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Zürcher Hochschule der Künste
Zurich University of the Arts

cineDESK:
A Simulation Enviroment for Virtual Filmmaking

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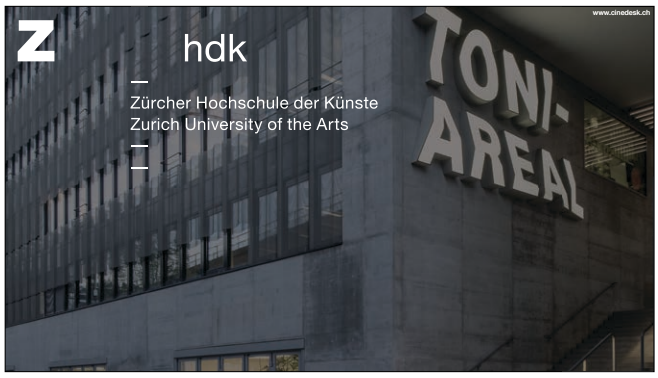
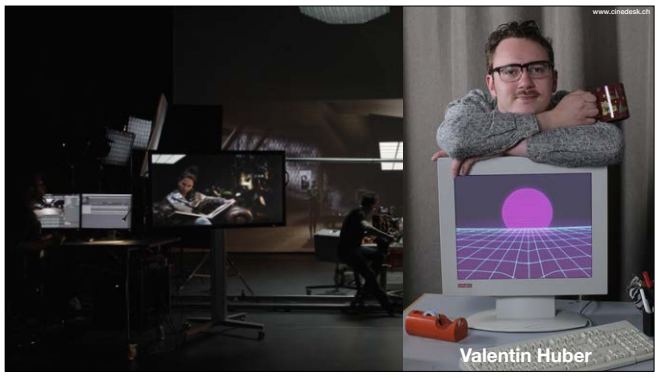
My name is Norbert Kottmann. I am a computer scientist and film editor. I work as a research associate at

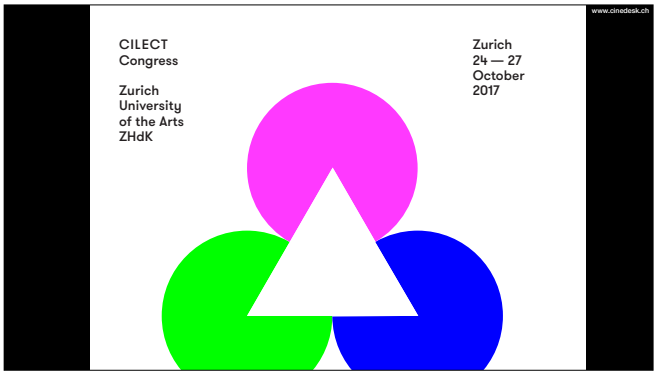


the Film Department of the Zurich University of the Arts where I am responsible for postproduction and…

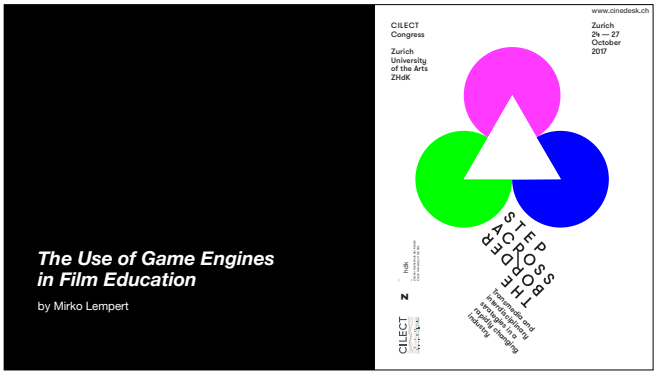


developing virtual production tools at the Immersive Arts Space together with my colleague Valentin Huber.

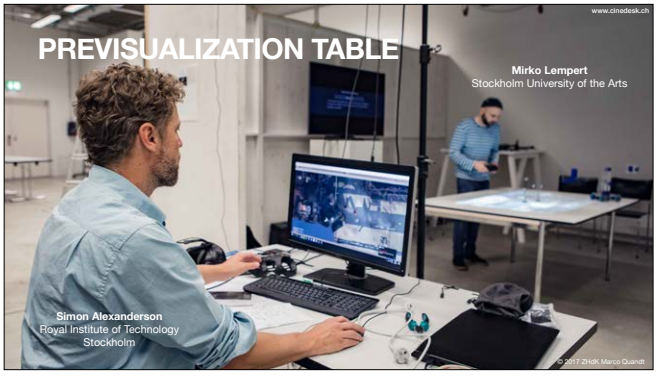
Once upon a time - and it was actually not so long ago …



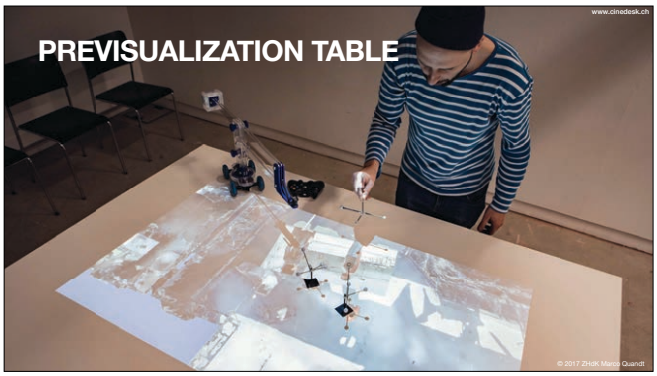
… in 2017 there was a CILECT congress on transmedia at our University with the title “Step Across The Border“.



Mirko Lempert from the Stockholm University of the Arts gave an inspiring talk on *The Use of Game Engines in Film Education*.



Mirko and his colleague Simon Alexanderson also brought a tool to Zurich: their "*Previsualisation Table“*.



This interactive tool makes it possible to visually map out a scene before filming in a very playful way.

We were fascinated – using game engines for pre-production was just new to us at that time.

So we went on a journey with Mirko to step across this border!

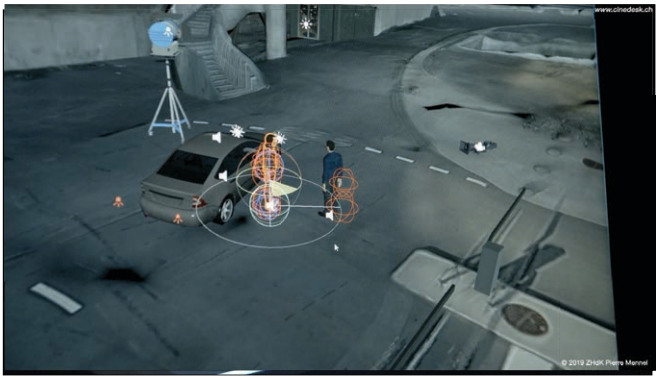
We invited him and his previz table for a residency at our University.

The idea of the previz table was that a floor plan of a film location modeled in 3D is projected onto a table as we can see here.

Different objects on the table, representing virtual cameras and characters, can be freely positioned on this virtual floorpan.

A second screen shows the image of the virtual camera which is rendered in real-time depending on its position.

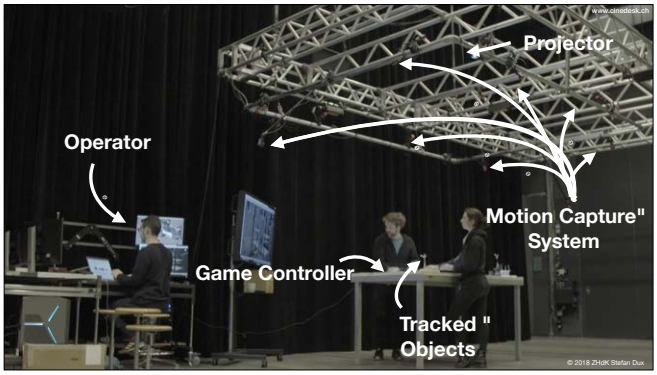
In this student project, we used the table as a tool for the director and DoP to communicate with production design or visual effects department to check what's in the frame.



We also used it in a light seminar, where different lighting moods were first tried out virtually and then recreated on the real set.

But we soon realized that the students were simply overwhelmed. Creating a previs of a movie or even

just a scene was too complex for them.



Also the setup of the previz table was rather complicated.

A projector has to be mounted on the ceiling as well as a motion capture system to track the objects on the table.

A game controller is used as a user interface and Valentin has to operate the system constantly.

So Mirko’s initial idea of of a collaborative easy to use pre-production tool was great, but the technical setup was a dead end.

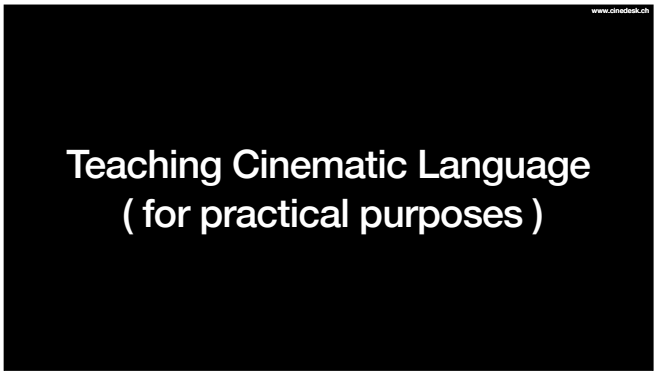
So we asked ourself: is there a way to improve this system?

Yes, and this is where my story with the Cinedesk starts [Click[

My name is Manuel Hendry. I m a screenwriter and Director of feature films and commercials.

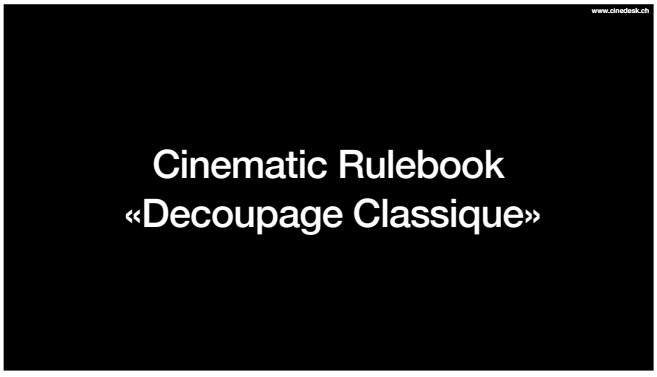
I've also been teaching at film schools since the mid-nineties and I'm now a permanent lecturer and researcher at the Zurich University of the Arts. And that's where I first encountered

Mirkos Machine. I was totally excited. I felt that this could be the solution to a problem that we've been wrestling with for a very long time:



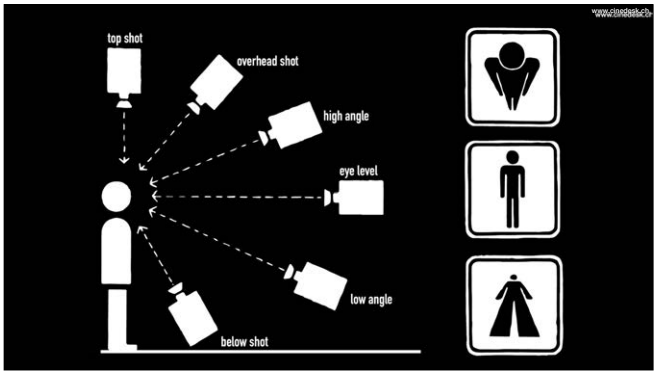
How do we teach visual language to film students in a way that is actually *useful* to them.

Most film schools have more or less the same approach: we introduce our students to a

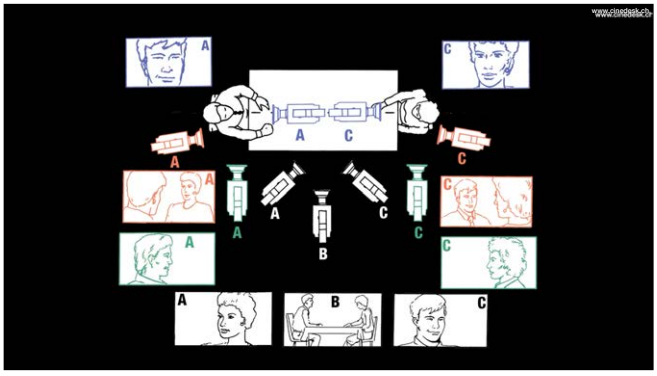


set of visual rules and principles that make up the grammar of the cinematic language. We tell them about

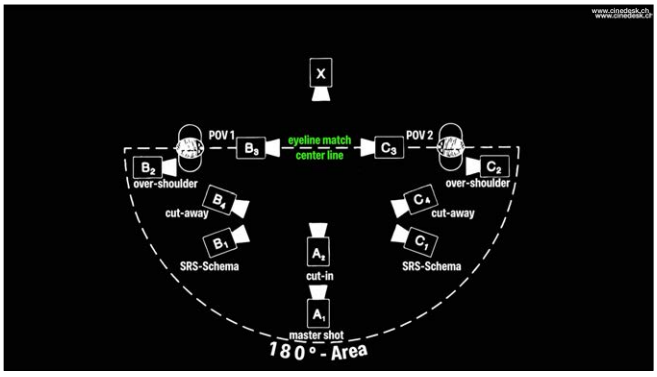
shot sizes and their different applications. They get to know



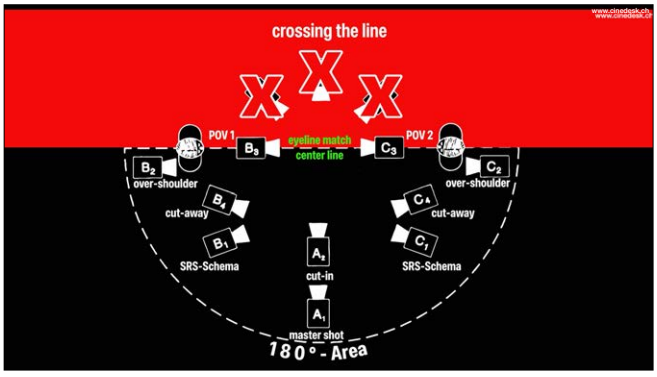
visual angles and their relationship to psychology, They see how



camera setups neatly cut together as long as they all on stay the



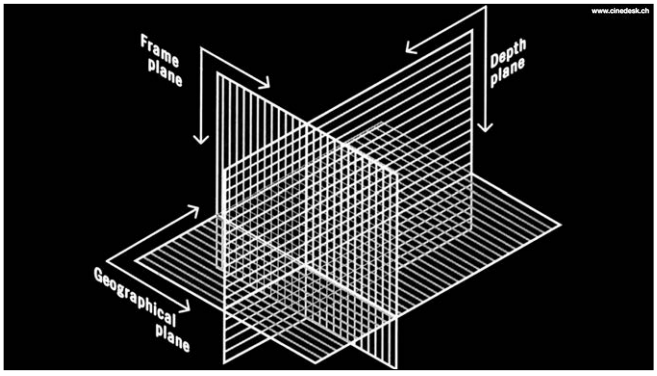
same side of the eyline. And we also tell them that



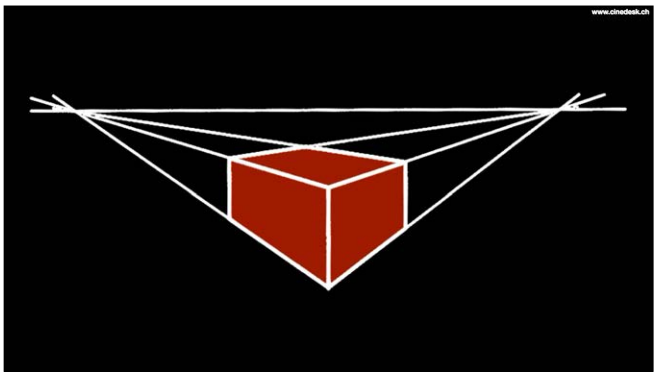
crossing that line is verboten. They learn how

aspect rations determine image composition, they use

focal lengths to modify visual space. We tell them about



different planes and

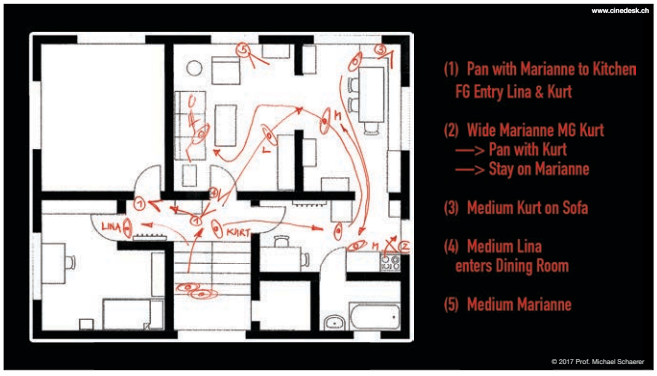


different perspectives and

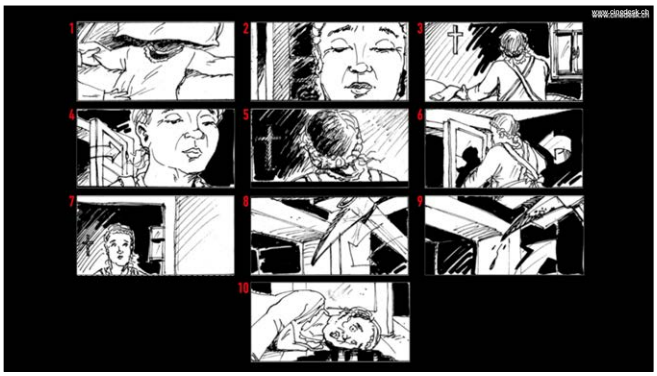
focus shifts … and

long and lovely Dolly shots - or with

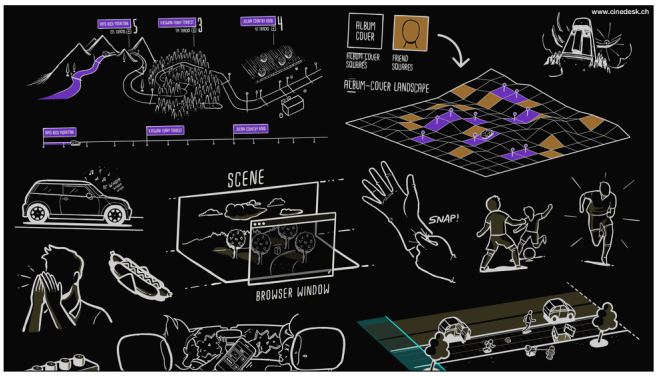
vrane setups like all those great masters of cinema have used them. And we teach them how to prepare their own movies - by drawing



floor plans and writing shotlists and creating



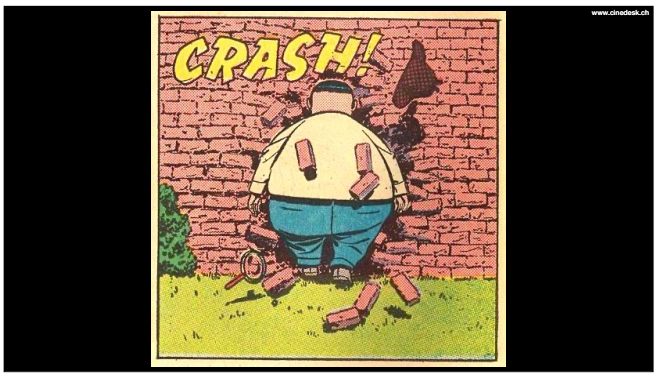
storyboards. And then finally, their big day of shooting comes.



They come to the set extremely well prepared with a plan for each shot and they block their actors and set up the camera.

confused. Because reality gets in the way of their visual planning. The

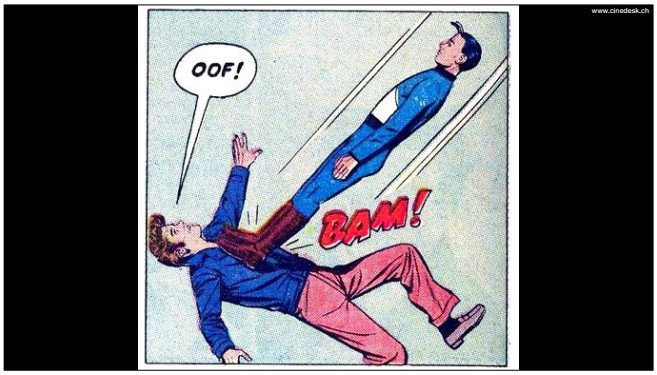
actors don't do as they're told, the dolly shot looks shitty, they’re already behind schedule before they even started... in other words:



their beautiful plan crashes into the brick wall of reality. And what looked so

beautiful before their inner eye becomes a

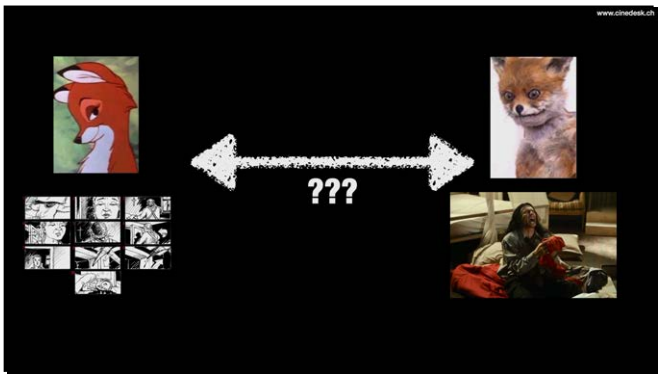
total mess once it's been shot.And that gap can really feel like a



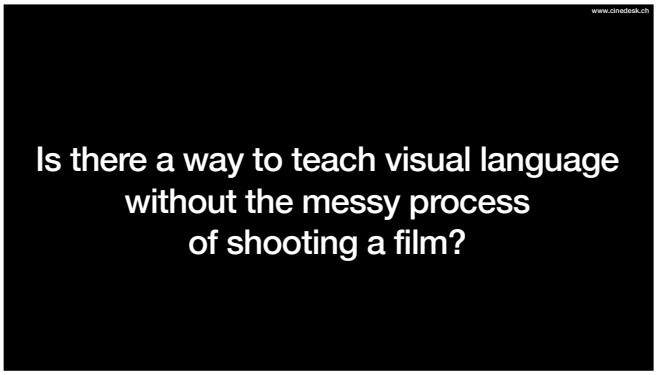
punch in the gut. Now everyone who ever directed a movie knows that this is not a student problem, but just the way filmmaking works.

You get on set each day thinking you have a plan, and then spend the rest of your day just dealing with unforeseen events. And hopefully, with each movie you shoot, you become better at adapting.

More flexible. More intuitive. More creative on the spot. But if you're just starting out, like students do, you don't have those skills yet. And as far as learning visual language is concerned, that is a problem. Because by the your movie is finished,

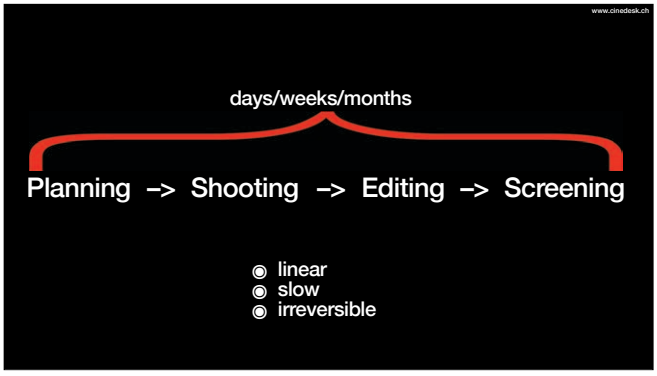


reality has twisted your visual concept so much that's it's very hard to connect the dots between your initial idea and the finished product. So the question becomes:

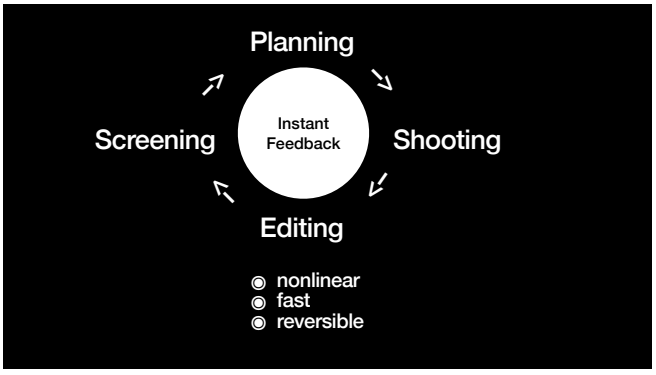


Is there a way to teach visual language without the messy process of shooting a film? Because let's face it:

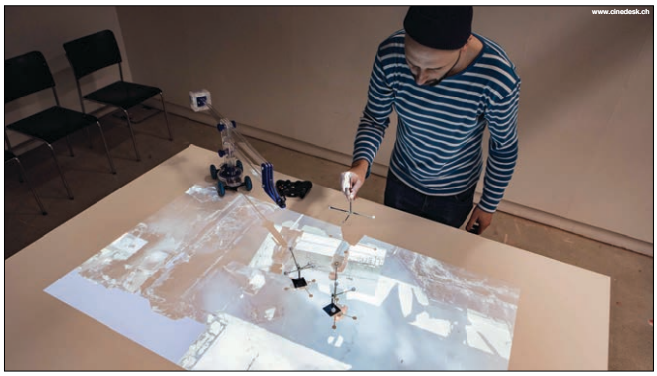
shooting a film is a really bad method for teaching.



We slowly crawl from planning to shooting to editing to screening, taking days or weeks or months for a linear process that is both slow and irreversible. Wouldn't it be amazing if we could change this process?



Into something cyclical? So we can go back and forth any way we want and see the results of our decisions instantly instead of waiting for weeks? As opposed to shooting a movie, this process would be entirely non-linear, fast and reversible any time we wished.



So could Mirkos Idea be turned...

...into a Teaching machine
for visual storytelling?

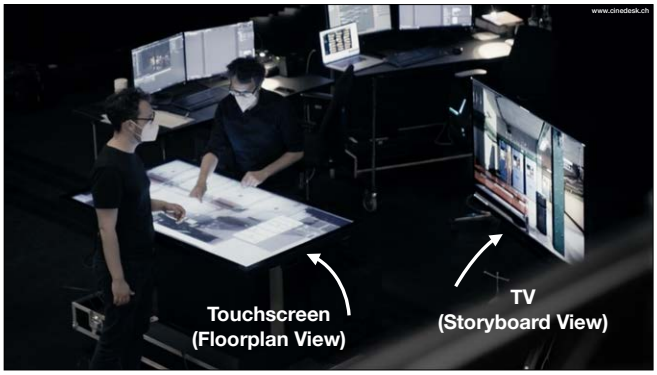
Meanwhile, back in reality… while Manuel was dreaming, Valentin and me went back to coding.

During the COVID lockdowns, we discovered the

Unreal Game Engine. It’s a piece of

software a lot of film productions started using at that time.

As we believed in the potential of the previz table for creative and joint work …

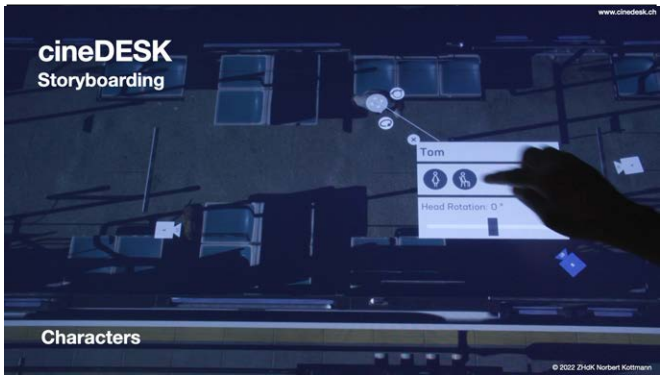


... we started developing our own version. Instead of a projector and a motion capture system, we simply used a large touchscreen table as a user interface.

We named our new tool…

cineDESK.

Let me now show you what you can do with the cineDESK.



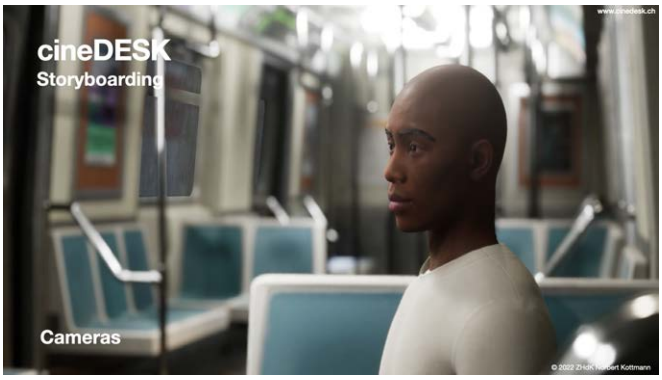
We implemented a basic storyboard function that allows you to position characters in 3D space.

With simple touch gestures, characters can be moved, rotated or even changed in their posture.

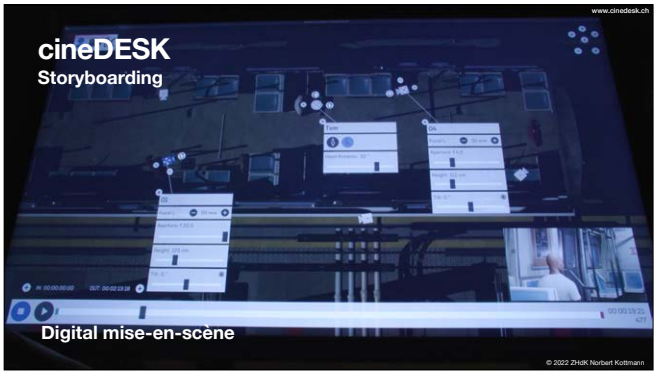
You also have virtual cameras, which can freely be positioned in the 3D space with a fingertip.

Focal length, aperture and the focus point are adjustable as well.

These cameras can be configured in

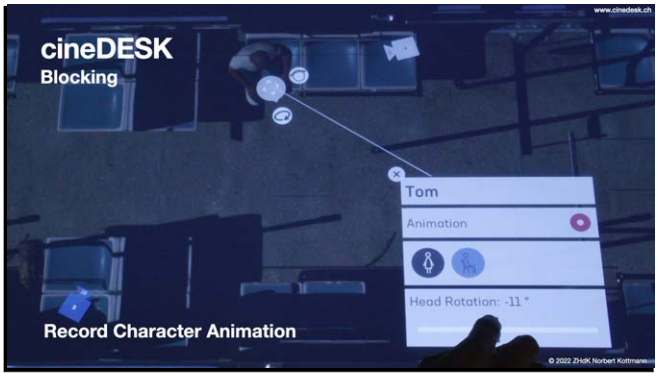


the Unreal Engine to simulate real physical cameras.



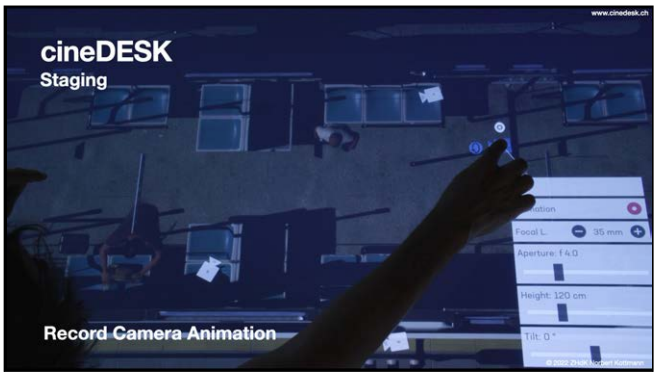
You end with a digital *mise-en scène.*

The floorpan view now shows all the positions of your cameras and characters. You can easily cycle trough all the different angles which are rendered in real-time.



In a further blocking step, the position of your characters can be timed by means of an animation.

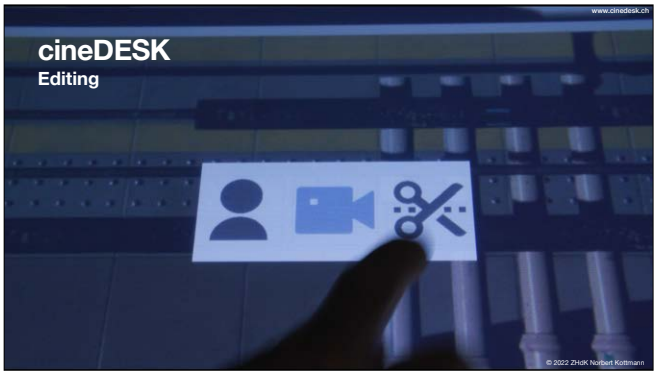
This animation can be re-recorded and played back as many times you like.



After recording all character animations, you can do a playback of these while simultaneously recording the camera trackings.

This process is repeated for each camera shot.

You should then end up with a fully staged and animated scene.



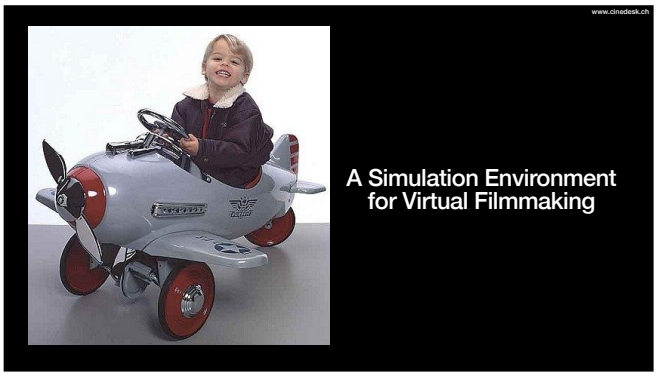
Finally, a simple linear film cut can be made directly at the cineDESK in order to check if the different camera angles can be edited together.

So after countless nights of coding, the first version of our CineDesk was finally ready.

Now all we needed was someone to use it with.

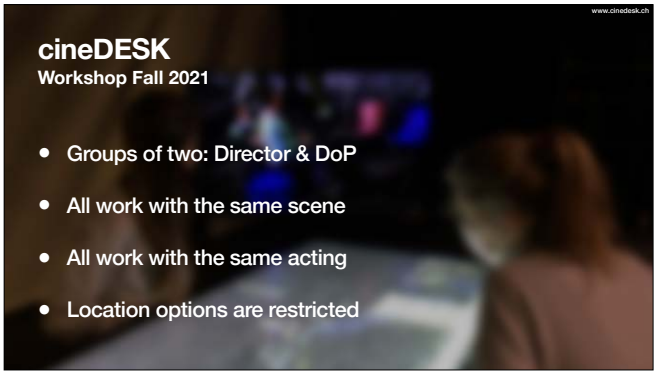
So by the time Covid restrictions were eased and we were able to go back to physical teaching, I saw what Norbert and Valentin have created.

And I thought: wow. That's like a

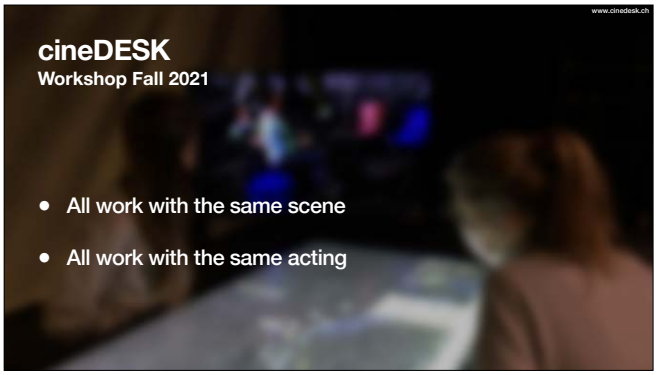


flight simulator for Film students. I mean: when pilots first learn how to fly a plane, they don't sit in a real airplane right away. It's too complicated, too expensive - and too dangerous. A bit like shooting a movie. So if we could simulate a film shoot with the CineDesk, it

would liberate the students from the gravity of reality and free them to experiment - and fail - much better. So we got together as a team and prepared



Our first workshop with the cinedesk. We decided on a few ground rules: The students would work in groups of two, as director and DOP. The students would not direct their own scene, but all work with same the scene we gave them. The students could choose the appearance of their actors, but not the acting itself - we get to that in a moment -, and the students could chose their location from a few options we presented them.



Now when we do acting seminars, we often give the students pre-written scenes to work with. It takes away the pressure of writing their own material, and makes them focus more on the actual process of directing.

For the CineDesk workshop, we've decided to take this one step further and not only give them the text of a scene, but also the staging and acting. So all the could alter was the visuals. But how did we do that?

It’s simple. We did it by theft. We hijacked an acting master class I gave

Where this student David staged a scene from a play. The story, in a nutshell, was about

a slightly neurotic

Couple where the

Man starts obsessing

about a woman screaming-

outside the window.

And meanwhile his

wife who does not hear this screams tries to calm him down with

a cup of tea. But it doesn’t help:

The guy puts his shoes on .

The woman

freaks out…

There’s an awkward moment of silence between them and

in the end, they live unhappily ever after.

So David rehearsed and shot his scene, and then the CineDesk team

stepped in and took over. We dressed Davids actors

in motion capture suits, got back on set

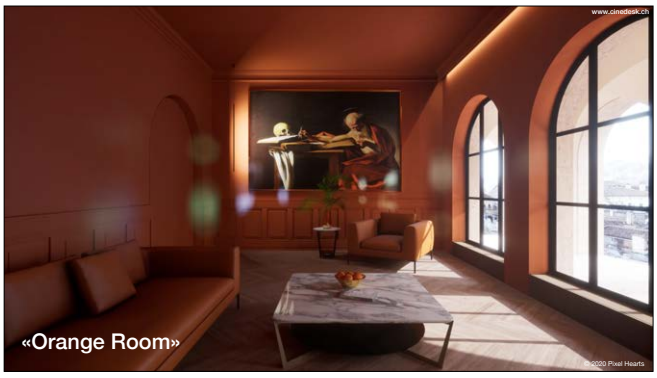
and recorded Davids staging in cyberspace, meaning:

We used a film camera just to document this one wide shot here for reference,

but what we actually captured was just the motion data and the voices of the actors.

And in our CineDesk workshop, we then showed the students just this robot version of Davids scene. And asked them: what location would you chose for this? And how should your actors look like? As for the location we gave them four options:

This rather creepy forest



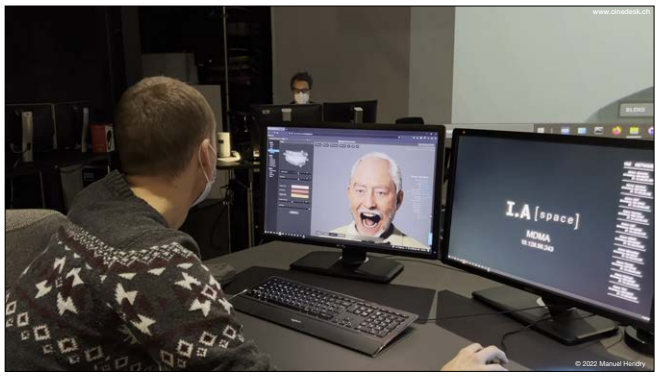
A fancy living Room

A moody house interior

And a rather bland kitchen set. Then we moved into casting. And as our casting agent, we used a brand new tool that had just been released: Unreal Engine’s metahumans.

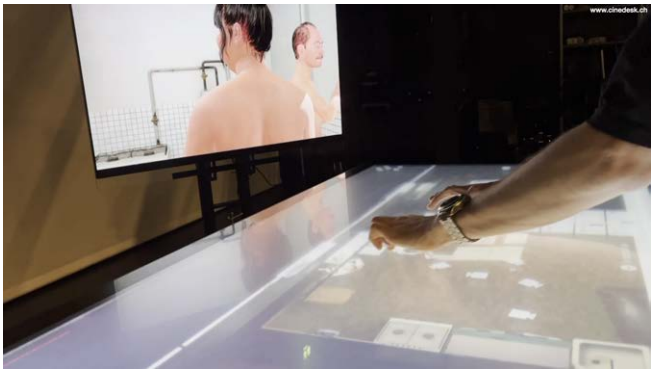
The metahumans are high-end photorealistic virtual humans based on scans of real people that you can

freely modify, mix & match with a really easy to use web interface.

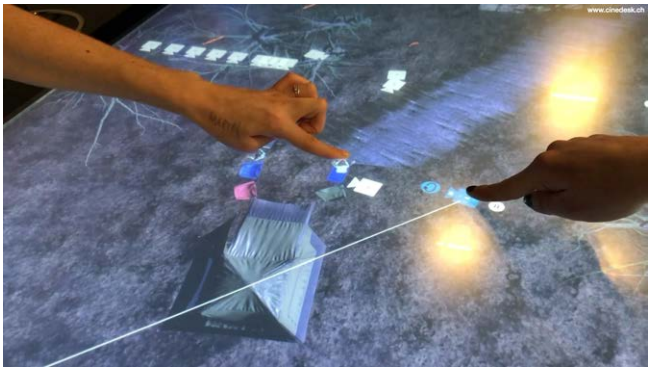


So based on their analysis of the scene and together with the choice of location, the students decided on the personality of their characters and shaped them accordingly. This was their “casting process. And now they were ready to shoot. But instead of going on set, they got together at the Cindesk. And this is where the real fun started.

It was such a new experience for everyone involved, because all those tedious little questions of shooting were gone. Is the makeup right? Is the actor too tired to shoot another angle before lunch? We had none of that.



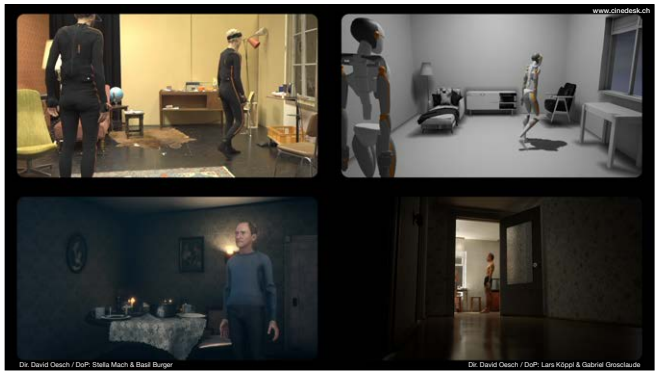
And there was also none of that slightly toxic embarassment on student shoots when the teacher steps in and starts pontificating about the framing or acting or whatever – and ruins the authority of the student director in front of their cast and crew. There was no embarassment because wasn't any cast or crew around.



So we were able to have really intense, quality discussions about framing, lens choices, camera angles and movements. No top down lecturing, but actual discussions between creatives. And we could see the results of these discussions right away - and learn from it together. It was a really unique and new way of interacting with each other in class and stracturing the cinematic material together based on the ideas that the students brought to the table.

We would now like to show you the complete four minute scene in the original motion scan on the top and in two of the student's interpretation.

It was interesting to see that for some moments - like this dialog bit here at the window - all student groups chose exactly the same visuals, because the staging and the rhythm of the scene made those choices almost inevitable.



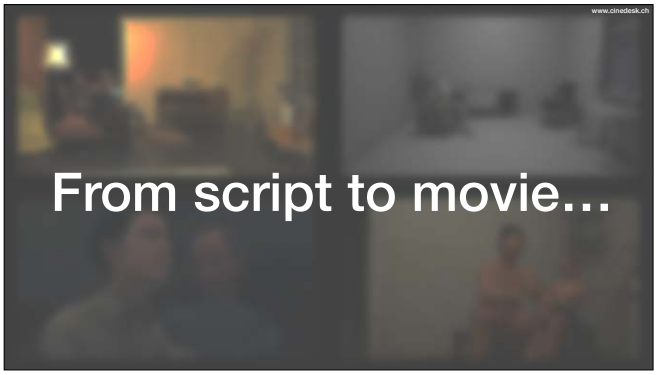
For other moments - like that long silence after the woman screams, they had the same visual intent - isolation - but different solutions.

And sometimes, they ended up with very different shots like that beat at the end when the woman considers for the first time that her husband might actually be right about those screams outside and really listens.

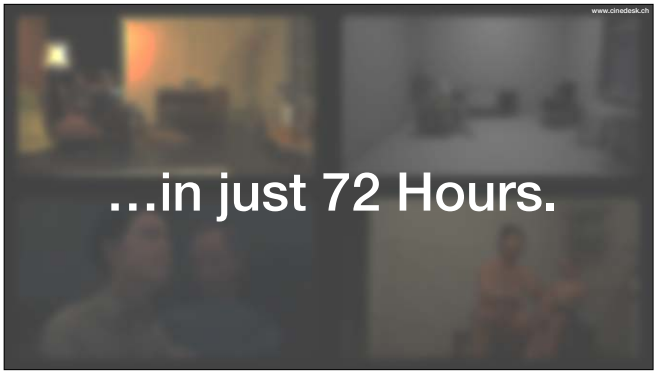
One the left you see the spooky “there’s something lurking outside” shot, while on the right the students chose to emphasise how that beat brought the couple back together. Comparing these approaches and their effect on the viewer was really helpful for our teaching.

And you can also see, there are still a lot of bugs in the data. For example we didn’t track the hands of the actors and the objects they grabbed, so there’s a lot of

twisted fingers suspended in mid-air. And facial capture is also still very rough. But the quality of the output is good enough to judge the /concept/ of how the scene was treated visually. And in the end that's what this workshop was all about.

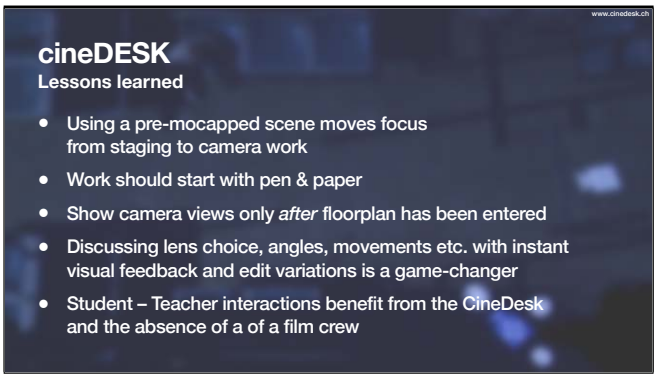


So this process of going from script to finished movie scene would usually have taken two to three weeks. But thanks to the CineDesk, we went from script to finished movie in just



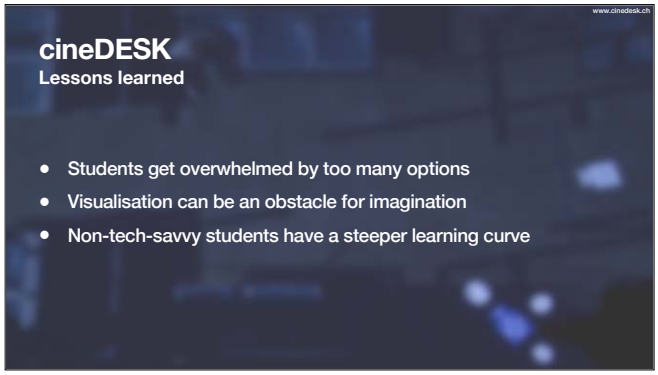
three days. That's the beauty of simulation: instant gratification.

So what lessons did we learn?



1. Working with pre-staged mocap data made students focus on camera work instead of staging. 2. The classic workflow is still indispensable: First use pen and paper and your brain, analyse and visually break down the scene before you move to shooting. Visual storytelling is about dramaturgy, and if we skip the dramaturgical analysis und jump right into visualisation, total chaos is the result. 3. To enforce this workflow, we switched off camera rendering in the beginning so students just saw the floor plan while they were setting up their shots. 4. The most important lesson: discussing lens choices, angles, movements and framing combined with instant visual feedback and edit variations is a total game-changer for the way we teach cinematic language.

But like any new technology, the CineDesk also has some issues:



Students tend to get easily overwhelmed by the endless options the CineDesk provides them with.

Visualisation can be an obstacle for imagination. I think this is an important argument against over-using previz in film education. Imagination is the most important resource any artist has. And as painful as it sometimes is to think of a shot purely in your mind, the training that this brings with it is irreplaceable.

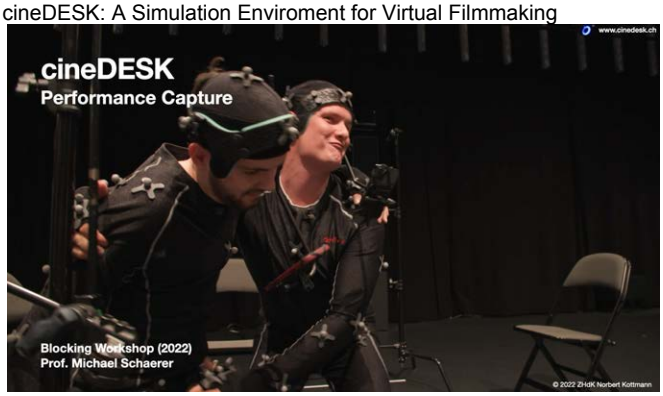
And also, less geeky students have a bit of a disadvantage hhere because their learning curve with this tool is just quite steep.

But overall we were very happy with this first workshop and we'll do another one soon.

So what's next?

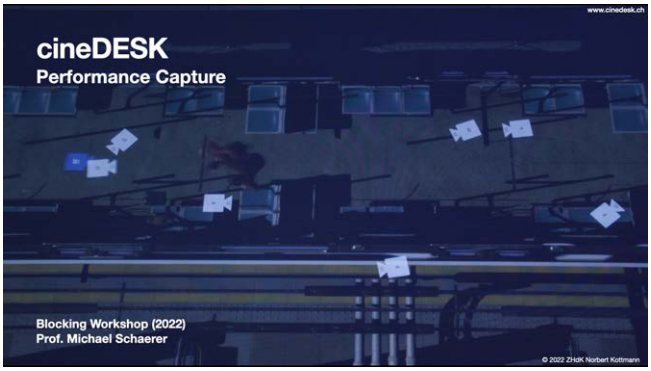
cineDESK is still under development.

We use it not only to teach visual storytelling, but also for blocking workshops.

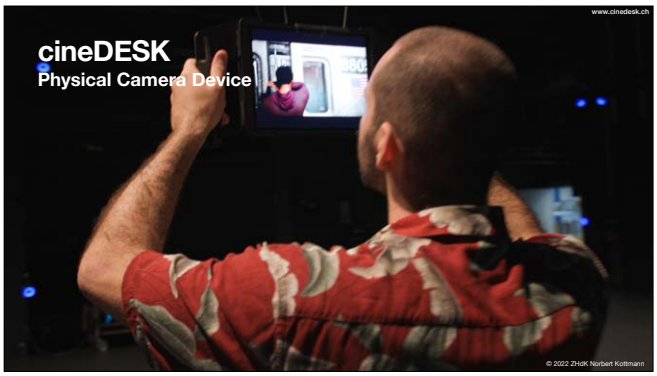


We connected the cineDESK with a motion capture system to record body movements.

Facial expressions can also be captured by the use of a smartphone.



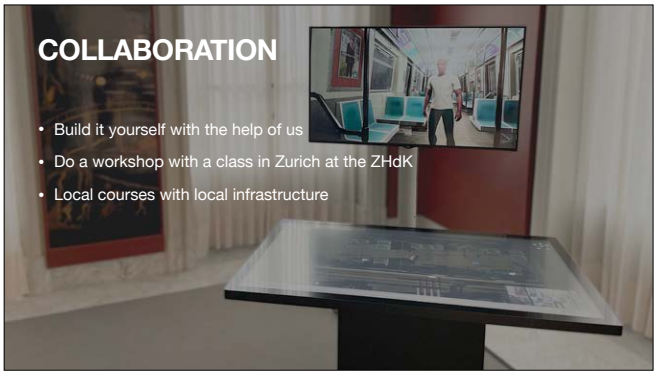
The students can now directly block their actors and record performances on the cineDESK.



A virtual camera can be guided by a tracked physical device, which makes camera handling much easier and more intuitive.

The position of the camera is streamed in real-time to the cineDESK, where a second person can act as a focus puller.

Overall, cineDESK is a good example how research can be tightly integrated into teaching and both can benefit from it.



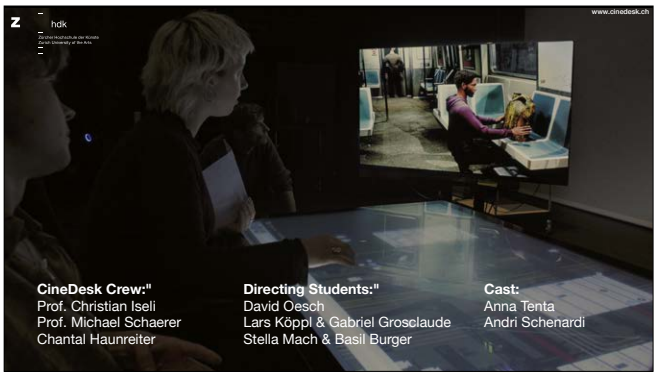
As you've seen, the development of the cineDESK so far was a collaborative effort from the very beginning.

And we would love to extend this collaboration to other film schools. So if you're interested in working with us on this project in any shape of form: please let us know. For example

- We can offer you tutorials so you can build a cineDESK yourself.

- You can send your staff or students to a hands-on workshop in Zurich

- We can do workshops at your school



So thank you for your attention, and we look forward to your questions and comments

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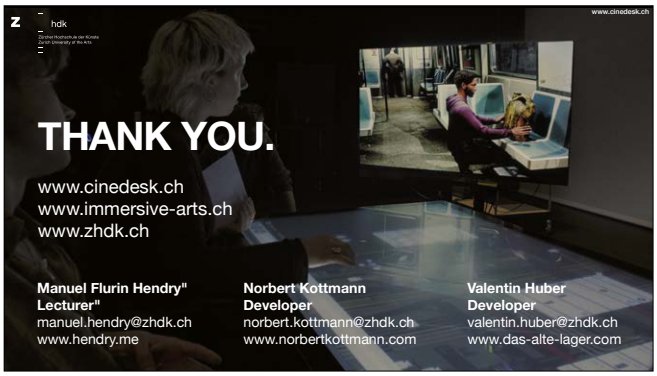

Thanks a lot.