Hi I'm professor Kenny Mitchell from Edinburgh napier university and carousel research lead.

In this section we'll cover the consortium's scientific challenges of how make dancing online together more immersive and responsive

and highlight some of the achievements we've had so far in these early stages.

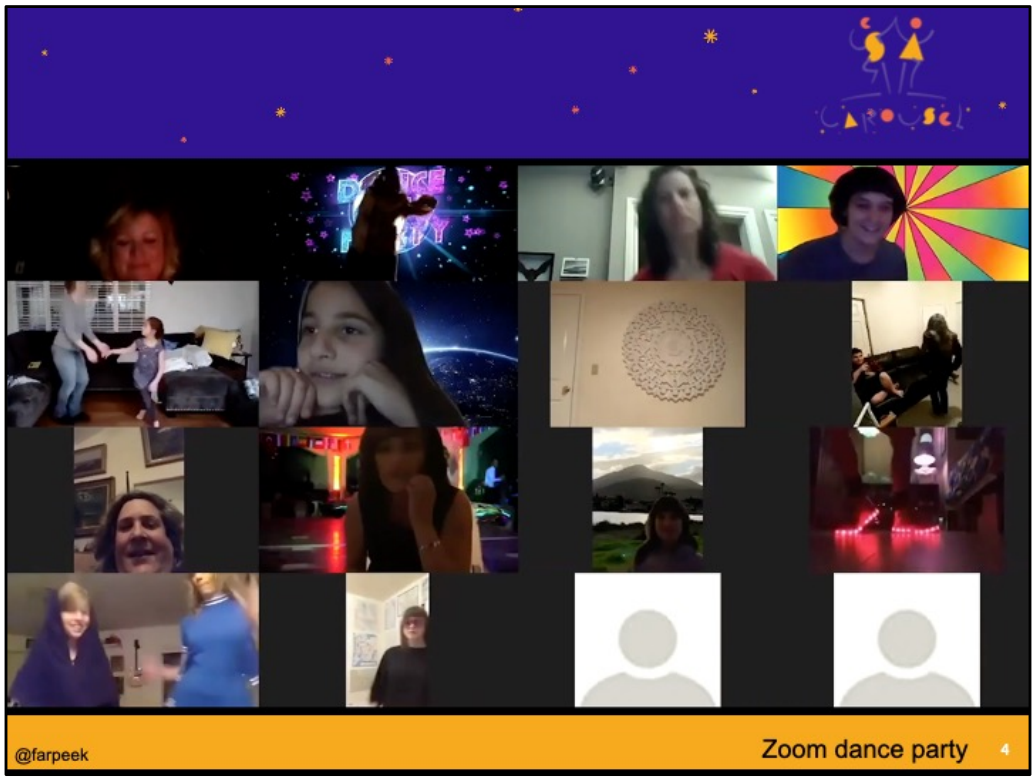
We love getting together and having fun, especially if it's for a good cause.

But this isn't so easy now and so we have this super important basic need to try to make our presence in online gatherings more real and connected.

The most profound experiences in our lives can arise from moving together in synchrony feeling each others' movements in sync with music can be truly life changing.

Or simply being able to connect more tangibly with your partner even when you're remote.

Like this jewelry that can trigger touch remotely, I don't advise to do when bored in board meetings, but it's an interesting start to move beyond our phones.



If you've tried out an online dance party, it might have looked a lot like this.

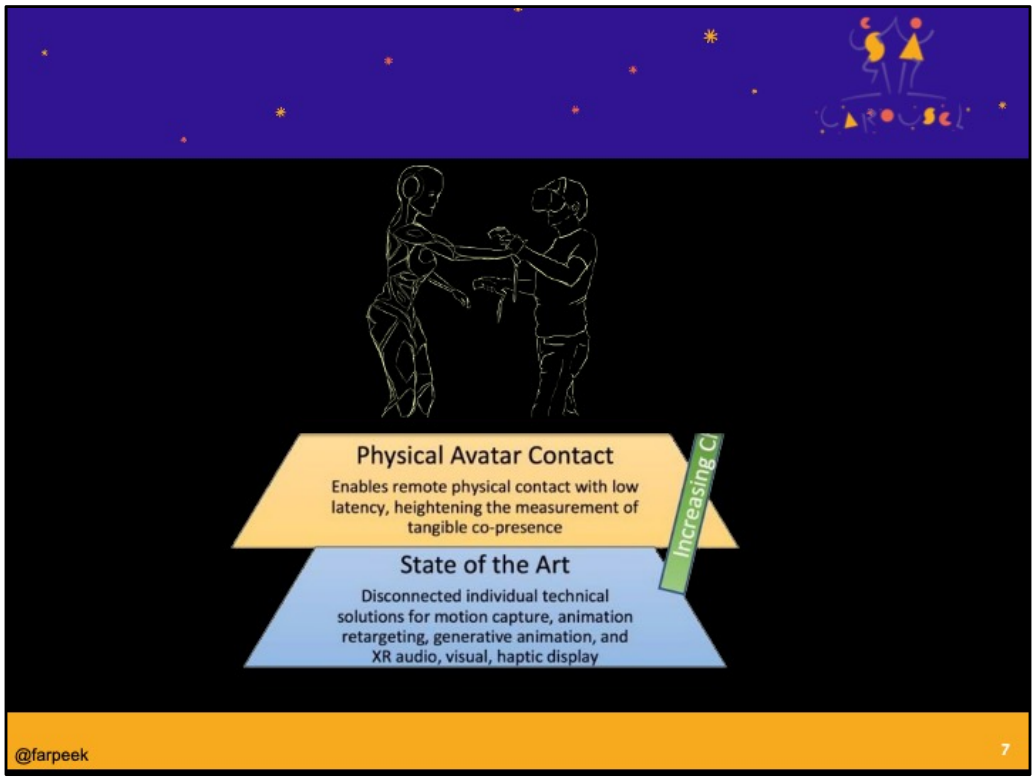
Which can be pretty fun, but it's not really feeling like you're sharing the same space or even feeling like your there with others which is a pretty fundamental element of dancing together.

Already since dancing in VR can happen and looks like this.

Where 4 players can arrange to meet in a lobby and play a challenge,

However, motion tracking is limited to headset and handsets with the rest of your avatar inferred. another version used Kinect camera full body tracking, but that's discontinued and not VR. There's some beat vibrations in controllers, but nothing super cohesive or really well connected with touching the other dancers.

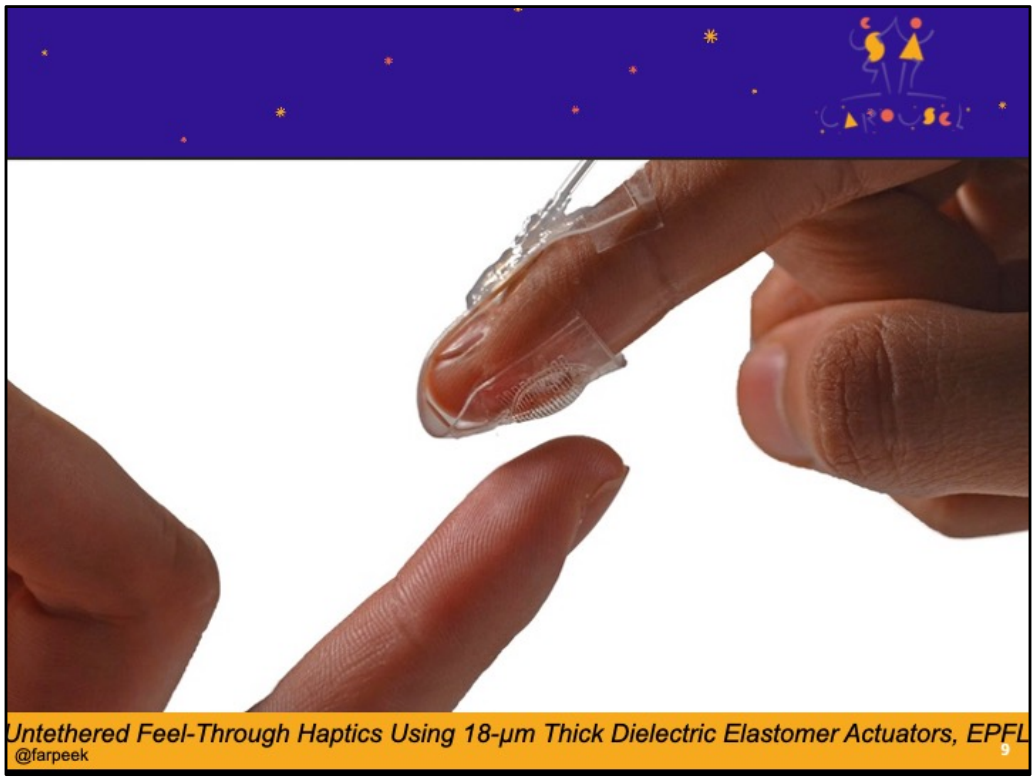
So, the state of the art is really a collection of individual technical solutions which each might be very good, but not yet seen in a combined haptic, audio and visual experience.



If we want to go beyond the current state of play for online dancing, a key element is making first physical contact online,

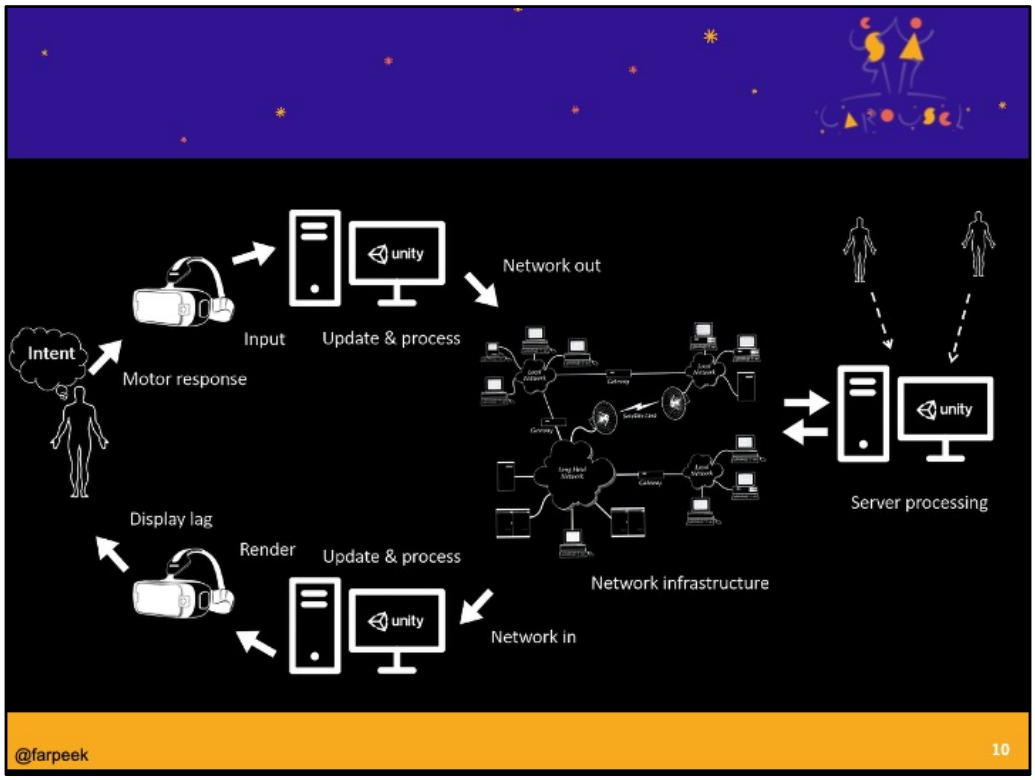
So what are the main technical challenges in just enabling physical avatar contact?

Even just to touch each other with our finger-tips remotely online?

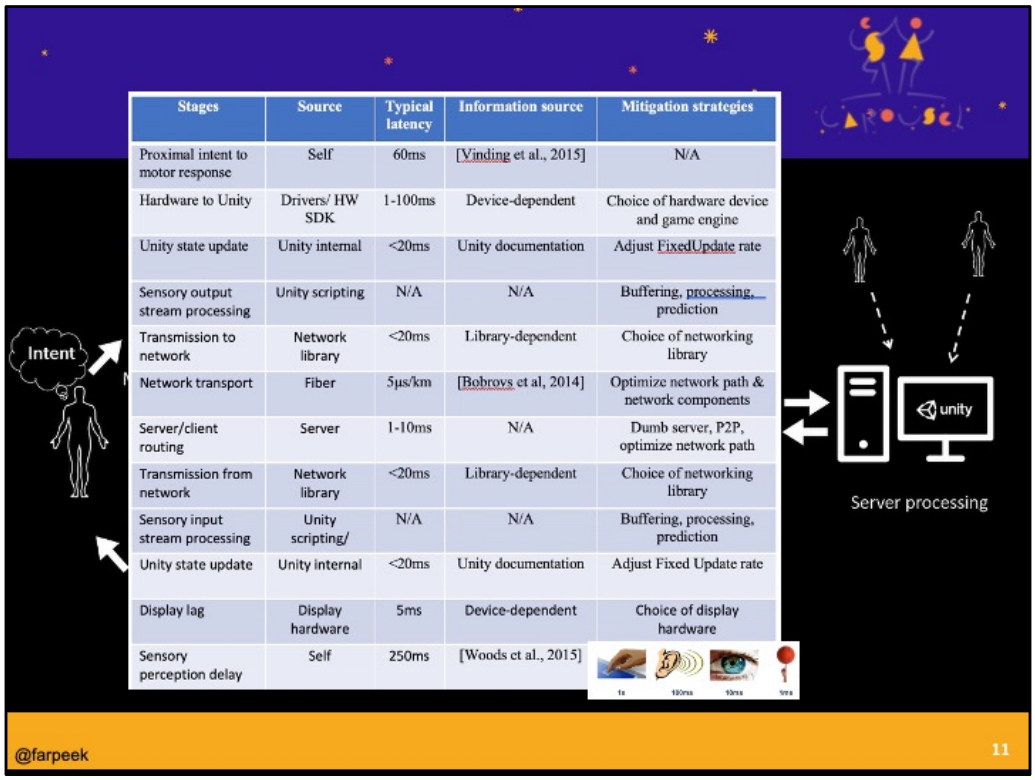


Shouldn’t that be pretty straightforward?

What if I just want to have my handset vibrate when it touches the remote person’s handset? That should be easy really…



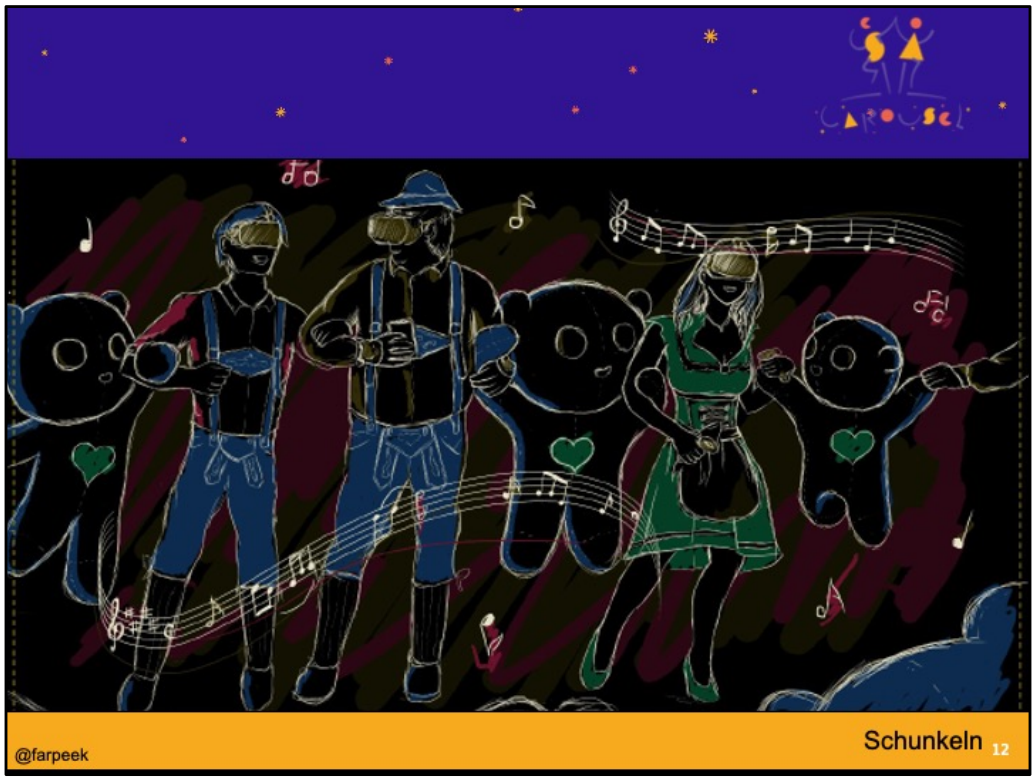
Well, if we break down all the steps involved in making a physical touch happen, we find the not only the regular interactive loop latency for a local video game, with input lag and display lab, but we just introduce a global network connection into the loop and regularly…



This can all start to add up, and regularly result in about half a second delay, even in the optimistic system conditions.

And half a second might not seem much, but in dance with physical connection with your partner, that's of course ideally instantaneous, or as close as we can get.

So, we're really dealing with how to address each of these latency stages and in inventive, out of the box ways.

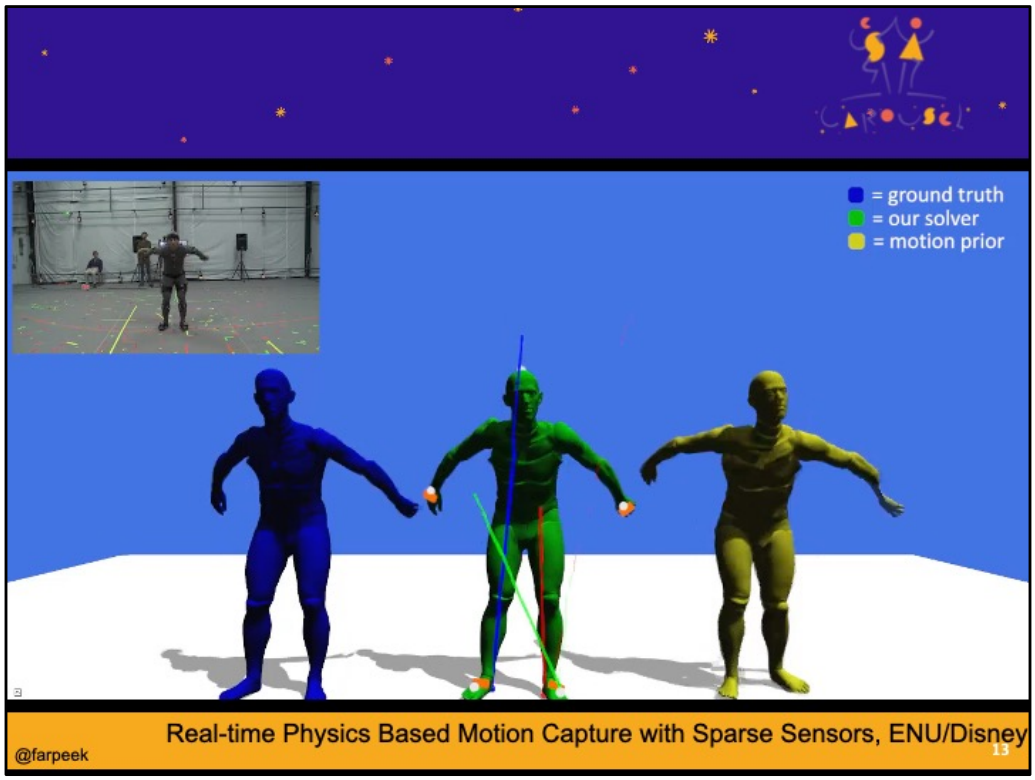


First, if we consider a regular rhythmic motion of dance, to a beat, really simply to begin with, like this swaying dance.

Then we mostly know at any given time where your remote partner ‘should’ be next to you.

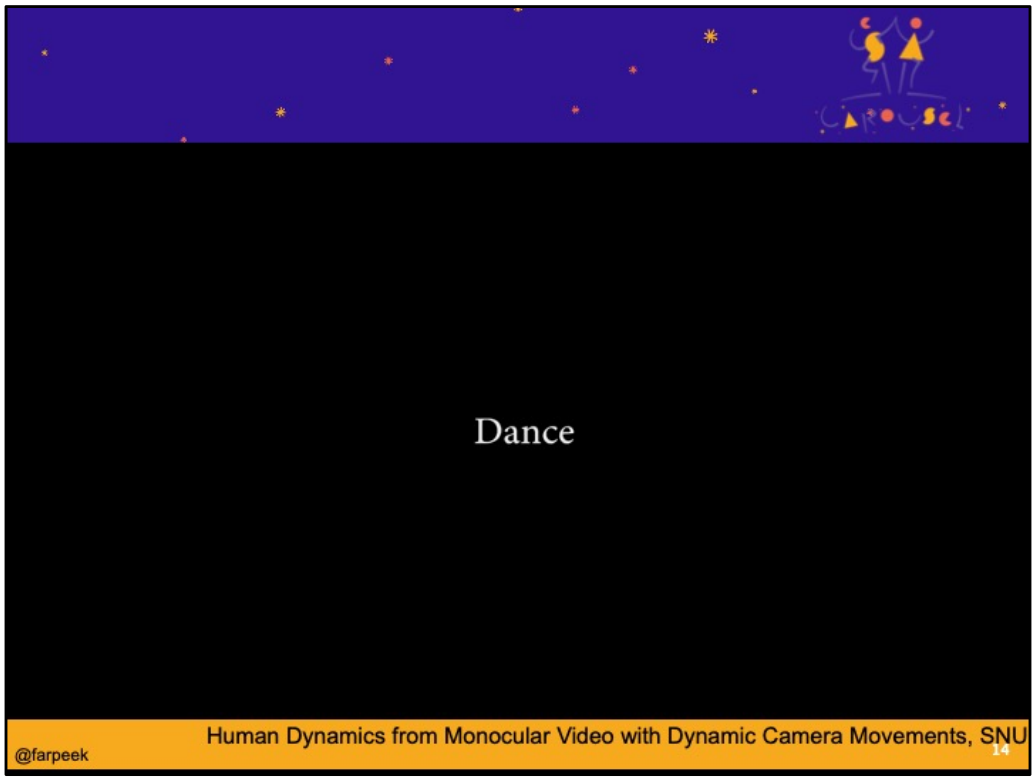
So, you in your own local time you are in sync with your partner, even though their movements might have happened half a second ago.

As monica with elisa mention, we’re running experiments to evaluate how this format affects the experience, and it’s just the start.



If we know how our bodies move physically, we can make motion predictions to keep you in sync with your friend's avatars.

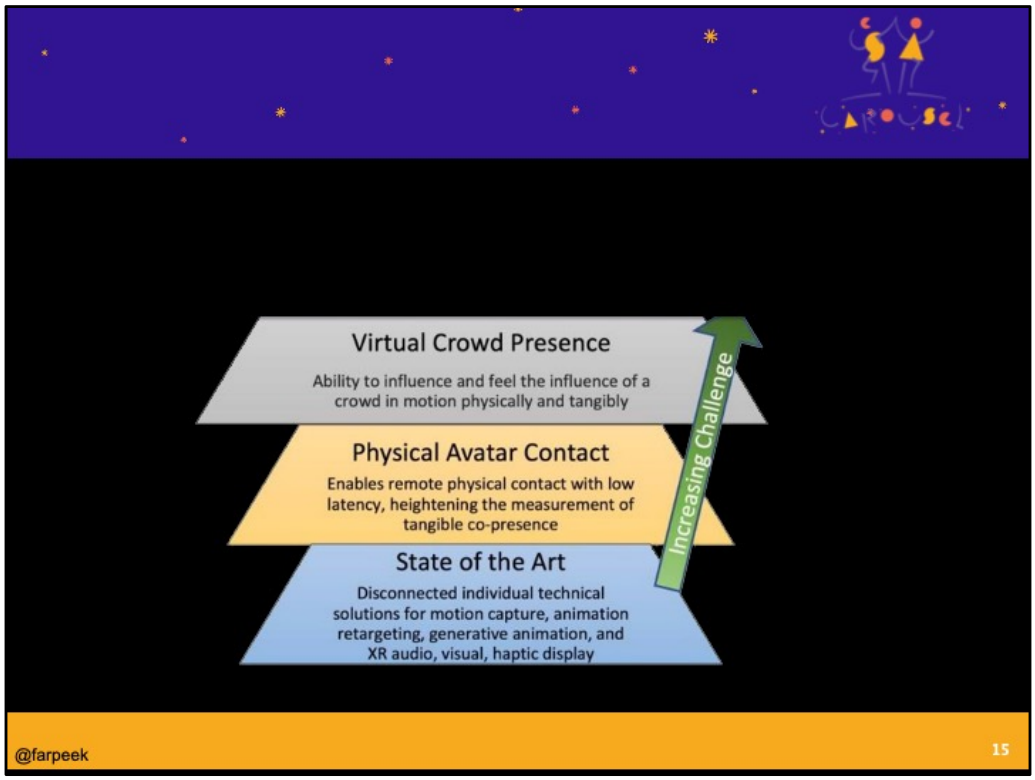
Like this earlier work with Sheldon Andrews using body models and physics priors to solve for gaps in mocap data in real-time.



And this work from Seoul National University appearing later this year at SIGGRAPH Asia is quite relevant for us in again using physical models,

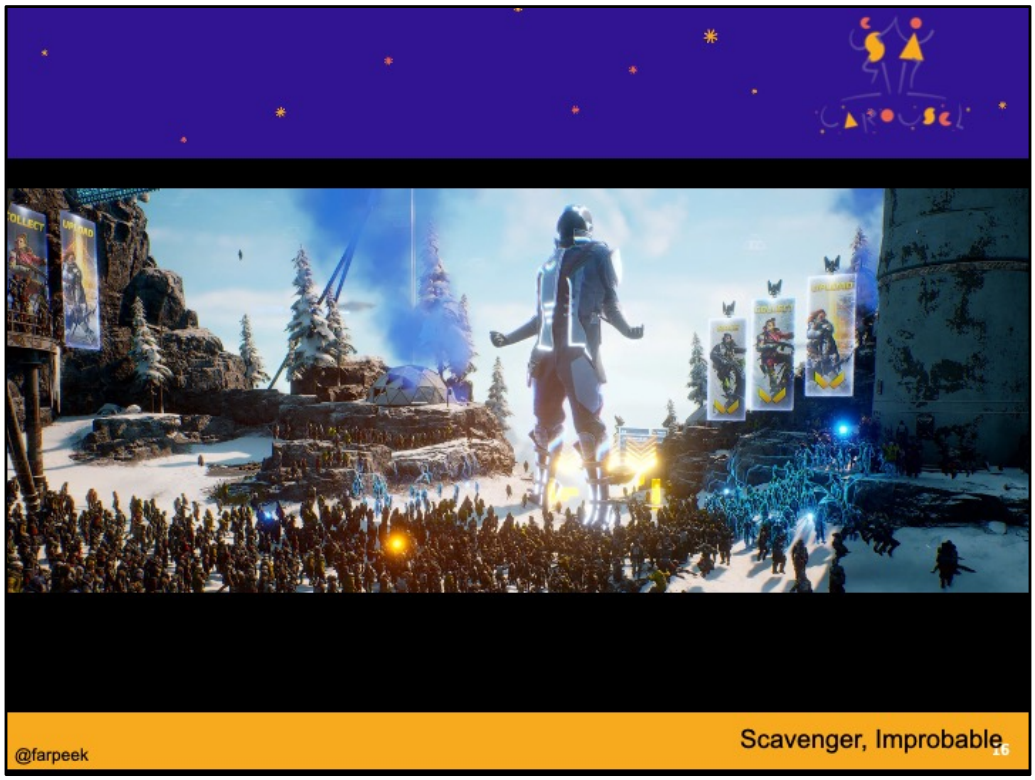
and being able to deal with uncalibrated camera setups even moving cameras that might arise in a home VR set up,

so could be helpful in our network variable latency dance scenario.



But what if we want to scale up to larger groups with 20 dancers

or even 1000s like at Live Aid in 1985, but all online seeing, hearing and feeling each other?

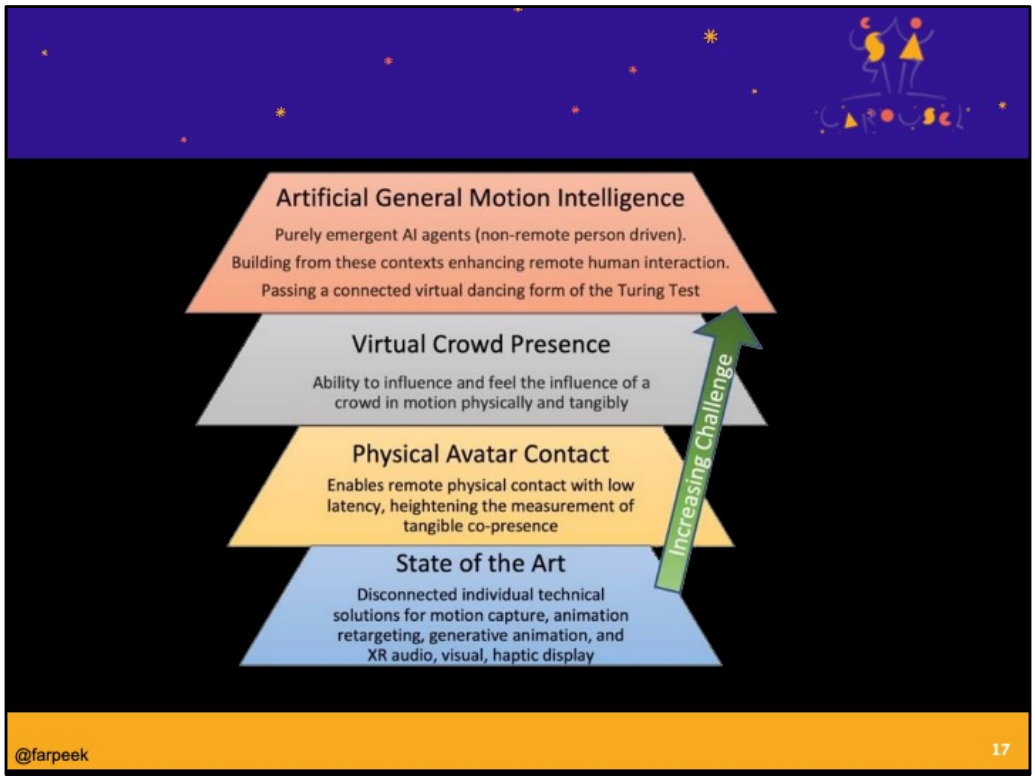


Improbable with their KCP network stack ran a test with 6000 participants, with some interactions like run to the blue light or yellow light.

If scaling dance to these numbers, perhaps it's only feasible if those near you are fully sync'd with body tracked motion, haptics and local spatial audio.

And those further away are simulated to greater degree with their real body presence signals updating less frequently.

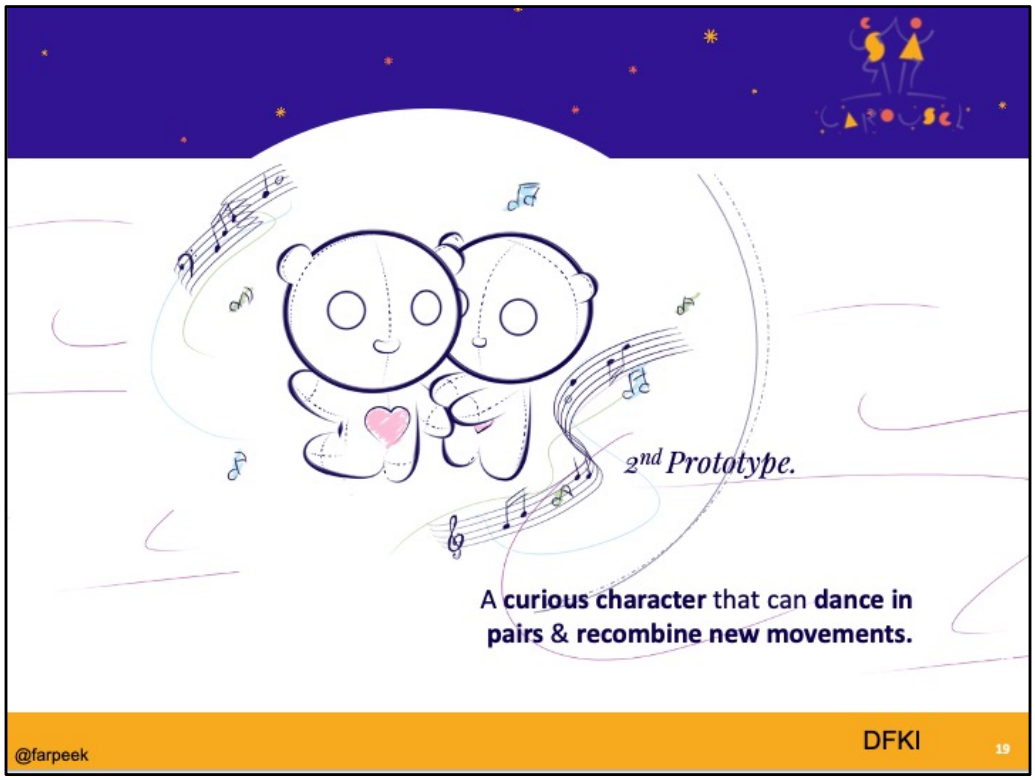
Actually, it occurs that only having your friends nearby being as real in sync as a possible is all that matters to still feel connected as part of a huge crowd.



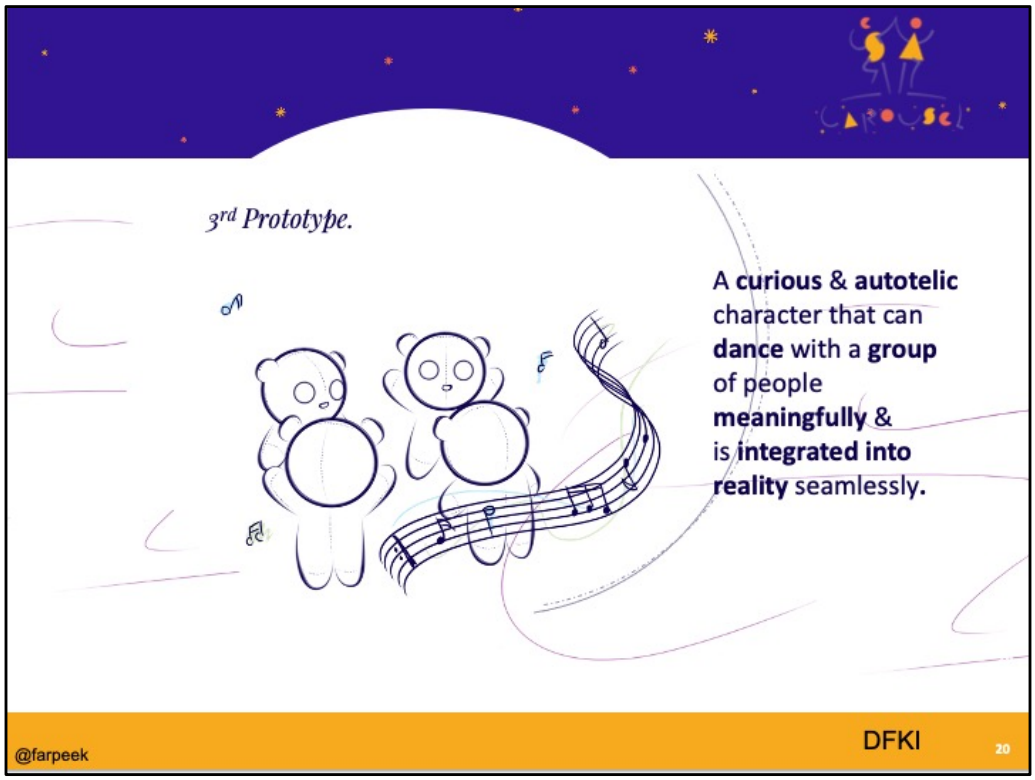
So, if we consider to partially simulate people's avatars in order to cope with system bandwidth and latency physics limits,

why not consider to go the whole way and simulate with a kind of artificial general motion intelligence? For your 1-1 dance partners or crowd dance partners.

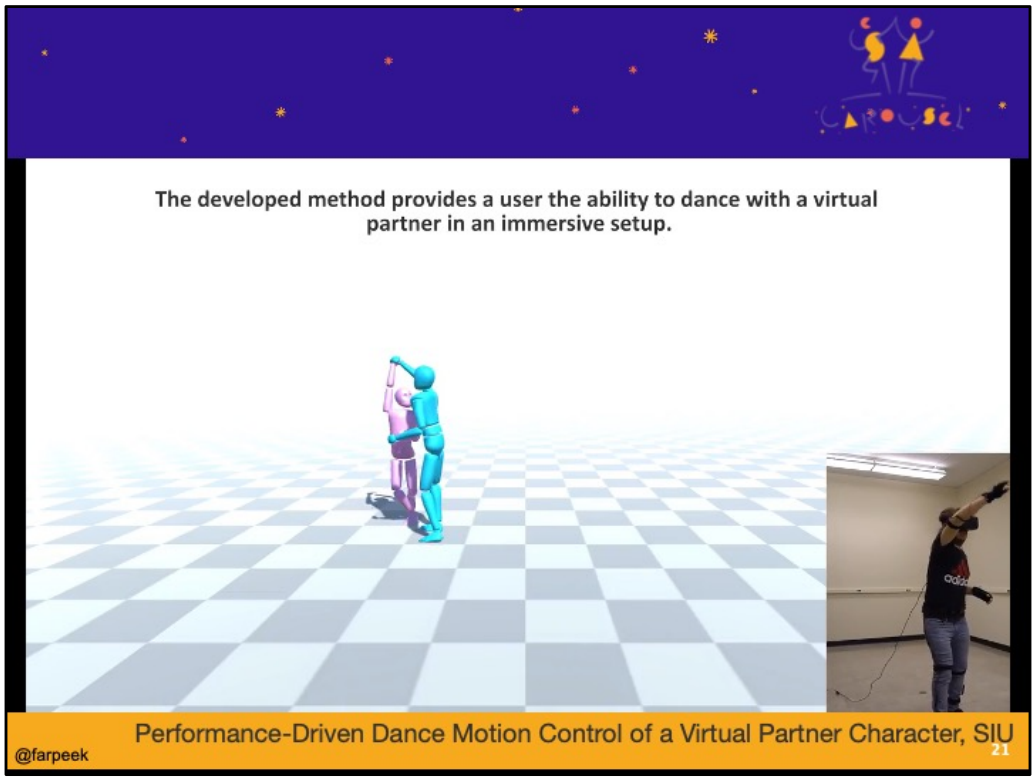
In this direction, we‘re looking at creating a character initially just able to react to some movements.



Then can dance in pairs with improvisation.



And further meaningfully integrate into a group dance.

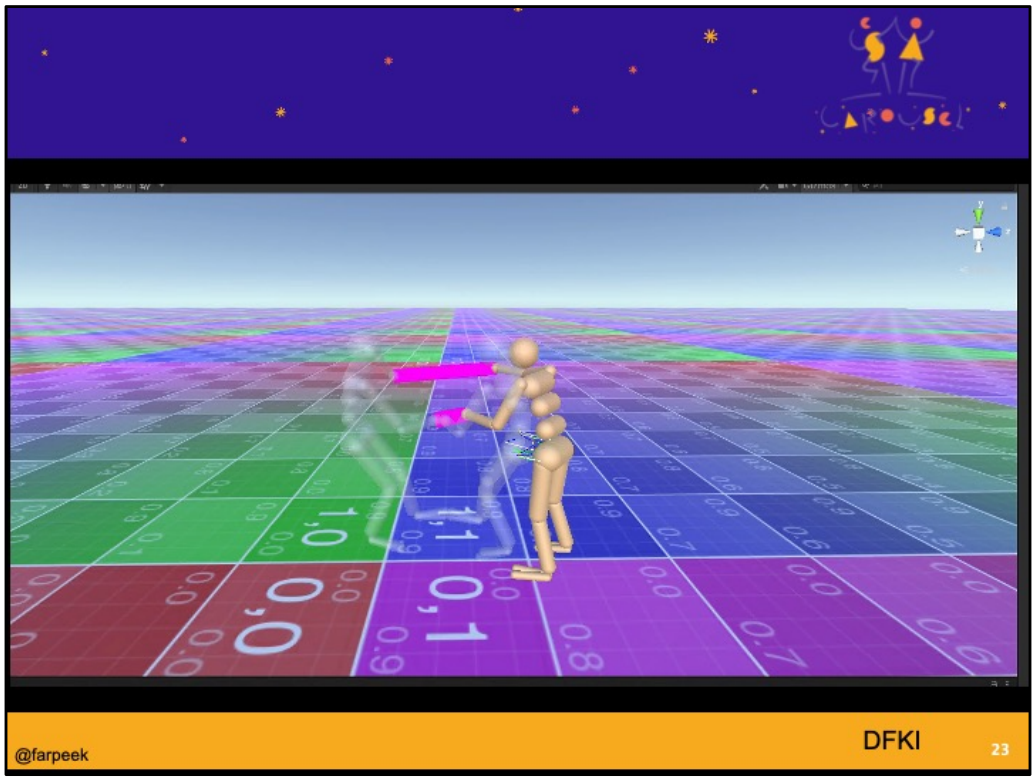


This ieee vr 2018 work is a good background,

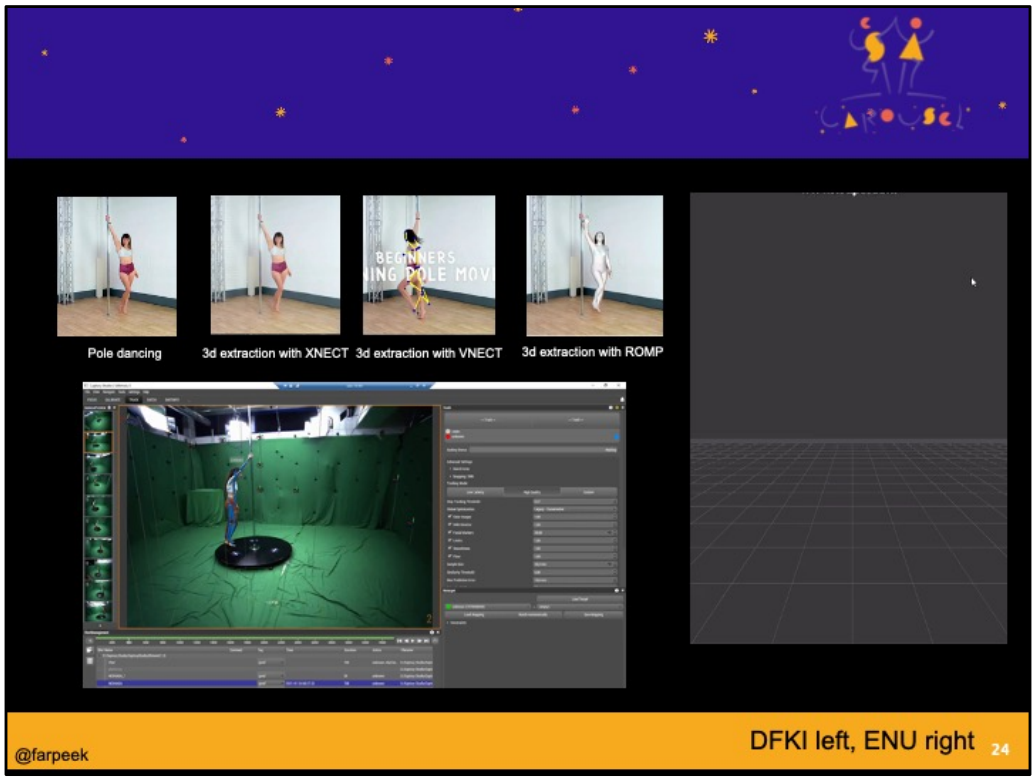
but only works for a subset of motions, without music synchrinization and only kinematic model based.

While we are in intial stages, we have some early progress to show

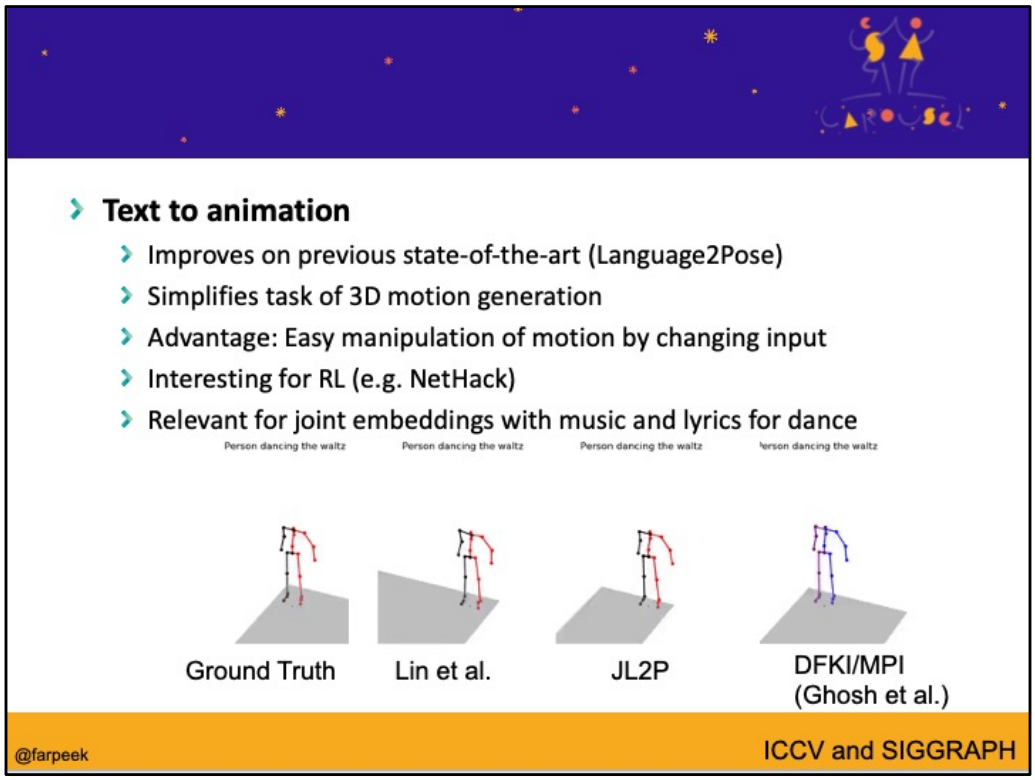
This test uses a DeepMimic-based controller in a VR setting (with UCL's Ubiq framework).



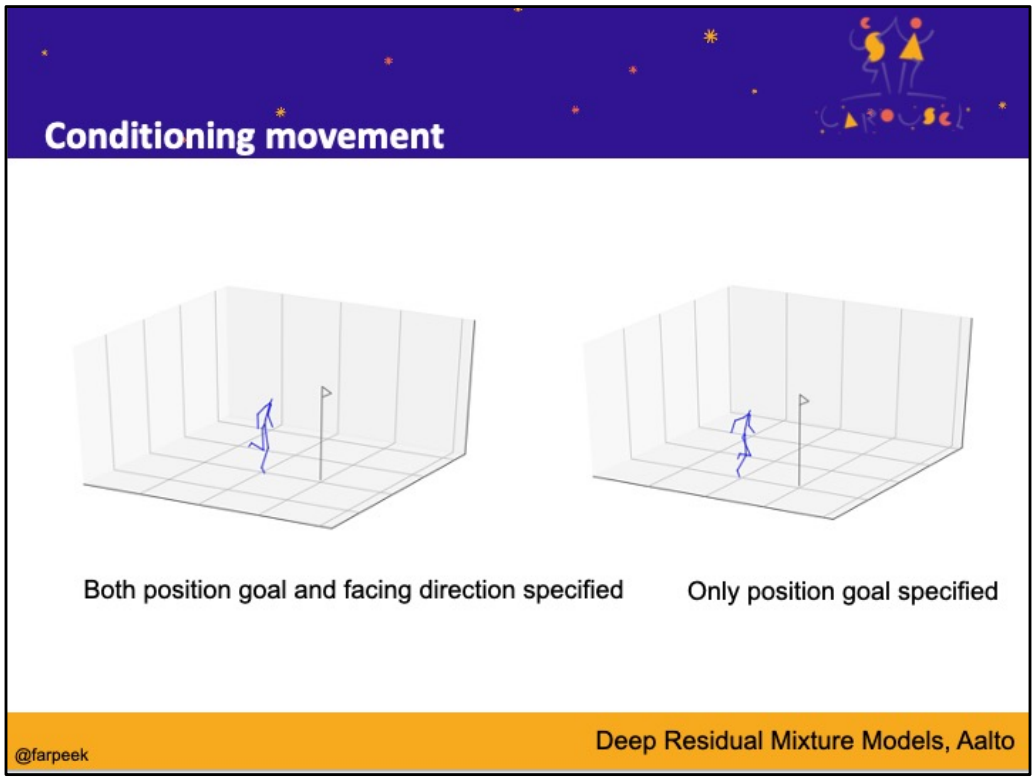
This explores use of DreCon-based controller



We've been trialing various capture setups for both generation of ground truth and deep learning training data, and also live real-time capture using low-cost stereo cameras.



During this first year of the project, we've already published motion synthesis from simple textual sequences.



Using a method of deep residual mixture models, we've applied to conditioning movement for positional and directional goal seeking.

An active learning method for speeding up the process of training animatronic avatar facial animation from physical skin simulation generated data.

Aalto have organized a SIGCHI workshop and explored visualizations for training and learning choreography.

On further techniques for immersive rendering, Edinburgh Napier University have contributed gaze adaption for improved eye contact, volumetric lighting scattering including use in optical see-through augmented reality glasses, and a patent on relative chroma/luminance compensation for AR glasses.

Finally, we all participated in a workshop position paper at IEEE VR, birds of a feather event at SIGGRAPH and of course today's event.