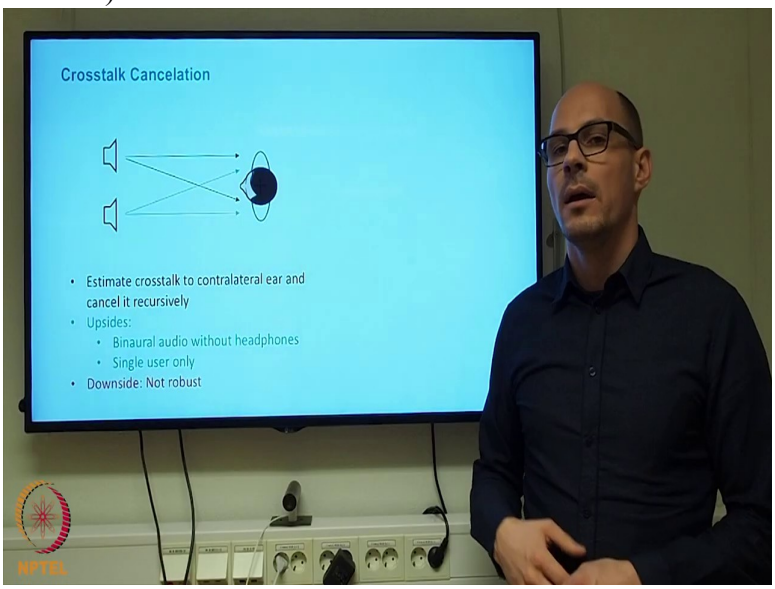

A solution that would not have this restriction of being able to render phantom sources or virtual sources between the two loudspeakers on the standard system make use of so-called crosstalk cancellation.

Crosstalk refers to the signal from; let us say the right loudspeaker in a standard system that spills over to the left ear, to the contralateral ear. This is called crosstalk

And the way these systems work is that the crosstalk

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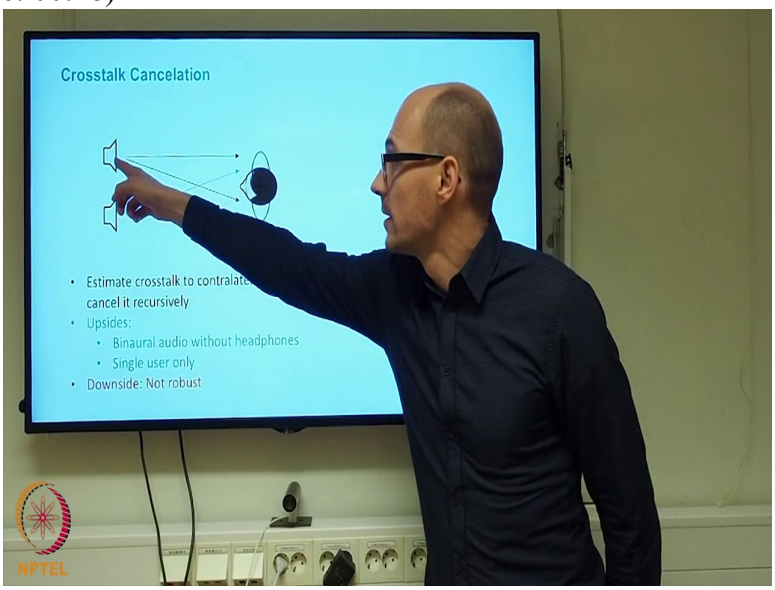

from let us say, from the right loudspeaker to the left ear is predicted and then the left ear

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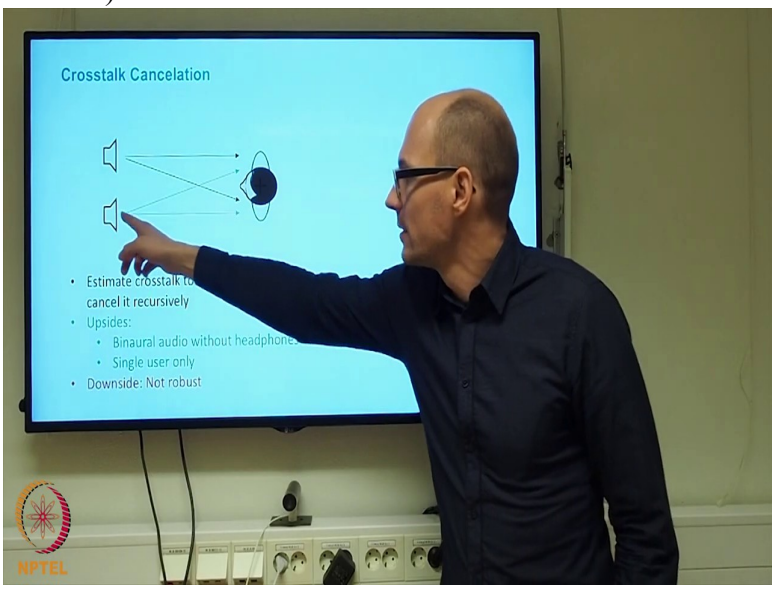

sends a signal to cancel out that crosstalk so the signal is, the crosstalk is predicted.

And then a signal is radiated at the right moment with opposite algebraic sign and then in the ideal case the crosstalk and the cancellation signal, they cancel out each other perfectly at the contralateral ear.

But of course unfortunately the cancellation signal also produces crosstalk to the right ear in this case so that you need to cancel the cancellation signal of the crosstalk. And then of course that signal will also spill over so you have infinite recursion.

But fortunately it converges so that you eventually arrive at a stable solution and this allows you

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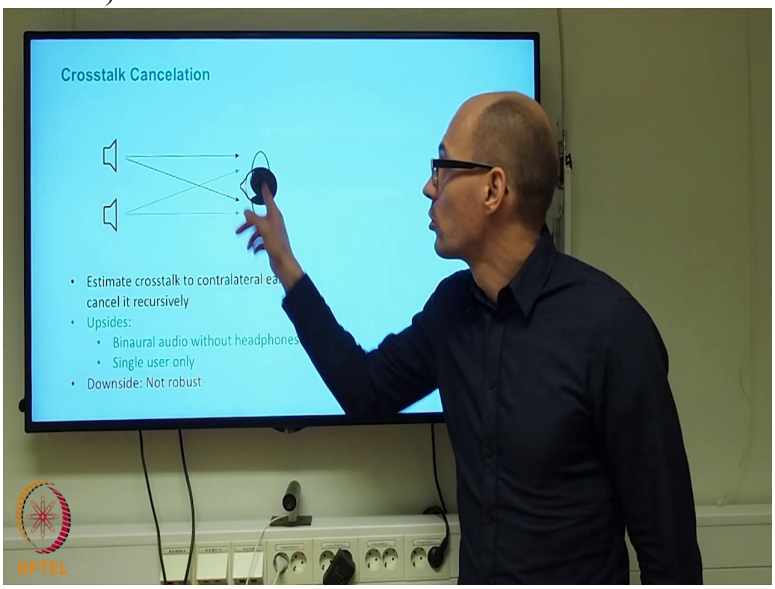

to control the ear signals of the listener independently of each other so that we can again make use of head related transfer functions and perform binaural audio reproduction over loudspeakers that are located away from the user, that are not mounted in headphones.

This works for 2 loudspeakers

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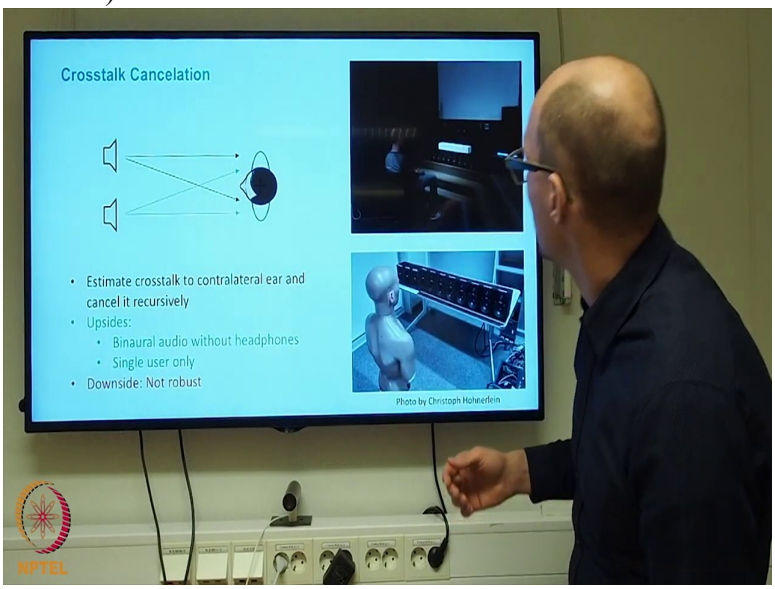

but you can also do it with more loudspeakers, with a loudspeaker array for example then all these loudspeakers will be active at the same time and they will then take care that there will be constructive interference of the signals at the ipsilateral ear and destructive interference at the contralateral ear so that you can again use binaural signals to render spatial information.

And it, the situation tends to be more stable, more robust with a loudspeaker array. You can imagine tiny movements of the user's head can dramatically change the crosstalk that occurs and it is only possible to predict it with certain accuracy.

So any uncertainty in this, any inaccuracy in the system, in terms of for example the loudspeaker gain or the reflection of the wall or so can impair the experience dramatically.

So the upsides are you can do a 3D, locally you can render 3 D localization cues without headphones and, sorry this is single user only that is a downside.

That is not an upside and because you want to control the ear signals at an second or even more users inside that scene would notice very soon that this is not possible.

The downside is that single user and it is not robust meaning that certain inaccuracies in the system as I said or the movement of the listener can totally impair the experience.