

**HCU**

**HafenCity University  
Hamburg**



**HAMBURG'S NEW UNIVERSITY**  
Europe's first University for the Built Environment

**Thomas P. Kersten**

**Virtual Monuments and Virtual Museums in a  
Game Engine – An Immersive Experience  
using the VR System HTC Vive**

# Outline of Presentation

- Introduction
- Project Workflow
- Game Engines & VR System
- VR Implementations
- CH Monuments & Virtual Museums
- Conclusions & Outlook



# 1. Introduction

- Virtual reality (VR) will change our future life – for everyone & everywhere in the world



# 1. Introduction

- Virtual reality (VR) – technology change for gamer conferences





# 1. Introduction

- Visit new worlds with VR you could not image before





# 1. Introduction

- Time travel – Visit the past with VR



**Gigant des Nordens**  
Hamburgs Aufstieg zum Welthafen

Donnerstag, 29.09.2016 um 20.15 Uhr im NDR Fernsehen

Erzählt von Nina Petri

REGIE UWE KERKEN | DOKUMENTARISTEN CRISTINA TREBBI | PRODUZENTEN EVA FREILING UND JOCKEY HARTENBUCK | REDAKTION JUTTA KRÄMER  
 DARSTELLER OLAF MARKMANN UND THOMAS BRESENKY | MUSIK MARCO MINNWE GEN | DREHBUCH DIETRICH WILHELM | YVONNE DIFPERMANN  
 PRODUKTION FABER COURTIAL | ANTIKONSERVATORIE EIKE WYCHMANN UND PETER BARBER | FOTOGRAFIE RITSCHE JAKOBICH | TRANSPORTMANUELE MANUEL MICHONER  
 MONTAGE VALENTIN FINKE | ANSCHAUUNGSMATERIALIEN MANUELA RÜSCH | VERLEIH SVENJA WOLTER (GRUPPE 5) UND JOST NOELING (NDR)  
 HERAUSGEBER STEFAN SCHNEIDER | REDAKTION DIETK NEUHOFER | MONTEUR SCHÄFER, BARMEN WILGEN

MIT PHILIPPE GOOS, HENNING HARTMANN, MATTHIAS MAX HERMANN, BENJAMIN KRÜGER, VOLKER MÜTHMANN, TOM SEMMLER, MARTIN WINCKELMANN

EINE PRODUKTION DER GRUPPE 5 FILMPRODUKTION, KÖLN  
 IM AUFTRAG DES NDR IN ZUSAMMENARBEIT MIT ARTE  
 GEFÖRDERT MIT MITTELN DER NORDMEER- , FILM- UND MEDIENFONDS LEICHTAT NIEDERSACHSEN/BREMEN MBH

GRUPPE 5 | NDR | arte | nordmedia | faber courtial | pollog | polydamed

# 1. Introduction

- Existing & past cultural heritage monuments for Virtual Reality
- Projects of the Photogrammetry & Laser Scanning Lab
- Integration of VR in the Master study program Geomatics
- Basis – over 15 years experience in object recording & modelling
- Implementation in the game engine Unreal and Unity
- Immersive VR visualisation (walk- & fly-through) with VR systems



## 2. Project Workflow

- Model the world – replicate real or past environment for a VR visit

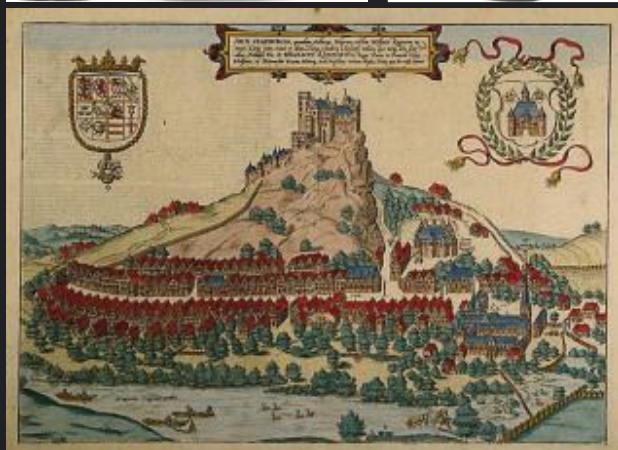
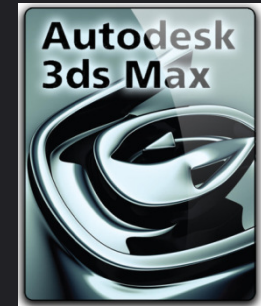
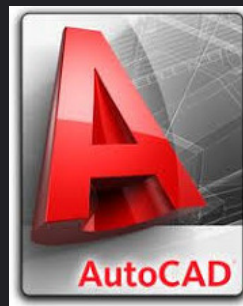
Data acquisition



3D Modelling



Texture Mapping





## 2. Project Workflow

- Model the world – replicate real or past environment for a VR visit

Implementation Game Engine

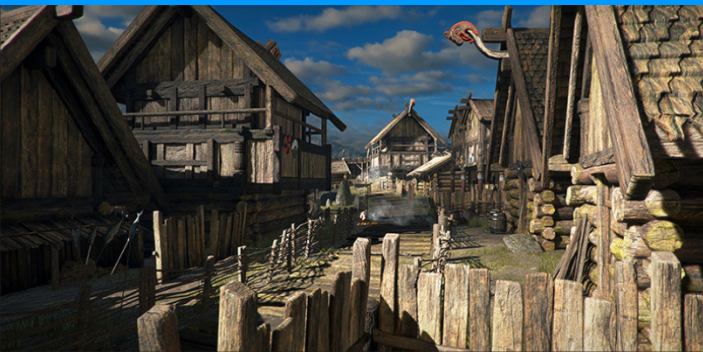


Visualisation in VR System



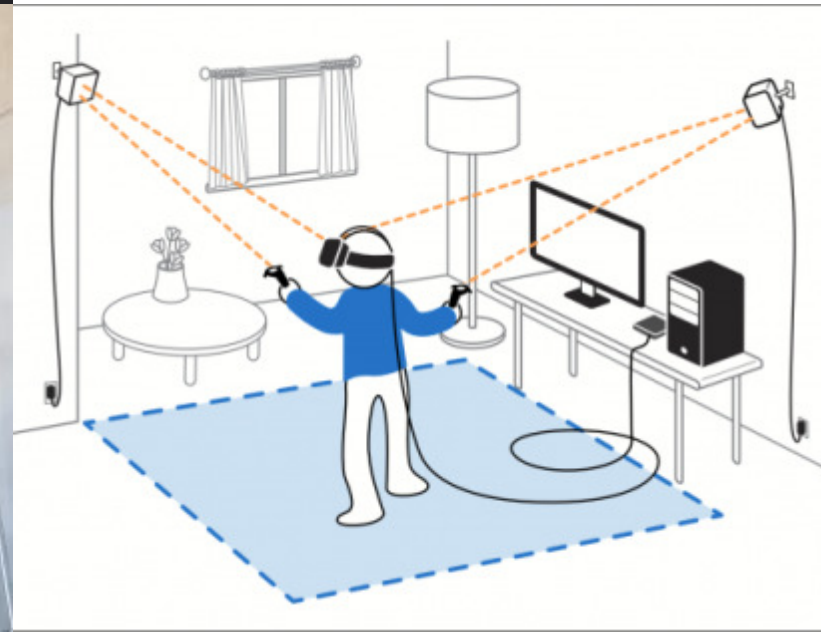
## 3. Game Engines & VR System

- Game engine = software framework for the creation & development of video games for consoles, mobile devices & personal computers
- Core functionality – rendering engine for 2D or 3D graphics, physics engine or collision detection (& collision response) for the interaction of objects, audio system, ....
- Game Engine Unreal from Epic Games ([www.epicgames.com](http://www.epicgames.com))
- Unreal Engine 4 – Free since 2015 for non-commercial use
- Visual programming language (so-called Blueprints)
- Unity – Free version (incl. source code) for Windows



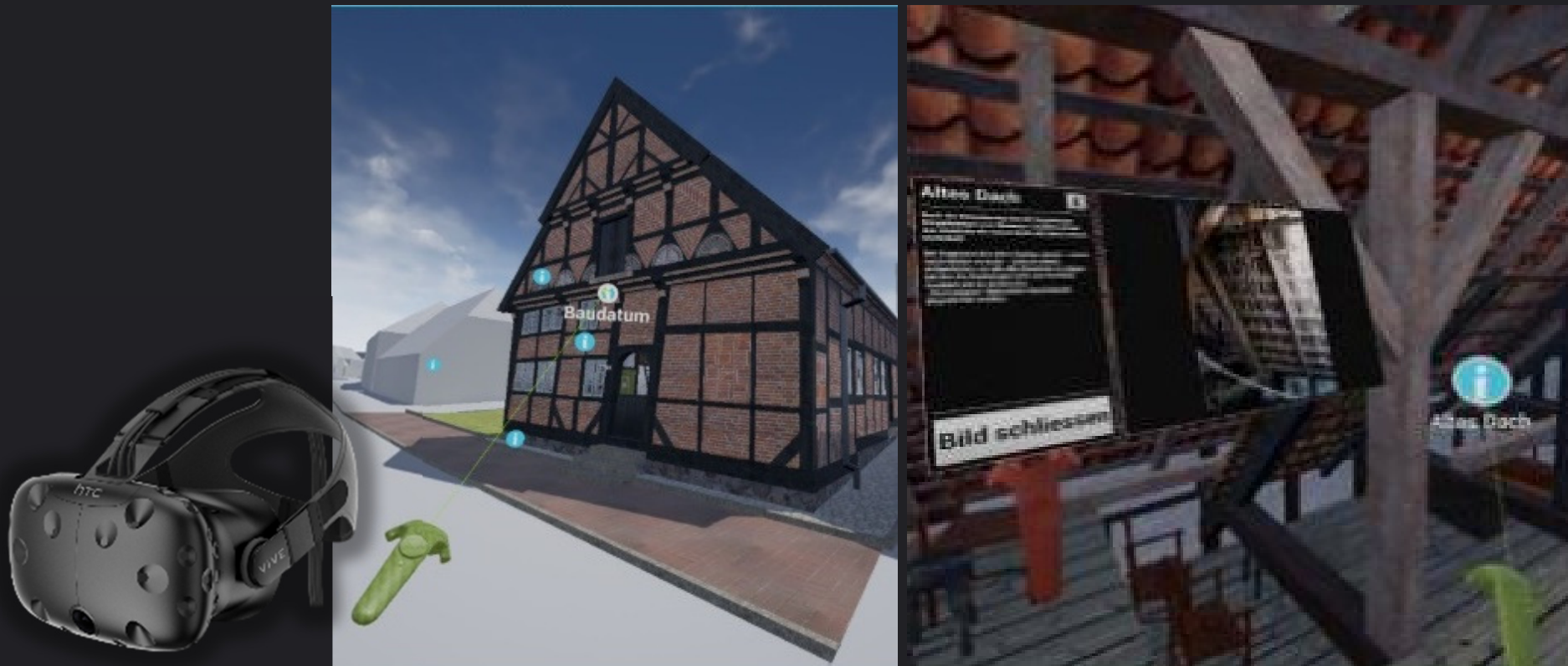
## 3. Game Engines & VR System

- VR System HTC Vive (April 2016)
- Free motion as walk-through
- Tracking of controller & glasses by pulsed IR laser at 4.6 by 4.6 m tracking space
- Interaction with VR environment using two wireless controllers



## 4. VR Implementations

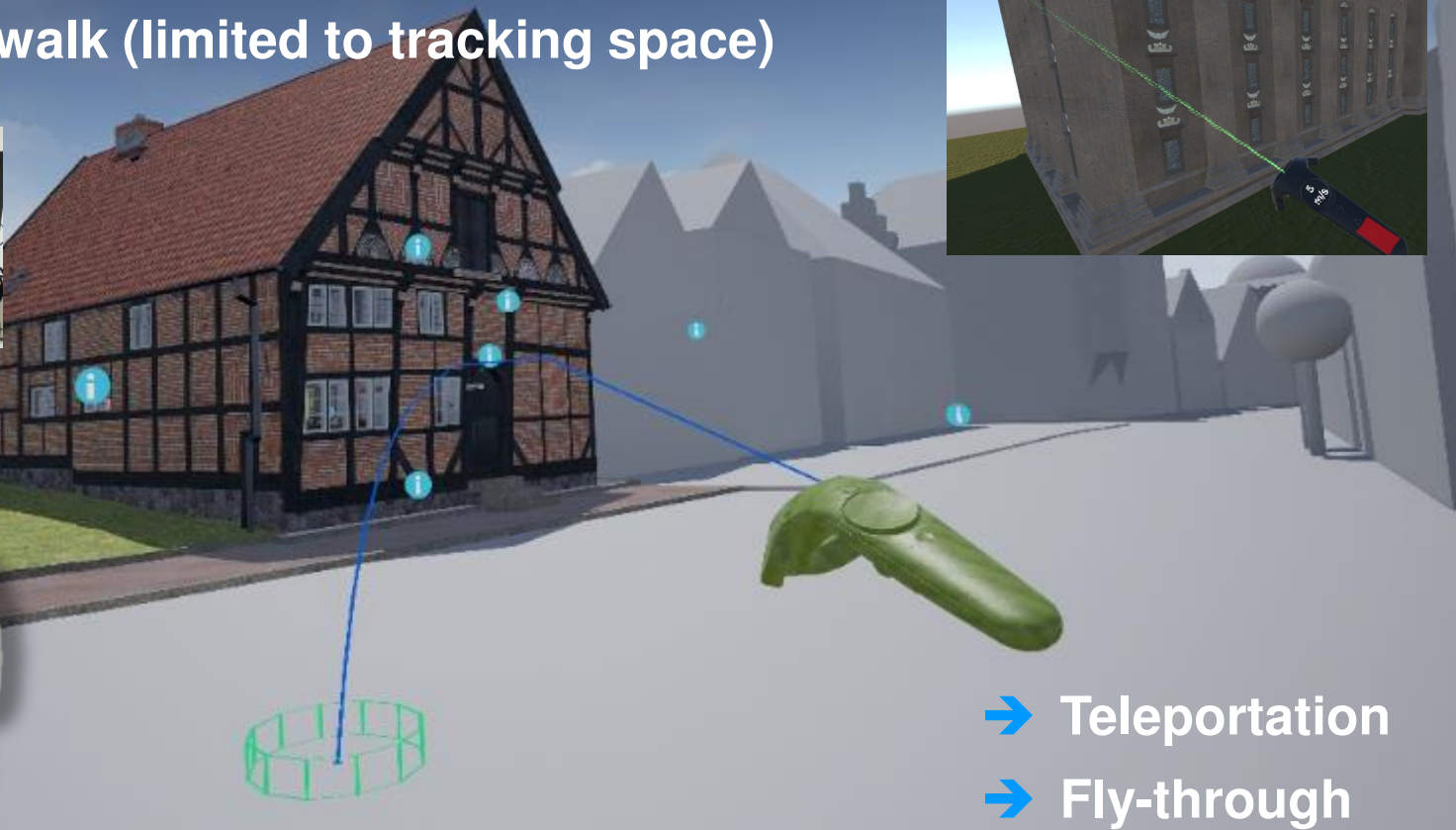
- VR system HTC Vive
- Menu navigation with green motion controller by "laser beam" (left) & second red controller for the information menu (right)
- 52 info menus with detailed information (text/photos) for the visitor



## 4. VR Implementations

- Navigation in VR (here: virtual museum Old-Segeberg town house) using the developed teleportation function for VR System HTC Vive

➔ Physical walk (limited to tracking space)



- ➔ Teleportation
- ➔ Fly-through

# 4. VR Implementations

- VR system HTC Vive
- Animations for visualisation of changes of six construction phases



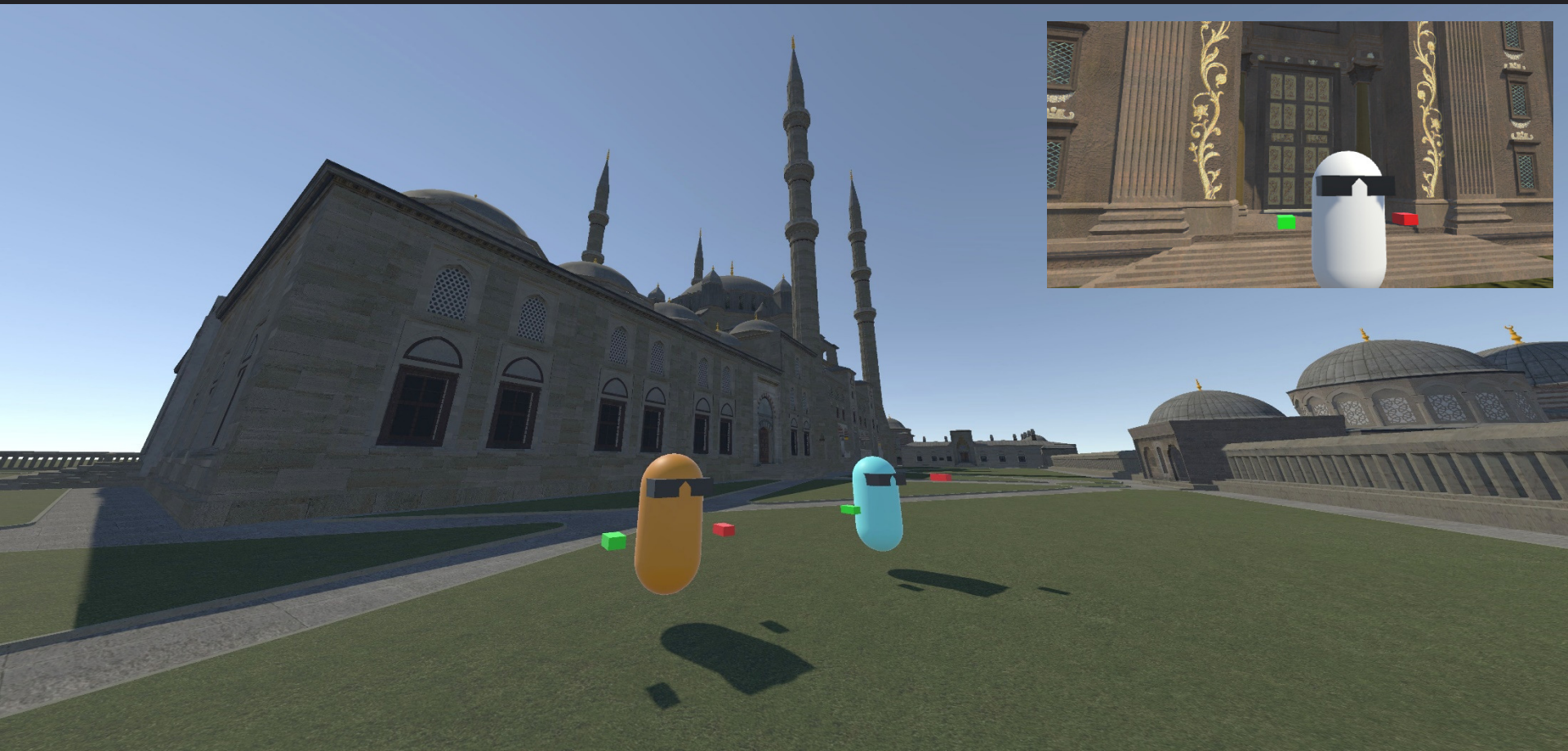
# 4. VR Implementations

## ■ VR system HTC Vive - Animations of non-existing objects in VR



## 4. VR Implementations

- Multi-user functionality of the Virtual Reality System HTC Vive
- Multi-users at different locations (e.g. Hamburg – Istanbul)







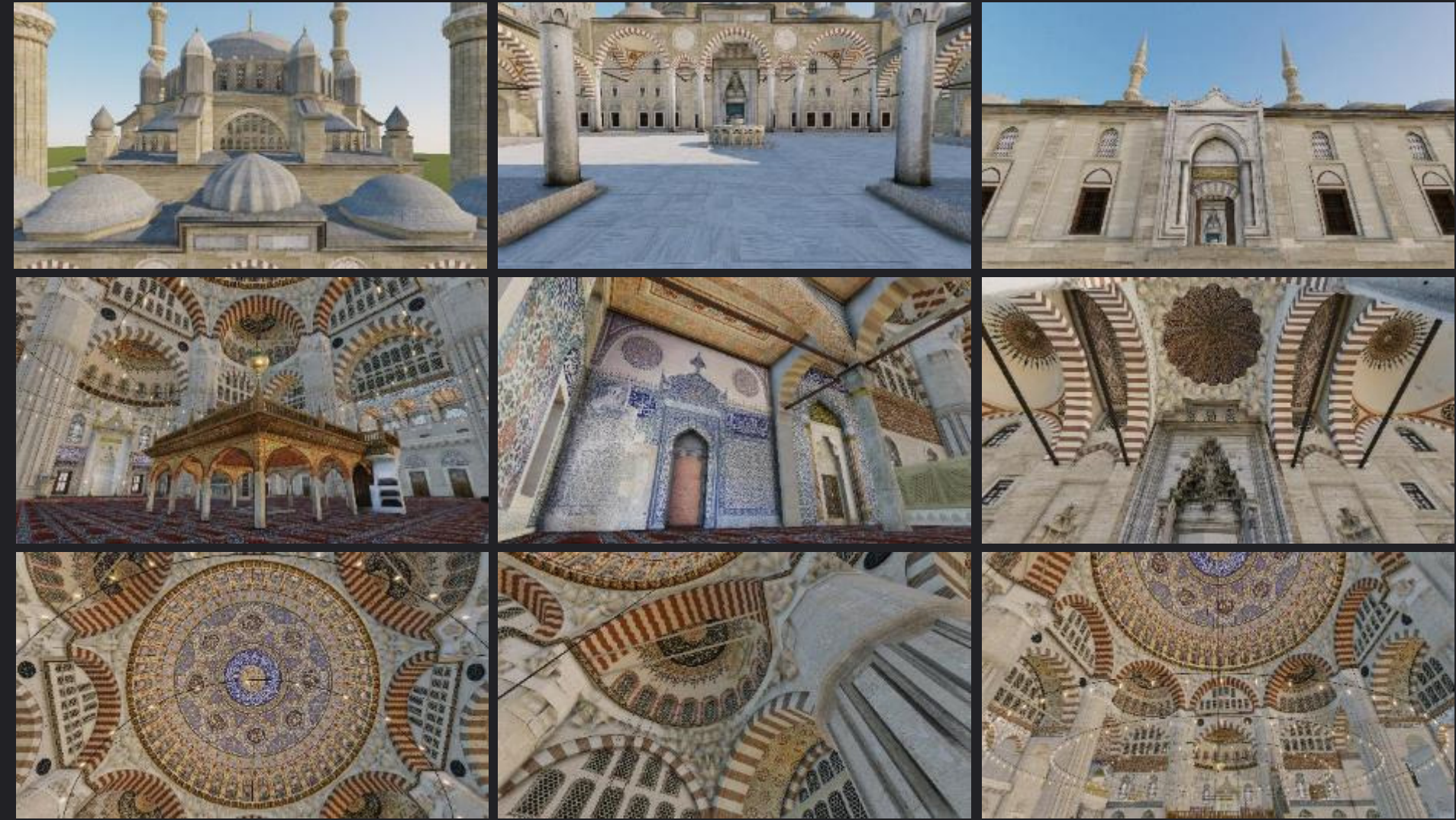
# 5. CH Monuments & Virtual Museums

HCU projects



# 5. CH Monuments & Virtual Museums

VR project Selimiye Mosque in Edirne, Turkey



# 5. CH Monuments & Virtual Museums

VR project Selimiye Mosque in Edirne, Turkey

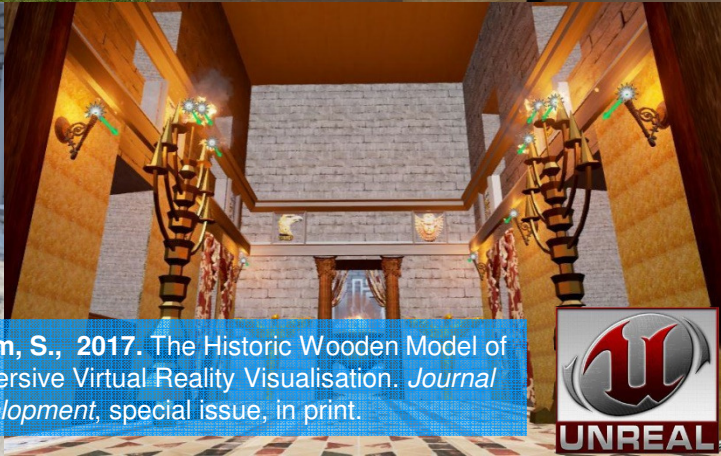


Kersten, Th., Büyüksalih, G., Tschirschwitz, F., Kan, T., Deggim, S., Kaya, Y., Baskaraca, A. P., 2017. The Selimiye Mosque of Edirne, Turkey - An Immersive and Interactive Virtual Reality Experience using HTC Vive. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XLII-5/W1, GEOMATICS & RESTORATION – Conservation of Cultural Heritage in the Digital Era, 22–24 May 2017, Florence, Italy, G. Tucci and V. Bonora (eds.), pp. 403-409.



# 5. CH Monuments & Virtual Museums

Two VR projects Solomon's temple



Kersten, T., Tschirschwitz, F., Lindstaedt, M., Deggim, S., 2017. The Historic Wooden Model of Solomon's Temple – 3D Recording, Modelling and Immersive Virtual Reality Visualisation. *Journal of Cultural Heritage Management and Sustainable Development*, special issue, in print.



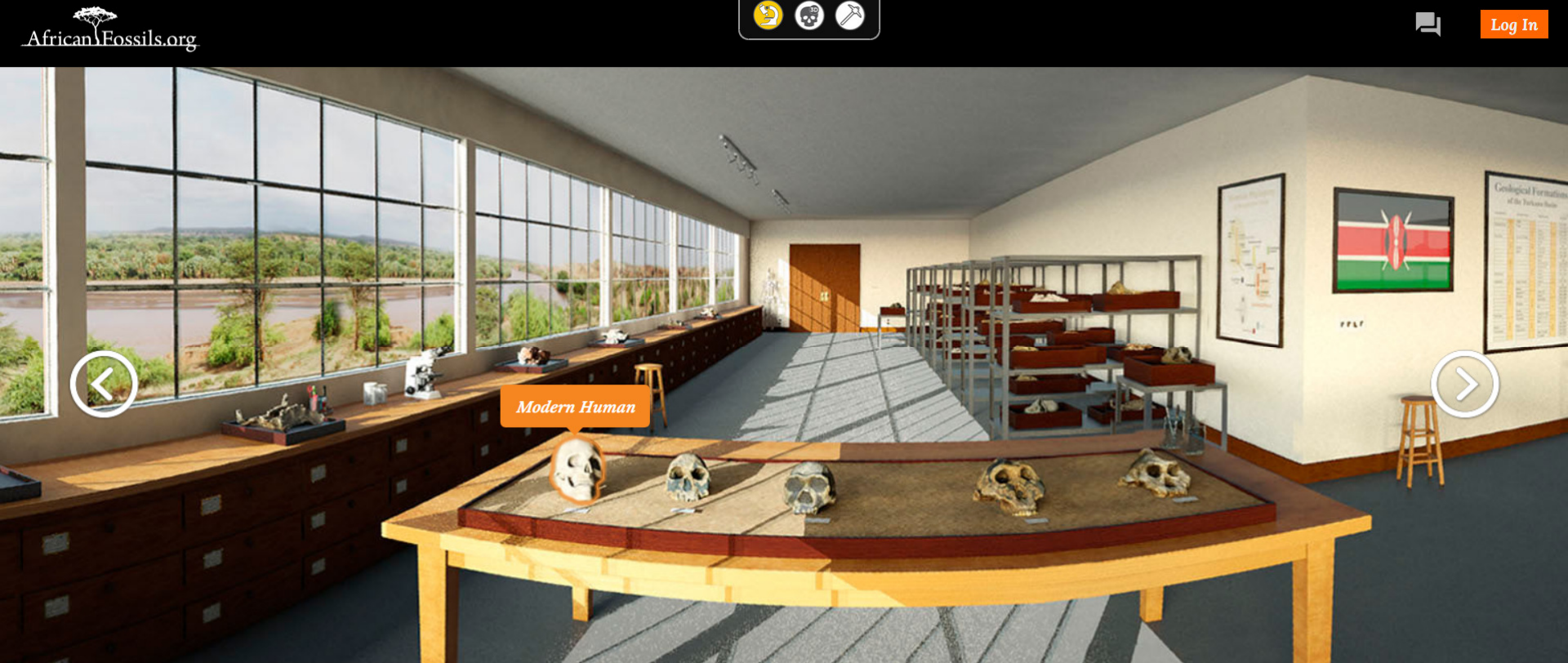


## 5. CH Monuments & Virtual Museums

### ■ What is a virtual museum?

*“There is no virtual museum. There is only a physical museum!”*

Head of the foundation of historic museums in Hamburg (2015)



## 5. CH Monuments & Virtual Museums

- **Virtual Museum Transnational Network (2011):**  
“a virtual museum is a digital entity that draws on the characteristics of a museum, in order to complement, enhance, or augment the museum experience through personalization, interactivity and richness of content. Virtual museums can perform as the digital footprint of a physical museum, or can act independently ...”.
- <http://www.v-must.net/>



v-must

Virtual Museum Transnational Network

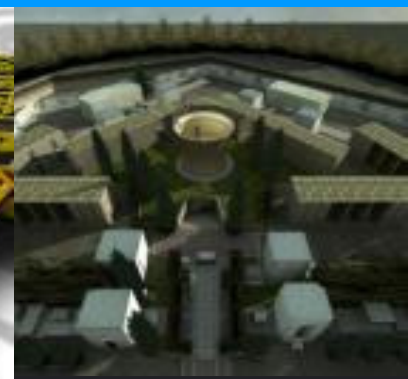
Virtual Museum of Iraq

The Virtual Egyptian Museum

VM of Daily Life

VM of BH Traditional Objects

Certosa Virtual Museum



# 5. CH Monuments & Virtual Museums

- **Our Definition:**  
Virtual representation of a real museum with additional geometric and semantic information
- **VR visit as**  
an immersive experience
- **Guided tour or free navigation**  
with interactions
- **Animations for the visual**  
description of processes



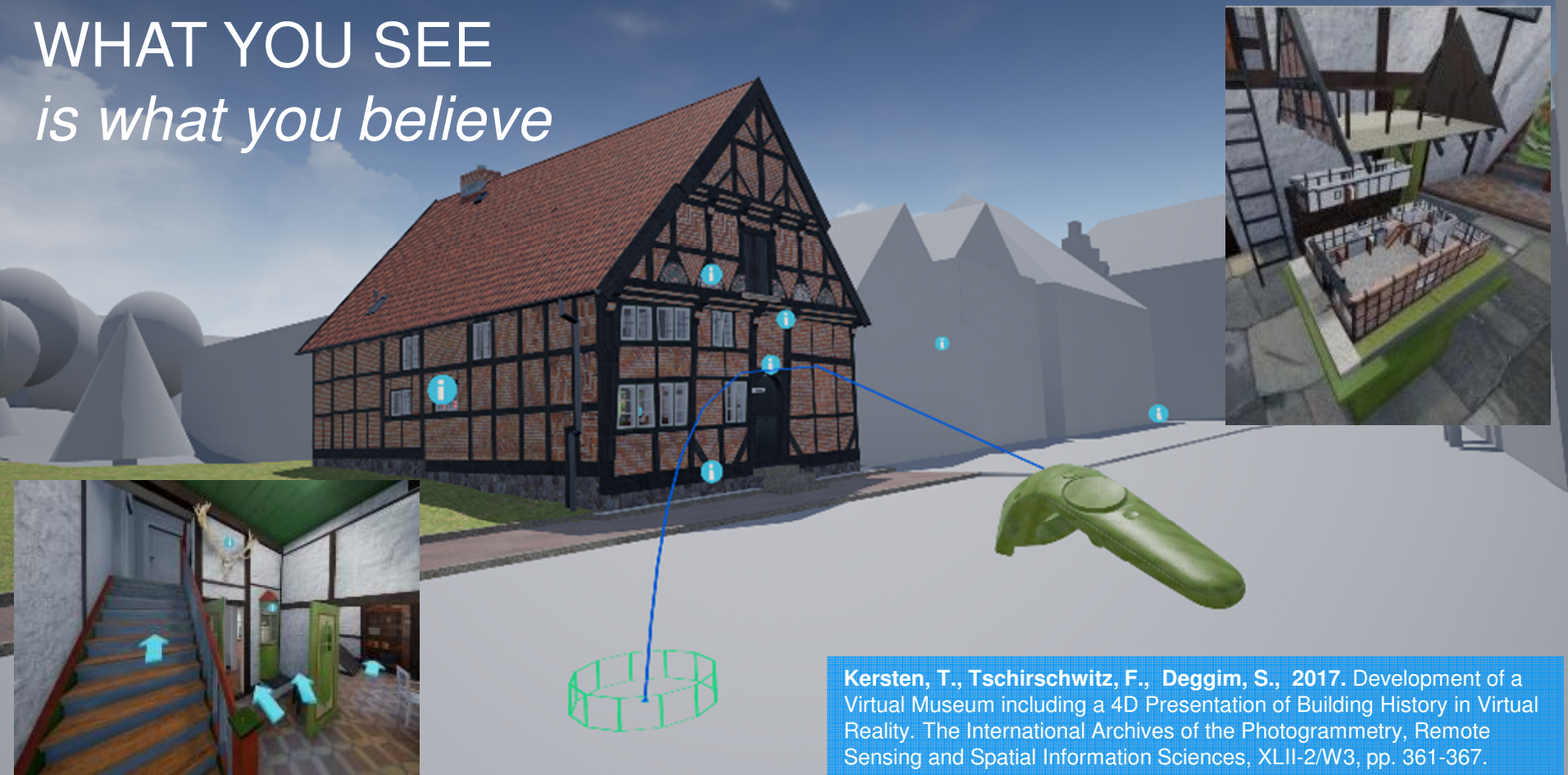


# 5. CH Monuments & Virtual Museums

- Virtual Museum Old-Segeberg Town House including the animation of six construction phases



WHAT YOU SEE  
*is what you believe*



Kersten, T., Tschirschwitz, F., Deggim, S., 2017. Development of a Virtual Museum including a 4D Presentation of Building History in Virtual Reality. The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, XLII-2/W3, pp. 361-367.



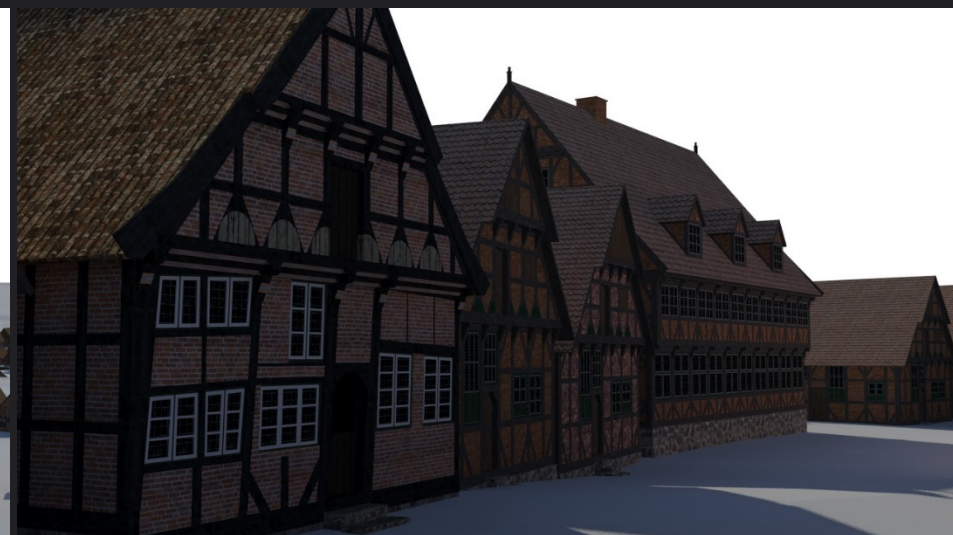
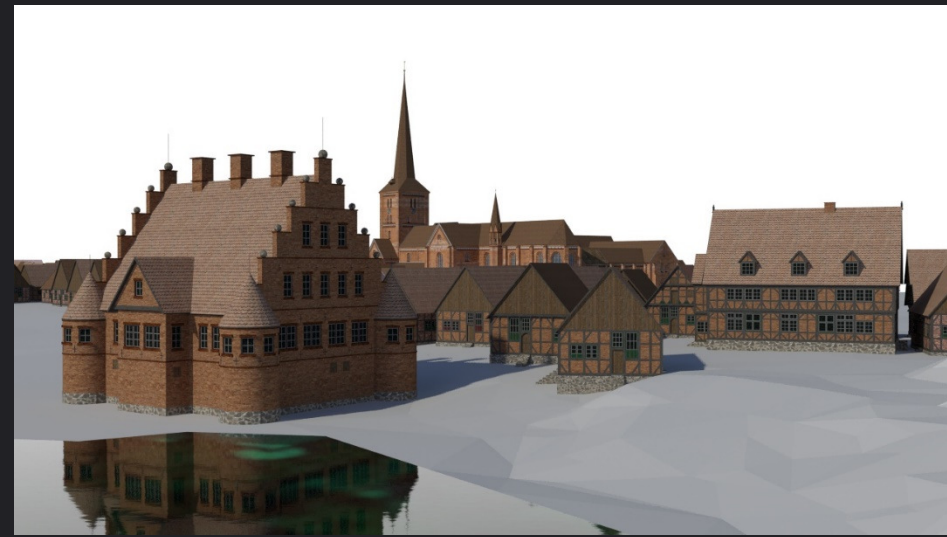
## 5. CH Monuments & Virtual Museums

- Immersive experience in the virtual museum using HTC Vive



# 5. CH Monuments & Virtual Museums

Realisation of current VR project Segeberg 1600



## 6. Conclusions & Outlook

- Virtual Reality & Virtual 3D Museum – attractive opportunity
- Realisation of VR projects – tasks for Geomatics/Geoinformatics
- Future – Game engines & VR systems in many diff. applications
- Serious games – new ways for dissemination of knowledge
- Virtual Reality – History as an attraction & immersive experience
- Storytelling reinvented in virtual reality
- Bottleneck – data volume & computer/internet performance





# 6. Conclusions & Outlook

More Virtual Reality Objects at HCU Hamburg



HCUHamburgGeomatics



# LowCost 3D 2017

More

 HAMBURG, GERMANY  28 - 29 NOVEMBER



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<http://www.lc3d.net/>

# HCU

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University for the Built Environment  
and Metropolitan Development

Acknowledgements:

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Simon Deggim

Maren Lindstaedt



**Thank you  
for your attention!**

An aerial photograph of the Hafencity University Hamburg building, a modern structure with a large glass facade and a flat roof. The building is situated on a waterfront, with a canal or river visible to the right. The roof features various mechanical units and a walkway. The surrounding area includes a road with cars and a construction site with materials and a crane.

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Photo: Height-Tech GmbH / Cubert GmbH

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