

Im/material Theatre Spaces

VIRTUAL AND AUGMENTED REALITY

DTHG DEUTSCHE
THEATERTECHNISCHE
GESELLSCHAFT

Im/material Theatre Spaces

VIRTUAL AND AUGMENTED REALITY FOR THEATRE
RESEARCH PROJECT DIGITAL.DTHG 2019 TO 2021

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Digitality in the theatrical interplay of art and technology

FOREWORD BY WESKO ROHDE

Theatre is a place of blurring boundaries and continuous technical appropriation. Theatre people have always worked on existing technology for art and its purposes, reshaping and developing it, often creating new technologies beyond its original purpose.

Theatre is the largest ensemble art we know. More than 50 professions are involved in a theatre; to build a theatre, at least as many more people come together. All of this flows into the building and its uses. Art pushes the limits, perhaps demands the impossible, drives and sets new milestones with its positive ambition.

Digitality is only a concept, not an innovation in itself. It emerges in the interplay of those who think technically and artistically. The motivation for the research project „Im/material Theatre Spaces“ is to combine the most innovative forces, to research, to gain insights, to make them known and to communicate them to a broad public. Concurrently, this project impulse led to the founding of digital.DTHG as a competence area for digitality and new technologies.

What this power accomplishes can be read impressively in this publication. It is not only a description of the completed project, but a compendium, a basic work for subsequent projects and a call to continue and act.

Our great thanks go to the Federal Commissioner for Culture and the Media and the team that accompanied and supported our work with such interest. My personal thanks, on behalf of the wonderful digital.DTHG team, goes to Franziska Ritter, Pablo Dornhege and Hubert Eckart. Thank you for embarking on this journey!

Kind regards

Wesko Rohde

Chairman of the Board DTHG and
Managing Director DTHG e.V.

Learning from the theatre. Virtual and Augmented Reality as space- and time-based media

INTRODUCTION BY PABLO DORNHEGE AND FRANZISKA RITTER

The theatre has always been a place for creating fantastic stories, a retreat and a place of longing at the same time. As “world builders”, theatre makers enable their audience to visit diverse places and travel through time to the future and the past. In theatre, spacious, participatory and interactive forms of narration are constantly being re-explored and reinvented. Basically, theatre is the analogue and original form of virtual worlds, a kind of „Proto Virtual Reality”.

“So this is the material the world of the stage is made of: a mixture of reality and appearance.”

Alewyn, Richard: Das Theater als Zwischenreich, in: Das große Welttheater: Die Epoche der höfischen Feste, München 1989.

Accordingly, Virtual and Augmented Reality are not to be understood as a vogue in the current media landscape, but as a consistent further development of classical media and art forms into a new and independent medium. Both theatre and virtual and augmented reality are spatially immersive media and work with similar methods, such as suspending physical laws or playing with social conventions; both address questions of participation and provide opportunities for changing perspectives.

„Our project is characterised by an artistic-technical engagement with theatre and virtual & augmented reality – as spaces of imagination, as places of shared experience, reflection and learning, as possibilities for experiencing art and reflexive self-awareness.”

The medium of VR – like theatre – holds great potential for experience through the interaction of different approaches from other artistic disciplines (film, literature, music, scenography, architecture, visual arts...). By putting on VR glasses, one steps out of one’s immediate environment and shifts one’s presence into a digital world, into a new reality. This complete dive into the virtual experience is called immersion (see glossary). The distance that is created in most narrative formats by the viewing distance between the user and the experience is eliminated.

With its characteristics as an immersive, interactive, space- and time-based medium, virtual reality offers countless new variants of storytelling. Virtual reality enables a multitude of shifts in perspective, be it embodying different characters or „roles”, travelling to other times or to inaccessible places and situations. Physical laws and social conventions can be suspended: Spaces are not only entered but even flown through, leaps in scale become possible, the viewers themselves become actors.

The medium of augmented reality acts differently. Here it is much more about an enrichment, a mixing of reality and digital content. The theatre has been familiar with this effect for a long time: in 1862, a ghost magically appeared on a stage and triggered a veritable illusion hype as Pepper’s Ghost Effect. The method of enriching the visible stage action with immaterial content is exactly what happens – figuratively speaking – when using augmented reality: The overlaying of reality with digital content. The potential of augmented reality lies in its fusion with our directly experienceable environment, so the city can become a stage just like the living room. Due to this permeability between realities, the degree of immersion of AR is significantly lower than with fully immersive virtual reality.

In this research project we „augmented” the potentials of new technologies with the centuries-old „theatre knowledge” and in this interplay we have explored the new possibilities and narrative forms of immersive technologies. This publication is intended to help those who want to deal with issues of digitality in theatre, as well as to provide suggestions and impulses for their own creative work. Our prototypical solutions are intended to sharpen the view for a more conscious use of immersive technologies.

Last but not least: To familiarise yourself with the vocabulary of New Technologies, we have created a glossary at the end of this publication (p. 128) and explain the most important basic terms. We also recommend a look at our website, which is continuously expanded and updated: <https://digital.dthg.de/en>. In the „Knowledge” section, we explain even more terminology, give software recommendations and present the latest projects from art and culture that can be a source of inspiration.

We hope all readers enjoy this publication and we are looking forward to your feedback and a stimulating exchange.

„Pepper’s Ghost Effect” (1862) as an early form of augmented reality: a brightly lit figure in the understage is reflected in a slanted glass pane between the stage action and the audience – and appears as a transparent ghost.

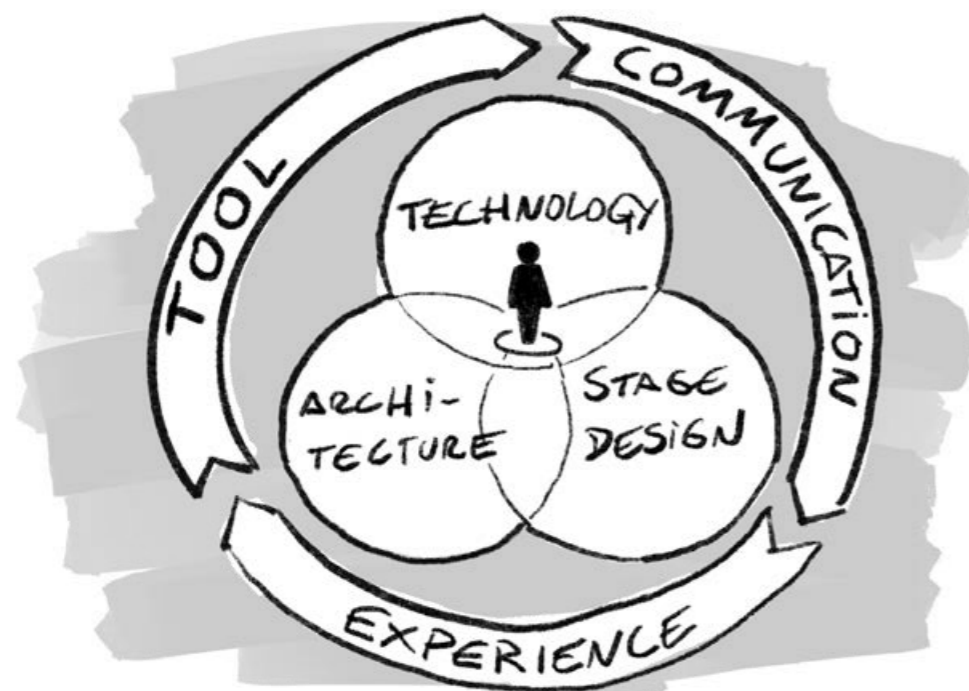
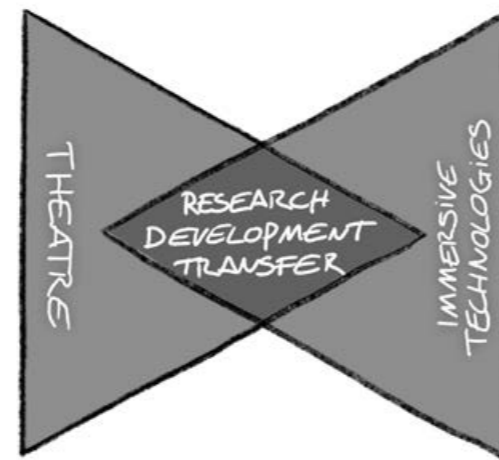


The „Im/material Theatre Spaces“ research project

STARTING POINT, RESEARCH QUESTIONS AND GOALS

The theatre has always been a pioneer for the development and application of new technologies, it is a place for artistic and technical innovation, experimentation and research. Theatres were the first electrified buildings long before trams in Berlin were electrically powered.

So why is it so difficult to introduce new technologies such as virtual and augmented reality into the theatre, while they are now an integral part of development strategies in business enterprises? Because in fact there are already sensible and technically feasible application and business opportunities in many sectors. But so far, such applications in the theatre and event industry have only rudimentarily arrived in individual companies or in the form of temporary projects. Theatres and event venues should remain places of technical innovation and laboratories for new technologies. With the research project „Im/material Theatre Spaces“ we investigated how theatre can be thought together with virtual and augmented reality.



digital.DTHG team meeting with sound designer Lorenz Fischer and screenwriter Ralph Tharayil in the inspiring Berlin-Friedrichshain studio space.

The aim was to explore the new technical spaces at the interface of analogue and digital worlds and to make them usable for theatre practitioners.

In this context, we explored the digital theatre world in a practical way with our interdisciplinary team and our project partners from theatres, universities, museums and industry. Together, we have outlined new approaches, developed prototypical solutions for the theatre and event industry and communicated our findings to the theatre landscape in a variety of workshops, lectures and blog posts.

At the centre of our exploration were three concrete thematic fields of theatre: architecture, stage design and theatre technology. On the basis of these disciplines, various forms of application and use scenarios of augmented and virtual reality were tested: both technologies open up new ways for human experience, they create innovative access and new levels of mediation and can serve as tools for the planning and implementation of processes.

Specifically, the following questions were at the centre of our research interest, which we developed in various sub-projects with the cooperation partners:

- How can augmented reality applications be used to plan and discuss the future renovation process of a theatre building?
- Can digital technologies be used to improve compliance with safety-related industry standards and improve everyday working life backstage?
- How can immersive technologies create new access to im/material cultural heritage and what communication strategies result from this?
- What are the potentials of co-creative audience formats in a hybrid-real stage setting?
- How can stage designs be conceived and discussed virtually - how does a virtual „Bauprobe“ work?
- What conditions must be created at the theatres in order to be able to use immersive technologies in the often hectic everyday work and production stress?

This publication presents the project results and gives an insight into our working methods. In discussions with our project partners, diverse aspects around the topic of digital transformation are illuminated and the ideas are tested for their practicality. We give an outlook on possible further developments, perspectives and the sustainable transferability to other scenarios in the theatre and cultural landscape.

Augmented reality in event technology

INTERACTIVE 3D MODELS AS OPERATING TOOLS FOR COMPLEX CONSTRUCTIONS AND SYSTEMS

How do users of complex technology and products in the stage and event sector benefit from augmented reality? In addition to possible time savings when setting up complex machinery, the main focus here is on increasing safety through a greater understanding of the correct operation. As a basis for a practical examination of the requirements of such an installation aid and for discussion with the various stakeholders and dialogue partners, a first functional prototype for the AR-supported setup of a curtain rail was developed in close cooperation with the company Gerriets.

RESEARCH QUESTIONS

- How can XR technologies be used to improve and facilitate the daily work of event technicians?
- What tools are needed to increase safety on stage?

APPLICATION

- Augmented installation instructions for complex theatre technology

TECHNOLOGY

- WebXR (browser-based interface for
- AR and VR applications)

PARTNERS

- Gerriets GmbH
- cast C.ADOLPH & RST DISTRIBUTION GmbH
- Akademie für Theater und Digitalität Dortmund
- Deutsches Theater Berlin

Augmented reality in event technology

INTERACTIVE 3D MODELS AS OPERATING TOOLS FOR COMPLEX CONSTRUCTIONS AND SYSTEMS

Based on the question of how work safety in the stage area can be increased through the use of augmented reality, we first outlined basic application scenarios of AR technology in the context of event technology. Thus, in workshops with industry partners of the DTHG, ideas emerged for the use of augmented reality in the remote maintenance of control technology, as support through hazard recognition in safety-relevant work and as a construction aid in the assembly and dismantling of complex technical stage decorations.

Due to the technical feasibility, we have dedicated ourselves to a more in-depth investigation of an augmented construction aid. Highly complex equipment is used in the event sector and on theatre stages. The technologies and products used are so diverse that their operation cannot be taught comprehensively in training. In addition, assembly and operating instructions available as paper documents are often too unspecific and – especially in the working environment on stage – impractical to handle. This is where digital instructions can support the work of stage technicians and create a decisive added value through the increased readability of digital 3D models.

We have chosen the TRUMPF 95 curtain rail from Gerriets as an exemplary product. The system is used worldwide and several dozen kilometres of this type of rail are sold and installed every year. Before we devoted ourselves to developing the digital instructions, we first took a close look at the analogue product. Under the guidance of Andreas Gause (Head of Marketing & Key Account Management at Gerriets), we assembled and disassembled a rail several times and created an overview of all the operating steps that a construction aid requires. Decisive for the successful assembly of a curtain rail is the sequence in which the elements are assembled. In addition, it was possible to understand in the analogue which individual module types the module set „curtain rail“ consists of. Since augmenting analogue objects with digital content requires an understanding of the analogue material, this practical workshop was an essential step in the project process.

The result was a first functional prototype for the AR-supported construction of a curtain rail: the instructions in the form of an interactive website guide the user through the construction in ten simple steps after an overview of all the parts and tools used.

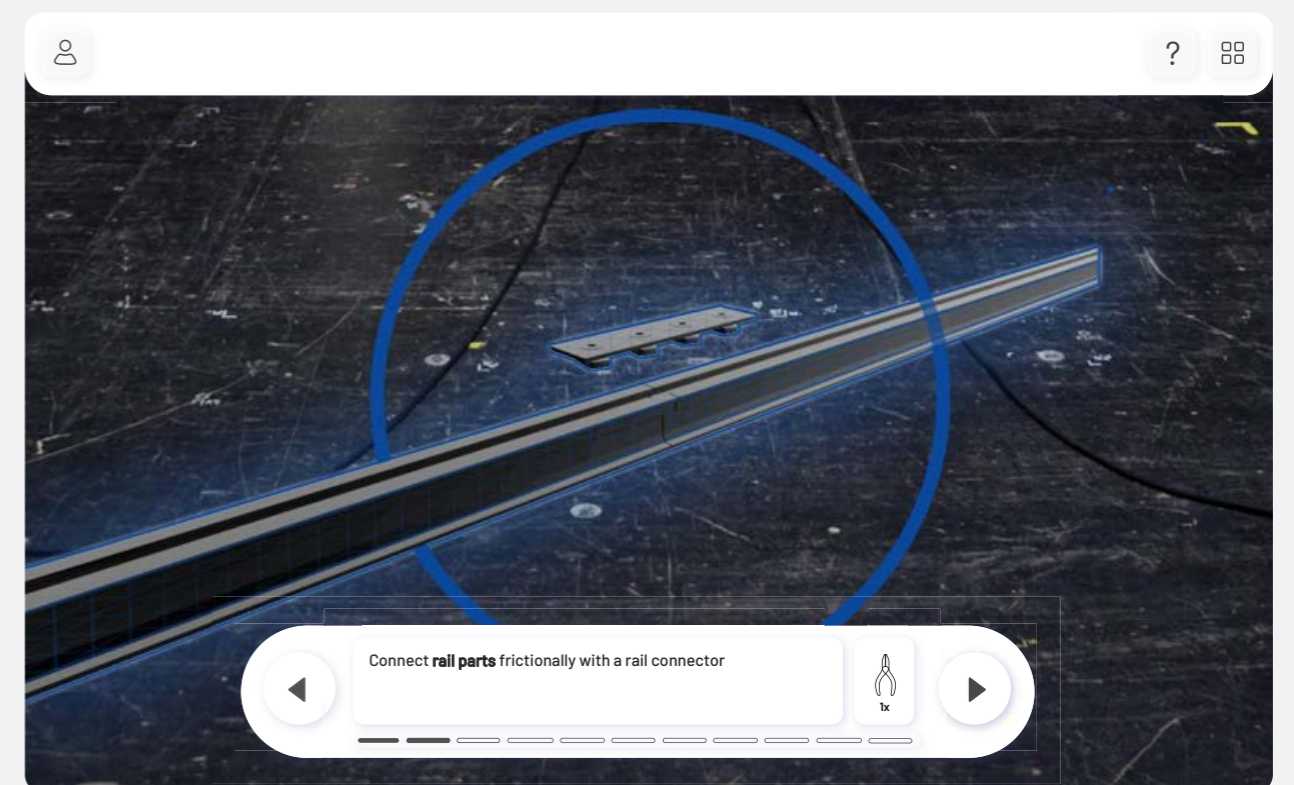
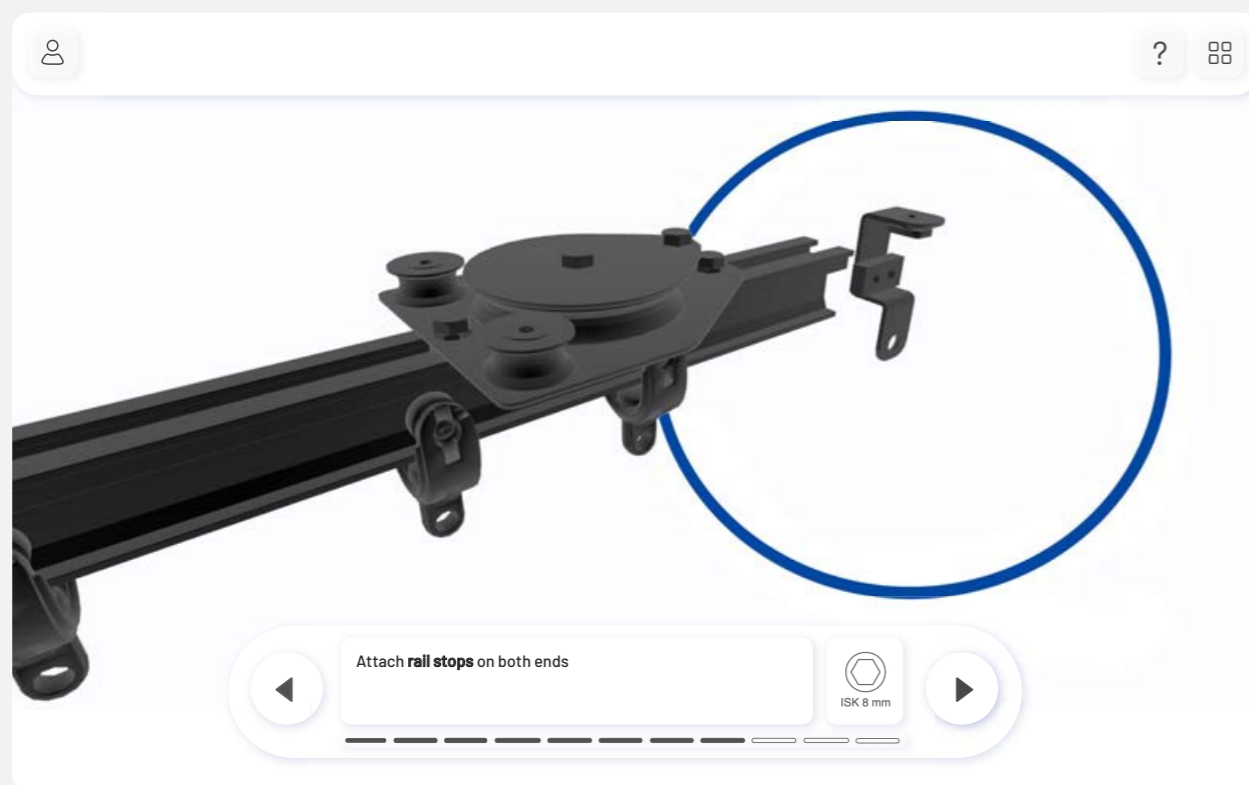
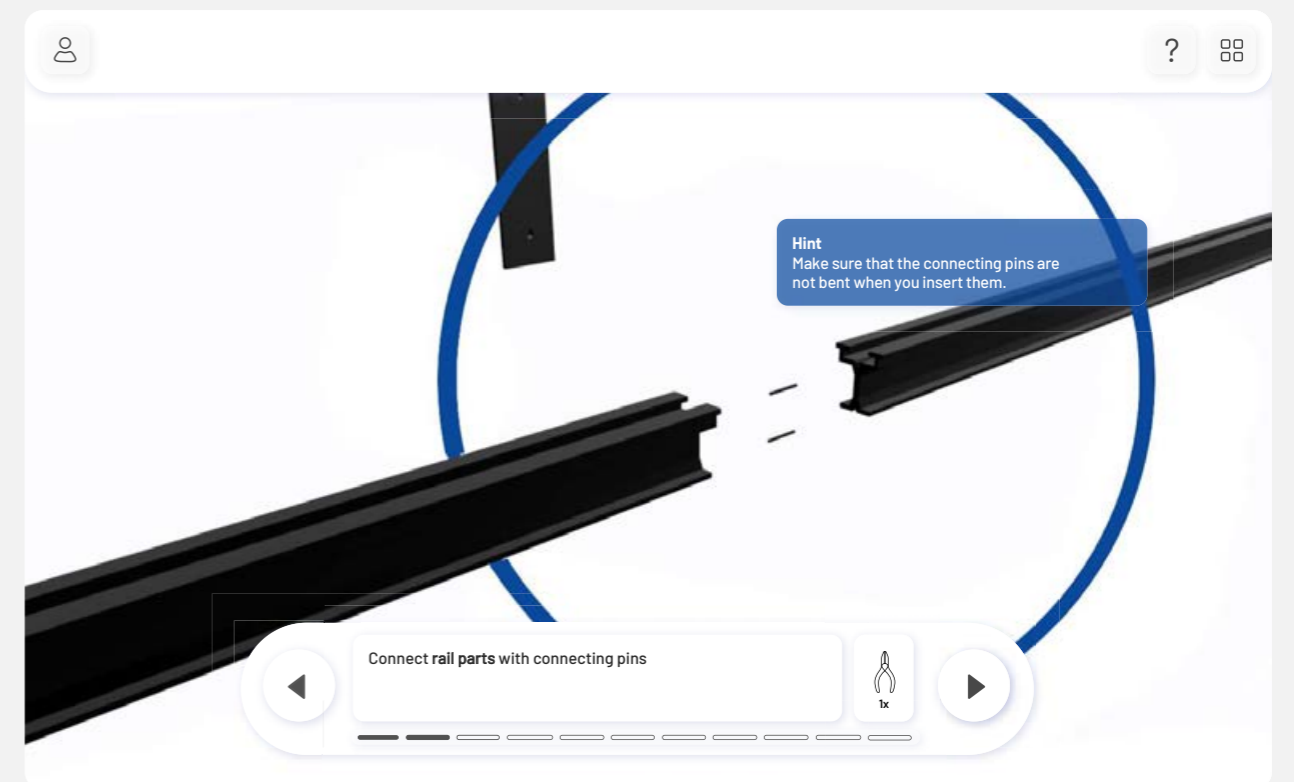
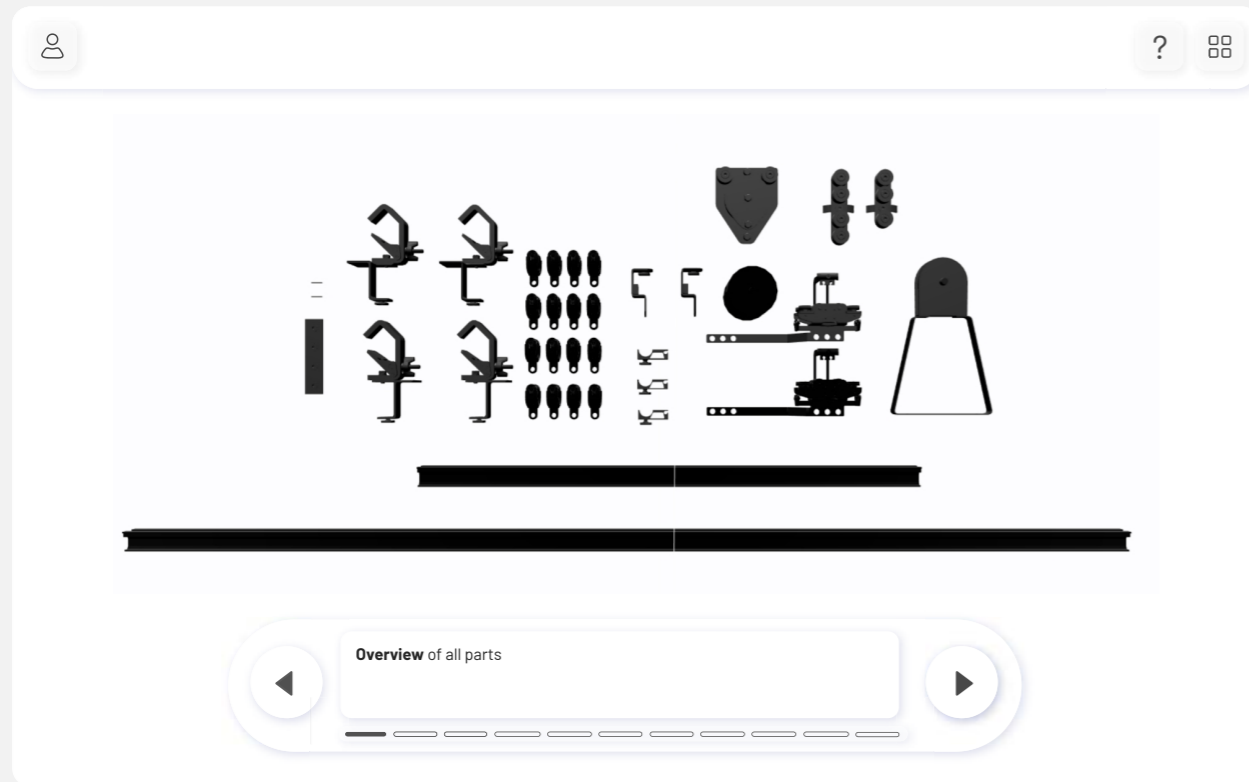


A short accompanying text (theoretically also possible in several languages) describes the processes, points out possible pitfalls and reveals tips and tricks. The individual construction steps are shown as three-dimensional animations and can be called up by the users one after the other. The viewing angle and zoom factor can be determined by the user.

The implementation as a website makes it possible to change or improve the instructions afterwards and then quickly pass them on to the users – without having to update the application on the end devices. By using the relatively new WebXR interface, the website and assembly instructions can be displayed on a variety of different devices. On the one hand, the technology makes it possible to display 3D objects on conventional screens (for example, on a computer or tablet), and on the other hand – through the use of augmented reality glasses or the AR function of a smartphone or tablet – to „project“ them immersively into one’s own environment.

The digital.DTHG team on an „analogue“ exploratory tour during the assembling a curtain rail at the Deutsche Theater Berlin.





Designs for the user interface, showing examples of how the WebXR tutorial for the TRUMPF 95 curtain rail works in desktop and AR mode. The challenge here - as with any good UX/UI design - is to find the right balance between depth of information and attention to detail on the one hand and simplicity and clarity on the other.

Reality-Check WebXR-Tutorial

AT DEUTSCHE THEATER BERLIN



In a field test, we used the WebXR prototype for setting up the Gerriets TRUMPF 95 curtain track with the technical team of the Deutsche Theater Berlin end of April 2021.

Our main questions, which we explored on site with the technicians, are presented below. The answers are paraphrased from the comments and opinions of the participants.

What was your first impression, how well did you get along?

- On the smart phone, tablet and computer, the operation was very self-explanatory.
- The operation of the VR and AR glasses had to be explained briefly, but then the use of the application was comprehensible.
- After initial skepticism, the digital setup help was helpful overall, because the individual steps are quite complex

The 3D models in the prototype were very detailed. Could the representation also be more abstract?

- The realistic and detailed rendering was very helpful. The level of detail is necessary to be able to quickly identify the components. During assembly, you don't want to "translate" a too abstract representation into reality
- The assembly steps could be shown in more detail and include more information: Which tool do I need and where is it used?

How practical do you think such a tool is?

- I can already imagine working with a tablet or a touch screen on stage.
- Augmented reality glasses are probably very sensitive and still somewhat unwieldy, but that will change in the future.

What additional features would you like to see?

- I would like to have my own account, so that I can adapt existing tutorials.
- For example, I can imagine leaving notes for colleagues, for specific solutions within our house or for the respective production. As an audio commentary or as a graphic sketch.

What other scenarios and target groups can you imagine for the application?

- I can imagine many more tutorials for other equipment and machinery, such as scene conversions or complex stage setups.
- Definitely helpful for pre-visualization, for example, when building a new theater, an expansion or renovation of the house.
- Such an application is useful for technical onboarding: New colleagues or stagehands can familiarize themselves with the conditions in advance.
- With such a tool, tasks that rarely occur could also be practiced in a knowledge check.
- The tool would be a good method to accompany safety checks and maintenance.
- Such a method would be a very good addition to the teaching materials in training, vocational school or university as a digital exercise situation.



What technical barriers and organizational challenges do you see?

- Isn't that much too expensive, where do the budgets for such a way of working come from?
- I found the handling with the additional "devices" complicated, because I don't want to work with mouse and keyboard on stage.
- What about data protection? We don't want our employer, for example, to be able to "monitor" us directly – or even virtually look over our shoulder.
- Many theaters do not yet have a basis for this kind of working method, and often there is not even a stable WLAN connection.
- We need time to try it out and learn, because not all colleagues have the understanding for the new technologies.
- Such a digital app requires high quality 3D data: who provides the data, who hosts it and who maintains it?

We would like to thank all DT employees who participated in this practical test: Olaf Grambow, Marco Fanke, Jörg Tippelmann, Philipp Kurth, Martin Ziebart, Katharina Langer and Naomi Mead.



Technology is much more than a gimmick

INTERVIEW WITH ANDREAS GAUSE, GERRIETS GMBH

Franziska Ritter and Pablo Dornhege, both digital.DTHG project leads, sat down with Andreas Gause, Director of Marketing & Business Development at Gerriets, to talk about digital transformation in the field of theatre. For 70 years, the family-run company has been a world market leader in stage and event requisites. Their product portfolio includes curtains, films and backdrops, decorative fabrics, stage velours and fancy materials that are all manufactured onsite as well as stage technology such as hoist and rail systems. The virtual assembly instruction prototype, developed using the TRUMPF 95 curtain rail as an example by the digital.DTHG team in cooperation with Gerriets, is meant to make it easier to work on and behind the stage. This conversation took place on February 7, 2022 at the Assmann showroom in Berlin.

Over the past two years, there has been a lot of development in the field of theatre regarding digitalization and digital competence. Where do you think your company is at when it comes to digital competence?

At Gerriets, we're looking at two areas: First, we have the artistic field that we support with our products to facilitate the staging of digitally motivated productions. An example for this would be our classic projection films for front, back or combined projections as well as soft edge, panoramic or dome projections. We also have visual effect materials and real 3D projections like our Pepper's Ghost film or our 3D projection gauze, both of which make it possible to create amazing hologram projections.

The second area in which digitization is progressing is our internal processes. This includes our inventory control system, calculation tools, stockkeeping and the CRM systems for customer service as well as our web shop, which works very well with integrated CMS tools. All our products have been fully digitized as 2D and 3D CAD drawings so architects and planners can already use them.

Together, we have created a prototype for digital assembly instructions for the TRUMPF 95 curtain rail and we have run several tests including one with the technical team at the German Theatre in Berlin. What are some of the conclusions that you can draw from this?

We are always open to trying new things and we like investing both time and energy into new technologies. When you first told me about what you were planning to do in our first meeting at Dortmund's Academy for Theatre and Digitality, I initially had trouble imagining what augmented assembly instructions might look like. In the workshops that followed, I began to see not only the technical feasibility but also the potential value: One of the big advantages is the plastic and therefore very realistic presentation. Someone who has never worked with a rail system like this before can just put on the glasses and the pieces are virtually projected onto the stage. Then, all that needs to be done is to fill in the „blank spaces“. The system shows where the pieces need to be placed. This saves time and helps with understanding both the setup and the interaction of the different elements – this is a great advantage, especially compared to a classic paper manual that requires you to find the right page at the right time.

Our collaboration and experiments with the prototype have shown me and our company that this can be a valuable tool if we continue to develop it. There still is a bit of work to do to take it from an experiment to an actual tool but I can already see the value it will bring.

What would be the next step to further develop the prototype?

The parts that are most exciting to us are design and configuration. Somewhere in the world a customer can connect to our website, get on stage, create their own individual system, visualize it in real time and, for example, discuss it with their director. It doesn't have to be perfect and final because later, there will be an individual consultation.

Our goal is to make it possible to use a menu guidance to freely configure a modular rail system and have the system automatically configure the correct assembly instructions from the modules. There is a great advantage here because since we ship our products globally, augmented, three-dimensional instructions are much more accessible and comprehensible. When we provide a printed manual, we don't have this plasticity and there is more potential for misunderstandings. There is no longer the need for an "old hand" who has set up the system 60 times. But this can be useful when training new our current employees. The next step would be smart FAQs so that questions can be answered on site. Ideally via speech recognition – this way, a person can use the system and it will feel like somebody is standing next to them and explaining the product.

Based on your experience with the prototype: What other scenarios can you imagine at your own business?

I can think of several scenarios, for example project acquisition. interested customers can get a first idea of our products or test a virtual curtain rail in their own theatre before our first consultation. This way, the customer can specify their own requirements better and discuss them with all the stakeholders at the theatre. If there are any questions, an expert can digitally join the conversation and discuss the customer's needs. During an on-site consultation, the simulation could be supported with AR glasses – bringing augmented reality onto the stage. One thing that is important to us is the fact that a personal conversation can't be replaced by digital tools. But it can be prepared for with technology so that we can make the most of the available time and focus on what's most important during our conversation.

In this case, the live-configuration and adjustment tool can be utilized by the consultant. The system checks the components for compatibility and the final set up can be visualized right there in the room. This visualization goes way beyond a regular on-screen 3D rendering. Since we can see the visualization on our human scale, it becomes much more engaging, regardless of whether we see it through glasses or through our smartphones. It is much easier to assess. Once everything has been cleared on site, the configuration can then be passed on to the planning department.

Our team could also use a tool like this while preparing for a complicated on-site assembly. Technical employees at theatres all over the world can familiarise themselves with the specifications of our products and practise controlling them – even before the systems have been delivered and set up. This way, installations can be prepared for in a useful manner, which is especially helpful in remote locations.

You recently tested the prototype in a class with trainees. What were your experiences?

We think we can use a tool like this in the training of our industrial mechanics as well as in the preparation and training of employees who will be sent off to assemble systems. We already follow a “learning by doing” approach but we do this using the actual object. That means we do this on real construction sites, which is a lot of work. Using this tool for training purposes means that augmented reality – in this case, virtual reality – helps people get to know a product. They assemble a “virtual” setup, either alone or with a group of people.

And, unlike working with assembly instructions, we don’t even need the actual object. We can practise the planning steps and think about how to best set up a system in a particular room. In this case, technology is much more than a gimmick that delights our trainees and students. It is the hands-on effect, the learning with the object, that has the greatest effect. And this works even if the object is virtual and simulated. And it doesn’t only work in our own rooms, but also in its (virtual) place of use. This tool can also be very useful in training sessions with our global distributors.

This way, our partners and subsidiaries can familiarise themselves with new products without having to travel to our headquarters. This also has a positive effect on our climate.

What is your wish for theatres in the future?

Theatre is a field that works in a very traditional way in many areas – both on stage and in the workshops. Catalogues, product descriptions, price sheets, and manuals are frequently used in a printed format. It does not necessarily promote digital ways of working. It seems to me that the creative industries are more open to change, for example the event industry seems to be quicker. But this is beginning to change. We see more and more acceptance for digital tools, and things like price sheets and catalogues are more frequently accepted as digital documents. And as the generational change at theatres and workshops continues, other digital applications will become more common.

What needs to be done to make sure a digital cultural change can take place across the board?

Theatres still work in a very analogue manner. One reason for this is that not everyone is aware of all the possibilities that digital tools offer. I can imagine that this is the direction we will be going in, though. Especially in the field of stage design. People will say: “What will it look like if I add a Gobelin net here? How will the scenery change if I use a different fabric instead? And how will our projection look?” This will touch on your other project area, the virtual construction rehearsal. Right now, we are still a long way from that but in other areas, technological tools are not only requested but also very commonly used for visualisation and planning. At some point, similar demands will become common in the theatre as well. But this will require a collaboration between manufacturers. Maybe this cooperation could be moderated by the associations. Politics, associations, universities and manufacturers must work together – the private sector will most likely not be able to foster a sustainable development on its own. I think associations, universities and manufacturers generally need to connect and work together more closely.

WHAT HAPPENS NEXT?

Based on the findings from the first prototype, which was developed for the construction of a specific curtain rail, and in combination with the WebXR editor/viewer application, which was created for the visualisation of theatre architecture, a transferable workflow for the creation of augmented assembly instructions and operating aids was developed. This combination brings to bear the special advantages of an editorial system with an easy-to-use web interface. Thus, manufacturers can compile new instructions from existing 3D modules and publish them immediately. Knowledge of coding and 3D modelling is not necessary. This means that the tutorial can later be transferred to other theatre technology products and elements. A further expansion stage would be the connection to an online configurator in combination with a product library. This way, customers could have their individual combinations of products displayed directly at the respective venue.

Through the development of the augmented assembly instructions, the draft for a utopian, infrastructural concept emerged in collaboration with the cooperation partners, which could not be deepened within the framework of this research project. Building on the vision of a manufacturer-independent database for theatre technologies, the aim is, among other things, to recognise and augment objects or products in order to precisely determine the origin, compatibility, test history and life cycle of a machine or object. Linked to the findings of this research project, these data sets could be used to support safety-relevant work, such as risk assessment, functional safety checks or remote diagnosis and maintenance.



IMPRINT

PROJECT TEAM DIGITAL.DTHG

Project lead: Franziska Ritter, Pablo Dornhege
Development: Lea Schorling, Sascha Sigl
3D-Modelling / Scans: Sascha Sigl
Design and Interface: Maria Bürger

PARTNERS AND ADVISORS

Andreas Gause, Gerriets GmbH
Olaf Grambow and his team of Deutsche Theater Berlin
Arved Hammerstädt, cast C.ADOLPH &
RST DISTRIBUTION GmbH
Vincent Kaufmann, digital.DTHG

TOOLS

Visual Studio Code, Figma, Miro, Steel cable round slings, adhesive tape, foam cubes and plastic cups

PROJECT WEBSITE

<https://digital.dthg.de/en/projects/augmented-reality-in-event-technology>

Virtual teaching and learning spaces

IMMERSIVE TECHNOLOGIES FOR TRAINING AND EDUCATION IN EVENT TECHNOLOGY

The current situation shows how important digital teaching and learning formats are and will be in the future at universities and in training and learning situations in the theatre and event sector. In cooperation with teachers and students of the Theatre and Event Technology and Management master program at the Berlin University of Applied Sciences, we have developed prototypical new teaching and learning tools in virtual reality. In a practice- and project-oriented approach, we developed and tested specific scenarios and tried out new ways of learning. The result is a series of digital, interactive training units.

RESEARCH QUESTIONS

- How can existing learning processes be meaningfully expanded with the help of immersive technologies and lead to new qualities of spatial teaching and learning?
- What methods, workflows and competences are needed for the development and everyday application in teaching and training?
- How must the training of event technicians change in order to prepare for new, digital working worlds and requirements?

APPLICATION

- Virtual training simulations and practice spaces

TECHNOLOGY

- VR applications for Windows PC created in Unity3D and Simlab Composer

PARTNERS

- Berliner Hochschule für Technik
- ETTE Council (European Theatre Technicians Education Project)

Virtual teaching and learning spaces

IMMERSIVE TECHNOLOGIES IN TRAINING FOR EVENT TECHNOLOGY

The importance of digital technologies has been growing not only since the coronavirus pandemic banished art and culture behind the screens. Rapid technological development and the progressive digitalisation of work processes are changing the everyday working lives of theatre and event technicians. New fields of work are emerging around online events, hybrid theatre forms, virtual construction rehearsals at the interface of physical and digital realities. How can the training of event technicians prepare for these new challenges and how can teaching be meaningfully expanded to include digital formats?

During the last semesters, teaching took place primarily online; the pandemic has shown how important digital teaching and learning methods are and will be in the future. Learning on the fly" is outdated - instead, it is becoming increasingly important to be able to successfully apply knowledge in practice-related problems. This „experiential knowledge" is becoming a key competence.

Digital technologies such as virtual reality can make a major contribution to this, because they create new opportunities for interaction and promote the active - especially spatial - acquisition of the learning material. These technologies offer a potential that goes far beyond learning with books. For example, lessons that require a great deal of technical preparation and even risk of injury in a real working environment can be learned in simulated experiences in an uncomplicated way and without worrying about physical consequences. The structure and internal functioning of technical systems and equipment, for example a chain hoist, are often not visible from the outside or the equipment is not available at the actual learning location. In addition, the group size of the learning classes often does not allow for individual experimentation and laboratory and teaching times are severely limited. Virtual learning environments, on the other hand, are independent of time and place and enable the active design of one's own learning process through cooperative learning with and from one another.



Typical „analogue" teaching situation in the theatre lab at the Berlin University of Applied Sciences with Prof. Stephan Rolfes explaining the construction and functioning of a chain hoist to the digital.DTHG team.

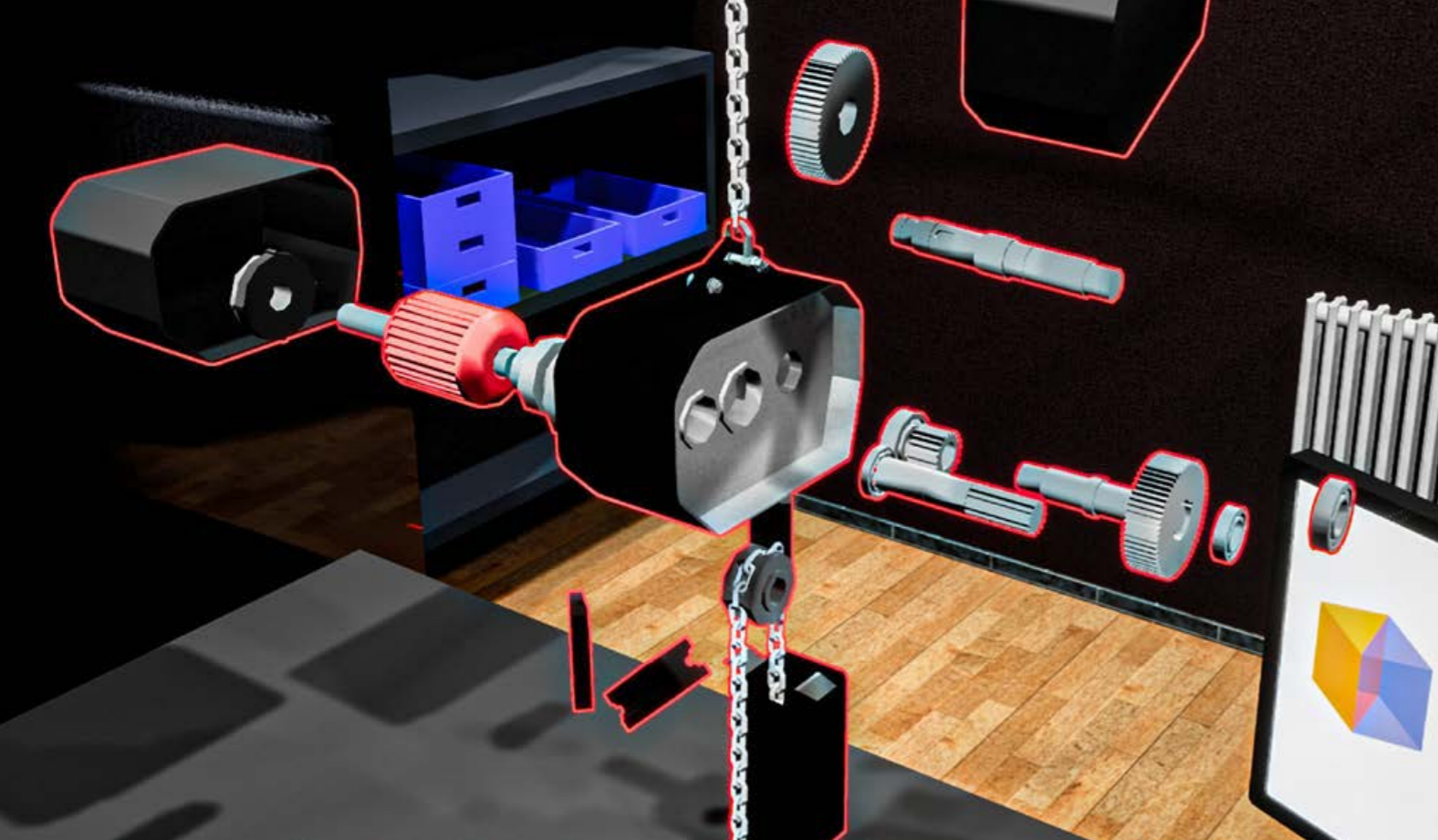


The Berlin University of Applied Sciences with its Theatre and Event Technology and Management degree programme has recognised this potential and embarked on this journey at the initiative of digital.DTHG. Stephan Rolfes, professor for machine elements and construction exercises as well as head of the programme, gave us insights into the analogue teaching methods of the programme during a guided tour of the theatre laboratory. The goal of the cooperation became clear: together we wanted to create an understanding for the new technologies among teachers and students, break down barriers and foster confidence in the use of digital media.

In a series of pre-studies, the digital.DTHG team, especially Vincent Kaufmann, tried out various teaching methods and developed exemplary application scenarios in the virtually reconstructed theatre laboratory, for example the 3D reconstruction of a chain hoist or an interactive exercise on the construction of rehearsal stages.

Prof. Stephan Rolfes describes the initial situation:

"Initially, there was some reluctance among the teaching staff towards a virtual teaching format. However, the preliminary studies developed have convincingly shown the great potential of the technology for our teaching. More ideas from all subject areas immediately emerged and the desire for additional VR exercises became louder."



Prestudy in the digital.DTHG team, prototype for a virtual exercise on the functioning of a chain hoist (Software: SimLab Composer)

In the winter and summer semesters of 2020/21, two practical seminars with 15 students were conducted under the direction of Pablo Dornhege, Franziska Ritter and Lea Schorling. The aim was to analyse the existing preliminary studies and to design new virtual teaching and learning spaces, which were then prototypically realised in teamwork.

The starting point of the seminar was the joint examination of the potential of virtual reality in teaching and the outlining of various areas of application. In six teams, specific tasks were formulated with reference, to the subject canon of the degree programme. In particular, Prof. Alexander Lindau (Audio, Video and Media Technology Department), Prof. Dr. Matthias Salein (Machine Elements, Construction and Technical Mechanics Department) and Prof. Dr. Joachim Villwock (Head of the CAE and Simulation Laboratory - CAVE) provided impulses and feedback on content and didactics.

How could a VR seminar be taught when the university was closed due to the pandemic, students had no or hardly any VR equipment available privately and meetings were only held online? The challenges were mastered above all through the high motivation and

curiosity of all those involved: the Zoom video conferencing system with the possibility of breaking out into team-internal meeting rooms became a digital classroom, communication channels such as Slack and Discord became a „lecturer hotline“ that could be reached around the clock, and the Miro whiteboard application became a constantly present pinboard for conceptual work.

„The great enthusiasm about the technical possibilities of VR must not lead to it being used as an end in itself: Didactics and technology must be equally considered and meaningfully brought together. Therefore, in addition to the technical implementation, the pedagogical design of learning concepts was especially important to us.“

Lecturer Pablo Dornhege

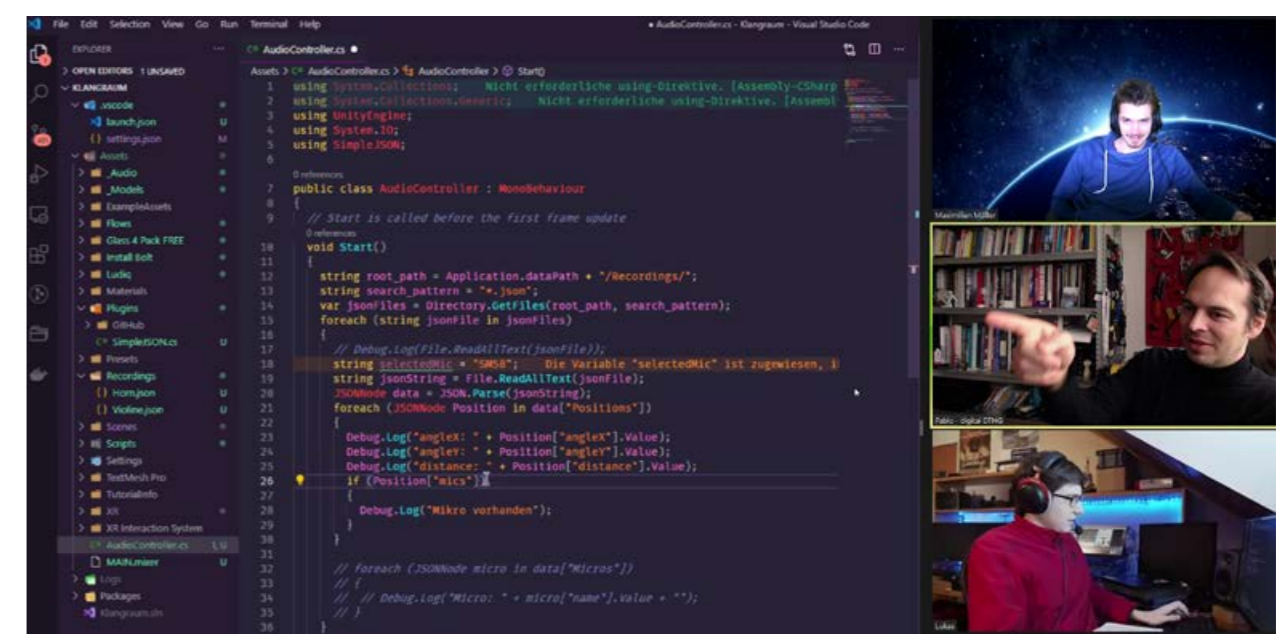
All these tools have established new forms of joint learning and working and will be indispensable in the future.

The special and at the same time challenging aspect of the seminar was to enable the students to realise their prototypes themselves in the Unity 3D development environment despite their lack of previous knowledge. The decision for this software brings with it a high entry hurdle, but enables the development of complex interactive applications.

„A basic understanding of programme logic is helpful for students in any field of study. We should not simply use existing applications, but much more actively develop our own solutions – from software consumers to software producers!“

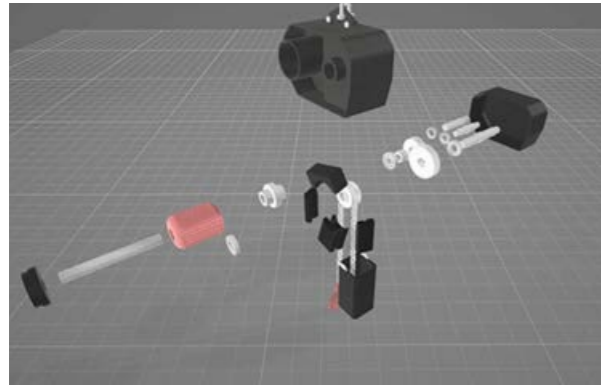
Lea Schorling, developer in the digital.DTHG team, gave the introduction to software development and supported the students in the coding process.

Live coding session with Pablo Dornhege and students in small groups via Zoom. Both semesters took place exclusively online due to the pandemic.



Prototypes

INITIAL STUDIES IN THE DIGITAL.DTHG TEAM



VIRTUAL CHAIN HOIST

STAFF MEMBER: VINCENT KAUFMANN

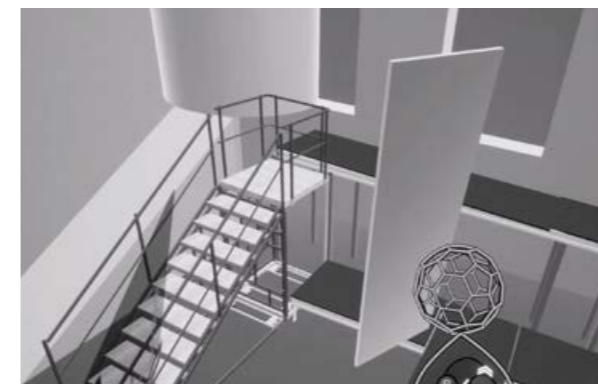
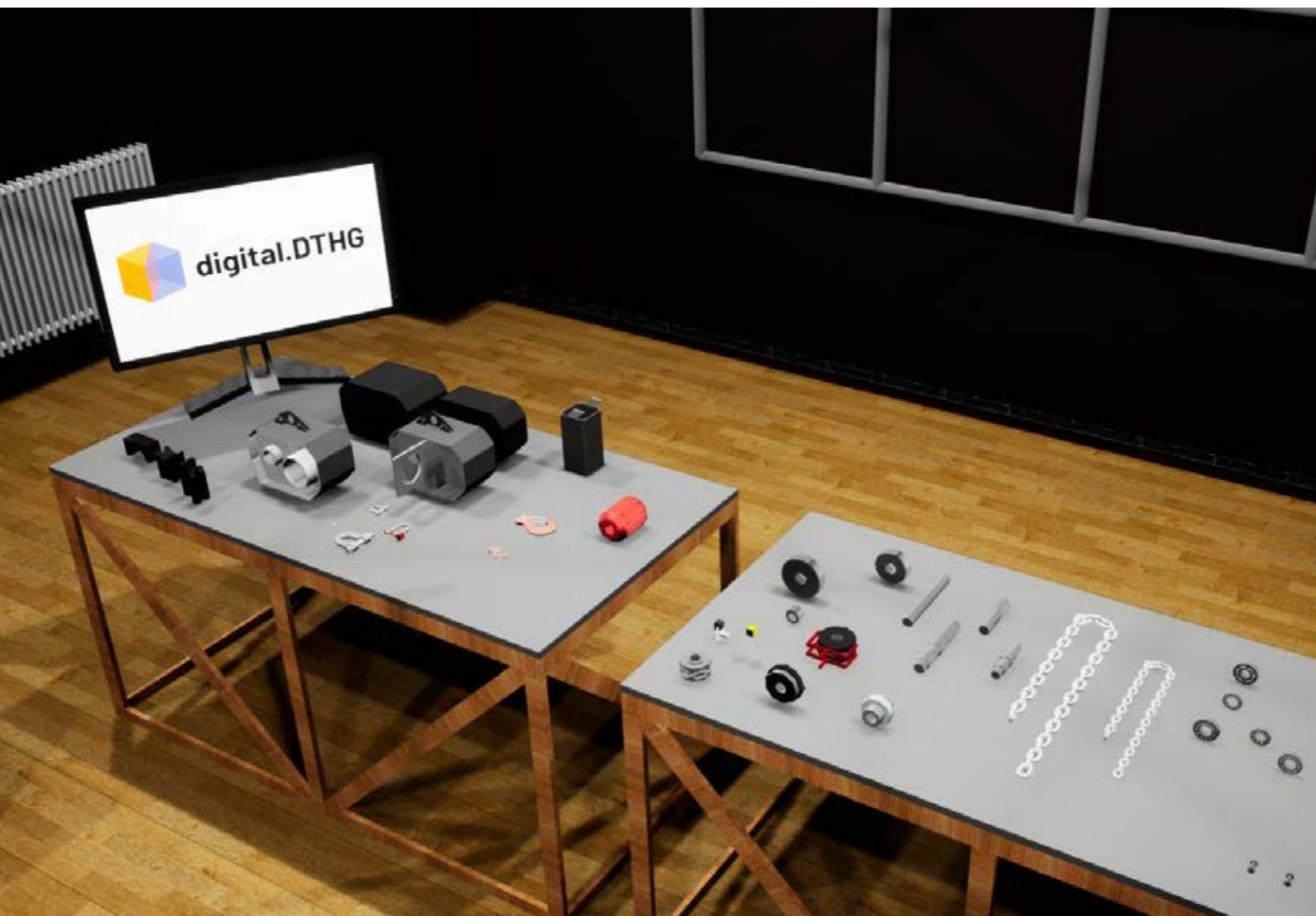
In preparation for the seminar, digital.DTHG colleague Vincent Kaufmann first created a virtual twin as a true-to-scale 3D model for the theatre laboratory of the degree programme. In the following, the „chain hoist exercise“ was designed and adapted as a virtual learning task. So now the „virtual chain hoist exercise“ can be completed in a practical way in the VR theatre lab: first there is the possibility to get to know the components, the structure and the functioning of D8 / D8+ / C1 chain hoists in an explorative mode. In addition, a task prepared by the lecturer from a specific event context can be solved with the correct choice of chain hoist and the combination of the relevant components. The prototype was developed in SIMLAB Composer.



SAFETY SIGNS

STAFF MEMBER: VINCENT KAUFMANN

The virtual learning space „Safety signs“ aims to help memorizing the functions and messages of safety signs in a practical and playful way in the virtual space. In this exercise, selected safety signs such as escape route signs or traffic and mandatory signs are to be placed correctly in the room - like a puzzle game. This is followed by a small fire-fighting exercise in which the knowledge about fire-fighting is to be applied correctly. For example, the correct fire extinguisher must be selected and the correct safety distance from the fire must be maintained.



REHEARSAL STAGE SET-UP

STAFF MEMBER: VINCENT KAUFMANN

The virtual learning space „rehearsal stage set up“ aims to reduce the construction time of rehearsal stages by shifting the planning and organisation of construction processes into the virtual space. The rehearsal stages often consist of standard materials and the transformation of the actual stage design into a design made of standard materials requires its own planning. In exercises, students learn how to handle typical standard materials such as frames, stairs, steps and walls, and must also take safety requirements into account in planning and construction. The virtual learning space supports this planning process. For this purpose, the true-to-scale 3D model of the theatre laboratory was equipped with 3D models of the existing standard materials. Learners and teachers can use the space to develop ideas and create concepts. Their own designs and 3D models can be entered and discussed together. The step-by-step construction of the rehearsal stage is recreated in virtual space. Thanks to the VR glasses, planning can already be done on the right scale, so that a feeling for the real dimensions of the rehearsal stage construction is created.

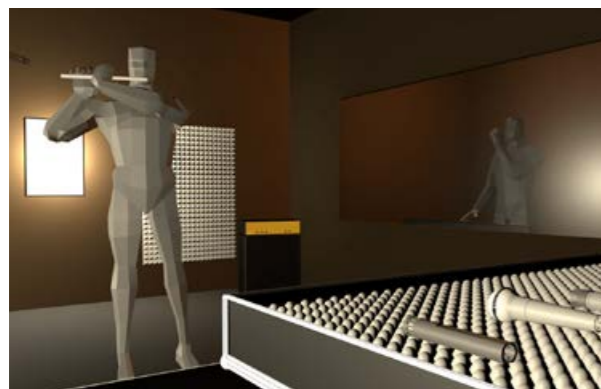
Prototypes

IN COOPERATION WITH STUDENTS FROM THE BERLIN UNIVERSITY OF APPLIED SCIENCES



CONNECT
SEBASTIAN FINSTERER, MARIUS MIRSCHBERGER,
GILBERT ADAMEK

„Connect - virtually experience and understand media technology“ is a virtual learning space where you can get acquainted with modern media technology in a realistic way. The framework for this is an exhibition stand on which typical audio and video media technology is installed. For example, radio microphones, lectern microphones and feeders can be transmitted to various locations and video images from various laptops and cameras can be distributed to LED walls, displays or an internet stream. You can get an overview and start looking for all the cables, equipment, adapters and converters you need at the lectern, backstage, FoH, etc. For better orientation, there is a clear cabling plan on the wall. To consolidate the knowledge gained, there are various games and tasks that have to be solved within a certain time: for example, marking different devices, cables, signal paths or even a faulty sound check situation in which not everything works as it should.

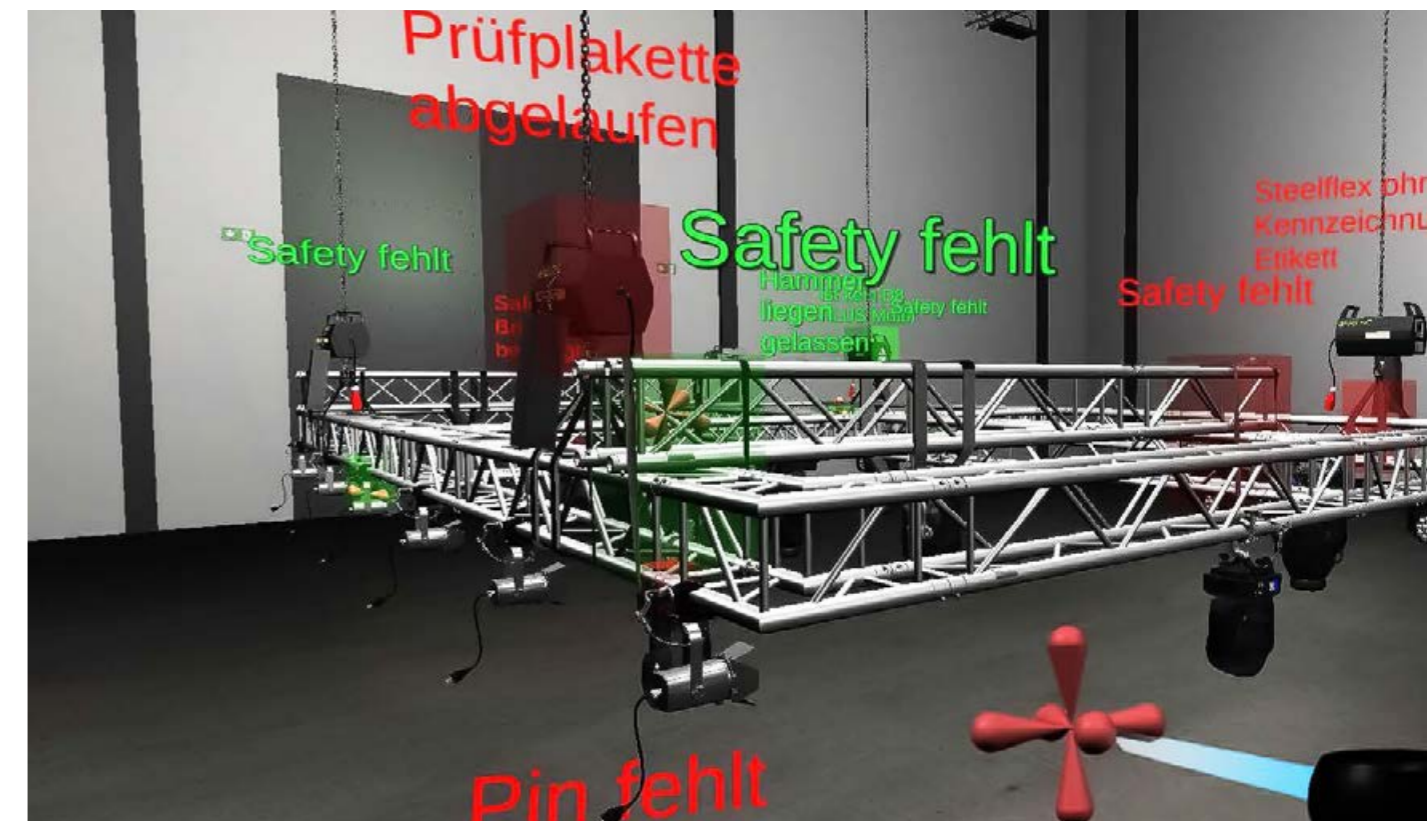


SOUND SPACE
LUKAS RUNGE, MAXIMILIAN MÜLLER,
CHRISTIAN ECKEL

„Sound Space - Experience Microphonation Virtually“ is a virtual learning space for the field of sound design. The aim is to be able to listen to and compare different microphone setups of instruments. Two different rooms are available: On a stage, instruments can be miked and the correct selection tried out. In a recording studio, the focus is on the positioning of the microphone relative to the instrument. For this purpose, different microphones are available that can be moved in a 360° radius around the sound source. This makes it possible to experience differences in sound qualities and to understand the relationship between pick-up positions and microphone types. The auditory impression is calculated live on the basis of real sound recordings. For this purpose, recordings were made with several microphones of the same type at six positions around the particular instrument. The „sound space“ offers the possibility to assess the effect of microphone position and selection when miking different instruments without much effort and to acquire basic knowledge for recording practice.

HAZARD DETECTOR
JOHANNES MUCK, ERIK BAYER

The virtual learning space „Hazard Detector - finding errors in virtual space“ aims to test theoretically learned knowledge in a realistic working environment. A trade fair hall with a traverse rig suspended at working height is available as a VR training room. Before the rig is pulled to its final position by the chain hoists, the users will have to carry out a final safety check and identify possible sources of danger. Both obvious mistakes, such as a hammer forgotten on the truss, and those that require a thorough knowledge of the rules and regulations, such as a missing sling label, are to be found. In addition, there are stress factors, such as the noise of hammering in truss pins and the noisy work of the surrounding trade fair. This learning space gives the opportunity to identify hazards, while at the same time, the multifaceted everyday work of event technicians is made tangible.



Prototypes

IN COOPERATION WITH STUDENTS FROM THE BERLIN UNIVERSITY OF APPLIED SCIENCES



BENDING BEAM

ROBIN KLEIN, JONAS KRAPF, SAMUEL VOCKE

The virtual learning space „bending beam“ makes it possible to experience the theoretical subject content of technical mechanics using objects typical of the theatre and event world. The aim of the VR prototype is to understand the influence of forces and mechanical loads in their complex interplay. The virtual learning space simulates a spacious trade fair hall with a practice situation consisting of a drawbar or beam and a range of technical equipment (spotlights, loudspeakers, etc.). In three levels with different degrees of difficulty, load variables and force curves can be tested. Because the tasks are based on random variables that are readjusted in each run, there are no identical repetitions. The real-time calculation allows immediate feedback, which enables precise conclusions to be drawn about the cause-and-effect principle. This prototype is intended as an accompanying tool for theoretical teaching.



CYBERTHEATRE 2077

JAN STEFFENS, FELIX RIDDER

The aim of the learning game „Cybertheater 2077“ is to give an insight into the different technical professions and departments of a theatre. The pre-university internship for the study programme theatre and event technology and management at the Berlin University of Applied Sciences serves as an analogy: the users have to pass through several technical departments of a theatre. Level by level, the players work their way up the departmental organisation chart of a large multi-genre theatre. Starting with logistics, stage, lighting and sound technology, through the workshops to the construction department. In the final level you reach the technical directorate of the Cybertheater 2077. In each department, job-specific tasks are set, and the degree of challenge increases with each level. In a humorous way, the game aims to encourage players to immerse themselves further in the virtual and, above all, real theatre world. Target groups are prospective students, advanced students, alumni but also professionals.



LET THERE BE LIGHT

LUKAS BERGER, JAN GRAEV

The VR project „Let There Be Light“ teaches basic concepts and functions of lighting technology. This learning environment, gives the possibility to complete a series of exercises, such as lighting a stage, tracking an object or additive mixing of light colours. The learning space is divided into two areas: First, in the „theory room“, there is the opportunity to learn about the components of a profile spotlight and the physical principles of additive colour mixing. In the following „practice room“, a guide leads the participants through three tasks, which they can try out on their own. After completing the tasks, an evaluation takes place; exam situations are also conceivable here. The target group of this learning space are students and trainees in the event sector, but also an interested general public. Both the range of lamps and tasks can be upgraded and adapted to the respective target group in the lecture or learning group.



Welcome to the future

PERSPECTIVES AND INSIGHTS OF THE PROJECT PARTICIPANTS

The main goal of this sub-project was to initiate necessary structural changes at the universities. In the long term, access to XR laboratories is needed, such as those currently being established in neighbouring disciplines at the Berlin University of Applied Sciences, as well as dedicated financial and technical resources in the respective degree programmes. In order to work on VR projects, which are fundamentally interdisciplinary in nature, cross-disciplinary cooperation with external partners and academic networks is needed. For this purpose, the „XR Academic Network“ was founded last year at the TU Berlin – also on the initiative of the digital.DTHG – a cross-university network in which academic staff from Berlin and Brandenburg universities regularly exchange information about teaching and research in the field of XR technologies. The challenge in the future will be to create our own flexible structures within the university and to skilfully combine these with external practical knowledge.

In this respect, the two practical seminars at the Berlin University of Applied Sciences were an impulse in the

right direction. Project leader and lecturer Franziska Ritter emphasises: „It was very enriching for all participants to think together so experimentally and openly about how to prepare for the new professional challenges with good digital teaching.“

For many students, this way of working was new, unfamiliar and challenging.

Student Lukas Runge summarises: „Pain is temporary – Glory is forever! Through the seminar, our small team of three students – despite little previous knowledge – was able to get started with the game engine Unity3D in a short time and thus develop a functioning prototype. With our contribution „Sound Space“, you can train skills in the field of microphoning virtually.“

Student Gilbert Adamek also sums up: „The last academic year under pandemic conditions was extremely challenging, so it was very motivating to put ourselves in the role of a teacher for once in this seminar

and to think about how we would like to be taught in the future. The seminar was extremely varied, from designing a task, to developing a didactic mediation strategy, to coding and implementing (which we had all never done before). And on top of that, I not only learned something in the subject area of theatre technology, but also about agile working, virtual working worlds and game design! It would be great if there were more offers of this kind in the future.“

An essential guarantor for the success of the project was the close didactic-conceptual cooperation with the teachers of the subject areas of the study programme „Theatre and Event Technology and Management“.

Prof. Stephan Rolfes, head of the degree programme and professor in the subject area of machine elements and construction exercises, describes the work on

the prototypes: „We developed the first concepts for virtual learning spaces based on existing courses. In the process, the advantages of the technology became apparent very quickly: the possibility of making teaching content tangible, for which otherwise a considerable spatial, technical and also financial effort would be necessary. This is demonstrated, for example, by the exercise on the configuration of electric chain hoist systems, which would not be feasible in „real“ reality: students learn the requirements and safety-related components of electric chain hoists and their controls. They can then configure and use systems in a virtual exercise.“

For Stephan Rolfes, the introduction of virtual teaching and learning spaces is trend-setting: „The innovative approaches and excellent results that have emerged have shown how sensible it is to continue with VR in teaching, but also in research. We still have

digital.DTHG team and Prof. Rolfes visit an architecture simulation in the CAVE at the Berlin University of Applied Sciences



a long way to go. At the Berlin University of Applied Sciences, we are currently building our own laboratory for this purpose, in which VR and AR will be used in teaching across all courses.”

Prof. Villwock, who heads the „CAE and Simulation - CAVE“ laboratory and the project „Interactive Teaching in Virtual MINT Labs“, also sees great potential in the use of immersive technologies in teaching:

„The learning tools presented here are an important milestone in the profiling of the degree programme. Beyond the project, the VR scenarios created form an important basis for further developments in the direction of hybrid teaching at the university. The goal here is to consistently link the possibilities of virtual laboratories with digital teaching and learning concepts and to bring them to the university at large. These innovative interaction formats in the virtual area must be anchored and thus strengthen the university through digitalisation. I was particularly impressed by the maturity of the virtual learning tools developed by the students. It shows how profitable the cooperation between IT experts and specialists in event technology and theatre can be and how quickly applications can be created that can be implemented in practice.“

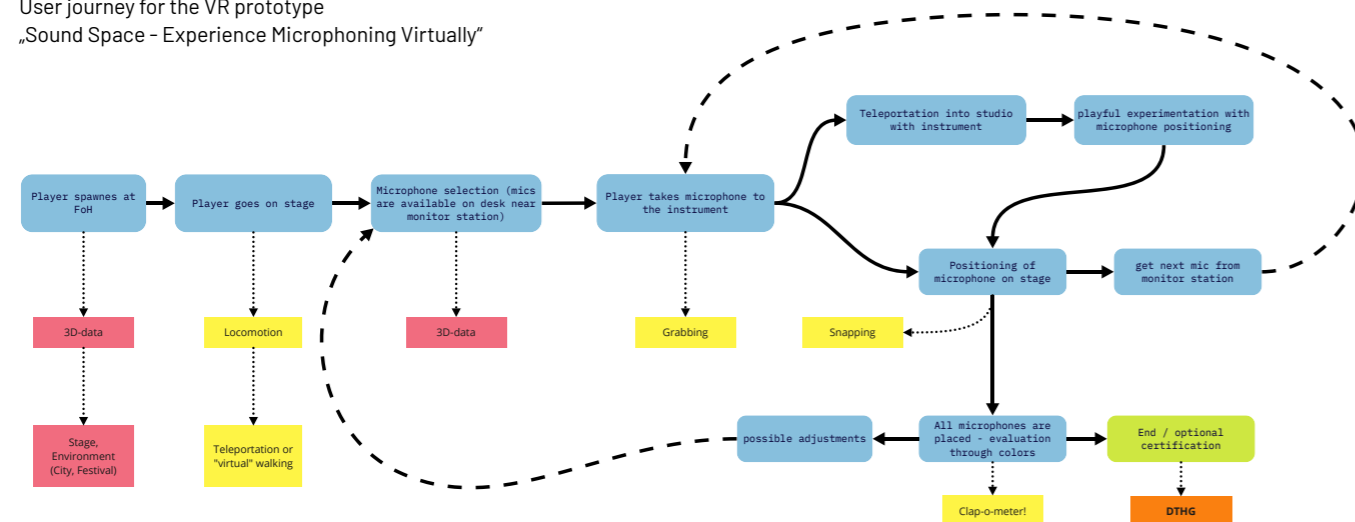
In addition to the potentials, the cooperation has also made clear which framework conditions will be necessary at the training institutions in the future.

Prof. Dr. Alexander Lindau, who has supervised the content of two virtual teaching projects in the field of media technology, states: „The potential of virtual teaching spaces can only unfold when technical and operating barriers for online or face-to-face users are minimised. We have gained valuable experience in this regard within the framework of the project. In my opinion, a successful integration of virtual teaching into higher education requires long-term investments in personnel and technical infrastructures. Only then can virtual reality fully exploit its advantages in higher education.“

This sub-project and the prototypes created show in a convincing way that this practical type of cooperation requires an agile and creative way of working and the strong commitment of everyone involved in order to be able to react quickly and flexibly to constantly changing conditions. In this way, a new way of learning could be tested together with students and digital teaching could be advanced. Welcome to the future!

User journey for the VR prototype

„Sound Space - Experience Microphoning Virtually“



WHAT HAPPENS NEXT?

Training institutions, like large theatres, move only slowly. The digital competences needed now and in the future must therefore be urgently anchored in the curriculum of training institutions and universities. Above all, this includes a critical and value-based approach to digitality. Here, new competences are clearly needed in all disciplines, if not completely new job profiles, for example virtual scenography, digital event technology and hybrid real stage work.

The DTHG has already processed some research results for a sustainable further training offer for the theatre landscape and offers online impulses and workshops. Within the framework of the EU programme „PACT FOR SKILLS“ the prototypes are currently being tested and further developed with international further developed.

At the Berlin University of Applied Sciences, two of the prototypes developed are currently being further developed within the framework of the funded project „Interactive Teaching in Virtual MINT Laboratories“ (see: <https://www.bht-berlin.de/4500>). The project, which is funded by the „Innovation in University Teaching“ foundation, started on 1 August 2021. In order to enable students to use their skills in applied, scientific work and carry out experiments despite limited access to laboratories, so-called virtual laboratories were created at the BHT.

Here, students have the opportunity to carry out experiments virtually and step by step before they will then practise them in reality. This has the advantage that material costs are reduced and fewer errors occur. In addition, students can repeat experiments as often as they like, which in turn results in a high learning effect. Additional AR and VR options for gesture and voice recognition offer realistic interactions. The innovative idea of the project is to consistently link the possibilities of virtual laboratories with digital teaching/learning concepts and to carry them into the breadth of the university.

IMPRINT

PROJECT TEAM DIGITAL.DTHG

Project lead: Franziska Ritter, Pablo Dornhege
Development: Lea Schorling, Sascha Sigl
Mentoring and initial studies: Vincent Kaufmann

PARTNERS AND ADVISORS

Content project supervision:
Prof. Stephan Rolfes, Prof. Dr. Alexander Lindau,
Prof. Dr. Matthias Salein

Guest critics and dialogue partners:
Prof. Dr. Bri Newesely, Dr. Martina Mauch,
Prof. Dr. Joachim Villwock, Andreas Swienty,
Thereza Schmelter

TOOLS

Unity3D, Visual Studio Code, Simlab Composer
Zoom, Miro, Slack, Discord, Github, gamer chairs,
transverse flutes, chain hoists, old lesson notes

PROJECT WEBSITE

<https://digital.dthg.de/en/projects/virtual-training-tools>

Digital twins of Technical Theatre History

AUGMENTED REALITY AS A TEACHING TOOL FOR THEATRE TECHNOLOGY AND ARCHITECTURE

The Erasmus+ project „CANON” promotes awareness of a European history of theatre technology and contributes to the current discourse on the preservation of the cultural heritage of international theatre technology and techniques. Teachers and students from nine European higher education partners from Belgium, the Czech Republic, Spain, Germany, Italy, Sweden and the UK are developing structures for an open database of European theatre technology. They are producing teaching methods for a better training and a canon of the 100 most important European milestones in technical theatre history. In the digital.DTHG team, we have developed a range of digital learning materials that can be integrated into teaching in different disciplines or used as reference material.

RESEARCH QUESTIONS

- How can content be prepared and presented interactively with the help of immersive technologies?
- How can content be made available independently of time and place (on demand) through the use of digital learning tools?

APPLICATION

- Digital and interactive visual objects for the classroom

TECHNOLOGY

- WebXR (browser-based interface for AR and VR applications)

PARTNERS

Hochschule für Technik Berlin, Institut del Teatre und Escuela Superior d'Arquitectura Universitat Politècnica de Catalunya, Kennntniscentrum Podiumsteknieken Erasmushogeschool Brüssel, Rose Bruford College of Theatre and Performance, Real Escuela Superior de Arte Dramático, Institut Umeni – Divadelni Ustav, Konstnarliga Hogskola Stockholm, Academy of Fine Arts Frosinone

Digital Twins of Technical Theatre History

AUGMENTED REALITY AS TEACHING TOOL FOR THEATRE TECHNIC AND THEATRE ARCHITECTURE

Raising awareness of a European history of theatre technology and contributing to the current discourse on the preservation of the cultural heritage of international theatre technology and techniques is the aim of the Erasmus+ project "CANON". Teachers and students from nine European higher education partners from Belgium, the Czech Republic, Spain, Germany, Italy, Sweden and the United Kingdom are developing structures for a common and open database of European theatre technology, developing teaching methods for training and a canon of the 100 most important European milestones of technical theatre history.

Teaching theatre technology history in a clear and comprehensible way is challenging because spatial relationships such as the interplay of upper and lower machinery or temporal dependencies of historically related developments often have a high degree of complexity in the presentation. In addition, these topics are often given only little time in the classroom and access to reliable sources is not always available.

In the digital.DTHG team, we used 3D learning materials to design a profile of requirements for an augmented reality application and developed a feature set. To do this, we partly drew on existing material (for example, the digital reconstruction of historical theatre architecture such as Shakespeare's Globe) and on the results of other sub-projects (for example, the cloud machine from the Große Schauspielhaus Berlin). In some cases we have also digitised completely new objects (such as the wind machine, see illustration).

The starting scenario for the development of the prototype is a teaching situation in which a timeline is available on a table or wall on which the content is "located". In a first step, the contents can be placed on the timeline using a marker set (which can be used in many ways as an analogue teaching aid / for example as a set of postcards) and lectures or teaching units on specific topics can be flexibly compiled. In a second step, the objects can also be accessed without markers.



The potential of the AR prototype is well illustrated by the example of a wind machine. A moving 3D representation with sound, video and images supplemented with texts and other sources makes theatre history easily accessible. Thanks to the location on the timeline (here with QR codes) and the connection to the CANON database, the tool can be integrated into lessons or used freely.

The media content is linked to the database and can be easily compiled into a presentation mode with an editor tool and played out independently of the device. The 3D objects compiled in this way can be vividly visualised in space using augmented reality and expanded with further information such as photos, videos, texts or diagrams.

With this tool, different teaching scenarios (frontal, teamwork, free work, presentation) can be implemented, taking into account different teaching methods and didactics such as a "guided tour", the discoverer mode "explorer" or the "flaneur style".

Similar to the augmented user assistance, a workflow for the WebXR editor/viewer application could also be developed for this use case. In the process, the 3D data and content from the first prototype were entered into the editorial system (knowledge of coding and 3D modelling is not necessary for this).

The resulting workflow shows the transferability of the WebXR editor/viewer as a universal tool for teaching complex three-dimensional content.

The following developments and expansion stages are conceivable for sustainable use in the classroom:

- Access of the application to external databases and linking with 3D, media and text files (for example from the emerging CANON database)
- Access to compilations via QR codes
- 3D anchoring of the displayed 3D objects via visual markers (QR codes or graphics)
- Possibilities for interaction with the 3D objects (for example activation of animations)





Digital tools are just a reflection on the fact that we want to work together

INTERVIEW WITH CHRIS VAN GOETHEM

Chris van Goethem, researcher and teacher for technical theatre and history at Erasmus University in Brussels at the RITCS School of Arts, started in the 80s as a stage manager with touring theatre companies. By now he is working in two different areas: on the one hand everything that has to do with competences, knowledge management, organising of education programs and structuring international exchanges. On the other hand researching the history of technical theatre. Why is that? He noticed when teaching, there was hardly anything written, and what was written was mostly written by non-technicians, that in a sideline of a book told something about technology. So bit by bit he started to find out that what they told him, sometimes just was impossible. So he started researching that.

Franziska: We are working together in the Erasmus+ CANON Project. What is this project about and why is it so important to work together at a European level about theatre history?

Chris: In fact we aim to have an overview of what happened in theatre history and what brought us to where we are now - in a European context. When you look at history from different points of the world, you see a different history. We just had our Erasmus-Meeting in Spain and got to know a lot about the very special and typical theatres of the Corrales de comedias, which is something we hardly know in Belgium - where we very well know Shakespeare, while all these things are related, but we don't see how technology travels from one country to another, how it appeared, how it developed.

So that's why we use this Erasmus-Project with 8 university partners from 7 different European countries to look at it together, to take a critical dive at each others histories, see where the differences are but also where we have things in common (which is rather a lot), how one country influenced the other and so on. And that leads us to a "CANON of theatre technique history" - the most important elements in our history that every theatre technician should know, but also people from the outside should understand how we got where we are.

The CANON Project has different sub projects like a huge open source Database (like a WIKI) serving as a platform connecting international knowledge, sources and collections; or different teaching methodologies like practical exercises, drawing methods or playful digital applications.

Looking at the topic of digitization - not only during the pandemic THE buzzword in transforming education - which role plays digitality in your teaching process in your lessons at RITCS, what kind of tools are you using?

Well, you have to divide that into two parts: On the one hand all the equipment we are using is more and more digital. We came from analog, to electronic and now it's more or less virtualized, so we don't use physical equipment or physical controls anymore but virtual equipment as a software, running sound and light from the same computer for example. That's the part, where our students are pretty familiar with.

On the other hand as teachers we are very much working from practice, not starting from theory classes, we do everything in the studio, at the theatre space, on the floor. And based on that we look at theory. Because what we saw is that it's very important for students to have context and to understand how it works. Most of the context we give them is physical - but that's also a limitation we have in our school, because if you are talking about light you can only work with 3 students in one physical space, otherwise you start influencing each other. And I think there, the virtual can do way more.

The only doubt I have is that I don't think people can make an interpretation of the virtual world if they haven't seen the real world. If you have never seen how light could be manipulated in the real world it's very hard to make an interpretation of a visualisation of light in 3D renderings etc.

In my own classes about history I mainly use a lot of videos, like short clips to support what I am telling. And a lot of visuals but mostly on a sketch level because I don't have the possibility to prepare them in a more sophisticated way.



The WebXR-Prototyp, we developed for the CA-NON Project, would give you as a teacher and the students the possibility to connect the timeline with the database and act between analog and digital representation - like a presentation tool for three dimensional data. How do you evaluate the potentials of this?

Students are more and more visual oriented, so the moment where you can see something in action it becomes clearer. The most important thing is that you don't have to describe what a machine does, you can just show it. For example it is very hard to explain how an under machinery works, but the moment you see it moving it becomes very evident. That's a nice example, because if you are in a theatre house you will never be able to see the stage and the under stage and the upper stage at the same time - in a virtual model you can do that, you can also show what is happening also behind the walls. So for a thing like that it's extremely useful. So I guess the most important thing we would use it for is for movement, how the mechanics works. For this application, visualisation tools work very well.

When we developed the tool, we also had in mind that you can use the tool not only in your classroom or your theatre lab, but wherever and whenever you want. So that makes you independent from time and space. How important is this aspect?

Yes, that's connected to what we see more and more. Students are learning based on need. And that need is not related to a class room, to a specific moment or a specific course. They are working somewhere or they are taking the bus and they want to look up something - and it should be available! And in that sense it's different from our traditional way of teaching where you start with the Romans and where you end today. But in reality when you are in a theatre and you discover something or you have an idea and you want to figure out how it works, you need the information on the spot. So you're not anymore talking about linear learning but you are talking more about knowing where to find stuff.



By developing those digital tools, what do you think is the biggest challenge?

It's extremely time-consuming and technologically it's quite a complex issue. And I think there is no School in Europe that can afford to develop all these tools themselves - there it is absolutely necessary to do something on the European level. Be it that you develop things together or at least that we create a kind of standard to distribute it. Because it would be a shame to spend so much time and then not be able to use it in another place. And a second thing is: we have to find a way to make it open source in the sense that we all invest a little bit in these things and we share them then we create way more than if we all would work on our little island.

In 10 years - how would you imagine your teaching in future?

I think it's far more than my teaching, it is how teaching will work in general. My ideal is that you are starting in school - because you need a foundation - and then you swap between practice and school and more and more you have practice and less school. But you continue learning for the rest of your life. That's one of the concepts we developed in another project, we call it a „structured portfolio“, where you just gather information of all your learning moments, where you set apart like “I want to learn this” and then you get some targets and then you get some learning content and you can do that on the bus or you can go to a course or you can go and work somewhere for a training for a

couple of days. And that this whole learning part from the moment you get into professional education until the moment you retire and probably later you have one system that guides you through learning. And in fact at that moment we go back to the first universities where there was no management or professors organising the university but where students were asking experts to come and talk to them about subjects. I think that in a digital way that would be perfectly possible: You decide what you're doing, what you want to do, where your fascination is and you'll learn based on that.

Anything you would like to share with us?

For me in fact the most important but also difficult thing is to get people to work together. If I go back to what we do with the database for example, ideally that will become a research tool that is used by a lot of people that all bring in their knowledge, so you create a common knowledge base.

But people seem to be very scared - for all kinds of different reasons: mostly they think it's because the others will know more than I do. Or they think they are not so good in comparison with their colleagues.

Which is in fact against the whole logic of the freedom of research. The essence of the freedom of research is that you are allowed to fail. So creating this cooperation is the most difficult thing. The digital tools for it are just a reflection on the fact that we want to work together. I think that's the essential.

The interview took place on 17 February 2022 in Madrid during a CANON meeting.

WHAT HAPPENS NEXT?

The CANON project will end in December 2022. Until then, the participating students and lecturers from the partner universities will develop the content for the database in various workshops in Stockholm, Rome and Berlin.

Through the cooperation and practical collaboration, synergies could be created, ideas visualised at an early stage and potentials uncovered. The developed 3D data will be stored and accessible in the CANON data-base.

Student workshop at Stockholms konstnärliga högskola - SKH / Stockholm University of the Arts in May 2022.

IMPRINT

PROJECT TEAM DIGITAL.DTHG

Concept and project leadership:
Franziska Ritter and Pablo Dornhege
Development: Lea Schorling, Sascha Sigl
Concept and UX: Maria Bürger
3D: Vincent Kaufmann

EXPERT ADVICE

Chris Van Goethem, Prof. Dr. Bri Newesely

TOOLS

Visual Studio Code, Unity3D, Sketchup, Sketchfab, a long table for the timeline, Zoom and passport

PROJECT WEBSITE

<https://digital.dthg.de/en/projects/canon-theatre-technical-history>
<https://www.canon-timeline.eu>



Bringing theatre heritage to life



VIRTUAL RECONSTRUCTION OF THEATRE ARCHITECTURE AS AN IMMERSIVE EXPERIENCE

On the occasion of the 100th stage anniversary of the Friedrichstadt-Palast Berlin, we bring the no longer existing previous building „Das Große Schauspielhaus Berlin“ and its stage art back into the public consciousness. The VR project „Opening Night at the Große Schauspielhaus - Virtual Reality Time Travel Berlin 1927“ opens a digital window into the past through which the history and the stories of the theatre, its architecture and its art can be spatially experienced in the here and now. The special nature of this project is that historical objects from the Stadtmuseum Berlin and other archives are integrated into the virtual narrative. In this way, the digital exhibits such as posters, props or stage equipment convey theatre-historical knowledge in a poetic way.

RESEARCH QUESTIONS

- How can im/material cultural heritage be made more accessible to a broad public?
- How can archives and collections make their objects visible by digital means?
- What potentials can virtual reality unfold in the reconstruction of (theatre) architecture and what are the specifics in terms of narration and dramaturgy in space?

APPLICATION

- Virtual staging as an immersive experience

TECHNOLOGY

- VR application for Windows PC, created in Unity3D

PARTNERS

- Friedrichstadt-Palast Berlin
- Stadtmuseum Berlin - Theatre Collection
- Museum of Architecture TU Berlin
- Theatertechnisches Kabinett of the Leipzig Opera

Bringing Theatre heritage to life

VIRTUAL RECONSTRUCTION OF THEATRE ARCHITECTURE AS AN IMMERSIVE EXPERIENCE

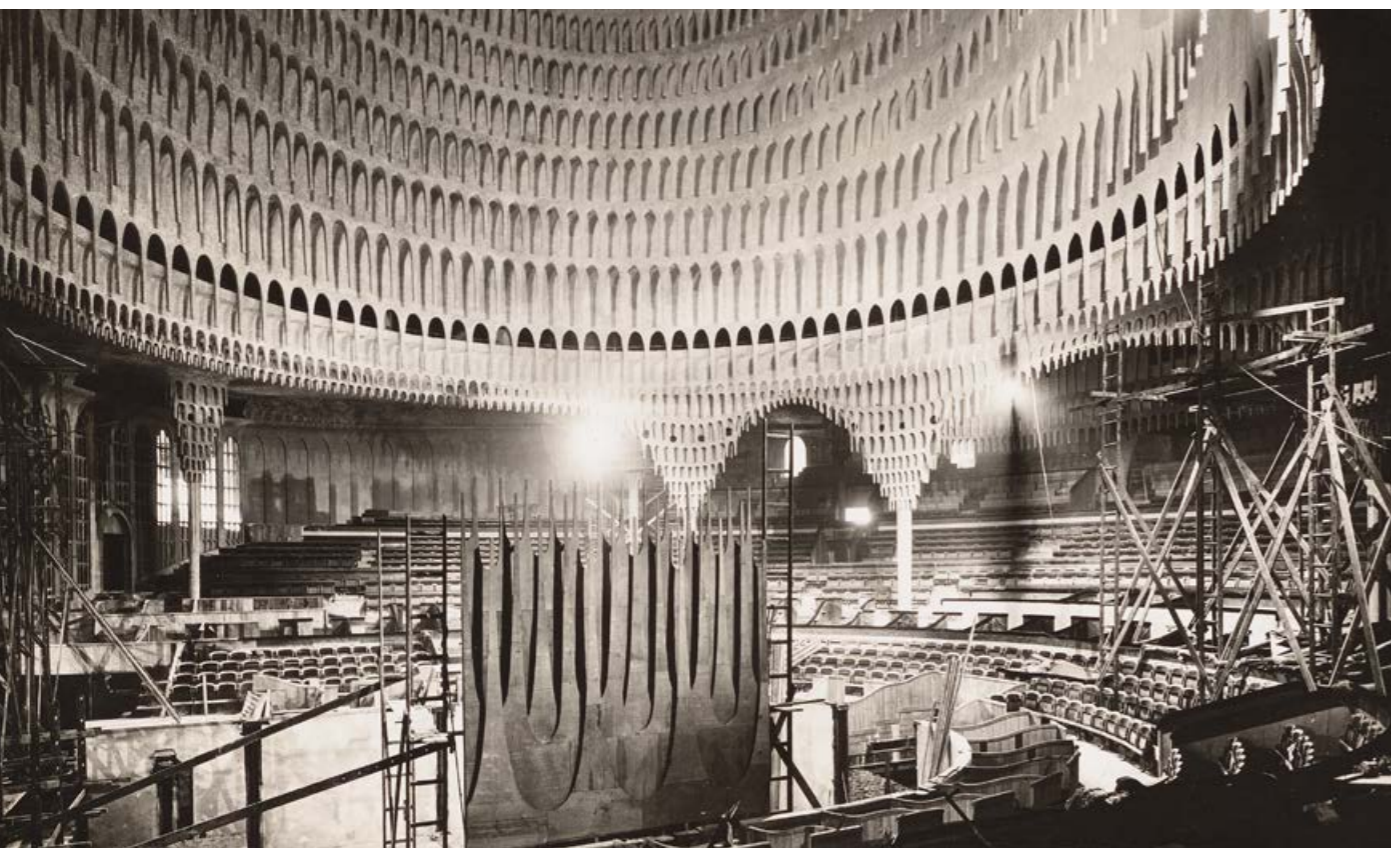
This sub-project is dedicated to the challenge of making theatre heritage visible and finding forms of outreach that do justice to "theatre" as an immaterial art form in its holistic nature. For the communication of theatre heritage – like theatre per se – is rich and complex; the interdisciplinary "teamwork"-character of theatre is also reflected in the heterogeneity of its objects: Objects such as props, performance recordings, technical apparatus, costume sketches, director's books, stage models or architectural drawings each allow only one-sided perspectives on the genre.

The objects of "theatrical memory" are preserved in numerous but insufficiently networked places (private archives, artists' estates, theatre houses, city museums, local history or technology museums). The artefacts of the "theatrical memory" are often torn from their contexts of meaning and are difficult for the public to access. In addition, the elusive nature of theatre as an "ephemeral art form" and the complexity of theatre as a "Gesamtkunstwerk" cannot be represented in the collection structures, or only in part.

There is also much more to the intangible cultural heritage of theatre: for example the stories and the diversity of its participants, the interplay of artistic-technical forces and the atmosphere in the space. We have taken this challenge as the occasion for a series of DTHG workshops in the European Year of Cultural Heritage 2019/2020 under the motto "Sharing Heritage" and explored what role immersive technologies can play in conveying theatre history, especially historical theatre architecture. An interdisciplinary project group with participants from theatre studies, art history, theatre technology, stage design, art and design, computer science and archaeology developed initial prototypes that served as the basis for the work in this research project.

One of the most important theatre buildings of the last century was at the centre of the discourse: the no longer existing Große Schauspielhaus Berlin. In 1919, theatre founder Max Reinhardt and architect Poelzig created one of the most visionary theatre buildings of the 20th century in the heart of Berlin. With expressionist formal language, innovative stage technology and

Photo of the Große Schauspielhaus Berlin in 1919, construction of the dome in the auditorium



pioneering stage spaces, an icon of architecture was created that became famous in the vernacular as the "Tropfsteinhöhle" (stalactite cave). During the Golden 1920s, theatre director Erik Charell and his revues brought the glamour of big Broadway shows to Berlin.

As part of the research project, the digital.DTHG team produced the VR project "An Evening at the Große Schauspielhaus – Time Travel with Virtual Reality Berlin 1927" to mark the 100th anniversary of this special theatre building. The team of developers, 3D artists, graphic designers, art and cultural scientists was supported by other experts from the fields of script, illustration, scenography, sound design, acting as well as theatre architecture and history.

As an exhibition installation (in the foyer of the Friedrichstadt-Palast) and as a VR application that is accessible free of charge, the production opens a digital window into the past through which the history and stories of the theatre, its architecture and its art can be spatially experienced in the here and now. An experience that can be followed from three different perspectives: Theatre-goer Walter Schatz leads us through the impressive foyers into the gigantic auditorium. The celebrated singer Fritz Massary takes us into her dressing room and lets us immerse ourselves in the cosmos of a stage star. The young lighting technician Otto Kempowski shows us the fascinating world of theatre technology. These three protagonists invite us to accompany them on their very personal journey down memory lane through the Große Schauspielhaus – in front of, on and backstage.

The specialty of this project: historical objects from the Stadtmuseum Berlin and other archives are integrated into the virtual narration. In this way, the digital exhibits, such as programme booklets, props or technical stage equipment, convey theatre-historical knowledge in a poetic way. Hans Poelzig's unique architecture becomes an exhibition space that can be experienced virtually, contextualising the objects through the stories of the three protagonists.



"It is fascinating and irritating at the same time how history comes alive here. The spatial experience feels very realistic and enables a better understanding of the contexts. Now I actually want to read more about the history of the house. Was informative and fun!"

Staff member of the Friedrichstadt-Palast at the first user testing in December 2020

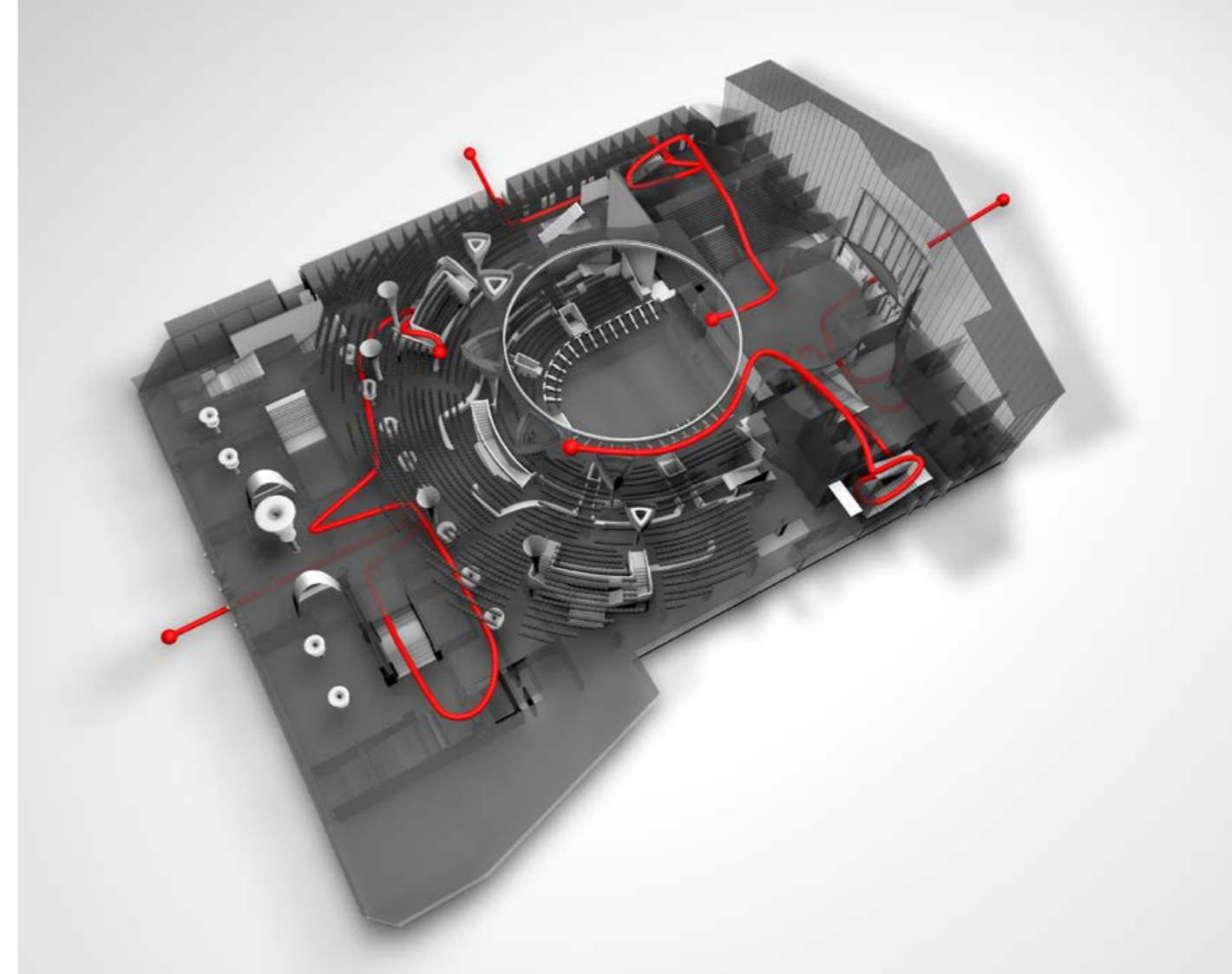
The online premiere took place on 1 April 2021. The virtual reality project is available as a free download on the internet platform Steam and can thus be experienced by users with VR glasses at home and is also accessible to an international audience with English subtitles. An additional payout as a 360-degree video on YouTube allows access without VR glasses. The opening in the foyer of the Friedrichstadt-Palast is planned for the next possible date.

Spatial narratives in virtual reality

"There, backstage centre right, that's where I liked to stand before it started." In the middle of the backstage, halfway up, hangs a massive, mirrored, spinning apparatus that resembles an oversized drill head. Behind that, we see the round horizon, the curved backstage wall on which miraculous clouds glide along and make their circles. "The rattling of the cloud machine ... yes, that was its real name: cloud machine. It just produced clouds ... but what clouds!" Our gaze wanders from the round horizon towards the backstage, where we can observe from a distance the

hustle and bustle of extras, make-up artists and a group of dancers. "Hearing the clouds rattling and looking at the hustle and bustle backstage ... that always calmed me down."

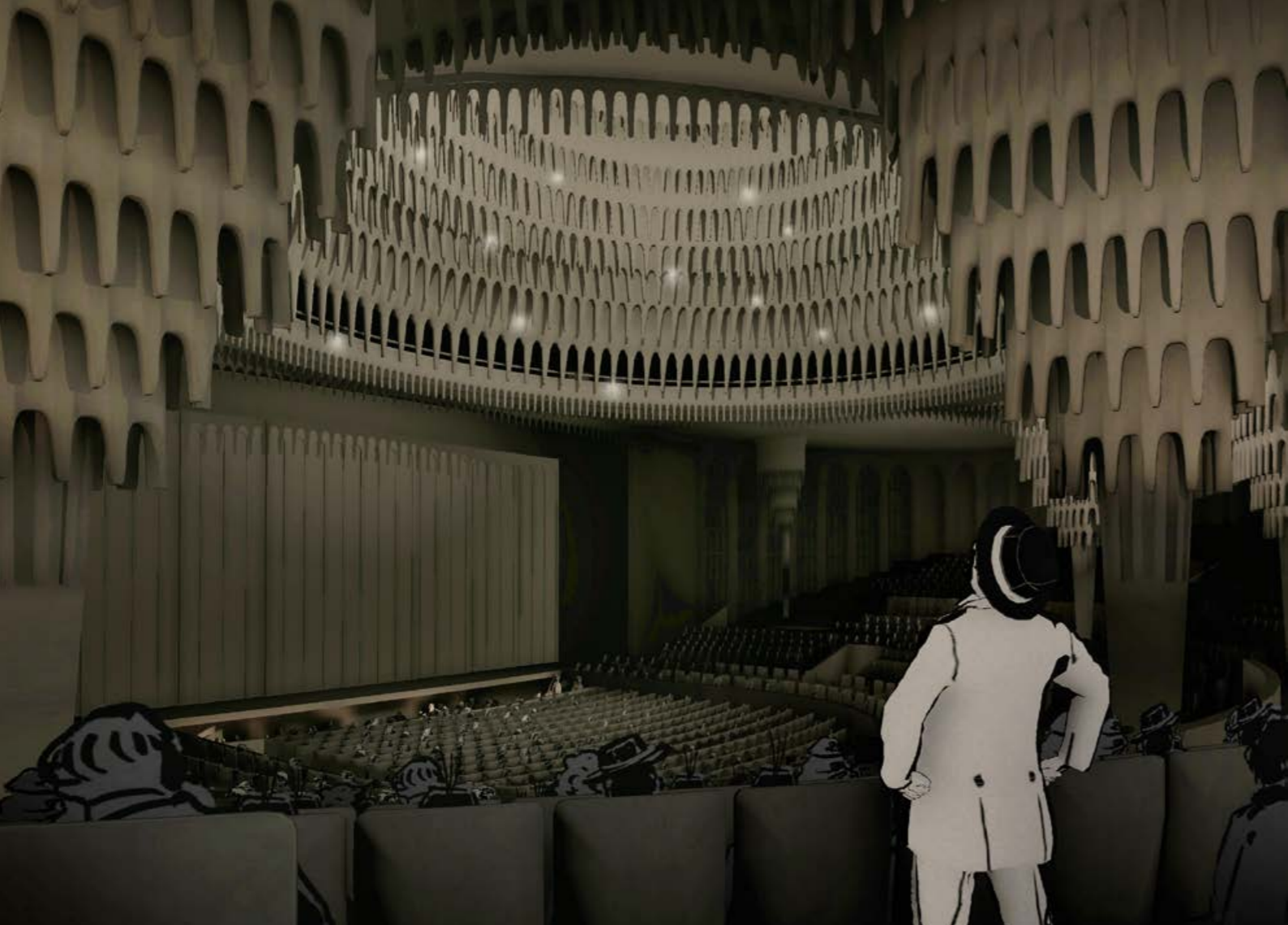
This excerpt from the script for the VR production „Opening Night at the Große Schauspielhaus Berlin“ takes us into the emotional world of the young lighting technician Otto Kempowski. You feel for him when he stands on the lighting bridge for the first time on 23 December 1927 and the opening curtain opens for the celebrated singer Fritzi Massary at the Große Schauspielhaus Berlin.



Navigation of the three protagonists Otto Kempowski, Walter Schatz and Fritzi Massary in the VR-Experience „Opening Night at the Große Schauspielhaus - Berlin 1927“

As a virtual companion, you follow Otto Kempowski for ten minutes through the impressive building. It is the premiere night of the operetta "Madame Pompadour" and the theatre shows its exciting, vibrant side. So before the red velvet curtain rises, Otto takes us behind the scenes and shows us en passant his everyday working life: from the lonely cigarette at the stage door in the bone-chilling December cold, to the damp and cheerful walk through the smoke-filled canteen, to the side stage where other technicians are frantically making final touches to the spotlights. Individual, coordinated spatial images are strung together - like in a kind of exhibition production or a play - some of them alternating, others building on each other. The collage-like spatial images are linked dramaturgically and scenically to form a multi-layered overall experience.

Thus we look through a digital window of experience into the past, in which the history of the theatre, its architecture and its art can be experienced spatially. This kind of guided, linear narrative dramaturgy contrasts with other non-linear dramaturgies, such as those used in the VR experiences The Colosseum District, Home After War or Schumann VR, which also have virtually reconstructed, historical architectures as their subject matter. These projects use different but singular narrative perspectives and thus paint a certain mono-perspective picture of musical, urban or contemporary history.



Protagonist Walter Schatz in the auditorium of the Virtual Große Schauspielhaus

In order to make theatre heritage and theatre-historical knowledge tangible in all its facets – as architectural and as thematic space – we approach the theatre from three different directions in the VR project "An Evening at the Große Schauspielhaus": In addition to the aforementioned narrative thread of stage technician Otto Kempowski, users have the option of either accompanying theatre-goer Walter Schatz through the impressive foyers into the auditorium or joining singer Fritz Massary through the stage entrance into her dressing room and finally standing at the edge of the stage in front of 3,000 audience members.

The necessity to choose between different protagonists at the beginning of the experience leads to different approaches to the theatre building in terms of content and architecture: For example, the view of the theatre guest Walter Schatz conveys to us the socio-political tension in the Weimar Republic, which was shaken by the economic crisis; the ageing diva Fritz Massary, on the other hand, gives us an insight

into the emotional world of a world star and lets us share in her self-doubt after harsh newspaper reviews. For the User this brings the opportunity to literally take a stance themselves and view the building in its social context from their own perspective.

Even though the protagonists Otto, Walter and Fritz have their say in the virtual Große Schauspielhaus, the actual main actor is the building itself. Through the voices of the three characters, we make it speak and make it the secret "hero" of the story. In this way, Hans Poelzig's unique architecture becomes a space of knowledge that is expanded through the spatial contextualisation of the individual stories. In addition, the targeted linguistic highlighting of architectural elements, spatial situations and objects directs the user's gaze and creates further offers of knowledge.

The Große Schauspielhaus is a space that we know today only from photographs. Our image memory is limited to individual, specific architectural motifs and spatial situations that, without context, create a highly

reduced image of the theatre building. These singular and static positions do not reveal the complex spatial contexts. In order to develop an understanding of a spatial body in its three-dimensionality, movement is required and thus a change in the relationship between the object and the person viewing it. This movement is indispensable in virtual space, because it is only through this dynamic that the image of space develops into an effective pictorial space.

In the VR experience, the virtual theatre visitors are moved through the Große Schauspielhaus as if on rails: the direction of movement is predetermined, but there are no forced camera pans or zooms – the visitors can let their gaze wander freely. Protagonist Walter Schatz asks them: "Look up! Those huge columns hanging from the ceiling – like in a stalactite cave! [...] That was pretty daring for the year 1927, don't you think? And if I remember correctly, there were lights in the dome showing real constellations."

This linear-narrative method of guided viewing is supported above all by scenographic means of design. Cinematic lighting that goes beyond technical illumination emphasises architecturally significant areas and directs the user's gaze. A spatially immersive sound design gives a sense of the dimension, materiality and atmosphere of the different spaces. From time to time, situations are condensed by an artificial fog and concentrated on the surrounding field of vision, sometimes the fog clears and opens up new vistas.

The visual reconstruction of the architecture does not attempt a naturalistic reproduction of the original materialities. Buildings and objects are instead textured with a paper-like surface, creating associations with Poelzig's hand-drawn design sketches. Following this sketchy style, the protagonists and supporting actors are drawn as two-dimensional "stand-ups" and are reminiscent of book illustrations from the 1920s with their quick and contoured penwork. The visual proximity to graphic novels corresponds with the use of other comic stylistic methods. For example, written comments by critics appear in the wardrobe mirror, press comments float as oversized texts in the stage space and at the finale the visitors fly weightlessly through the applause-filled auditorium. The creative

liberties do not break the inherent logic of the story, but create a special atmosphere and promote immersion in the story.

In the VR project "An Evening at the Große Schauspielhaus", we combine the use of narrative and scenographic means with two methods of creating presence that have always been familiar from the theatre: Gripping narratives create emotional immersion, while an atmospheric and consistent scenographic design contributes to spatial immersion.

In order to create a plausible, i.e. a "believable" imaginative space, a realistic spatial representation is not absolutely necessary. A feeling of presence and immersion can be created in a virtual stage space equally with a high degree of visual and acoustic elaboration or, as we demonstrate in the project "Cocreative encounters in hybrid-real stage spaces", can already be achieved with minimal and abstract design means.

The scenographic design, the narrative style and the communication strategy are determined by different factors: the target audience, the existing knowledge and data basis, the historical or cultural relevance and characteristics of the subject, but also one's own artistic and creative attitude.

Further reading:
Björk, Staffan und Holopainen, Jussi:
Patterns In Game Design. Charles River Media. S.206, 2004
Zhang, Chenyan & Perkis, Andrew & Arndt, Sebastian:
Spatial Immersion versus Emotional Immersion,
Which is More Immersive? 2017

Further links of mentioned projects:
The Colosseum District: <https://www.romereborn.org>
Schumann VR: <https://www.schumannvr.com>
Home After War: <https://www.homeafterwar.net>



Im/material Objects

BETWEEN ASSET, PROP AND EXHIBIT

The special feature of the VR production of the Große Schauspielhaus is the integration of historical objects into the virtual narrative. In cooperation with the theatre collection of the Stadtmuseum Berlin, the Museum of Architecture of the Technische Universität Berlin, the archives of the Friedrichstadt-Palast Berlin, the Technisches Kabinet of the Leipzig Opera and other archives, approximately 50 objects were selected and digitised after a lengthy curatorial process - these include posters, props or technical stage equipment. If we want to examine the use of the resulting digital twins in virtual worlds, we must first shed light on the field of tension between objects and artefacts in the museum context and digital objects in computer games.

The functions of objects in exhibitions and museums are manifold and have been discussed extensively in the research literature. "Exhibits as signs, as traces and as actors" (te Heesen 2015) have knowledge and epistemological functions: As soon as we turn to them and make them "objects of sensual-visual and intellectual attention, they become epistemic objects" (Abel 2014). However, secondary exhibits such as facsimiles, reproductions or replicas can also assume this function. Also relevant are the so-called auxiliary objects, such as showcases, display cases and pedestals, which are "technical things of museum practice in that they create an exhibition context around the museum things without themselves being the object of the exhibition." (Niewerth 2018) This inevitably leads to the essential task of the space: there, the deposits become exhibits. They are put in the right light, dramatically related to each other and perceived by the visitors as they move through the space.

In computer games and VR experiences, too, there are clear tasks for different types of objects. Level architectures and ambient sounds form the backdrop and atmosphere for the play, and the game world is also populated by "non-player characters". Through interactions with these characters and the use of "game objects" - such as coins, clothing, weapons, vehicles - the player can influence the gameplay with his avatar and advance the plot. All types of virtual objects used in the development of video games are called assets.

This includes media content such as 3D data, images, videos, audio files as well as software elements such as scripts that control the logic of the game or materials that define the visual properties of 3D objects.

When museum objects are transferred into virtual forms of mediation and experience, new questions arise about the meaning of objects and challenging tasks for curators and scenographers. In addition, it is necessary to develop an appropriate attitude towards the "digitalifacts" (Schweibenz 2012) - the emerging digital representations of analogue objects. In the classical exhibition system, the museum as an institution guarantees the authenticity of its objects - this task is also transferred to the exhibition of digitised cultural heritage in virtual spaces. The question arises as to the significance of the individual object and how a "digital twin" (Bienert, Emenlauer-Blömers, Hemsley 2018) relates to its original. What effects does it have on the analogue originals when their digital copies are staged in a virtual exhibition and used as props? Is there a danger of forgetting that we are not looking at the originals, but - Platonically speaking - only at their "digital shadows" (Caraffa 2009)? Does the existence of a virtual reproduction reinforce its "auratic presence" in the material world (Witcomb 1997)? Or is there even a migration of the perceived aura from the original to the reproduction (Schweibenz 2012)? In order to take a closer look at this relationship between museum objects and their images in virtual space, we will present in the following the object approach we applied in the VR project "Das Virtuelle Große Schauspielhaus Berlin".

The essential basis for the project are objects from various collections that have a serving function but are not shown as „hidden objects“ in the project itself. These are, for example, photos, diagrams, textual descriptions and drawings such as floor plans or sections that were used in the digital reconstruction of objects and architecture, but do not themselves enter the virtual world as digital exhibits. They are indispensable for the work, but remain invisible to the users.

The core pieces in the Virtual Große Schauspielhaus are digitised and reconstructed museum objects that we call „non-fictional objects“ - objects that are



curated for the VR experience with the cooperating archives and collections and used as digitally generated reproductions. On the one hand, these are digitised objects captured by two- or three-dimensional scanning methods. Flat objects such as posters, programme booklets, sheet music and tickets are scanned or photographed, spatial objects such as theatre spotlights and stage tools are photogrammetrically recorded (photogrammetry is a method for the three-dimensional recording of objects based on photo series). On the other hand, there are reconstructions that are digitally reconstructed on the basis of various templates such as drawings, photographs or textual descriptions. This category includes, on the one hand, objects that cannot be scanned due to their dimension or complexity – and, on the other hand, historical objects that no longer exist and therefore have to be reconstructed.

Our central „object of desire“ – the building of the Große Schauspielhaus, demolished in 1988 – is available neither in the original nor as an original 3D model, as is usual for more contemporary buildings. As an object within the exhibition project, the architecture has a special task: in a double role, it forms the space

for the staging of the objects (as level architecture) and at the same time is itself an exhibit. As a digital 3D reconstruction, it is the result of the interplay of the various hidden objects / the invisible auxiliary objects. The partially incomplete material does not allow for a complete reconstruction of the original building, nor does it allow for an unambiguous reconstruction. To take account of this lack of clarity, the visual representation of the architecture in the virtual exhibition has a sketchy character, so as not to suggest precision where such is not possible.

Connecting, contextualising elements between the „museum“ objects are the „fictional objects“. Based on extensive research, these also incorporate anecdotal knowledge and are woven into a fictional story through a script. The fictional „decorative“ objects determine the visual and acoustic density of the scene, similar to equipment elements on a film set. Thus the sounds of passing cars, the babble of voices and clinking of glasses in the foyer, the cacophony in the voicing of instruments, similar to the ambient sounds in a computer game, become the acoustic backdrop. The use of fictional elements and objects brings with it many possibilities, but also risks: the facts must not be the

background of a narrative, rather the fictional must serve as a link to the historical facts. It is important to find the right balance between scenographic-narrative dressing and factual information transfer.

In order to make the different functions of the objects as well as the degree of their authenticity recognisable in the virtual production, different methods of representation are used: While the fictional objects have a sketchy character visually and are restrained in their colourfulness, the museum objects appear as realistically depicted 3D objects in true-to-the-original colour and texturing.

If we turn back at this point to the question of how a digital twin relates to its original, we come to the following conclusions: Since the artificiality of the virtual world always remains obvious when entering it due to the technical and staging framework conditions, there is no „migration of the aura from the original to the reproduction“ (Schweibenz 2012). Nor does the analogue disappear through digitisation; on the contrary, it is revalued and even enhanced (Stalder 2016): While traditionally designed exhibition environments arouse more content-related emotions, virtual reality evokes more experience-related emotions (Heidsiek 2019).

Experiential emotions are relevant because they lead to lasting learning effects. This is not only important in the exhibition context, but also for researchers, teachers and students working with and in university and museum collections. Artefacts and digital artefacts complement each other: through narrative contextualisation and through experiencing a digital reproduction in its digital environment, a period in the life history of an object can be made tangible. This virtual experience can also intensify the perception of an „auratic presence“ of the original in the material world.

In the absence of an original, as in the case of the architecture of the Große Schauspielhaus, the virtual reconstruction – as an interpolated result of existing artefacts and mentefacts (Schweibenz 2020) – is a placeholder that can be experienced and in the process can reproduce experiential aspects of the original: Without physically recreating the building, the digital reconstruction allows viewers to experience the architecture in its spatiality. We are talking here about a scenographic concept of the object: what is meant here is the object as a necessary prop in its virtual „use“, which is contextualised by staging means.



If we take up this idea and compare virtual exhibiting with performance practice and the common (re)production aesthetics in theatre, it is remarkable how the lack of originality is dealt with: „The point of „playing“ [a play] is to re-enact it. [...] No one has ever seen the absolute Platonic ideal of the play [...]. One will never see the original as presented by the author himself, not even the original text, but only several first performances and several dozen written versions with endless glosses and variations.“ (Latour, Lowe 2011)

This way of looking at theatre can equally be applied to objects in virtual space: By re-presenting the material artefact as a digital object, a new version is generated in addition to the original. An independent aura is created: the sensual presence of the immaterial object. Digital objects are compelling when they enable new ways of exploring the original and contribute to the discussion of what originality is.

This text is an abridged and edited version of the article "Im/ materielle Theaterräume erlebbar machen. Sammlungsobjekte virtuell erforschen" from the volume "Objekte im Netz - Wissenschaftliche Sammlungen im digitalen Wandel", published by transcript Verlag on 14 December 2020.

Download the full article as a free pdf (in german language): <https://www.transcript-verlag.de/978-3-8376-5571-1>



WHAT HAPPENS NEXT?

An enthusiastic user wrote to us:

"This VR experience pulls you out of the day. I felt like I was in the middle of the action. Interesting insight into the time. It would be great if this process could be expanded to include other cultural, historical and architectural experiences!"

After all, the project is repeatedly brought to life as a mobile VR production at congresses and symposia. At the moment, there is a seminar at the Technical University of Berlin in cooperation with the Department of Art History under the direction of Prof. Dr. Wittmann-Englert and Prof. Dr. Hopp entitled "Theatererbe virtuell erlebbar machen", which explores the topics of architectural reconstruction, digital handling of archive objects and narratives in virtual space on the basis of our VR project. The aim is to develop further concepts and ideas for the Große Schauspielhaus Berlin; at best, these will be implemented in the near future as part of other research projects.

IMPRINT

This is a joint project between digital.DTHG and Friedrichstadt-Palast Berlin. The concept is based on the design "One Show - Ten Perspectives" by Rebecca Eisele, Elena Kunau, Dominique Lauvernier and Lea Schorling.

PROJECT TEAM DIGITAL.DTHG

Project lead: Pablo Dornhege, Franziska Ritter
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Development: Lea Schorling, Sascha Sigl
Script/Direction: Ralph Tharayil
Sound: Lorenz Fischer
Curation: Franziska Ritter, Rebecca Eisele
Illustration: Regina Hapel, Pablo Dornhege
Graphic design: Maria Bürger
Subtitles: Julie Kamprath

PROJECT TEAM FRIEDRICHSTADT-PALAST

Intendant: Berndt Schmidt
Project lead: Guido Herrmann
Technical Director: Thomas Herda
Archive: Gero Konietzko
Script editing: Johanna-Friederike Krüger
Project coordination: Nora Botzenhardt

SPEAKERS / MUSICIANS

Narrator: Roman Knižka
Walter: Sven Brieger
Fritzi: Sabine Arnhold
Otto: Max Schimmelpfennig
Supporting roles: Florian Krüger-Shantin, Heide Domanowski, Jasper Domanowski, Johanna-Friederike Krüger
Violin: David Wedel
Piano: Andreas Wenske

ARCHIVE PARTNERS

Stiftung Stadtmuseum Berlin – Theatersammlung
Theatertechnisches Kabinett der Oper Leipzig
Architekturmuseum der TU Berlin
Stiftung Technikmuseum Berlin

ADVISORS

Reinhold Daberto, Bärbel Reissmann

TOOLS

Unity3D, Blender, Cinema4D, Procreate, Marvelous Designer, Google Docs, Slack, Spotify, Recording studio and broom closet, old books, Mannequin heads and powder puffs, Cloud machines and feather fans

PROJECT WEBSITE

<https://digital.dthg.de/en/projects/bringing-theatre-heritage-to-life/>

DOWNLOAD VR-PROJEKT

https://store.steampowered.com/app/1535360/Ein_Abend_im_Groen_Schauspielhaus__Berlin_1927



Hybrid-real stage spaces

COCREATIVE PERFORMANCES IN ANALOGUE-DIGITAL INTERMEDIATE SPACES

The focus in this sub-project is on the relationship between physical reality and virtual space and interaction processes between spectators and musicians/performers. With the development and realisation of the VR performance „Spatial Encounters“, we explored the extent to which the combination of a real/physical space with a digital/immaterial space can be used as a design tool, thus enabling new spaces of experience. The secondary aim was to explore co-creation processes in the context of artistic stagings and performance spaces, with a focus on musical experience.

RESEARCH QUESTIONS

- What are the characteristics of a hybrid-real „in-between world“ as a transitional space?
- What technical, scenographic and dramaturgical prerequisites are necessary for the success of co-creation, immersion and co-presence in hybrid-real space?
- What spatial effects can be developed in hybrid parallel worlds?

APPLICATION

- Artistic-experimental live performance

TECHNOLOGY

- WebXR (browser-based interface for AR and VR applications)

PARTNERS

- Hochschule für Technik und Wirtschaft Berlin
- Technische Universität Berlin
- Kloster Volkenroda

Hybrid-real stage spaces

COCREATIVE PERFORMANCES IN ANALOGUE-DIGITAL INTERMEDIATE SPACES

In the sense of an artistic-experimental research, this project is dedicated to the question of how a hybrid-real stage space can be staged in which artists and audiences meet and become both actors and designers of a jointly created experience.

In collaboration with students from various universities and with scenographers and musicians, we developed and tested different approaches for the use of virtual reality in co-creative scenarios in prototypical experimental arrangements. In addition to exploring the technical limits and possibilities, the focus was on the question of how collective creativity and scope for action can be used to produce a joint work with artistic expressiveness. We implemented the insights gained in the experiments in the VR project „Spatial Encounters“: This hybrid-real encounter space explores dialogue processes between music, people and space at the intersection of analogue and digital worlds.

The motive for this project is the dissolution of classical concert conventions and frontal transmitter-receiver situations, combined with the search for new bidirectional forms of dialogue between acoustic and visual spaces. In this transformative transitional space, we want to direct the attention of the participants on the one hand to the moment of „making music“, and on the other hand to the joint creation. This is connected with an invitation to „listen differently“.

The underlying software solution for the project is a web-based XR application developed by us and hosted on a local server: Mobile VR headsets (for example Meta Quest 2) can access a shared virtual space via the integrated browser. This is where the live performance takes place: One or more musicians, a visual jockey as „Master of Virtual Scenography“ and up to nine visitors meet in an equal dialogue.



The first live showing of „Spatial Encounters“ took place in summer 2021 at the Thuringian Chamber Music Festival in the Volkenroda Monastery. Together with violinist David Wedel, nine performances with a live audience were realised and further variations of the technical set-up were developed.

In an open space of about 150 square metres, the audience is immersed in a virtual scenery, which is then filled, designed and experienced together for the next 20 minutes. They move freely in these digital landscapes and generate visual effects and sculptures through their encounters and spatial relationships. The resulting immaterial spatial bodies and virtual sceneries are interpreted live musically. At the same time, the musicians themselves give stimulating impulses and moods to the performative interplay. Through these diverse interactions, the shared experience in virtual space becomes a catalyst for a co-creative process of creation.

„For the audience, this experience was a completely new one. Whether young or old – the magic was the same for everyone and everyone was on the field together and with curiosity. We have had a first-time listeners programme for a few years now and have been able to involve these people in the rehearsal work of Spatial Encounters. Being an active audience member has made it much easier for many to access to music and culture and has led to a great response.“

Christian Siegmund
Facilitator Chamber Music Festival – Volkenroda Monastery



Actors in co-creative playing environments

When looking at the design possibilities for a VR production, it helps to first draw attention to the target audience: How do the users behave – alone or in community, in relation to different contexts, media and formats (such as museum, cinema, visual arts, theatre or video game)? How much influence do we allow the users and how much interaction is possible, how much is necessary? How do we turn passive viewers into active creators?

In the context of museums and exhibitions, we are used to choosing our own path and exploring a subject area according to our interests. Interaction with media and exhibits is commonplace; participation has become the supposed recipe for success. In the cinema, on the other hand, the audience becomes a pure consumer: interaction takes place (if at all) only between the spectators, the events on the screen cannot be influenced in any way. With conventional concert and theatre audiences, interaction is possible in the form of spontaneous expressions of applause or dislike; but also here, influencing the course of events on stage is not common. However, for a time there have already been experimental ways of playing that involve the audience to varying degrees. The audience is „activated“, can – or even has to – participate in the action and is able to influence the course of the plot. The theatre group Rimini Protokoll, for example, uses methods from game design to let the „theatre users“ interact with the production (see their work „Situation Rooms“). Some productions even do without actors at all and make the audience the main actor („100% City“). In video games, the participation and influence of the gamers is indispensable: Here, the interaction between medium and audience is an integral part of the format and is closely related to the phenomenon of (user) agency. In contemporary art, a variety of strategies of audience participation can be observed since the 1960s and 1970s. Artists not only take the public into account, but also plan its participation from the very beginning and make it part of the artistic practice itself. Ultimately, the recipients help to shape the artwork, the performance or the piece through their participation.

In the conception of digital experiences in virtual reality, all these forms of participation are part of the repertoire. The blending of real spaces with virtual worlds and the encounter of human actors with AI-controlled NPCs create new, inexhaustible possibilities for interaction and creative freedom. (NPCs – or non-player characters – are characters in a game that are not controlled by human players. The term includes actors in the action as well as extras.) Forms of active audience participation increase the degree of immersion and the intensity of the experience, resulting in a stronger identification with the characters and their role in the story. Activating the audience also means dismissing them as spectators and establishing them as actors – in other words, turning them from receiving audiences into performing protagonists.

How can this potential of activated audiences and co-creative work be used to create an artistic experience?

When the audience is integrated into an artistic performance through the use of participatory strategies, the suggested cooperation at eye level often takes place only superficially. The participants are only given limited power to act and are usually involved in the supposedly collective creative process without authorship. As an extension of participatory processes, co-creative processes are playing an increasingly important role, not only in the artistic field. Their aim is to create works in which all actors are directly involved in the creative process and simultaneously act as recipients, co-authors and editors of the work. Co-creation thus describes the method and the result of a joint creative process by heterogeneous groups of people or statuses. This kind of art process distributes authorship between artists and the audience, leads to a kind of de-hierarchisation and expands the role of the recipient in the „artist-art-work-viewer complex“.

In these digital landscapes, the members of the audience move freely and generate visual effects and sculptures through their encounters and spatial relationships. The resulting immaterial spatial bodies and virtual sceneries are interpreted live musically. At the same time, the musicians themselves give stimulating impulses and moods to the performative interplay. Through these various interactions, the shared experience in the virtual space becomes a catalyst for a co-creative process of creation – an ephemeral collective artwork and a musical-visual resonance space emerges. Co-creative processes are characterised by the greatest possible scope for spontaneity and the unexpected. In order to unfold this potential, a high degree of flexibility and openness on the part of all participants and clearly formulated framework conditions, rules and boundaries are necessary. For „Spatial Encounters“, we have therefore conceived a predefined framework that consists of a code-based set of rules that determines the visual and of a dramaturgical framework that moderates the processes. In „Spatial Encounters“, this dramaturgical structure corresponds to a tried and tested sequence: the actual performance is embedded between an initial welcome scene with technical onboarding, a free exploration phase and a final offboarding.



The hybrid-real space Spatial Encounters at the 2021 premiere at the chamber music festival in the monastery Volkenroda

Within the concert performance, different spontaneous narrative dramaturgies with about five to six scenes are created through the collaborative interaction of the actors. The design is determined solely by the actors – audience, musicians and VJ – so each performance is unique and develops its own atmosphere.





Hybrid-real stage spaces

Scenographically-visually, we work in two realities: On the one hand, there are pre-produced virtual scenarios and landscapes made of simple basic elements (ground, horizon and sky) in different dimensions, colourfulness and texturing. For our premiere, we have put together a series of monochromatic colour spaces, futuristic-technoid cyberspaces and naturalistic landscapes (for example, gentle Thuringian rapeseed fields and shimmering-hot desert surfaces). The combinability of scenes and components results in formally abstract but atmospherically specific moods that leave room for interpretation. On the other hand, the staging of physical space – as a playing surface – focuses the audience's attention and at the same time formulates a protective space: the more spatial „safety“ can be created for the performing group, the better the participants can engage with the common ground. The use of scenographic design elements, such as staged lighting, fog, floor surfaces (soft carpeting, dance floor, etc.) and the visual framing of the playing area determine the performance space and thus the artistic event.

The hybrid-real stage space of „Spatial Encounters“ is defined by the synchronicity of subtle anchor points, recognisable spatial edges and surfaces that appear equally in both worlds. Both spaces – the physical and the parallel virtual – influence each other in their entanglement. The congruent overlapping creates a third space: a hybrid-real in-between world as a transitional space. This third space is characterised by special qualities and exposes the viewer to new perceptual phenomena. (Blumenkranz 2010). It is clearly more multi-layered, more complex and determined by more variables than the physical or virtual stage space. Such a hybrid-real bridging space enables communication between the real and the virtual. It functions as a medial space in the original sense of the word: as a mediator, as an intermediary. „The connection of the real and the virtual constitutes the substance of hybrid space. This space [...] cannot exist autonomously, however, since no independent additional space is created.“ (Blumenkranz 2010) In its fleeting presence, it is indispensably linked to the coexistence of both realities. The nature of this in-between world is determined

by the relationship between real and virtual space and the synchronicity in terms of time and place: are the two realities on an equal footing or do they have different importances? Are all the actors in the shared space at the same time and do their actions seem to be in real time or time-delayed? Are they congruent, divergent or contradictory in their spatial position and scale? The variability of these properties and the resulting complexity is what makes im/material spaces so appealing.

The perception of the in-between space is determined by the temporary state of separation between physical existence in physical space and mental existence in the virtual environment. Through this conversion of the familiar mind-body relationship to a new mind-avatar relationship, the tension between material and immaterial space can be experienced in one's own body. The dialogue between the realities mediated by the third space only appears through the (inter) actions of the actors. The spatial dialogue is fed by the interaction between the real bodies and their digital avatars: In order to actually be able to act in the virtual world, the actors need a representative entity that transforms their physical characteristics into the virtual. The digital body is the interface that needs to be designed: the avatarised body determines our relationship to the virtual environment (Fetzer 2020).

In „Spatial Encounters“, the virtual avatars are embodied as a cone-shaped stack of floating rings whose abstract forms are reminiscent of Oskar Schlemmer's costume designs for the Triadic Ballet. The coloured rings not only define the visual appearance, but also describe a protective area around the bodies of the users. The kinetic physique of the ring avatar has a slight delay in movement (like a billowing ball gown) and encourages the user to playfully explore his or her own ability to act: swaying the body in place, dancing through the playing area, jumping in the air, crouching down, lying down and even merging with other avatars. These physical actions additionally trigger visual effects, such as colour changes, perspective changes or light explosions. One performance participant describes her VR experience like this: „I was

curious to get close to the other colour cones, to touch them, to sway with them in dance. Again and again we were connected by ribbons in a triangular relationship. Rhythmically rising lines became sculptures, like modern skyscraper architectures. We could change their shapes again and again. And then we could climb into these flying sculptures or watch them fly away.“

The dynamic movement patterns of the users evoked in this way become a shared dance in the group and spontaneous choreographies emerge. Unconsciously, the joint exploration of closeness and distance becomes the defining theme of the performances. Through the sense of self-location, body ownership and agency created by these simple means (Kiltner, Groten, Slater 2012), a „sense of embodiment“ develops in the users. This is a prerequisite for the success of immersion and co-presence in hybrid-real space. It is not the dramaturgical framework or the predefined staged spaces that creates the artistic work. Rather, the work unfolds through the interaction of the dancing actors and their immaterial movement sculptures, the virtual environments and the improvised live music. The performance thus becomes an intersubjective experience between the participants that places the relationships between them at the centre of the art event. The result is a multimodal – ephemeral – collective artwork.

„I was surprised how an additional new space is created – a kind of in-between space, so to speak – that can be used as a performance space for musical purposes and thereby enables completely new possibilities of staging and interaction. Encounters actually take place here and the space invites active listening, listening differently.“

Prof. Stephanie Winker, University of Music and Performing Arts Frankfurt am Main

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 Fetzner, Frank. Mixed Reality Is Already There! The Player's Body as Foundation of the Videogame Experience in Mixed Reality and Games, 2020, S.252f
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WHAT HAPPENS NEXT?

The experimental work with the developed instruments continues. These new performative forms of work can be explored in other performance contexts and with different focuses. At the beginning of 2022, for example, we held a workshop at the Master's programme in Stage Design and Scenic Space at the Technische Universität Berlin to explore the role that scenographs can play in this set-up. What are the potentials and limits of such a set of design rules? What influence does the design of the visual scenery have on the experience? How does one design for virtual space? The students of the Technical University of Berlin designed a series of virtual scenes that were immediately tested live on a 1:1 scale on the same day and demonstrated the strengths of this tool.

In the next step, it would be logical to further develop the tool in collaboration with other disciplines, such as dancers and choreographers, actors and puppeteers. On the musical level, an expansion is also conceivable, both into other genres such as jazz or contemporary music, but also with larger ensembles or a whole orchestra. The setting also lends itself to cultural education work with children and young people or use in the sense of community music.

These initial approaches for possible new contexts result in new requirements for the software: in our view, additional features include a simplification of the user interface, the possibility of location-independent participation via the internet, the integration of audio streams, further interaction possibilities for the audience and a spectator mode for passive visitors.

IMPRINT

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Development: Lea Schorling and Sascha Sigl

3D-Modelling and 3D-Scans:

Sascha Sigl, Pablo Dornhege

Event technology: Vincent Kaufmann

PARTNERS AND EXPERTS

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Kulturvermittler

TOOLS

Visual Studio Code, Unity3D, Photogrammetrie with RealityCapture, Mobile Internet, Miro, Slack, Spotify, Gaffatape, Coffee to go & Whisky Sour, Drones, Astera-AX1 Pixeltubes, Hazer, Carpet

PROJECT WEBSITE

<https://digital.dthg.de/en/projects/hybrid-real-stages>

Augmented reality as a communication tool



COMMUNICATION OF COMPLEX RENOVATION AND CONSTRUCTION PROJECTS THROUGH XR TECHNOLOGIES

Refurbishments of theatres and cultural venues bring great communicative challenges for all involved. The classic tools of digital architectural visualisation, such as drawings, models, photos, renderings and animations, are only suitable to a limited extent for the requirements of complex spatial situations such as those often encountered in theatres. In close cooperation with Fabian Schröter, the technical director of the Luisenburg, and the renovation consultant Christian Buschhoff, usage scenarios were developed for renovation planning and discussing stage productions.

RESEARCH QUESTIONS

- How can complex architectural transformation processes be presented in an understandable way?
- How can digital technologies such as augmented reality be used to add information to physical scale models, on drawings and in full scale?
- To what extent can planning processes be digitally supported using XR technology and how can it help to allow frictionless communication between all stakeholders?

APPLICATION

- Meetings for planning complex building projects

TECHNOLOGY

- WebXR (browser-based interface for AR and VR applications)

PARTNERS

- Luisenburg-Festspiele / Naturbühne Wunsiedel
- CAB Dienstleistungen Christian Buschhoff
- Komische Oper Berlin
- Estrel Congress Center

Augmented reality as a communication tool

MEDIATION OF COMPLEX REFURBISHMENT AND CONSTRUCTION PROJECTS THROUGH XR TECHNOLOGIES

Complex building projects, new buildings and renovation projects for theatres and cultural venues bring great communicative challenges for all involved. Not everyone is trained to read floor plans and many find it difficult to translate a plan drawing into a three-dimensional image. Tools familiar from architectural visualisation, such as rendered 3D views and animations, facilitate communication but often only show selected aspects – an understanding of the overall spatial context often does not emerge. A built model lends itself to spatial understanding, but this often does not meet the requirements for variability, mobility, scalability and expandability. There is also a great need for interactivity and flexibility.

To what extent can digital technologies such as augmented reality be used to support communication by adding digital layers to built scale models, on drawings and in real space and to present complex architectural transformation processes in a comprehensible way? digital.DTHG explored this question in a cooperation with the Luisenburg Festspiele in Wunsiedel, Upper Franconia.

Since 1890, Germany's oldest natural stage with its complex rocky landscape has been a spectacular backdrop for actors and spectators alike. Every year, up to 150,000 spectators visit the festival, which has been under the artistic responsibility of Birgit Simmler since 2018. Every season, musicals, plays, comedies, opera and operetta are shown for a broad and interested audience. The tradition of showing own productions is continued by Birgit Simmler. In addition, the Festspiele develops new formats and plays that are produced especially for the Felsenbühne.

The natural stage of the Luisenburg Festspiele is located in the middle of the forest and can hardly be compared to other theatre spaces. It covers an area of 4,000 square metres and is a place of animate and inanimate nature. Nature itself thus plays the stage designer here – and has done so since the beginning of the earth's history about 300 million years ago, when the Kösseine granite was formed as the basis of the imposing rocky landscape. The stage space is constantly changing and never looks the same on any given day.



The building structures installed by man in the last decades, such as stairs, platforms, scenery walls or lighting installations, require a fundamentally new consideration in the upcoming renovation process. The refurbishment is challenging due to weather conditions and production processes and requires a high degree of professional competence and expertise. In addition, the complex system of cavities, corridors and stairs is difficult to manage with conventional planning methods. In its form, this venue is therefore an extreme example in the theatre landscape.

In close cooperation with Fabian Schröter, the technical director of the Luisenburg, and the redevelopment consultant Christian Buschhoff, we have developed usage scenarios for redevelopment planning and the discussion of stage productions. In addition to the digitally supported „expert discussion“ between the

people directly involved in the renovation, a moderated „presentation“ with less involved actors also plays a role. These include, for example, the theatre management, political decision-makers, potential cooperation partners and financial backers. When communicating with these groups of people, it is important to give a concise and understandable overview of highly complex planning processes and building projects, so that well-founded decisions can be made without lengthy familiarisation.

„Not everyone is skilled at reading floor plans and even for us as experts, the mishmash of voids, corridors and staircases is hard to grasp in its entirety.“

Fabian Schröter
Technical Director of the Luisenburg Festspiele

The auditorium, which holds a good 1,900 spectators under a curved tent roof, was built in the 1960s according to an idea by the architect Prof. Dr. Frei Otto. Frei Otto became famous for his constructions, for example for the Munich Olympic site in 1972.





Both applications were designed in such a way that they are not only specific to this subject area, but can also be transferred to other areas: Thus, with this application, we were able to develop parallel adaptations for the topics „Augmented Reality in Event Technology“ and „Digital Twins of Theatre Technology History“.

„Unlike in an urban, classically built theatre architecture, there are no sufficiently precise construction plans for this theatre landscape constructed in and around the mountain and grown over the decades. Only with a spatial survey by laser scan, which we created in 2018, can we distinguish and separate animate from inanimate nature in sufficient detail in distinction to the man-made path network and the playing areas.“

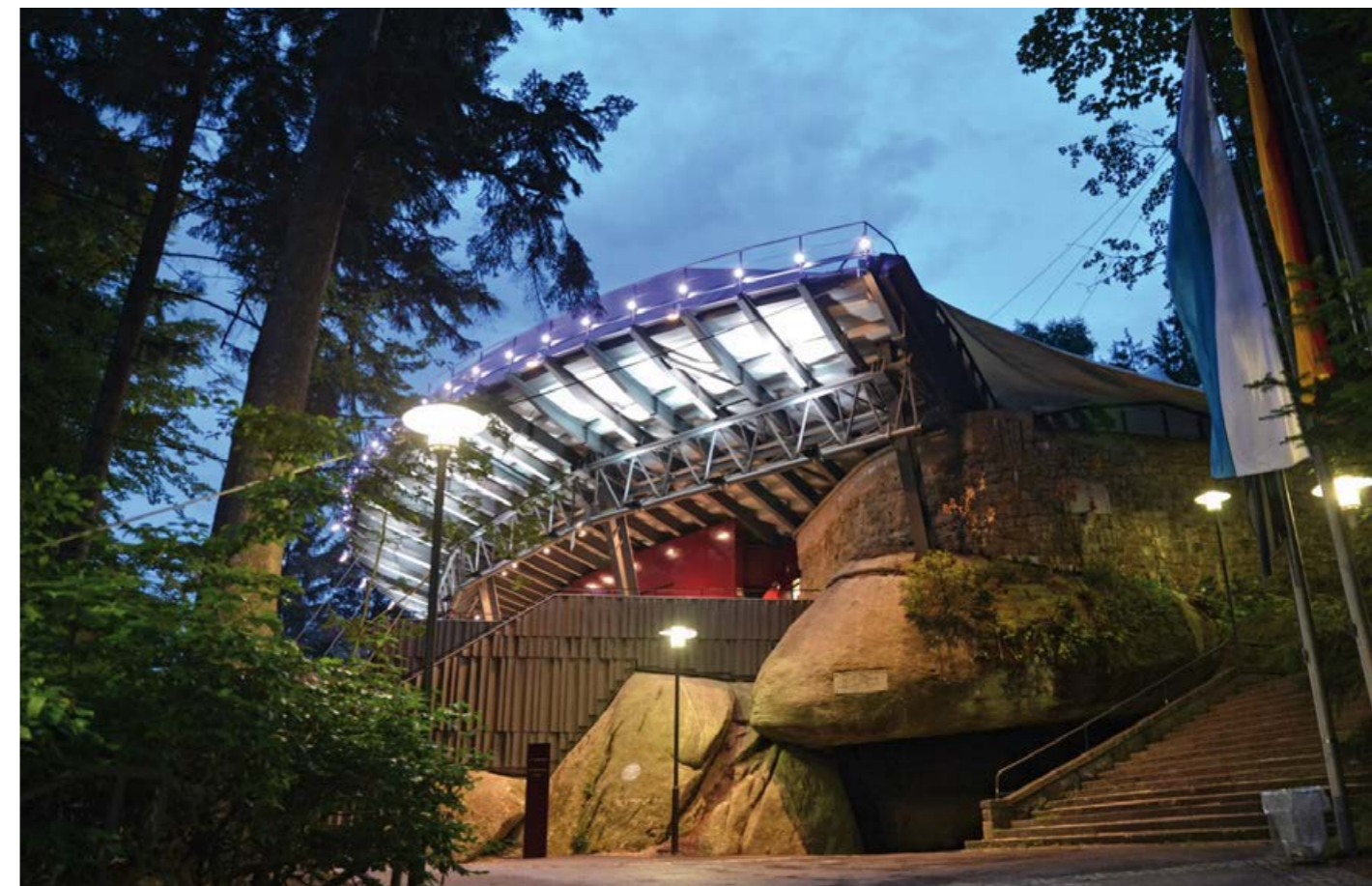
Christian A. Buschhoff
Redevelopment officer and external consultant

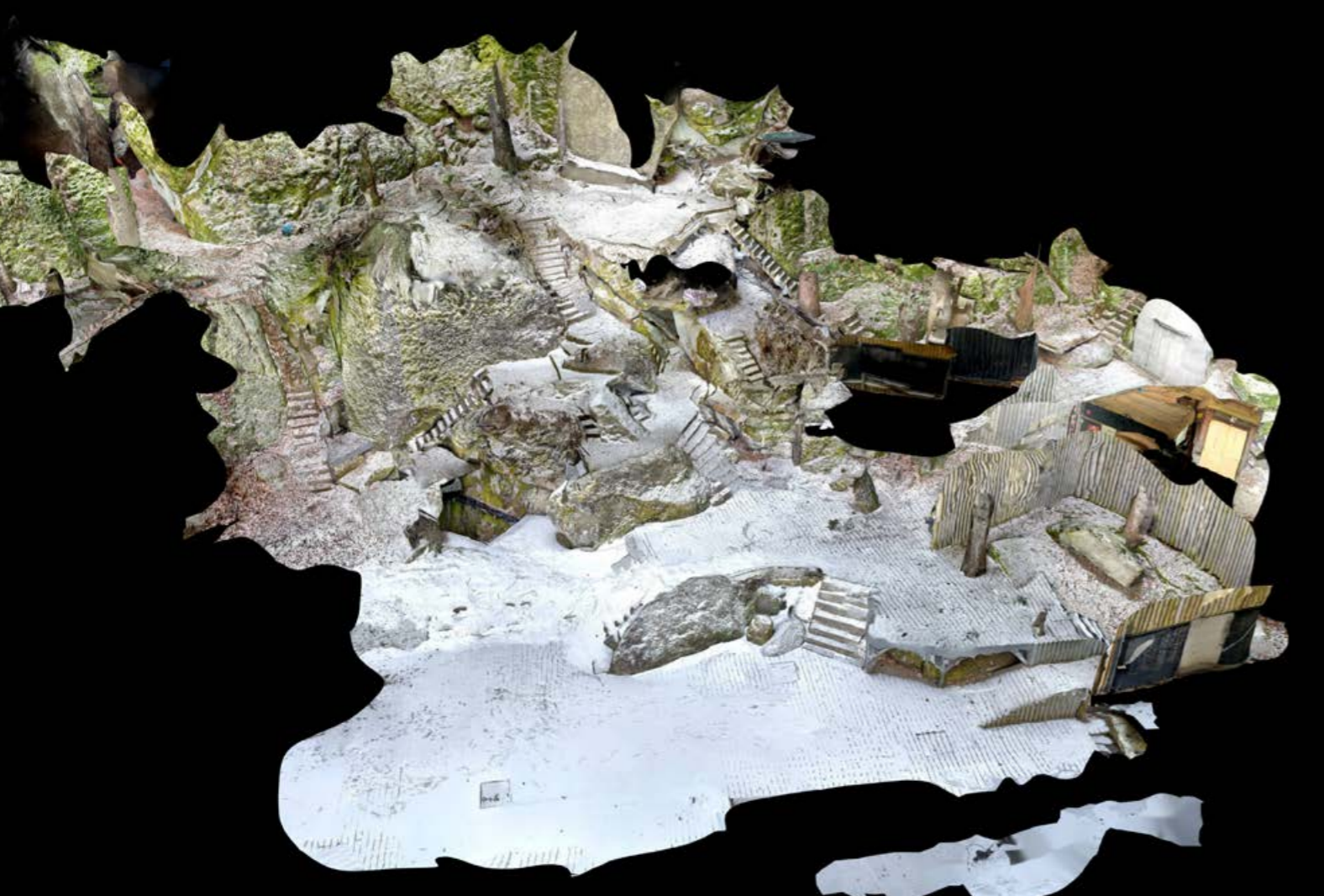
Based on the excellent existing 3D database (terrestrial laser scans, drone-based photogrammetry and CAD planning) of the present spaces, we first tested the use of available software solutions in the various scenarios. This showed that these tools can be used well for the coordination processes among experts and can be integrated into the planning process; for use with external stakeholders, however, these applications are usually too complicated to handle and can hardly be operated without an introduction.

Based on these experiences, we outlined an easy-to-use, „augmented“ presentation format: Using a tablet, smartphone or AR glasses, users can present three-dimensional content on a drawn floor plan or a physical terrain model, for example the current planning status or variants of a stage design. The physical-real objects serve as anchor points for the overlay of digital three-dimensional content. The presentations can be prepared in advance by the presenters and contain a wide range of information.

Similar to the slides of a PowerPoint presentation, the presenter and viewer can then click through the different 3D models.

After we defined the required features – such as the positioning of objects, scaling and the interface – in preparatory experiments, the findings were brought together in the prototype application „XR Editor/Viewer“ as a sample solution and thus serve as a starting point for further developments. The technical basis for the application is the new WebXR standard. It enables three-dimensional content to be displayed on a wide variety of devices, whereby the type of display depends on the technical possibilities of the hardware. The resulting application consists of two related components: On the one hand, this is the WebXR editor, in which the „slides“ are compiled and prepared, and on the other hand, the WebXR viewer, which can be called up online to display the presentation. This browser-based and device-independent use allows the same content to be played out in different ways.





You can clearly feel a transformation process here in Wunsiedel - there is added value through the results that we derive from digitalisation

INTERVIEW WITH CHRISTIAN BUSCHHOFF AND FABIAN SCHRÖTER

Christian Buschhoff, who oversees the renovation efforts at Luisenburg festival, and Fabian Schröter, the technical director, talked to project leads Franziska Ritter and Pablo Dornhege about digital tools used to plan renovations and virtual construction rehearsals.

Can you give us an idea of how and why you are organising Luisenburg's renovation process with digital methods?

Christian: In 2018, when we first assessed the requirements, we realised that construction measures in such a complex spatial context need to be complemented with digital site measurements and a digital process –

especially with our very limited budget. Consequently, we requested a point cloud from our structural survey team. We were motivated by the potential cost savings and more detailed planning possibilities.

Fabian: When all stage data is digitised, you can work and plan at any time. Wintertime is a good example. Currently, we have 10 centimetres of snow. If we needed specific information to be able to discuss details that concern the theatre stage, we would have to wait four months for the stage to be free of snow. So, working with digital methods makes our everyday work easier and leads to quicker results.

By creating the point cloud, you set a certain standard right at the beginning. What were people's reactions at the theatre and among your project partners? Was it difficult to establish this new way of working?

Fabian: I'll say yes, it was difficult because it was unknown. We noticed a lot of hesitation. Working with technology always requires time, interest and patience. If you have a knack for digital tools, you will enjoy this process. People began to see the value once we had the first results come in.

Christian: Here in Wunsiedel, we notice a clear transformation process and we see the value in the results that digitisation yields. The insights we have generated in our collaboration with you (digital.DTHG) are part of this. Too often, we still hear this response: „We have been doing things this way for years.“ If you try to establish something new and unknown, there will

be resistance at first. But resistance here wasn't so strong that it prevented us from receiving funds for the measurements and creation of our point cloud.

Which role do new digital presentation methods like augmented reality play? For example in your communication with external actors and stakeholders.

Christian: Our 3D models and the new (augmented) ways of presenting have only played a minor role in our communication with political deciders so far. The augmented reality tool is, as an addition to excel sheets, models and sketches, an impressive means of communication. But the visual impression should not distract but rather help to display the complexity of what we do and support us in explaining the necessity of the cost.



In your opinion, what will the digital transformation process look like? What do you consider the right path and where should things be headed?

Christian: Right now, we need to repair our stage floor. It is so fragile that we can't wait until renovations begin. The current state was assessed using a drone that filmed a 360° panoramic view. You can see the value of this digital documentation because we can look at the stage during winter if there is snow or after it has been fixed. So, it is like a classic photo documentation, but it provides a 360° view and in this case it is not a 3D point cloud. This helps us tremendously in speeding up the renovation process.

Fabian: Precise 3D models are essential, especially when it comes to the stage area and its basic structure. They are much easier to work with than oral descriptions or photos. The digital 3D data provides a shared basis for planning and the 3D models allow us to make sure we have a common ground in our discussions.



What does digital work look like in your team?

Fabian: In our daily operations, digital competence is not at 100%. Luisenburg is a seasonal business: There isn't just one big team that continually works on something like lighting, sound or stage technology. This makes it difficult to establish digital competence at a sensible scale, especially since there is not a lot of time for training in a seasonal business.

Digital competence is also a matter of generations: In our experience, it's more difficult to get started for our older colleagues while the younger ones have much less trouble. I have also notice this in theatre education, where we currently realise a lot of digital projects because of the pandemic. Our colleagues obviously enjoy the work. The generation that is growing up with digital competence will easily consider digital tools the standard.

Christian: I can still remember how difficult it was for me to let go of haptic experiences and to build trust in digital data. I had to learn to rely on the fact that my information can be stored for decades and that I will be able to find it anytime. I also think it is a matter of generations. We need to ask ourselves: "Where will we be when we retire?" I mean in 25, 30 years. By then, we should be at a point where the digital world has our focus. By then, we will look back on almost 60 years of digital data acquisition and we might be more reassured when it comes to storing data.

Do digital or virtual tools play a role when you're planning stage settings or designing sets?

Fabian: At this point in time, I can't use the 3D plans of our stage when planning stage scenery. The plans that I hand over to our scene designers are digital, but they are in 2D. This means that the overview plans, detail views and workshop drawings that are created while planning are also two dimensional. We can't yet work with three-dimensional construction drawings in our workshops, mainly because we don't have the necessary software yet.

Christian: The construction volume, meaning the budgets that we have for set construction, are not large enough to justify hiring a 3D design engineer, which is what we would need to do. The budgets we have available for the natural stage are limited. And this influences the complexity of the constructions. The stage area does not allow for large set constructions using suspended ceilings or similar constructions. And we should be honest with ourselves: The structures we can create don't really require a three-dimensional construction plan. Lighting, however, is a different story. This can be pre-produced in the virtual space, so we are not required to wait for sunset and the dusk to settle.

When we look at our renovation instead of set construction, things are different: Here, we rely heavily on a three-dimensional process. Only the abstract three-dimensional model allows us to evaluate and understand the real space. And even if the budget is limited, using digital tools and three-dimensional drawings is justified in this case.

What features do digital tools need to have so they can be used in theatre?

Fabian: We need basic, purposeful tools that only offer exactly what we need. Software needs to be simple, so it is easy for people to get started – and we don't mind paying an appropriate price for this.



Christian: We also need programmes and ways of working that include everybody. We can't afford leaving people behind because they lack digital competence. Everybody should receive the type of tool that they like to work with. It will be our challenge to synchronise those tools and make sure they work together.

What is the best way to talk about digital competence in the theatre world?

Christian: I'm thinking of a builder's hut, meaning that theatre is essentially a manufactory. Ways of working are location-specific. But we can't let ourselves become so narrow-minded that we consider ourselves a melting pot of technology and implementation. I wish there were more of an exchange between festival locations and the different actors. If you look at how common this is in the construction of sacred buildings, you can see that there is professional exchange on a national and European level and digital competence is an integral part of this. There is a steep learning curve ahead for the world of theatre.

Should digital competence play a larger role at training institutions and universities? What do you think of the status quo?

Christian: Yes, because it is essential that digital competence, digital communication and future-oriented work become integral parts of module compendiums. People who recently graduated university or completed their training already work with digital tools anyway.

Fabian: I see the same in my daily work – older colleagues prefer receiving their work schedule as a paper printout while the younger ones want to receive it by email only. We see the same effect when it comes to documenting work processes: The younger the employees, the more is done in the digital realm.

Do you think up-and-coming professionals are well prepared for the reality of working at a theatre?

Christian: No, not at all. There often isn't enough reflection on the role of technology in a project. A good technical director acts as a facilitator and as someone who understands both the work of art and ideally also the shop floor. This self-understanding is necessary to be able to support art with technology. Both worlds – the technical and the artistic, creative world – need to accept and respect each other and foster – as well

as demand – communication on an equal level. There needs to be a basic technical understanding on the artistic side just as much as the technical side needs a certain artistic understanding. These are topics that need to have a place in training.

What do you consider the role of professional associations when it comes to digitisation?

Christian: I think it's most important for DTHG and other associations to meet people where they are. You are already doing this with your "How to go virtual workshops" at the theatre locations. It is very important that the associations provide contact persons who push digital competence. As with other topics, we need continuity in our examination of this field.

This conversation took place on December 10th, 2021.

WHAT HAPPENS NEXT?

Even though the development of the platform within the research project has been completed, the servers will remain online for the time being and our cooperation partners and the digital.DTHG team can continue to work with the application and gain important experience. We also discuss further questions with external stakeholders and outline further use scenarios. Such use cases include, for example, interactive presentations with school classes (for example for theatre education), site and building overviews for the safety briefing of new staff or also the communication of tourist information for an interested public (for example in the outdoor area of a venue).

This leads to an extension of the desired functionality, for example, an option for georeferenced tracking is needed for outdoor use. The development of new applications also expands the circle of possible users. This shows that a further development of the application is also interesting for actors outside the theatre landscape and that independent and usable products and communication tools can be created on the basis of the prototypes.



IMPRINT

PROJECT TEAM DIGITAL.DTHG

Project lead: Franziska Ritter, Pablo Dornhege
Development: Lea Schorling, Sascha Sigl
3D-Modelling/Scans: Sascha Sigl, Pablo Dornhege
Design and Interface: Maria Bürger

PARTNERS AND EXPERTS

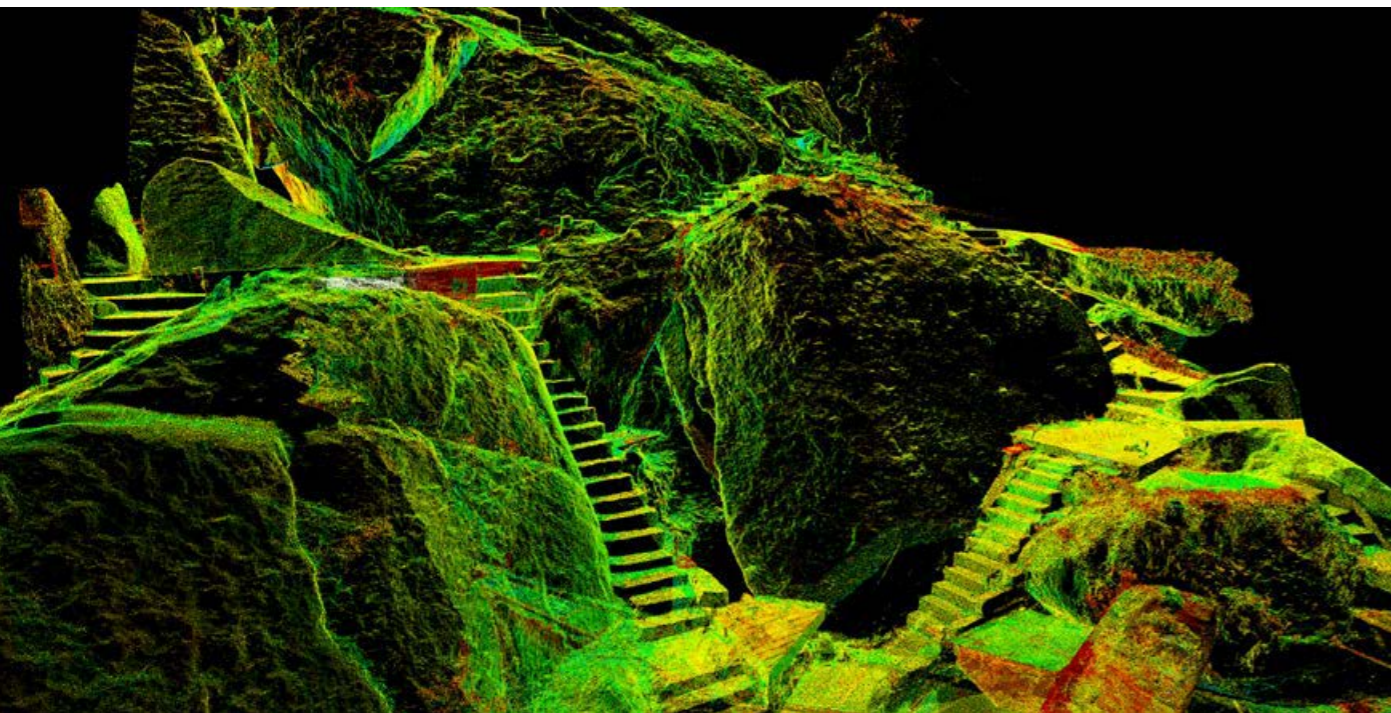
Fabian Schröter, Technical Director
Luisenburg Festspiele
Christian Buschhoff, Commissioner for Renovation,
CAB Dienstleistungen e.K.

TOOLS

Visual Studio Code, WebXR, Node.js, Strapi, Unity3D,
Polycam, Sketchfab, Mozilla Hubs, Miro, Slack, Hiking
boots and down jackets

PROJECT WEBSITE

<https://digital.dthg.de/en/projects/mixed-reality>



Virtual Bauprobe



DIGITAL TOOLS AND WORKFLOWS FOR THEATRE PRODUCTIONS

Together with our partners from different theatres, we have explored the potential of Virtual Bauprobe - rehearsals that do not take place physically in the theatre and on stage, but can take place in virtual space and independent of location. In the process, we tested different methods and tools and developed a series of different workflows that enables the integration of virtual reality as a medium for visualisation, design, construction and communication in the planning processes at theatres.

RESEARCH QUESTIONS

- What do workflows look like for carrying out „Virtual Bauprobe“?
- How does the „Virtual Bauprobe“ integrates in the process of a theatre production?
- What framework conditions - technical, financial and in terms of staff - must be in place or created?

APPLICATION

- VR workflows for (collaborative) visualisation, design, construction and communication scenarios

TECHNOLOGY

- different VR systems, platforms and software environments

PARTNERS

- Konzerthaus Berlin
- theater junge generation Dresden
- Komische Oper Berlin
- Berliner Ensemble
- Rheinisches Landestheater Neuss
- Theater Chemnitz
- Staatstheater Kassel
- Bund der Szenografen
- Luisenburg-Festspiele / Naturbühne Wunsiedel

Virtual Bauprobe

DIGITAL TOOLS AND WORKFLOWS FOR THEATRE PRODUCTIONS

The Bauprobe is an important milestone in the theatre production process, where the participants usually come together physically for the first time in a large group: the artistic team (first and foremost the stage designer, but also the director, costume designer, make-up artist) and the technical team (usually with the technical director, stage manager, lighting, sound, video and workshop manager). During the rehearsal, the stage design previously submitted in the model is marked on the stage - with simple means and standard materials.

This enables all participants to see the ideas and dimensions on a scale of 1:1 on the stage and to perceive the overall impression in the atmosphere of the theatre as well as to check sight lines. The Bauprobe is used to discuss and check the technical feasibility and implementation ideas. Depending on the stage design, it is also about the materialities, the use of light and projection.

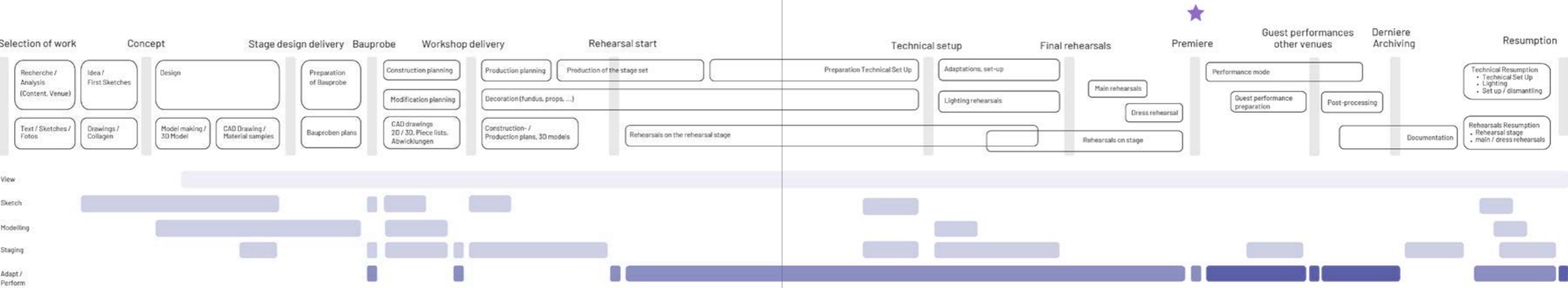
There is an interesting parallel here to the development process of computer games: There, so-called greyboxing takes on very similar functions, in which all parts relevant to the functioning of a computer game are simulated prototypically. This does not involve the final visual appearance, which is why simple grey cubes (hence the name) are usually used as placeholders for a later level architecture. Based on the greyboxing, the decisions and changes necessary for further work can then be made.

In this sub-project, methods and tools were sought for conducting virtual rehearsals - that is, rehearsals that cannot take place physically in the theatre and on stage, but in virtual space and independent of location. How can VR technology be integrated as a visualisation, design, construction and communication medium at the theatre, even beyond the phase of the Bauprobe?

The result of this sub-project is the publication of over 30 blog posts on the digital.DTHG website, providing basic knowledge for beginners, explaining terms, recommending projects and uncovering connections. This knowledge has been presented in detail at over 12 conferences and symposia so far.

The core of this sub-project is the workshop series „How to go Virtual“, which was conducted in cooperation with associations and cultural venues with the teams of nine different theatres and will be continued.

Our research is based on this prototypical theatre production process that represents the complexity of the creation process and shows potential intersection points for working with or in virtual reality.



Workshop series „How to go Virtual“

We developed the workshop series „How to go Virtual“ in order to test possible applications with theatres and venues on site in an uncomplicated way. The aim was to try out existing applications and software in a practical way as well as to run through specific scenarios of use: For example, the adaptation of a stage design to a different venue, the presentation of construction variants or the visualisation of a spatially particularly complicated design.

We have individually adapted the content of the workshops to the current needs and knowledge-level of the theatres and the participants:

- First contact with the technology, fascination with VR, trying out different systems.
- Getting to know the technical basics: What different VR systems are there, how do they work and what are the prerequisites?
- requirements (for example, for the Oculus Go, Windows Mixed Reality glasses, Oculus Quest)
- Areas of application of VR at the theatre: for sketching ideas, as construction software, for the preparation and visualisation of details, as a discussion platform and versatile means of communication.
- Software and working methods: from Tilt Brush to Sketchbox to VR Sketch
- How must the data be prepared?
- Individual use at your own theatre: Which workflows are best suited for one's own theatre, how can they be easily and quickly integrated into the daily work routine?
- Opportunities and risks of VR in the theatre
- Integration into the digital transformation process, dealing with human resources
- training opportunities, knowledge management, aspects of sustainability
- Practical aspects such as maintenance and hygiene



The enthusiasm at our first workshop with the theatre junge generation Dresden was enormous. Staff member Robert Rott talks about VR shortly after his first attempts:

„When I experienced and tried VR on my own that was the first time I was able to see the spatial impact and potential.“

Technical Director Lutz Hofmann also emphasises the great potential of the technology for collaborative work between artists and technicians, for example in the planning phase of a production:

„When meeting in virtual space, each participant finds easy-to-use tools to represent design or technical approaches, thus enabling effective translation and verification of thoughts beyond model building and pure drawing programmes.“



Virtual Bauprobe. How does it work?

There are many different options for Virtual Bauprobe: From simple to complex, from open-access to high-priced. To begin with: the range of 3D / VR software is large and confusing, but diverse! A detailed overview and evaluation of all the programmes we tested with theatre professionals in the context of our workshop series „How to go Virtual“ is published on the homepage <https://digital.dthg.de>.

Due to the prevailing diversity of programmes, we did not develop a new software in our research project, but rather a set of different workflows. The combination possibilities of the different tools are manifold and at the same time they have to fit to the own way of working and equipment. In general, the following conditions should be fulfilled or the basics should be available for all scenarios in order to be able to start well in the world of Virtual Bauprobe.

BASICS FOR ALL VIRTUAL BAUPROBE

- Theatre space as 3D model
- Stage design model / design as 3D model
- Platform / meeting space / software for virtual work
- stable and fast internet access
- Willingness and curiosity to try out new worlds

WHO HOSTS THE VIRTUAL BAUPROBE?

The advantage of virtual rehearsals is that the theatre does not necessarily have to host the rehearsal, thus creating independence in terms of time and place. A repetition or resumption is possible without any problems.

WHAT DOES A VIRTUAL BAUPROBE COST?

The question of costs depends on the type, scope of functions and technical equipment and is therefore made up of the following points:

- Software costs, licence fees, if applicable
- Costs for creating the 3D data
- Technical infrastructure (hardware, VR glasses if necessary)
- hosting (server rental), if applicable

IS THERE ANYTHING ELSE I NEED TO BE AWARE OF?

The integration of the various participants should be as simple as possible. The Virtual Bauprobe can only be successful if all users can handle the technology. Therefore, technical requirements should be checked and sufficient time should be planned for preparation and training so that, despite technical challenges, the focus of the virtual building trial is on communicative and design issues and not on mastering the technology.

If the 3D data was created in a CAD programme, it may be that it is too complex for display in VR. Then the data must be converted and simplified. The simplification can take place during export or in 3D modelling applications.

TIPS AND TRICKS

Particularly when starting out in virtual construction, attention should be paid to the technical equipment and performance in the various scenarios:

- Lowpoly: In each scenario, the basis is a live rendering of a model. In live rendering, the model is calculated from the perspective of the viewer and this is done on the respective end device. A mobile phone or a stand-alone VR headset has a much lower computing power than a gaming laptop. The following experiential values have proven to be useful for fluent handling: for Mozilla Hubs, the project file size should be a maximum of 120Mb; for VR Sketch, it should be a maximum of 300,000 polygons.
- Alternative approaches: Offer several variants. A 3D model can easily be included in Sketchfab and the link sent. Even if you are aiming for a build in



Workshop in cooperation with the Association of Scenographers, Vincent Kaufmann explains how to use the controllers, to create three-dimensional sketches in the TiltBrush software.

- Mozilla Hubs, it is advisable to have an alternative on Sketchfab. This way, alternatives can be used in case of technical problems.
- Planning communication: Especially in virtual space, conversations and communication need to be precisely prepared. Moderation and conversation in a digital environment due to the lack of facial expressions and abstracted gestures of the avatars have their own communication rules there.
- Save intermediate states: Some changes in the model can lead to inexplicable problems that are sometimes irreversible. It is therefore worthwhile not to always overwrite the same file and to work via a cloud.

- Documenting and labelling is the be-all and end-all: Over time, many versions of models, rooms and data are created. These should be well labelled, documented and logged right from the start.

We have set up and tested three workflows for you - from simple and inexpensive to complex and time-consuming - and present them to you on the following pages.

Virtual Bauprobe Extreme - the Pandaemonium

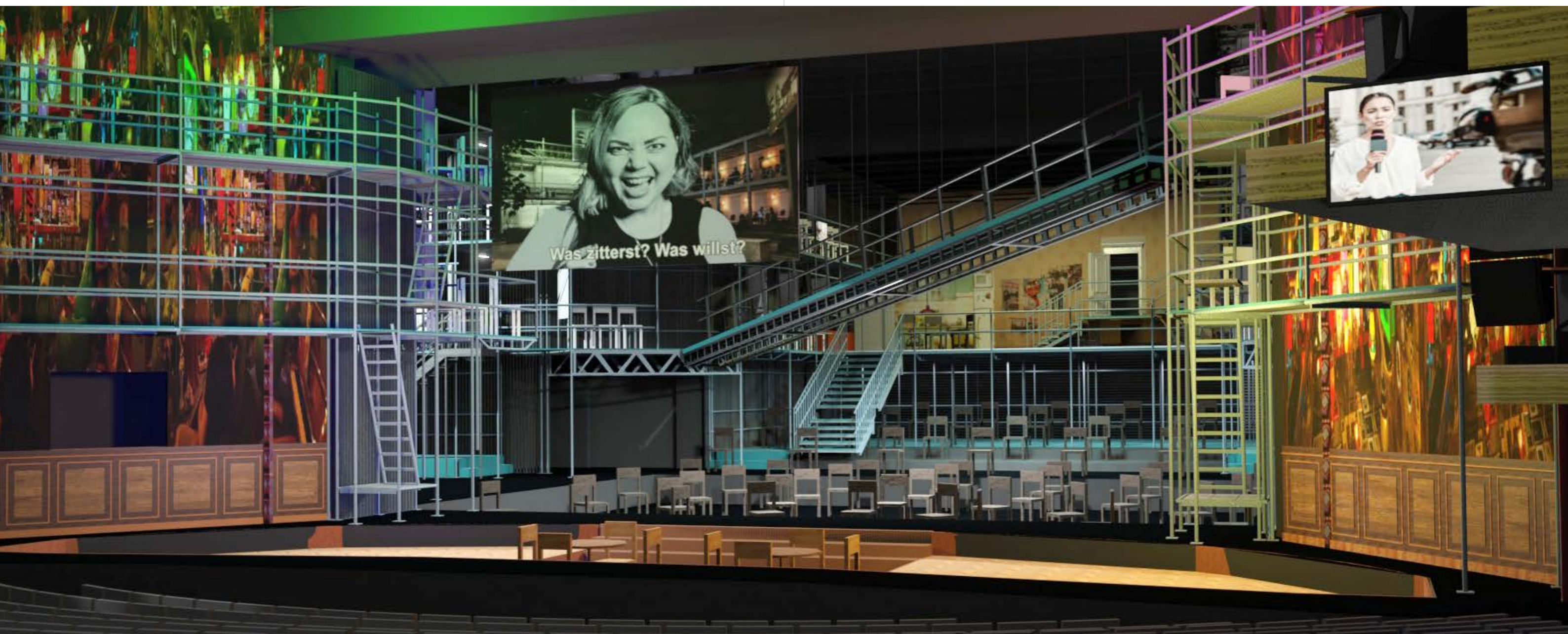
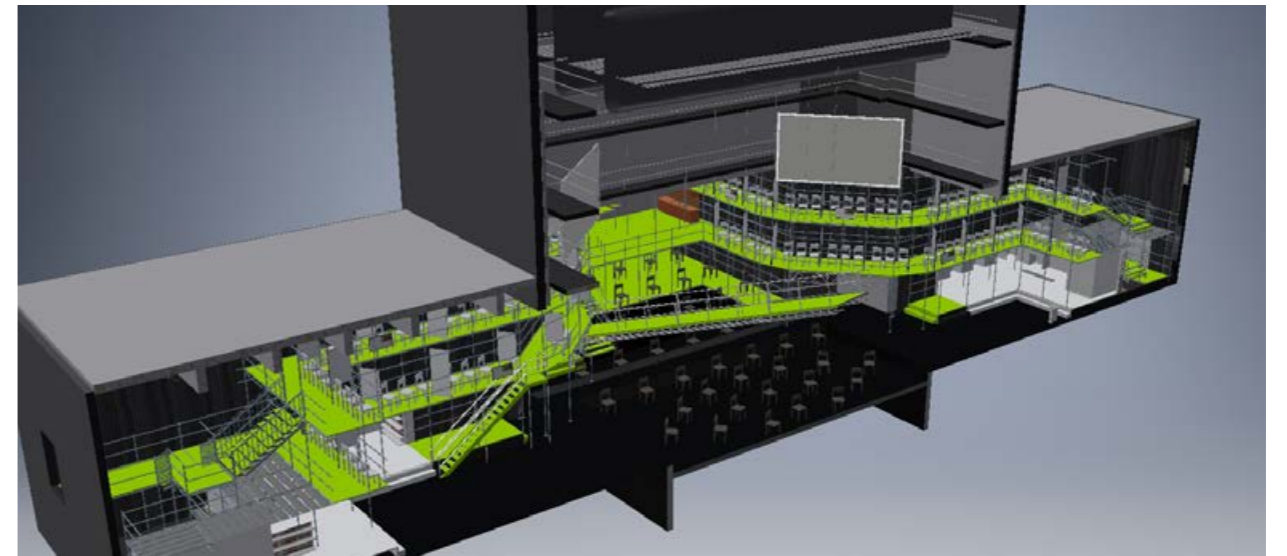
STAATSTHEATER KASSEL

Digital.DTHG staff member Vincent Kaufmann led the virtual production planning process of the „Pandaemonium“ at the Staatstheater Kassel - here, together with set designer Sebastian Hannak and the creative team, the research findings and considerations on the Virtual Bauprobe could be tested and applied in practice. The Pandaemonium is a modern total theatre with boxes, which extends over the back and side stages into the auditorium on three floors and turns the audience into actors as well as separating them from each other in a pandemic-proof way. Various productions played in this Pandaemonium space stage from September to December 2021.

With Wozzeck and Tosca, two operas celebrated their premiere in one weekend at the end of September. Over 60 tonnes of steel were used on the stage of the Staatstheater Kassel.

„I don't see how we could have done it in such a short time without the Virtual Bauprobe.“

Mario Schomberg, Technical director
Staatstheater Kassel



Workflow 1 - Sketchfab / Zoom

„Semi-virtual pre-rehearsal“

VIEWING AND DISCUSSING DESIGNS WITH UP TO 30 PEOPLE VIA TWO-DIMENSIONAL SCREENS

This scenario uses the free internet platform Sketchfab to present models. Here, meetings can be presented by sharing the screen in a video conferencing tool or made accessible to different end devices via a link in a time-delayed manner for illustration. This scenario does not allow live editing of the virtual 3D model during the meeting, but is convincing as an entry-level scenario due to its easy accessibility and implementation for all production participants.

OVERVIEW

- Software: Video conferencing tool such as for example Zoom; Sketchfab
- Degree of immersion: low
- Hardware: multi-device (smartphone, tablet, notebook, PC, VR headset)

TECHNICAL REQUIREMENTS

- Computer with current browser (Chrome or Firefox if possible)
- for 2D access: device with current browser (notebook, tablet, smartphone)
- for 3D access (Wired VR headset or standalone VR headset)

COSTS

- Hardware: VR headset from 500 to 1500 €
- Software: 0 €
- running costs: none, when upgrading to Sketchfab plus \$ 24 per month

ADVANTAGES

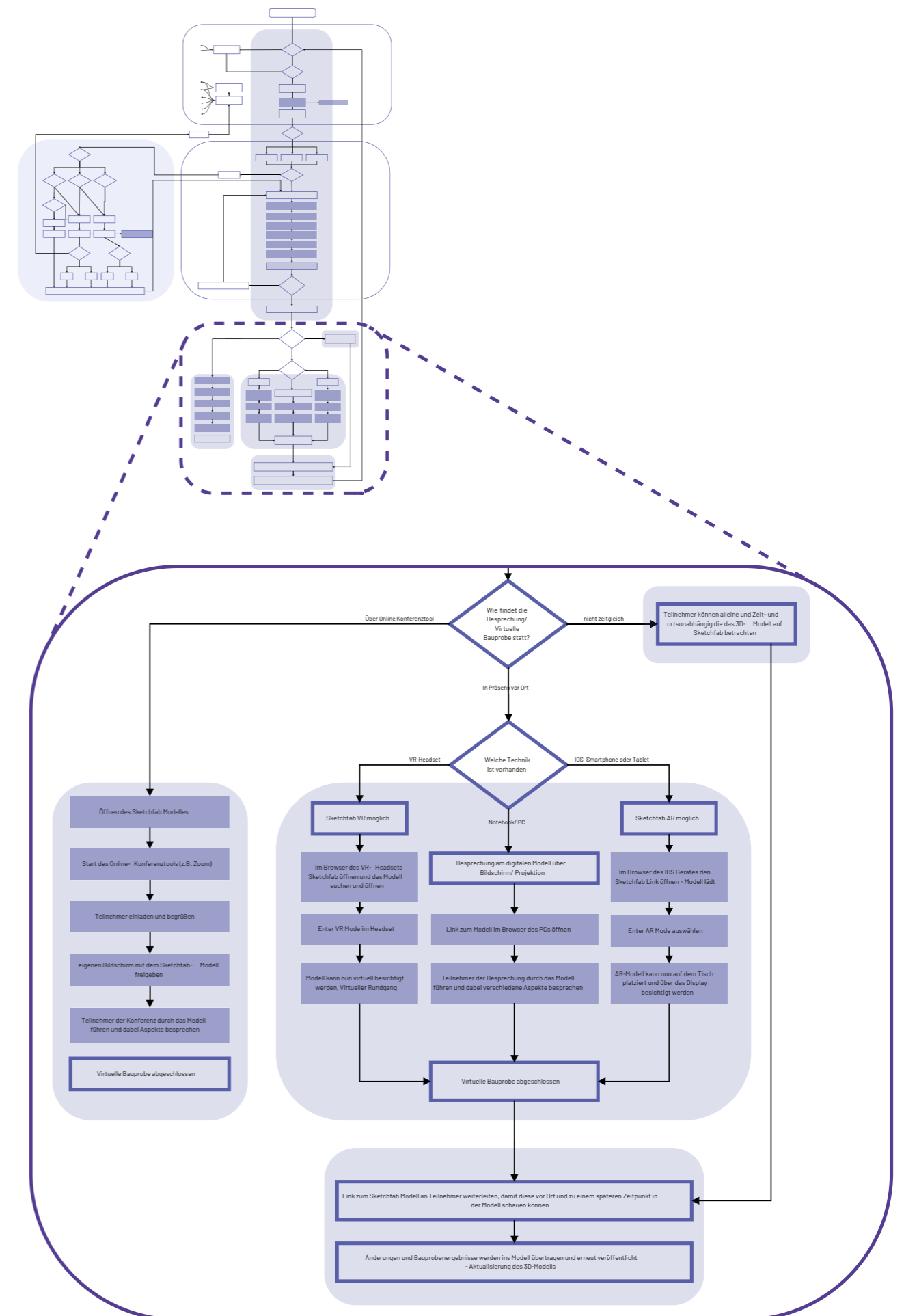
- Multi-device, can also be used without VR glasses (smartphone, tablet, notebook, VR headset)
- Free of charge up to a certain point
- intuitive use
- Sketchfab-Link is in use 365/24/7 and walkable models
- can be copied or duplicated as often as desired. Several model views / scenes are possible
- suitable for interdisciplinary creative teams with little previous experience and different end devices (VR glasses not necessary, but possible)
- High visual representation quality possible

DISADVANTAGES

- No tools for editing the 3D data
- no automatic meeting protocol (no digital transcripts)
- Limited amount of data / model size

COMPLETE WORKFLOW

<https://digital.dthg.de/en/workflow-1-en>



Workflow 2 - Mozilla Hubs „Bauprobe for everyone“

VIEWING AND DISCUSSING DESIGNS WITH UP TO 30 PEOPLE
VIA DIFFERENT DEVICES

This scenario uses the free Internet platform Mozilla Hubs with the associated editor Spoke. Here, meetings in the virtual room can be held simultaneously with several participants via different end devices. This scenario does not allow live editing of the virtual 3D model during the meeting, but is convincing as an entry-level scenario due to its easy accessibility for up to 30 people.

OVERVIEW

- Software: Mozilla Hubs
- Degree of immersion: medium for 2D access in browser, high with 3D access via VR glasses
- Hardware: smartphone, tablet, notebook, PC, VR headset (multi-device)

TECHNICAL REQUIREMENTS

- Computer with current browser (Chrome or Firefox if possible)
- for 2D access: device with current browser (notebook, tablet, smartphone)
- for 3D access (Wired VR headset or standalone VR headset)

COSTS

- Hardware: either already available, from 400 to 1500 €
- software: 0 €
- Running costs: none, no subscription model

ADVANTAGES

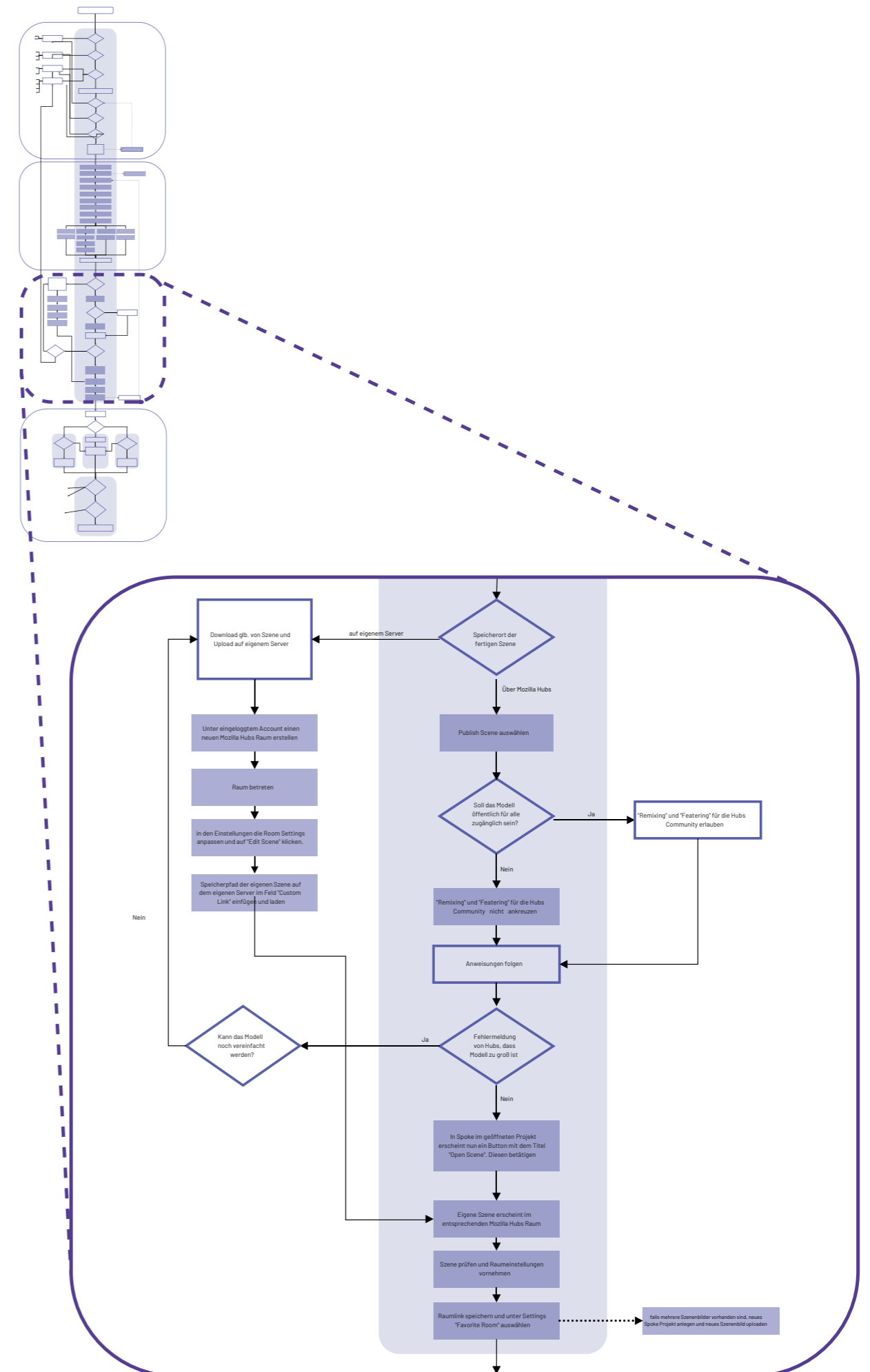
- free of charge
- Multi-User
- Multi-Device, even without VR glasses
- Mozilla Hubs room is in use 365/24/7 and walkable
- can be copied or duplicated as often as desired
- suitable for interdisciplinary creative teams with little previous experience and different end devices (VR glasses not necessary, but possible)

DISADVANTAGES

- No tools for editing the 3D data or live editing of the rooms
- no automatic meeting protocol (no digital transcripts)
- no great visual quality (which is not absolutely necessary for a Virtual Bauprobe)

COMPLETE WORKFLOW

<https://digital.dthg.de/en/workflow-2-en>



Workflow 3 - Virtual Bauprobe with VR-Sketch

VIEWING, DISCUSSING AND EDITING DESIGNS IN VIRTUAL SPACE

This scenario uses the paid plug-in VR Sketch for the SketchUp programme. Here, meetings and building samples can be held simultaneously in virtual space via VR headsets with several participants from different locations. This scenario enables live editing of the virtual 3D model during the meeting and also offers many other possible applications.

THE FOLLOWING MEETING SITUATIONS ARE CONCEIVABLE

- Alone in VR: The user can enter the model via two the model in two ways.
1) Model editing: This requires a PC and a VR headset. A single person can work in the model and change it. Changes are automatically saved on the PC.
2) Model viewing: Only a stand-alone VR headset is required for this. An online model can be viewed via an activation code, editing of the model or a meeting is not possible.
- Split VR screen: Presence on site, one person in VR, other people can follow the person in VR via an external screen, conceivably also via split screen in Zoom.
- We're all in this together: Everyone in VR, either in presence or from different locations.

TECHNICAL REQUIREMENTS

- current SketchUp version and PlugIn
- at least 1x stand-alone VR headset
- PC with active SketchUp and VR Sketch licence

COSTS

- Hardware: either already available, or from 1500 to 2500 € (depending on the number of VR headsets).
- Software: from approx. 624 € per year
- Running costs: SketchUp licence (274 € per year), VR-Sketch licence (30 € per month)

ADVANTAGES

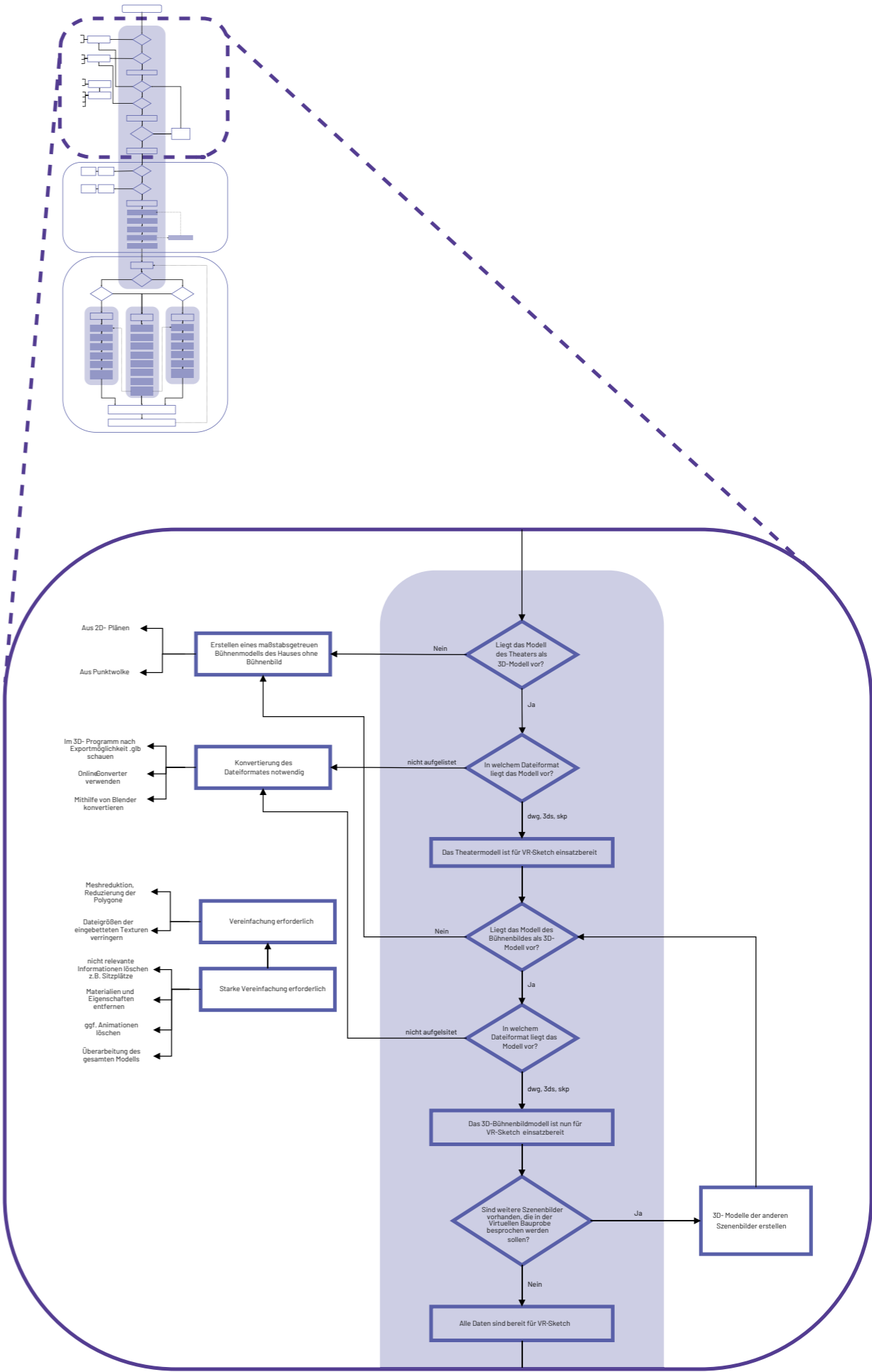
- Multi-user possible
- Live editing of rooms possible from any user possible
- can be copied or duplicated as often as desired, different scenes can be created
- Rooms can also be made available offline
- Different modes of operation, even with little previous experience

DISADVANTAGES

- not of great visual quality (which is not essential for a Bauprobe)
- greater preparation and training time necessary
- Limits on model sizes and number of users

COMPLETE WORKFLOW

<https://digital.dthg.de/en/workflow-3-en>





VR is the driving force for us

INTERVIEW WITH THEATER JUNGE GENERATION DRESDEN

The digital.DTHG team visits the theater junge generation Dresden, one of the first cooperation partners in the research project "Im/material Theatre Spaces". Project manager Franziska Ritter and VR coach Vincent Kaufmann ask about experiences and insights and show how the Dresden colleagues have made it from their first virtual attempts to established digital workflows in their daily work. Insights are provided by Lutz Hofmann (Technical Director), Robert Rott (Construction / Operational Safety Staff) and Grit Dora von Zeschau (Head Stage and Costume Designer).

We met at the Stage Set Scenery fair in 2019 in the Immersive Showroom, where we showed the first AR and VR prototypes from a two-week workshop. What made you curious?

Lutz: We were totally fascinated by the approaches and ideas that the workshop participants had created in a very short time. Rough diamonds that were waiting for their polishing... You showed with the prototypes: that's where you could go, that's the way! And the first ideas sparked off immediately.

What were your questions when you started the cooperation with the digital.DTHG team? Where was a need for action?

Robert: We had many questions and challenges on our wish list, but then we took a current production as an opportunity to generate insights that were as practical as possible. It was about Kästner's "Das doppelte Lottchen," which we wanted to stage for our summer theater at the Dresden Zoo. An unusual and

challenging outdoor venue in terms of the production process. The rehearsal situation during winter time takes place under difficult conditions and it is hard to imagine how the stage situation would be in summer with full tree cover and with spectators. So it made sense to use this example for our experiments in the direction of the "Virtual Bauprobe".

What about the time factor – one of the most important resources in the production process – were you able to save time? Were you more effective and what exactly was your requirement for a digital construction rehearsal?

Lutz: In the beginning, we didn't save any time, but actually needed more time, even until today, because these are additional work steps. However, we are not dependent on the varying availabilities of all parties, and we can do a lot of coordination in the virtual set – that's a great advantage in ongoing theater operations!

Robert: We have now started to provide the set designers with our new 360-degree photos and precise 3D models at the start of the project. This definitely ensures an easier spatial, but also technical understanding. From my experience so far, this reduces the risk of misunderstandings, so it definitely "saves" time, especially in communication.

Maybe it is also about a different way of working?

Grit Dora: Perhaps the stage design for the production "Tiere essen" serves as a good example: Above the almost empty stage hovers a large transparent sphere, a kind of oversized soap bubble, with a workstation for an actress who places there papercuts of various constellations that are projected onto the cyclorama with a live camera (see images page 108/109).

Robert: The challenge was to design an airframe that came as close as possible to the image of a feather-light soap bubble – with a limited budget and other requirements. The task here was to capture the implementation ideas from the various departments,

sort them out and lead them to a decision-making process – without bursting the bubble, in the truest sense of the word. And I can say quite clearly that VR is the driving force for us!

What does that mean exactly? When and how does virtual reality come into play here?

Robert: For us, virtual reality doesn't necessarily mean that you always have to put on VR glasses (which is what many people think), that's more the icing on the cake. We have modeled the different design variants and put them up for discussion, because that is actually the most important thing: to simplify the communication process. So right now we're trying to stop sending screenshots, and instead send active links with moving 3D models on our Sketchfab channel, which is permanently available as an online library for everyone to use. Or a link to our Mozilla Hubs 3D online platform when it comes to space. The more time I invest in this kind of pre-work, the more time I save after the construction rehearsal.

The "Tiere essen" project was also a model project on the issue of sustainability. To what extent did the digital workflows play a role in this and how were they evaluated?

Lutz: In a real-life laboratory situation, we worked with Sukuma Arts e.V. to investigate how much sustainability is possible in a staging process. This raises the question of how effective such a model review is from a sustainability perspective. What happens there? A team of two or three people travels for a two-hour meeting to review a model, then everyone gets back in their car, on a plane or on a train. You have very high time pressure to get all the issues sorted out. And then the same thing happens again at the Bauprobe. With digital ways of working, communication is much more sustainable. Collaborative ways of working, such as those possible on the Miro online whiteboard, have been incorporated into our learning process. This requires a high level of self-interest and a great willingness to learn on the part of all participants.

Can you briefly describe which programs you work with? What exactly does your workflow look like?

Robert: The first sketches of the set designers and scenographers are usually still analog, and that's a good thing. Ideally, both spaces – the theater space and the stage design – are well prepared with 3D data in parallel. We create the data in CAD (currently with the software Autocad and Inventor), export VR data from CAD, work on these (e.g. in Blender) for “display” or for a digital construction rehearsal, continue working in CAD until the workshop drawing and export this final version again in VR for the “digital workshop delivery” – and all this usually in addition to the analog drawings.

What is important to you about this workflow, where are the pitfalls?

Robert: For me, it's important that I can continue to use the data throughout the entire production process, because the main question is really: does it do anything for the workshops? Can the components be lasered from the 3D data right there? I have to be able to generate workshop data from the CAD data, and I can't do that with Blender at the moment. The biggest problem for me are the APIs. Which software brings me what? Often it is much too complicated.

Was it also important here that you initially offered the digital construction rehearsal as a supplementary work step, as an “add-on”?

Robert: Yes, that's how I do it. Particularly after the analog construction rehearsal, in order to then be able to quickly check the changes in the VR goggles. And a digital pre-construction rehearsal would of course be the optimum before going into the analog construction rehearsal. I can minimize the effort extremely if I clarify a lot in advance. This requires a great deal of understanding on the part of the other partners for

this additional effort, and there must be an awareness that you then have to deliver digitally well-prepared material before a construction rehearsal – in other words, in the balancing act between the model delivery date and the construction rehearsal date. Unfortunately, this is often not yet the case.

What kind of rethinking is needed in the teams to establish such new processes permanently? For example, an additional, earlier deadline for the digital 3D model in preparation for a digital construction rehearsal?

Lutz: Yes, it should. But that presupposes that the management of a house or an institution recognizes this as a great advantage and takes a leap of faith to create this freedom. On the pure project level, we often succeed, because it depends on the person and the individual. Sometimes circumstances also help, such as in the case of international teams, where it is simply enormously practical to open up a shared collaborative space very early on without having to travel a lot – so that our project meetings take place right away in Mozilla Hubs.

What kind of feedback did you receive? How did the colleagues react, was there any resistance? How much convincing did you have to do?

Robert: The pandemic situation certainly had an accelerating effect here and caused understanding – because we were virtually forced to deal with it. The reactions were very mixed in the various departments, ranging from great enthusiasm to resistance. I took various colleagues by the hand one by one (laughs) and led them into a safe space – with caution and without pressure, because the first steps in VR are always a bit shaky. I told them: “See if it's any good for you”. That required a lot of patience and individual moderation.

Lutz: When you work at the theater, you learn pretty quickly how much “social work” is done here. In prin-



Actors flit, climb and jump skillfully across the stage with VR glasses during rehearsals for “Der Mond schien blau”. They move as naturally in these hybrid worlds as if it were all part of everyday life.

ciple, we have to do the necessary persuasion work here if we want to use these tools in the long term. Acceptance is much higher when you realize that it is beneficial to you.

Will there still be an analog model for future productions?

Grit Dora: Preliminarily, yes. For the next production, I'm trying to design in analog and VR in parallel. I want to provide my colleagues in the workshops with the familiar format and at the same time give them an insight into VR. One important point is haptics: how do I explain the surface in the painting workshop when I really don't have anything in my hand?

Lutz: Maybe I don't necessarily need the model myself, but some stage designers may need it in the process, in order to become clear about what works and what doesn't. And if you can't find a solution in analog, the digital space won't help either.

When asked about stage design and scenography, Grit Dora: You are in a luxurious situation here at this theatre – digital, curious, open to experimentation. Other theaters probably (still) live in a different reality. How are you developing your digital way of working? How are you adapting it?

Grit Dora: Yes, the conditions at the theaters are extremely different. My own way of working is not yet as digitally established as I would like, for reasons of time and resources. We're in a good situation here at the theatre, because we're a group that's interested in it and is working hard on it. But there is not yet a really established way of working for me as a scenographer: I'm still searching for the ideal workflow.

I also had the fantasy “Ok – from now on virtual!” We will learn it and then there will be day X, and from then on we will only work with it. But that won't happen, except perhaps for the few VR experts in the theater sector. My way now is a “unclean” way of working – half analog and half virtual. At least that is how we established it

with our VR graphic designer in the current production “Der Mond schien blau – eine Wunscherfüllungssuche zwischen virtuellem und analogem Raum”: We often change live and together on the 3D model. But sometimes it’s just the printed screenshot that I hand-draw my changes into and email to the VR artist (laughs). It feels strange, but it’s totally productive. Interesting that you call that „unclean”. This is an extremely flexible, hybrid way of working – the quick change between analogue and digital, depending on the situation and close to the particular person!

Grit Dora: Yes, for me the insight was that it can be more productive if you first say goodbye to a certain perfectionism when it comes to VR and allow yourself more “work in progress”. My colleagues from the “Bund der Szenografen”, where I am active in the “Digital Space” working group, are also still trying things out. There are some people who have been working with it for many years and there are quite a few colleagues who have joined relatively recently and first want to know the basics quickly and in a comprehensive way: what is VR and how can we get started? More training and workshops are urgently needed in the future, such as those already offered by the DTHG. There are also



efforts to set up digital labs where digital help is offered already in the first design phase. It’s very difficult for the independent scene to act on its own here and it needs the interplay of theater institutions and associations to build this up together.

Where does this knowledge, where do these experts come from? Is there a need for new professions? Does the know-how have to be located in the core team at the theater itself, or is it more appropriate to work with external service providers on a project basis?

Robert: The ideal form for us here at the theatre would be a hybrid form. Because the digital expert always works at the interface, both with a technical focus, but also with an artistic focus and a staging competence, including public relations and communication. There are so many disciplines mixed together, they are specialists, and yes, it would actually be a full-time job.

Lutz: Of course, it would be more sustainable to implement such topics in apprenticeship training – on both sides: on the art side and for the technical side. Both require more comprehensive continuing education and training offerings, because ideally, one makes



one’s own staff fit to handle basic digital technologies. For certain productions, a VR graphic artist is needed – we book him externally if necessary. But if the financial belt has to be tightened or there is a lack of understanding for this enormous amount of work, the first thing we have to do is cut back on external services.

Experience from other industries shows that digital transformation can only succeed “in-house” in the long term. How do you ensure that knowledge remains in-house?

Lutz: That is an important point. Where is the knowledge stored, how is the knowledge passed on? Our worst-case scenario: If Robert leaves, we start from scratch and the technology gathers dust in the corner.

Grit Dora: That’s why, in the current play development “Der Mond schien blau”, we started to spread the knowledge widely and strengthen the core team as much as possible.

Virtual Bauprobe and stage situation for the „floating soap bubble” in the tjjg production „Tiere essen”



Robert: In the medium and long term, it is important to repeatedly confront people with VR technology in various project constellations. In this current production, we are dealing with it in a very playful way for the first time – four puppeteers with four Oculus Quest glasses are acting in parallel in Mozilla Hubs and on the analog stage. In this way, an understanding, a know-how and an acceptance is created almost incidentally, because the technology is brought into the house in a different way.

Have you developed tools and methods in-house to store this knowledge? And what will be needed in the future?

Robert: We are currently working with the whiteboard tool Miro, where we track errors on a daily basis and document possible solutions. This is being developed in parallel as a communication platform that will ultimately lead to a type of documentation in order to store the know-how for future projects and employees.

Lutz: And here, again, we would need a clear statement from the management level and an anchoring that we make this our standard work process. However, self-interest is one of the most important prerequisites here. Our puppet maker, for example, has observed the work of the VR graphic designer from afar and is now approaching us: I want to work like that too! And is now taking a further software training course for the Blender program at the university. That is time well spent. In the ups and downs of everyday theater life, we have to defend these learning spaces, even when the next productions are already lined up.

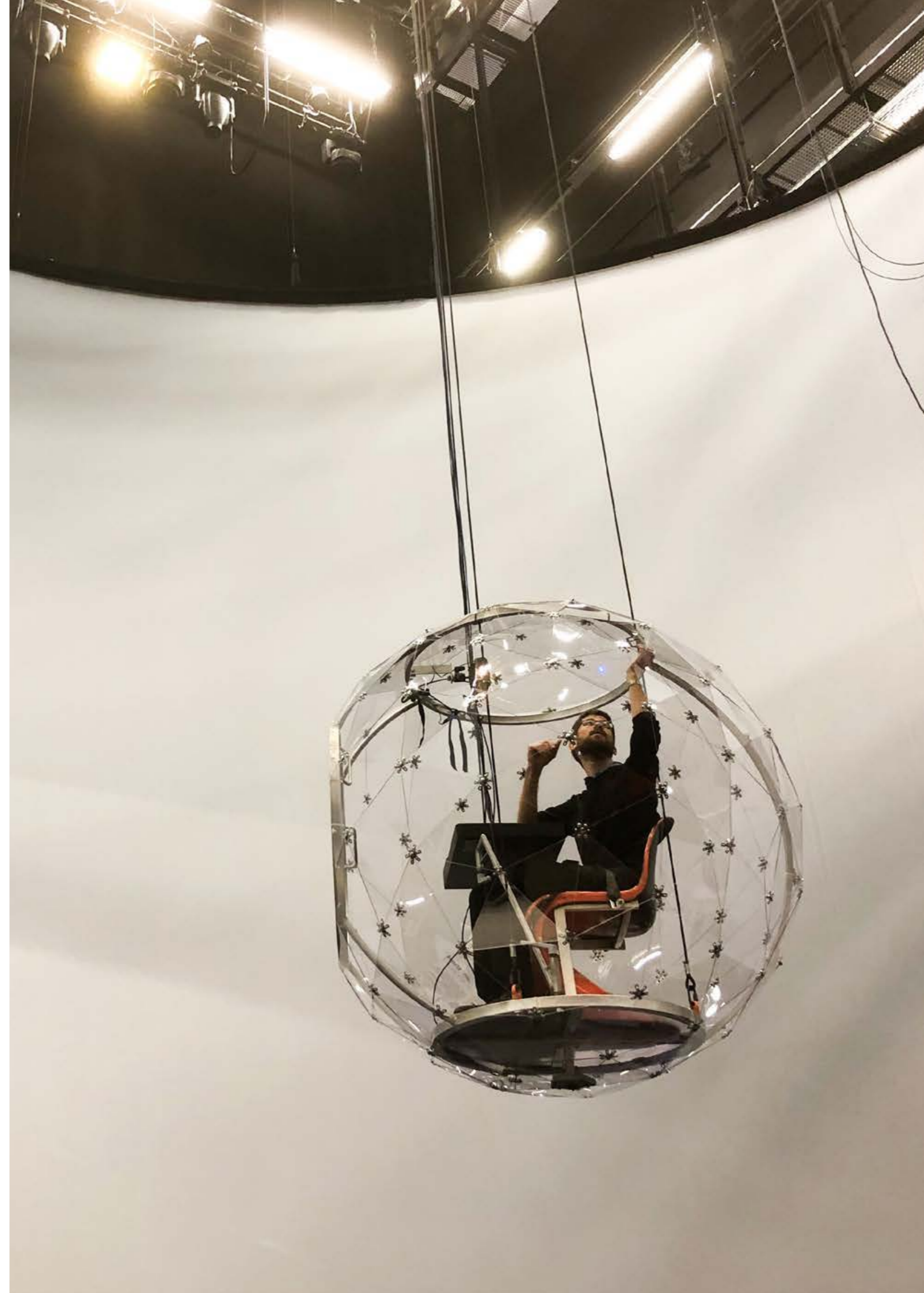
What is your vision of the digital theater of the future, what do you wish for?

Robert: There is a need for better trained young artists and professionals. At the same time, it is our task as a theater to declare the demand. What we also need, and not only in stressful situations when the Mozilla Hubs server doesn't work, is a stable and supportive digital theater network. I need people who know their stuff, who work in a similar way, who I can reach quickly.

Lutz: What I would like to see is easier technology access for everyone. For example, we are currently working on a "communication set": a suitcase with VR glasses and a laptop with software set up, which is given to the artistic teams at the beginning of a project and used there until the premiere. Like a kind of digital "care package." That will make collaboration extremely easy.

Grit Dora: Good networking and a successful transfer of knowledge between theaters, universities, and professional associations is essential. And time to experiment – even in everyday theater life! Time for small test projects that can pop up at short notice for our audience.

The interview took place on 24 November 2021 at tjg Dresden.





We are navigating an experimental field, which is still finding its form so that everyone can see its value

INTERVIEW WITH ALEXANDER SEGIN, KONZERTHAUS BERLIN

Project lead Franziska Ritter talks to Alexander Segin, Head of Event Technology Konzerthaus Berlin. During the 2020/21 season, which marked the concert hall's 200-year anniversary, we had a chance to test workflows for virtual construction rehearsals with him and his team.

To what extent do you run construction rehearsals (Bauprobe) as part of your regular concert activities and why do you think it is useful to support them with digital tools?

We host nearly 500 events every year. Usually, we only do construction rehearsals for a few scenic productions a year. But these „Bauproben“ are much more „marked“ than those done at theatres or opera houses because, with our stage being used so frequently for

rehearsals, concerts and occasions where we rent out our hall, we are always on a tight schedule. We already knew from the beginning that the „Freischütz“ (English: The Marksman) productions we had planned for our anniversary year of 2020/21 would pose a great challenge regarding space and technology.

Can you describe these challenges using an example? And can you tell us how you handled them?

We were trying something new when we planned to restage Carl Maria von Weber's „Der Freischütz“ with the Catalan theatre group La Fura dels Baus. We wanted to use the hall as an illusionary space. This meant that our approach and implementation were completely different from a normal concert situation. The hall's 14 chandeliers were covered in fabric, and we planned

an elaborate PreRigg construction for the different projection levels. We were faced with a very elaborate production that included a crane construction for artistry that made it necessary to plan out every centimetre. Our planning process constantly had to be adapted, not only because of the pandemic. In the end, we had to premiere it as an elaborate TV production without a live audience. This way, we could use the entire space, place the orchestra inside the hall and open different performance spaces for the choir, for example in the seating area. This meant we had to constantly change our plan; technically, we would have needed five construction rehearsals to reproduce everything.

How did the Virtual Bauprobe help you and how did you go about it?

We were working on an international production and several lockdowns prevented us from travelling and meeting up, so we had no choice but to establish digital ways of collaborating. Normally, a 2D plan in AutoCAD is sufficient for our scenarios. But in this case, because of the complexity of the design and our requirements for precision, we knew that working with 3D would be best. So, we worked on refining our blueprint, also using external help from Johannes Fried and Vincent Kaufmann from the digital.DTHG team.

I'm sure the data basis was excellent because of your cooperation with Berlin's University of Applied Sciences (HTW Berlin) as part of the project „Virtual Konzerthaus“. How did you utilise that data?

We had already created a 3D view of our location as part of another project with the HTW university. This textured building model helped us create the first visualisations when we began planning the „Freischütz“ project. But this type of model focuses on visual quality, which did not help us as technicians, especially when it came to avoiding collisions.



Set-up for „Freischütz“ production by La Fura dels Baus at the Konzerthaus Berlin 2021

Therefore, we had to redesign our very precise 2D drawings and transfer them into the three-dimensional space so that we could create an accurate „image“ of the building structure. Luckily, we could use the textures from existing 3D models and project them onto the new geometry. So, the data has gone through a large development over the past two years – and so have we (laughs).

Does this mean that, from that point on, you activated a VR-ready 3D model? How did you use this model?

I used it internally to keep my team updated on the current status of the Rigg construction. We used the platform Mozilla Hubs to bring together the digital building model and the digital stage design and we made the different variants and technical solutions accessible in 3D. As we approached the premiere date, we used this online space to meet up with the artistic team. In the two weeks before the premiere, we met up almost twice a week.



The 3D model of the Konzerthaus Berlin in the foyer exhibition „Virtual Concert Hall“, architectural tour as AR application.

Do you discuss this with other institutions, venues or colleagues?

There is a small network of institutions that work with digital projects like this one. That is why I think the more we all push this, the more podium discussions will be, the more we will be able to talk about it and eventually, we will no longer be in a niche of event technology. We are still at the beginning; task forces have yet to be formed. There is no standardisation in this field and workflows have not yet been defined. We are navigating an experimental field, which is still finding its form so that everyone can see its value.

The pioneer work that you are doing must require a lot of time and energy. What are the reactions in your team like, is there a lot of resistance? Following a trial-and-error approach can't always be easy.

I would not call it resistance, it is more a matter of ressort, which is understandable. Who is doing what, which department is responsible? We don't have a construction department that creates plans. I can't go to them and say, "This VR thing could take up about 10% of your work time." A healthy amount of scepti-

cism is necessary and normal when looking in a project like this. We need to ask ourselves: What is the value that this creates, now or in 10 years? We often hear things like, "We don't need this. This only creates more work for us. Don't we have enough to do already? We never used to do it this way!" At the same time, event technology is seeing constant development in the digital field and this is progressing faster than ever.

But isn't "digital" actually a professional field in its own right at theatres? We can't really expect everyone to go along with it on top of everything else.

We are currently learning in our digital projects what it takes, what we need and what needs to be considered. In my day-to-day work, I often don't have the time to focus on new technologies, read articles or attend conferences. We will need to make the decision to hire specialists and pay them to help us. We would never have been this successful with our Virtual Bauprobe if we hadn't had digital.DTHG to help us. You kept coming up with new ideas, showed us new software and tools and motivated us to go down a new path. This type of project support is almost like a department of its own and it was invaluable to us.

At the beginning of the project, we often talked about how difficult the situation is at large theatres when it comes to digital competence: One department doesn't know what another is doing, they often work completely separately. You managed to build bridges and work with the data across departments. What are your next steps?

I actually see great value in working with digital tools: I can use the existing data sets to work in a precise manner and that gives me the possibility to approach projects differently. Or I could continue to develop the 3D model. We have created the Beethoven hall and the Werner Otto hall as 3D digital stages in Mozilla Hubs. This can be a great advantage for us as an international establishment when we communicate with our customers. Many of the requests we receive come from embassies or from overseas and this setup helps with on-site visits. Quite often, it's not possible

for all decision makers to attend the visit. A tool like ours and a list of questions can easily help to give an online impression of the space. For this purpose, we have also recreated all the equipment such as chairs, orchestra podiums, lecterns etc.

What are you hoping for in terms of digital work in your field? What is your vision? What would you need?

My dream is a virtual orchestra lineup plan! We often work with orchestra plans that have been created to scale based on the stage blueprint – but those are usually pencil scribbles and sketches. Bubbles are drawn onto these plans, but they never represent the status quo. My vision for future digital work is for visualisation tools to improve even more so they will make our planning and communication easier. Because a lot of the time, people have trouble picturing the setup – the string section over here, violas right there, and over there we have the woodwind players. That is a beautiful ellipsis that has nothing to do with reality. To make it easier for us to prepare, do our work and give a conductor an impression of the space, we can use the existing data sets to create a tool that reproduces the stage true to scale – regardless of the scaling – and also includes chairs, stands and instruments if needed. This way, someone who doesn't know the space will have a tool that can help them develop their ideal setup, use the data sets to generate an Excel sheet and send bookings to our internal disposition software.

The interfaces are available and ready to be used. We have already taken a lot of the steps that other still need to take, so we can proceed with our projects more quickly and at a lower cost.

My goal is to continue testing methods and tools so we can stay ahead of the curve and keep making our own work easier in the long run.

The interview was conducted on March 1st, 2022, at Konzerthaus Berlin.



Mozilla Hub screenshot from the Virtual Bauprobe for the orchestra setting in the „Freischütz“ production



The challenge is to eliminate the existing mental patterns and to free oneself from the Newtonian world view that dominates our everyday life.

INTERVIEW WITH NORBERT RICHTER, THEATRE CHEMNITZ

Norbert Richter has been head of the workshops at the Chemnitz Theatre since 2007. For many years, he and his team have been the „digital engine“ at the theatre and are contributing their know-how to the upcoming renovation of the theatre and the move to the interim venue in the Alte Spinnerei. In the digital.DTHG's Workshop „How to go Virtual“, he and his team tested different ways of utilising immersive technologies at

the theatre. Workshop leader Vincent Kaufmann talks to him about his experiences around virtual rehearsals and the digital transformation process at the theatre.

Where do you place your department and your house in terms of digital transformation? Where do you stand?

We have been going increasingly digital at the Chemnitz Theatre for several years now, especially when it comes to the preparation of paperwork and the production of stage sets. This concerns not only the preparation of the construction but also the documentation, so that we „chase“ almost 100% of our productions through the computer. We have even started to provide individual productions with digital construction instructions, which makes the actual craft activity more efficient, both in terms of fabrication and construction on stage.

What other advantages do you see in the digital way of working?

For us, this has a great advantage, especially in terms of work safety, for example when checking elements for collision. I really notice that things need less reworking and we avoid mistakes during production. Also, in dialogue with the artists, we can better sketch and discuss new solutions or variants in 3D.

Can you give us a brief insight into your staff and technical resources? How are you positioned in the digital field?

There are currently three of us working in the team and we have three fully-fledged computer workstations. Since about 2000 we have been using the MegaCAD software. Unfortunately, we have a monopoly with the computer workstations here in our workshops. That's not nice, because of course we have to maintain and change all the data in-house, which is a big time factor, but on the other hand our plans are informative and consistent. Theoretically, we could work completely in 3D, so that the other departments could also work with our files, but there is a lack of staff and additional technical equipment in the rest of the building. We here in the workshops know about the power and possibilities of the new technologies. But we also need the departments in the process behind it to follow our vision and idea.

You are already experienced in three-dimensional space with your productions. In the workshop „How to Go Virtual“, we worked out scenarios for a „Virtual Bauprobe“. How did you get on with it?

With the venues themselves, we've actually been mostly in 2D drawings so far. We are currently in the process of rebuilding and moving, planning the new premieres virtually and adapting the previous plays that will be moving with them. In the preparations with set designer Stephan Morgenstern for the production of „Peter Pan“, we want to put a lot of energy into the topic of Virtual Bauprobe. For us it's not so important to get the atmosphere, but: „This is how it looks. This is how it's made. This is how it's built.“ That is the main focus, especially in the area of the Virtual Bauprobe. Thanks to the Virtual Bauprobe, I can now present changes that are necessary for our change of venues, at least virtually in a 3D model, without the venue being ready for occupation; we can have the actual discussion on site at the virtual object. Of course, this is much more elegant with the three-dimensionally available audience and stage space than with technical drawings. This currently saves us a lot of time and allows us to start the new season more quickly and hopefully more easily.

So apart from the Virtual Bauprobe, you are already looking one step further in the direction of production and manufacturing?

Exactly. For three years we have been working with 3D scanners to scan models and then digitally „saw them apart“. We did this, for example, with a 13-metre deer on stage, which we broke up into many frames. For this we scanned a small model, scaled it in the software and cut it apart in CAD to provide the corresponding plans. And that worked well. That's when I saw what else is conceivable. Fortunately, from time to time we are faced with tasks that require us to think in new ways and try out unconventional approaches.

Do you see other application scenarios in the course of a theatre production?

Yes, the other day during a virtual tour of our outdoor venue, I made the connection to the safety briefing. Especially with the outdoor venue, it makes meetings easier. And here you can integrate the virtual rehearsal again: the stage set can also be built up and shear edges and danger spots are marked.

What are our responsibilities as theatre-makers and what are the challenges?

I don't think you can pinpoint the responsibility exactly. I see it as an attractive topic that has jumped onto our agenda over time because the inhibition thresholds have become pleasantly low. The real challenge is to fade out the existing structures in our heads and to free ourselves from the Newtonian view of the world that determines our everyday life. Of course, it becomes exciting when I no longer have any limitations, because the limitation is only my own imagination. That is where I think we are challenged the most. Theatre should be very open to learning from the gaming industry, to participate in digital experiments and to dare to take a step into these virtual worlds.



Scenographers in the „How to Go Virtual“ workshop at the Chemnitz Theatre Chemnitz are exploring the design possibilities of the Gravity Sketch software.

WHAT HAPPENS NEXT?

The results, workflows and methods are now available to the theatre landscape via the digital.DTHG website as guides and tutorials. In addition, a comprehensive compendium of „knowledge articles“, glossaries, programme comparisons has been created like a kind of WIKI. The blog articles are already linked to other knowledge platforms such as Nachtkritik.plus and thus reach a large audience.

The knowledge transfer, which was already achieved during the project period in the form of lectures at many congresses and symposia, is currently being carried on within the framework of the newly created „Bildungsbühne“ of the DTHG. Free online impulse lectures and the further development of the workshop series have already been practised by Vincent Kaufmann and the DTHG team for several months.

The workflows developed are largely based on applications that we have adapted for our scenarios, but which were actually designed and developed for other purposes and areas of application. The discussions we have had with software companies such as ShapesXR (Tvor VR) or Vektorworks in this regard give us hope that tools will be developed for the specific needs of the theatre and event industry and application scenarios such as the Virtual Bauprobe.

IMPRINT

PROJECT TEAM DIGITAL.DTHG

Project lead: Franziska Ritter, Pablo Dornhege

Concept: Franziska Ritter, Pablo Dornhege, Vincent Kaufmann

Workshop Lead: Vincent Kaufmann,

Franziska Ritter

Workflow-Development: Vincent Kaufmann, Pablo Dornhege

TOOLS

VR Sketch, Gravity Sketch, Sketchbox, Sketchfab

Tools without Sketch in the name:

Microsoft Maquette, Tvor, Tiltbrush, Mozilla Hubs, SimLab, Spatial.io

Miro, Vincent's Car, Mobile VR sets in rolling cases

PROJECT WEBSITE

<https://digital.dthg.de/en/projects/virtual-stage-rehearsal>







Insights and outlooks

REFLECTIONS AT THE END OF THE RESEARCH PROJECT
BY FRANZISKA RITTER AND PABLO DORNHEGE

In the research project „Im/material Theatre Spaces“ and in this publication, the digital.DTHG team has shown what potential can be unfolded through the use of immersive technologies at the borders of analogue and digital theatre worlds: Whether as a tool for creative processes, as a knowledge space or as a place and medium for new theatrical forms of play - the possibilities are enormously multifaceted. After two intensive research years, the project leaders Franziska Ritter and Pablo Dornhege take a look behind the scenes, draw a summary and glimpse into the future. In doing so, they are asking themselves the same questions that they have posed to their partners in the current project.

In the past two years you have developed 17 prototypes in 9 different sub-projects. That is quite ambitious! How did you go about it?

The first task in autumn 2019 was to quickly find a team and setup a base, to find the right cooperation partners and define the contents in a series of kick-off workshops. And this was exactly the strength of

our project: the topics were outlined quite openly in the funding application and at the same time were specific enough. Giving us enough leeway to develop relevant questions with our partners and to be able to tackle urgent challenges. In the course of the project, we repeatedly adapted the objectives to the current circumstances and readjusted our approach accordingly. This may sound unstable at first, but it has led us resiliently through the pandemic turmoil. And above all, it made us flexible enough to adapt the project to the rapidly advancing technological developments. In the process, we looked at how we could pool our resources and energies and create synergies between the sub-projects.

Can you give us an insight into your daily work and your approach?

Similar to the development of a theatre play, there has almost never been a steady „nine-to-five working day“. The general conditions were too dynamic for that. The good thing was that we were able to react to this

with our very interdisciplinary team. We combined the different ways of working of the various disciplines; we developed new workflows and were able to adapt them again and again to the new circumstances. In this way, the strength of artistic improvisation was joined with technical and scientific precision. In other words, we have combined what we can learn from agile software development - „structured flexibility“ - with a pinch of theatrical magic, great curiosity and a perpetual love of experimentation. As a result, our project studio in Berlin was much less a classic office than a laboratory and incubator of ideas.

Research projects tend to miss the reality. From the beginning, your project aimed to generate usable and transferable results. How have you approached it?

In addition to the already mentioned kick-off workshops to define the specific sub-projects, we undertook a series of excursions with the digital.DTHG team into the various working environments. For example to stage workshops, theatre collections, training centres for event technicians - or right into the middle of the audience during premiere fever. Practical relevance is an important aspect of our project: like in the try-out sessions that we realised on site with the participants of the cooperating theatres, often very early on in the development process. Here and in the discussions with external consultants, an important learning and knowledge space was created for all participants: the constant dialogue between laboratory and practice. It was important to focus on the development processes and not only on the results. In other words, to open up a space in which mistakes are allowed and even desired. In order to quickly achieve verifiable results, we adopted working methods from coding practice: We conceived ideas together in the creative plenum and then dived into an intensive design and coding tunnel. We evaluated the results with our cooperation partners in order to transfer the findings to the next creative plenary - and here the design sprint comes full circle, as part of an iterative development process.

Can you name which digital tools you have used in your interdisciplinary collaboration?

Our way of working was characterised by flat hierarchies and dynamic-flexible working methods. This was supported right from the start of the project by the use of collaborative software. At this point, a big thank you goes to Hubert Eckart, who is a great advocate of such ways of working and helped us to set up these structures. To give some examples: right from the start we used the messenger service Slack for internal team communication, the whiteboard tool Miro was used for creative sessions and idea generation (also with cooperation partners), we managed task management with the software Notion, there was a Synology network hard drive in our own cloud for data and document storage and Zoom for the now indispensable video conferences.

In addition to these - by now widely used - applications, we also meet in virtual Mozilla Hubs rooms and use Sketchbox VR for virtual spatial meetings. This diversity of digital tools and working environments requires everyone to be ready and open to new things at all times. On this acquired basis, the team was able to establish a decentralised way of working right at the beginning of the Corona pandemic, which still ensures a high output regardless of time and place.

What were the biggest challenges for you and your team in the project? And how did you deal with them?

Particularly challenging - but at the same time refreshing - was that all team members worked 50% part-time on this research project. Everyone had other projects on their plate, were involved in university teaching or artistic projects. This was sometimes difficult to coordinate, but in return it created fireworks of new impulses every Monday morning. We completed three quarters of the entire project duration under pandemic conditions. This was no easy task, because it was precisely at the beginning of the pandemic that our first collaborations were to start and on-site workshops

were to take place. For understandable reasons could some cooperation partners not participate as planned, so we worked all the more intensively with others.

There were also challenges on a technical level: As expected, the continuous and rapidly advancing development of the AR and VR technologies has had an impact on the course of the project - the technical possibilities of hardware and software solutions are constantly changing. For example, the publication of the WebXR convention in summer 2020 enabled hardware-independent and thus more inclusive access to AR and VR content. We therefore took the liberty of constantly comparing and adjusting the targets of the sub-projects with the current situation and the technical feasibility.

Speaking of the current situation - what theatre reality did you encounter? What role does digitality play? Where does the theatre landscape stand?

That is not so easy to answer, because there is no comprehensive study of the status quo in terms of digitality in the German theatre landscape. We are therefore often dealing with perceived truths. However, the pandemic has made it more than clear how acute the topic of digitality and digital transformation is in the cultural sector and how much work still lies ahead of us. And this does not only mean the theatres themselves, but the theatre industry, the independent scene, and also the educational institutions.

In our daily work, we were sometimes shocked by the technical and personnel state of many theatres and venues: insufficient internet access, lack of computer workstations, little existing knowledge in the use of digital tools and working methods. In addition, strong hierarchies and strictly separated areas of competence result in very costly work processes and time-consuming coordination. And this can also lead to a rejection of new digital tools. „Never change a running system“ is not a good guiding principle for innovation.



But at the same time we also encountered great curiosity and thirst for knowledge. Many committed theatre people recognised the potential and enthusiastically passed on the impulses and new knowledge about immersive technologies to their colleagues. On the one hand, (digital) transformation is of course a „matter for the boss“, but revolution „from below“ is also possible and above all necessary for sustainable change - at least in our experience. So we appeal to the responsibility of each individual to drive modernisation and digitalisation forward and to demand sustainability. In our collaborations, we have experienced how fruitful it can be when theatre managers give their staff the freedom to explore possibilities and to try things out. Following the German proverb „Detours increase local knowledge“.

This is exactly why our research project „Im/material Theatre Spaces“ is extremely valuable. Above all, to close the gap between those who are just starting to put out their feelers and the digital pioneers who romp around in the virtual theatre space every day or have even already built up their own digital section at the theatre.

Why is it so important for theatre people to get involved in the digital world? And what advice would you give to those who want to go down this path?

Theatres have always been laboratories: for experiments, for the creation of the immaterial; they are places where the impossible becomes possible. Theatre-makers from all fields should definitely contribute with their specific creative, dramaturgical and technical skills and dare to conduct their own or joint artistic experiments. All that is needed for the first attempts is a little courage. And the right help for questions and the right accomplices for projects: with the founding of the digital.DTHG competence area, the knowledge generated in the project and the newly established connections, we have made a contribution that will hopefully continue to have an effect.

At the DTHG there is a dedicated cluster focusing on further education offers, in other associations there are working groups, on our digital.dthg.de website there is a WIKI. Together with Nachtkritik and the Academy for Theatre and Digitality, we have launched the nachtkritik.plus platform as a space for knowledge exchange and discourse. There, interested parties will find diverse suggestions and support for their own experiments.

What would be needed for the (digital) theatre of the future? What do you think needs to change?

Theatre has set out on its journey and has clearly experienced a „booster“ through the pandemic - it is now important that we continue to retain this curiosity and trial and error mode and do not fall back into old ruts. The playful and creative momentum is one of the intrinsic qualities of theatre. Of course, this requires an understanding at the political level for the early creation of the necessary conditions and openness and patience at the theatres.

This also applies to the users and the audience; in this new territory, things don't always work the first time. For the development of digital possibility spaces, access to technology must be made easier for everyone, but especially for the independent scene. This can be solved through open rapid prototyping workshops or the shared use of VR equipment such as laptops, software by local theatres and regional technology hubs.

To advance the technological development of the theatre landscape, the associations, the theatres, the industry and the universities should cooperate more and develop joint strategies instead of closed isolated solutions. Here we can learn from the communities and networks in game design and XR development: the actors help each other and share their knowledge in a surprisingly open way. In the same way, theatre makers should share their digital experiments, their failures, insights and successes.



Project team



HUBERT ECKART

Managing director of DTHG / project management

Hubert Eckart is the managing director of the Deutsche theatertechnische Gesellschaft since 2008. He studied theatre studies and worked as a dramaturge, artistic director, opera director and general manager at various theatres. In 2000 he founded the production company ABACUSFilm and produced short films, documentaries, audio books and more. He also works as a journalist and publicist.



FRANZISKA RITTER

Artistic and scientific project lead

Franziska Ritter is a scenographer, musician and theatre researcher. She studied architecture at the TU Berlin (Dipl.-Ing.) and film and photography at the University of North London. She is co-founder and assistant professor of the Master's programme Stage Design_Scenic Space at the TU Berlin and is currently doing her doctorate at the department of Art History in the DFG project „Theaterbauwissen“ on the TU Berlin's theatre architecture collection. She teaches and researches scenography, theatre architecture and technology at various international universities. Since 2019, she is the DTHG's Commissioner for Digitality and New Technologies.



PABLO DORNHEGE

Artistic and scientific project lead

Pablo Dornhege researches, develops and designs real and virtual narrative spaces. He was a visiting professor at the Berlin University of the Arts and has taught and researched at other international universities. These include Central Saint Martin College London, New York University Abu Dhabi, and the Institute for Advanced Architecture Barcelona. He is currently an editor for the knowledge platform Nachtkritik+ and will be leading the Future Realities Lab at the Berlin University of Applied Sciences as a professor of Transmedia Design from fall 2022. Since 2019, he is the DTHG's Commissioner for Digitality and New Technologies.



LEA SCHORLING

Concept / Development 3D

studied Computer Science at the TU Berlin and worked on media exhibitions and research projects at ART+COM Studios. Since graduating in 2019, she has been working as a freelance developer in areas ranging from extended reality to machine learning, including for Invisible Room and digital. DTHG. She teaches on the topic of VR at the Filmhochschule Köln and the Berlin University of Applied Sciences.



SASCHA SIGL

Concept / Development 3D

is the developer, co-founder and managing director of Invisible Room GmbH & Co. KG, which specialises in the production of extended reality (XR) applications. In addition to projects from the productivity and culture sectors, Sascha Sigl has worked as a lecturer at HTW Berlin and University of Applied Science. Before founding the company, he worked in the field of frontend development. His current area of expertise is 3D modelling, 3D on the web and Unity development.



MARIA BÜRGER

Project Assistance: Concept / Graphics / Marketing

studied communication design at HTW Berlin. Before that, she came into contact with theatre through a voluntary social year at the Mainfranken Theater Würzburg and managed the theatre association Projekt Inklud from 2017 to 2018. Since January 2020 she is responsible for the design of digital.DTHG and since October 2020 she has been leading the design- and communication team of DTHG.



VINCENT KAUFMANN

Project assistance: Theatre technology, VR

studied theatre technology at the Beuth University of Applied Sciences Berlin and came into contact with theatre as an actor at the age of 12. In 2019, he completed an internship semester in technical management at the Burgtheater Wien and has since worked as a lighting designer and technical director in several productions. Since 2021, he has been working as a technical advisor for digitalisation in the DTHG and has managed the virtual production planning of „Pandaemonium“ at the Staatstheater Kassel and of „Freischütz“ at the Konzerthaus Berlin, among others.

Former staff members: Rebecca Eisele, Magdalena Dimanski

Glossary

VIRTUAL, AUGMENTED, IMMERSIVE AND ALL IN ON THE FASHION WORD BINGO

In order to navigate safely through the world of immersive technologies, it is also necessary to understand the used terminology. In the spirit of developing a common language, we explain the most important concepts and terms. More detailed information can be found in a series of articles with basic knowledge on the topic of digitality in theatre on the project website <https://digital.dthg.de> and on the new knowledge platform at <https://nachtkritik.plus> (german)

VIRTUAL REALITY (VR)

Virtual reality describes the fully immersive simulation of physical space, i.e. the complete immersion in a virtual environment. Due to constant technological development, future virtual realities may no longer be distinguishable from the real world. Examples of VR are interactive experiences in which users can immerse themselves with virtual reality glasses.

VIRTUAL REALITY GLASSES (VR HEADSETS)

Thanks to their two eyes, people can see spatially: The viewing angles of the two eyes differ slightly and our brains superimpose the different image information in such a way that a three-dimensional image is created. This principle of „double-eyed vision“ is used by VR glasses: they consist of two screens and lenses that align the digital image slightly differently for each eye. The eyes then perceive the images as if they were reality and a virtual space is created in the brain. In addition, the virtual reality headset tracks the head movements of the person wearing it and thus calculates the viewing direction in the virtual space. This gives VR users the impression that they can move freely in the simulated world. A wide variety of input devices such as controllers, data gloves or treadmills enable movement in and interaction with the simulated environment.



AUGMENTED REALITY (AR)

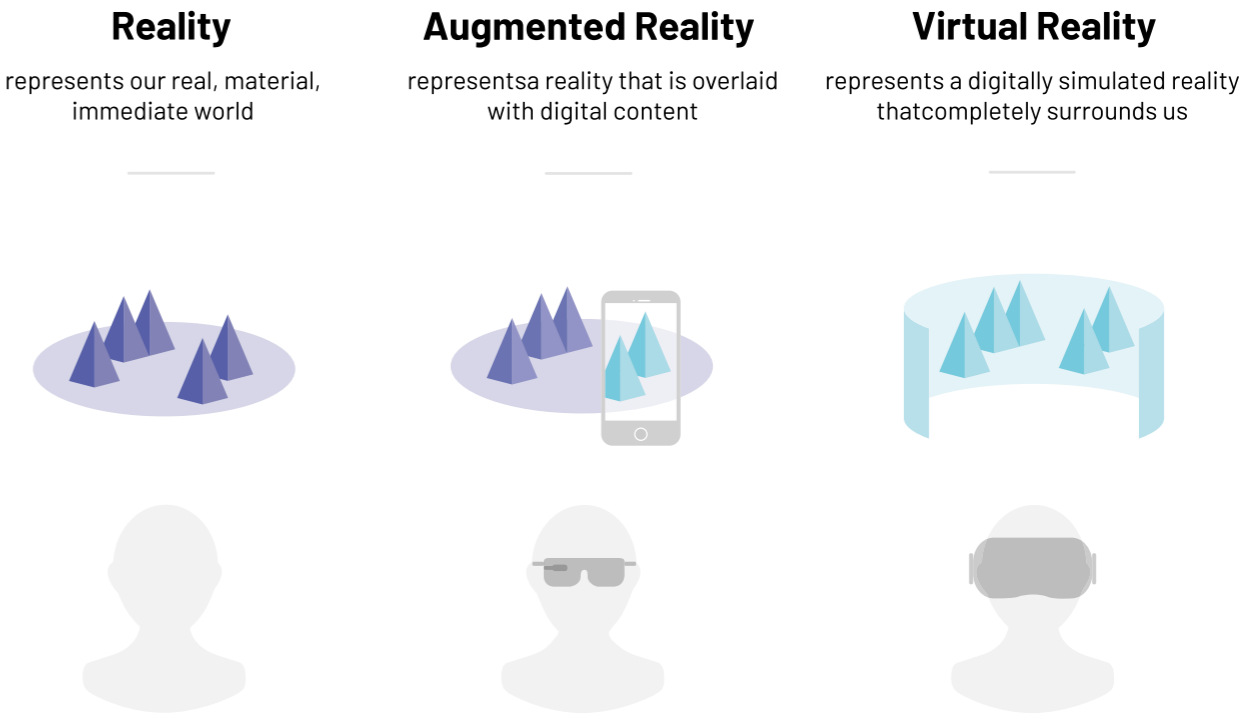
Unlike virtual reality, augmented reality „only“ enriches physical reality with digital content. One way to to that is using smartphones: the phones camera captures images of the „real world“, then digital objects are added on the phones screen. Another way is using data glasses and AR headsets in which reality remains visible through transparent glasses and is overlaid with digital image content. One example of AR applications is in museums, where visitors can capture a painting on the wall using a smartphone or tablet camera and the representation on their device is supplemented by new digital layers, such as early sketches of the work or X-ray images.

IMMERSION

In the context of VR, the term immersion describes the dive into an artificial, digital environment. The degree of immersion is strongly determined by the quality of the experience and the willingness of the recipient to accept the artificiality of the virtual worlds as natural (see also suspense of disbelief). The higher the degree of immersion, the stronger the presence of the user in the virtual experience: the perception of one's own existence shifts from the physical environment to the simulated environment.

The process of immersion and the state of presence in an artificial world are the main characteristics of virtual reality and the basis of its special potential. In game design, four different forms of immersion are distinguished: spatial, emotional, cognitive and sensory-motoric immersion.

Spatial immersion arises from the visual quality of the experience and determines the recipient's willingness to accept the artificiality of the virtual world as natural. Emotional immersion becomes possible when a narrative content leads to emotional interest in the events and thus to absorption by the story - it is thus similar to the effect of an exciting read or a gripping play. Cognitive immersion is based on concentrated abstract and creative thinking and is usually achieved by solving complex or creative tasks. Sensory-motoric immersion is the result of feedback loops between the physical actions of the user and their impact on the (game) experience, whereby the perception of one's own physical existence can shift from the physical environment to the simulated environment.



EXTENDED REALITIES (XR)

Extended Reality (XR) is an umbrella term for the entire spectrum of virtuality. According to the virtuality continuum introduced by Paul Milgram, this ranges from completely real to completely virtual. This is why XR includes not only virtual and augmented reality but also mixed forms such as augmented virtuality: the extension of a VR production by physical objects and props.

Some of the solutions and prototypes, which were created during the course of the project, include the innovative WebXR interface. This makes it possible to develop web-based applications to display three-dimensional content on a range of different AR and VR end devices. We used this new (and not yet full functional) standard, because it allows for manufacturer- and device-independent and thus transferable software developments.

WEBXR

The WebXR interface makes it possible to develop web-based applications to display three-dimensional content „device-independently“ - i.e. on VR glasses as well as on AR-compatible devices.

The relatively young standard is currently being developed by a consortium of Google, Microsoft, Mozilla and other XR industry giants. The goal of the standard, which was jointly developed by hardware and software manufacturers, is to recognise existing VR and AR devices and their technical specifications independently of specific products and to display 3D content accordingly. Integration in modern browsers makes access to corresponding 3D apps easy: no special software needs to be installed - one click is enough to start them.

The biggest advantage this offers is the resulting reach while at the same time reducing the programming effort: Instead of using an application or app to

access only one type of device or even only one specific product, a WebXR website can be used, for example, on the screen (with navigation via mouse and / or keyboard), a smartphone in AR mode or through high-end VR glasses. Because of these advantages, many experts see WebXR as a key element of future immersive technologies.

But the use of such a universal interface also comes with some disadvantages: Where game engines normally simplify the development of AR and VR applications, for WebXR most things must (still) be programmed „by hand“. At the same time, the desired high compatibility with a wide range of devices and different display performances means that compromises have to be made in terms of visual quality and complexity.

GAME-ENGINES

In addition to their function as the underlying mechanism of modern computer games, game engines are also the development environment in which applications are programmed and assembled: They are tools for processing different types of control inputs (for example, through VR controllers), 3D data (architectures and objects) and media (sound and video), and are used for playout to different end devices (VR glasses, tablets, game consoles). And this is precisely why they are also suitable for the production of interactive, transmedial, virtual or augmented art, media and theatre productions. Game engines are both a development environment and a universal interface between media, formats and technologies.

While professional game engines were originally reserved for large, financially strong game developers, there are now also numerous offers for beginners. The mostly free game engines are in no way inferior to the extremely high-priced proprietary systems. The best-known and most widespread

representatives of the free game engines are Unreal Engine and Unity 3D. There are many entry-level tutorials for both and both are fully suitable for the development of VR and AR applications. Whereas the main focus of Unreal Engine is on a very high visual quality, Unity 3D scores above all with its high flexibility in terms of programming and interfaces.

MOTION SICKNESS

So-called VR nausea or motion sickness is currently probably one of the biggest barriers to the spread of virtual reality. In terms of cause and effect, it is similar to seasickness and motion sickness: if there is a discrepancy between one's own physical movement

and the movement of our environment, then the eyes and equilibrium organ send non-congruent information and our brain is irritated. The consequences are dizziness, headaches, loss of balance, nausea and even vomiting. VR nausea is, so to speak, a „reverse seasickness“: a movement is simulated to the brain in virtual reality (for example, climbing stairs, flying, riding a roller coaster), while the body does not perform or experience this in the real world.

VR nausea occurs to different degrees in different people. To get the body and brain used to it, sensitivity to motion sickness can be trained. VR beginners in particular should not overdo it at the beginning and only spend a short time in virtual worlds. In the case of acute dizziness, it is often sufficient to close your eyes for a moment until your body calms down. If this does not help in the short term: take off the VR glasses, breathe fresh air, drink some water and take a break.



Transferability and sustainable usage of results

The solutions developed within the framework of the research project serve as sustainable and transferable concepts due to their prototypical model character. The insights gained and model solutions developed were published on various channels and are thus made available to the entire cultural landscape for free and flexible re-use.

LICENCES

To this end, all software developments created in the research project appear under an open source licence (GNU GPL, MIT License, etc.). If partial components subject to licensing (plug-ins, copyrighted image and sound documents, etc.) were used in the overall work, we make the newly developed code components available as open source without the components subject to licensing. In the code documentation, we refer to the subcomponents that are subject to licensing.

OPEN SOURCE CODES

The Main platform for publishing source code is Github: <https://github.com/digitaldthg>
A few of the projects are hosted on the DTHG web server due to very high data volumes. An overview of all published project data, source codes and playouts can be found at: <https://digital.dthg.de/en/results>

FIRST RE-USES

The possibilities for re-use and further development are already being used by various actors. These include: Bildungsbühne and workshops of the DTHG Service GmbH, knowledge platform nachtkritik.plus, Erasmus plus CANON project, project „Spielräume“ of the Berliner Ensemble and the Komische Oper Berlin, Technical University Berlin Department of Art History, project on the virtualisation of historical theatres at the Royal Institute for Theatre, Cinema & Sound Brussels, project Interactive Teaching in Virtual MINT Labs at the Berliner Hochschule für Technik.



FOUNDATION OF DIGITAL.DTHG

In 2019, we took the start of the research project as an opportunity to establish digital.DTHG as a competence centre for digitality and new technologies in the DTHG association. As commissioners and extended board members for this area of competence, Franziska Ritter and Pablo Dornhege will ensure a sustainable anchoring and representation of interests. digital.DTHG sees itself as a contact, discussion forum and communication platform – not only for members of the DTHG, but for the entire theatre and cultural landscape. In this way, the knowledge gained is sustainably secured for the future and passed on.

FURTHER TRAINING OPPORTUNITIES BY DTHG

The gained knowledge and workflows developed in the project is used by DTHG to offer a wide range of further training in the field of theatre and technology. This includes impulse lectures, seminars, workshops and expert consultations: <https://dthgservice.eu/en/>

Thanks

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Franziska Ritter and Pablo Dornhege



THEATRE PARTNER



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IMPRINT

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 Die Beauftragte der Bundesregierung
für Kultur und Medien

