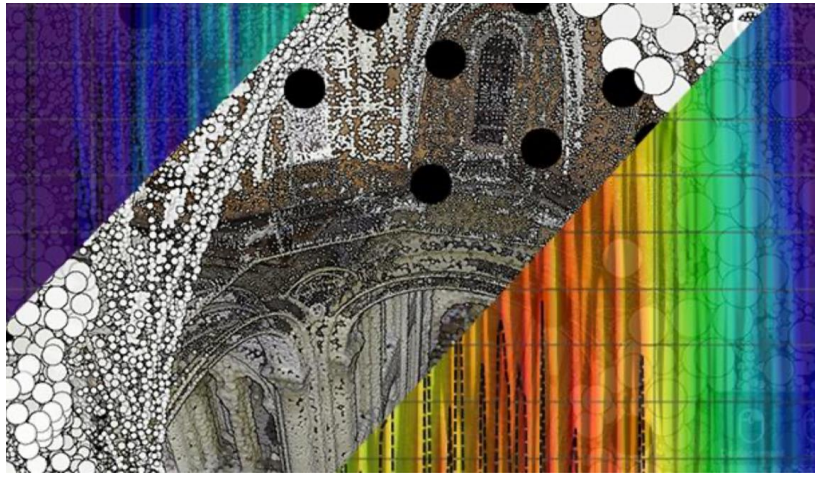
BIBLIOTHECA HERTZIANA
MAX-PLANCK-INSTITUT
FÜR KUNSTGESCHICHTE

Empty Boxes? Modeling the Lost and Ephemeral in Premodern Sacred Spaces

Interdisciplinary Conference

Rome, Bibliotheca Hertziana, 29-30 May 2025

Concept and organization: Chiara Capulli, Vera Grund, Klaus Pietschmann, Kris Racaniello, Elisabetta Scirocco, Tobias C. Weißmann
(Rome – Mainz – Zürich)



Webpage and program

Booklet of Abstracts and Biographies

Sources

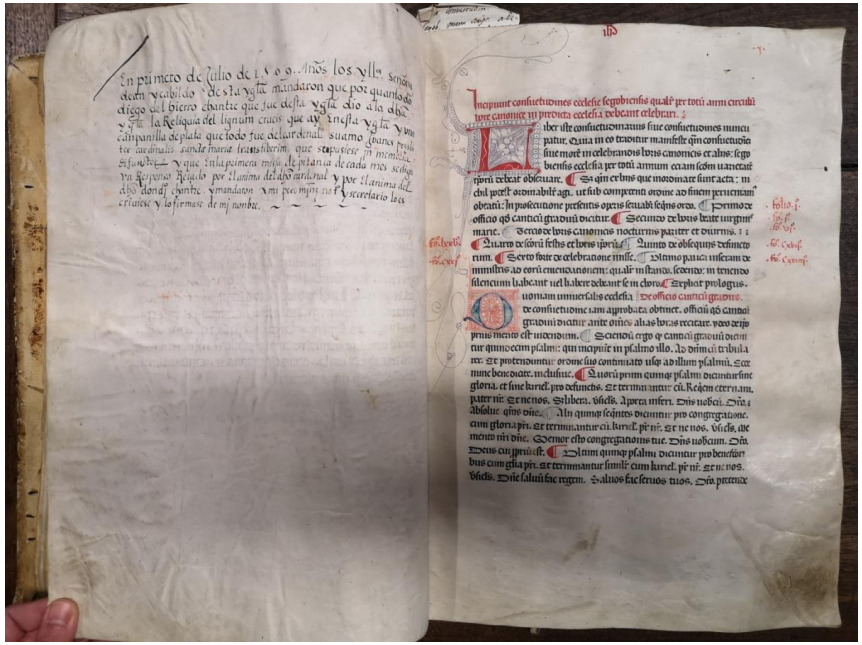
Chair: Elisabetta Scirocco (Bibliotheca Hertziana – MPI)

Eduardo Carrero Santamaría (Universitat Autònoma de Barcelona)

Ordinaries as a Source for Not So Empty Boxes

The myth of the empty church interior—originating from the ecclesiastical reforms of the 16th century onwards and reinforced by the aesthetic criteria of 19th- and 20th-century restorations—is effectively challenged by liturgical documentation. A liturgical ordinary records what, when, where, and how religious services were performed. Consequently, the explanatory rubrics contained in such texts often provide insights into a material reality that differs significantly from the barren architectural spaces we have inherited. A Medieval liturgical customary allows us not only to identify variations in rites and celebrations, as well as the homogenising reforms of the Roman Missal and Breviary between the 16th and 17th centuries, but also to access information about altars, chapels, altarpieces, choirs, and other liturgical furnishings that have since been removed or lost. Descriptions of processions and seasonal liturgies reveal a fascinating dynamism in the movement within the buildings, highlight its dynamism in visual and sensory terms. In this respect, liturgical documentation demonstrates that, up until the 19th century, the visual and sensory image of a religious building was in constant flux, shaped by liturgical practice: vestments, furnishings, images, tapestries, incense and censers, music and musicians, stages and actors—all contributed to shaping the perception of the cathedral. In this sense, a liturgical customary can be understood as the script of a grand theatrical performance enacted throughout the liturgical year, wherein everything was altered and replaced as the calendar progressed. This paper seeks to explore the potential of liturgical documentation as a source for the study of religious architecture, with specific reference to selected case studies from Iberian cathedrals.

Eduardo Carrero is Full Lecturer of Medieval Art History at the Universitat Autònoma de Barcelona, having previously held teaching positions at the Universities of Oviedo and the Balearic Islands. He holds a PhD in Art History from the Universidad Autónoma de Madrid and a Master's degree in Architectural Heritage Restoration from the School of Architecture at the Universidad Politécnica de Madrid. His primary field of study is European medieval architecture, with a focus on the interaction between use and function as shaped by the daily life of the clergy and liturgical practice. His research is particularly concerned with the relationship between space and function in the architecture of cathedrals and monasteries, the historical transformations of their uses, and contemporary perceptions of these buildings from a 21st-century perspective. He has an internationally oriented academic profile, having held visiting research appointments at the Universities of Coimbra (Portugal), Poitiers and Le Mans (France), at the École Française de Rome, the EHESS in Paris, and as a Leverhulme Visiting Fellow at the University of Bristol. He has served on numerous scientific committees and has been principal investigator or team member in various publicly funded research projects. Since 2024, he has been the principal investigator of a state-funded research project supported by the Spanish government, focusing on the impact of liturgical customary books on the architecture of cathedrals within the ecclesiastical territory of Toledo. His most recent publications include the book *La catedral habitada. Historia funcional de un espacio arquitectónico* (2019).



Gianluigi Viscione (Alma Mater Studiorum – Università di Bologna)
Gaia Ravalli (Università degli Studi di Firenze)
Marco Toffanin (Università degli Studi di Padova)

In medio ecclesiae: arte, musica e liturgia intorno al tramezzo. Verso la restituzione digitale di tre basiliche mendicanti

The tramezzo, the partition that once structured the interiors of churches and basilicas—occupying a central position both topographically and liturgically—is the quintessential lost architectural element, systematically dismantled with the transition to the modern age. Drawing on philological research and the most advanced digital technologies, this presentation explores this complex spatial junction through the ongoing development of three-dimensional models of three major mendicant basilicas.
The ponte of the Basilica of Santa Maria Novella was particularly imposing. Its appearance can best be understood in light of its various functions: it housed eight chapels, Giotto's Crucifix, and two fourteenth-century organs. At the beginning of the fifteenth century, its dismantling began, and the organs were replaced by a larger one, later renovated by Baccio d'Agnolo in the sixteenth century. By combining source study with digital technologies, it is now possible to attempt a reconstruction of the continuous transformation of sacred space.
In the Basilica of Saint Anthony in Padua, the elusive tramezzo—likely referenced in a 1377 document—was replaced in the following century by a pergula supported by columns, on which Donatello's bronze Crucifix was placed. Despite their importance, reconstructing the precise appearance of both barriers remains highly problematic. In addition to reinterpreting the sources, some valuable insights may be gleaned by examining the location of the organs.
In San Domenico in Bologna, the wide central bay between the vaulted church and the laypeople's space once housed the pontile structure, which remains elusive despite ongoing efforts to understand it. On the southern side, at considerable height, stood the Chapel of the Santo, completed in the early fifteenth century to house the Arca of Saint Dominic, flanked by the organ and accessible via a double flight of stairs, beneath which lay a system of five chapels.

Gaia Ravalli si è perfezionata in storia dell'arte alla Scuola Normale Superiore con una tesi su Santa Maria Novella tra XIII e XVI sec. Ha curato per i Musei Civici di Pistoia la mostra in corso Dalla città al museo: la galleria illustre dell'Accademia di Scienze, Lettere e Arti. Tra le sue pubblicazioni: Il chiostrino dei Morti di Santa Maria Novella e, con Giacomo Guazzini, Itinerari nel Medioevo pistoiese.

Marco Toffanin ha conseguito il dottorato di ricerca a Padova nel 2023 con una tesi sulla chiesa veneziana di San Nicolò dei Mendicoli. Le sue ricerche coprono un arco cronologico piuttosto vasto, dal Medioevo all'Età moderna con particolare attenzione alla ricostruzione di contesti perduti o profondamente modificati e alle fonti documentarie.

Gianluigi Viscione si è laureato a Bologna nel 2018 e ha conseguito nel 2023 il dottorato a Firenze con una tesi sul reimpiego e il recupero arcaizzante della scultura altomedievale in Toscana e Abruzzo tra XI e XIII secolo. I suoi temi di ricerca abbracciano gli arcaismi scultorei e la creazione di falsi spolia, lo spazio liturgico, la scultura funeraria e le relazioni tra le sponde del Mediterraneo.

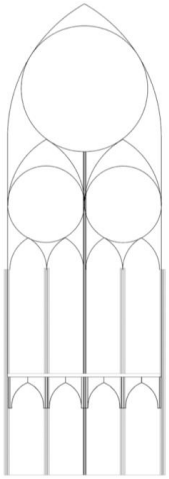
I tre storici dell'arte afferiscono al progetto PRIN "DAISI. Anastilosi digitale e interpretazione interattiva degli spazi: nuove metodologie per la storia dell'arte". Alcuni casi esemplari di chiese tardomedievali italiane, promosso dall'Università di Firenze, sotto la direzione di Andrea De Marchi, in collaborazione con il laboratorio DIDALABS e gli atenei di Bologna (tutor Fabio Massaccesi) e Padova (tutor Cristina Guarnieri), con l'obiettivo didi ricostruire digitalmente gli assetti di Santa Maria Novella a Firenze, il Santo di Padova e San Domenico a Bologna tra Medioevo e Rinascimento.

Spatial Voids: Modeling the Gray Zones (I)

Chair: Chiara Capulli (Bibliotheca Hertziana – MPI)

Meredith Cohen (University of California – Los Angeles),
Kristine Tanton (University of Montreal)

The Empty Box as a Workspace: The Case of the Lady Chapel of Saint-Germain-des-Prés



Digital reconstructions of lost monuments often involve multiple steps based on interpretation of the surviving evidence. As the field has moved forward, it has become common practice to color code and/or annotate areas of interpretation and uncertainty in visualizations. In this paper, we will discuss how our 3D reconstruction has sought not only to visualize uncertainties but also, more importantly, to make transparent our interpretations of the evidence. Our project has undertaken a reconstruction of the Lady Chapel of Saint-Germain-des-Prés, a part of the larger, collaborative research project Paris Past and Present (http://paris.cdh.ucla.edu/). The Lady Chapel, built between 1245 and 1255, was once one of the finest buildings of Paris, on par with the Sainte-Chapelle in the Palais de la Cité, and built by the renowned architect Pierre de Montreuil. However, it was razed to the ground in 1803, in the aftermath of the French Revolution, in order to make way for bourgeois housing and shops. Despite the many fragments, plans, drawings, and descriptions that remain from the Lady Chapel, a complete building could not be constructed from the collected evidence. For example, none of the chapel's plans were consistent, the chapel's forms and dimensions differed significantly. After testing our evidence, we prioritized the lithic fragments, as physical remains of the building, because they represented the highest level of certainty. To set the building plan, we identified minimum and maximum possible dimensions based on the information provided by all of our evidence. This resulted in an idealized and regular plan, devoid of the inconsistencies in an extant building. Within these parameters the model became a workspace in which to explore possibilities for the areas of uncertainties due to lack of evidence; extrapolation in three dimensions could only go so far. For example, one could not create the arches for the vaults directly from the pier profile. In such cases, we turned to statistical and probability analysis of comparable monuments. Our decisions for the model were thus based on quantitative analysis: minimum and maximum ranges, statistical analysis, and probability with clearly defined sets. The result is an approach that has broad implications for the field of art history. With this approach, the reconstruction of the Lady Chapel produced much more than a visualization of this structure: as a site of experimentation and analysis, we gained new insights into medieval metrology, Gothic architectural design, and construction, which now can be applied to other contemporary monuments.

Meredith Cohen is Professor of Art History. Her research focuses on the production, use, and reception of architecture and urban spaces, as well as cultural heritage and historiography related to medieval architecture, particularly the Gothic in France. She is author, co-author, or co-editor of *Imagining the Lady Chapel: Digital Reconstruction and the Art of Gothic Design* (forthcoming), *The Sainte-Chapelle and the Construction of Sacral Monarchy: Royal Architecture in Thirteenth-Century Paris* (2015, Society of Architectural Historians' Alice Davis Hitchcock Book Award, 2017), *Space in the Medieval West* (2014), *Memory and Commemoration in Medieval France* (2013), *Difference and Identity in Francia and Medieval France* (2010), and *Paris, ville rayonnante* (2010). She has received fellowships and support from external institutions including the Getty Research Institute, Keck Foundation, Kress Foundation, Mellon Foundation, and the National Endowment for the Humanities. Her essays and articles appear in The Art Bulletin, Journal of the Society of Architectural Historians, Speculum, and Res, as well as in edited anthologies. Her methods range from documentary analysis and building archaeology to digital reconstruction and analysis. In 2003, Meredith Cohen founded the International Medieval Society of Paris, a non-profit association that brings international and French scholars of the Middle Ages together in Paris for apéritifs, study days, and symposia. Currently, she is PI for two ongoing collaborative digital projects, Paris Past and Present, which aims to digitally reconstruct selected lost monuments of Paris, and Enriched Timelines (https://enrichedtimelines.humspace.ucla.edu/), which visualizes source material and historiographies for Romanesque and Gothic architecture.

Kristine Tanton is an Associate Professor of Medieval Art in the department of art history, cinema, and audiovisual media at the Université of Montréal (UdeM). Her research focuses on two principal areas: the dynamic relationship among sculpture, architecture, and ritual activity in the eleventh-thirteenth centuries, and digital methods for art historical research, specifically through databases and 3D reconstructions of medieval monuments. She is the co-director of Ouvroir, the digital art history and museum studies lab at UdeM (Ouvroir laboratoire en histoire de l'art et muséologie numérique). She is the co-author of *Imagining the Lady Chapel: Digital Reconstruction and the Art of Gothic Design* (forthcoming). Her current book project, *Marking Monastic Space: The Spatial Context of Inscribed Capitals in Romanesque France, 1080–1160*, offers the first comprehensive study of the function and architectural context of inscribed capitals in eleventh- and twelfth-century monastic spaces in France. Kristine has received support for her research from various venues, including the Social Sciences and Humanities Council (SSHRC) and the Canada Foundation of Innovation. She is an associate researcher on the collaborative digital project, Paris Past and Present. In addition to her research on medieval art and architecture, she is also a co-researcher on the partnership project, Des nouveaux usages des musées de l'art (PI: Johanne Lamoureux), focusing on the uses of 3D technology in art museum collections.

Donal Cooper (University of Cambridge)
Fabrizio Nevola (University of Exeter)

Packing Boxes: Reconfiguring Research for the 3D Modeling of Renaissance Church Interiors

Ongoing research on pre-modern Italian church interiors continues to advance our understanding of these 'sacred spaces' as intense micro-topographies, constantly in flux and populated with a rich array of material artefacts. We grow increasingly aware how the historical experience of paintings and sculptures – the traditional focus of art historical enquiry – was mediated by frames, grates, drapes, physical barriers, lighting both natural and artificial, and also sound and ritual. A fuller reconstruction of the church interior that reflects this developing awareness is a major desideratum for the next generation of 3D models seeking to articulate the historic experience of ecclesiastical artworks in context, but it also encounters significant challenges in terms of the survival of artefacts, the bias of documentation, and – perhaps more surprisingly – the availability of specialist scholarly expertise.

This paper reflects on these challenges through a portfolio of recent work undertaken through our *Florence 4D* project (a collaboration between the Universities of Exeter and Cambridge funded by the Getty Foundation) and with the Louvre in Paris (a collaboration between the Universities of Cambridge and Pisa). Our *Florence 4D* model of the Innocenti church was published in 2022: here we review for the first time a series of debates we faced during the creation of the model. The Innocenti church should be an ideal case-study for 'Serious 3D' to use Piotr Kuroczyński's term. A simple building with only three and later five altars, it is manageable in scale, all its major artworks survive, and it is well-documented in all its historic phases. Yet what seemed like minor details at the outset emerged as major research challenges, to such an extent that we decided to resolve them in a future iteration. We compare the parameters of our Innocenti work (grant-funded with a dedicated research team) with the reconstruction of San Francesco, Pisa for the recent Cimabue exhibition at the Louvre. Here again, surprising details (staircases and structural supports) proved to be the most difficult to resolve. New questions like these underline the importance of modelling as a dynamic research tool, but are also a challenge to resolve within the timeframe of projects with absolute deadlines. Allowing for the fact that major grant-funded modelling projects will remain the exception, achieving workflow efficiencies will be crucial for future work. A major challenge in the creation of such 'Serious 3D' models is the creation of the structured data that underpins them, and that documents the rigorous research that they represent. In closing, we discuss ongoing work in the development of a chatbot assistant for the conversion of natural language into CIDOC CRM which would provide a helpful tool in the workflow. Such a tool would also help close the divide between 'Serious 3D' models and those created for visualisation purposes for exhibitions and other public-facing settings, where frequently time and budget constraints mean that the research process that informs these is lost.

Donal Cooper is Professor of Italian and Mediterranean Art at the University of Cambridge and a Fellow of Jesus College. He specialises in the art and architecture of the late medieval and Renaissance, especially in Italy and with a particular focus on ecclesiastical art and architecture. He has developed his interest in recovering and visualizing church interiors through a number of digital projects, notably *Florence 4D* (with Fabrizio Nevola), his recent collaboration with the Universities of Pisa, Padua, and Naples on the mendicant churches in Pisa, and a series of GPR-surveys undertaken with the British School at Rome. His co-authored book with Janet Robson, *The Making of Assisi* (Yale UP, 2013), won the Art Book prize in 2014 and he is currently completing a monograph on Giotto.

Fabrizio Nevola is Professor of Art History and Visual Culture and co-director of Digital Humanities at the University of Exeter. His research focuses on urban and architectural history of early modern cities, with a particular attention on public spaces in Italy. His most recent monograph, *Street Life in Renaissance Italy* (Yale UP, 2020), was shortlisted for the Renaissance Studies Biennial book prize (2022). Through grant funded research projects, including the 'HistoryCity' apps (and a new project with the National Trust called *HistoryScapes*) and *Florence4D* (with Donal Cooper), he has developed digital art history approaches using geodata, 3D modelling and GPS technologies; Hidden Cities. *Urban Space, Geolocated Apps and Public History in Early Modern Europe* (co-edited with Nicholas Terpstra and David Rosenthal, Routledge, 2022) gathers some of that work.

Michela Young (University of Cambridge)
Luca Brunke (University of Exeter)

The Rucellai Chapels in San Pancrazio: Developing the Florence4D Workflow for 3D Reconstruction, Focusing on Collaboration and Data Integration

This paper discusses the work-in-progress of the reconstruction of the two Rucellai chapels of the ex-Florentine church of San Pancrazio, which now survives as the Museo Marino Marini. Suppressed in the nineteenth century, San Pancrazio suffered numerous structural interventions across the centuries that drastically and permanently altered the configuration of this sacred space. Textual and visual primary sources, together with data gathered from surveys, allow us to create an informed and interrogable digital model adapted for both a scholarly and a museum environment.
A particular highlight of the complex was Leon Battista Alberti's surviving fifteenth-century marble burial tempietto for Giovanni Rucellai; the sepulchre chapel sat adjacent to a second Rucellai chapel that housed Filippino Lippi's c.1485 altarpiece of the Virgin and Child with Saints Dominic and Jerome, now at the National Gallery in London. Questions regarding the recontextualization of these objects and the relationships between these spaces provide a test case for the refinement of the working methods already adopted by the Florence4D team for previous reconstructions of Santa Maria degli Innocenti and the camera terrena of Palazzo Medici. Our aim is to address and improve the efficiency of collaboration for the integration of documentary research and digital expertise, which are both fundamental to such visualisation work. Custom extensions for our main software applications seek to clarify interpretative decisions and to streamline and optimise the modelling process, allocating more time to research rather than technical setup.
We discuss our development of the Florence4D workflow and its current focus on improving collaborative working and data management, modular approaches, and the improved linkage of the 3D model to the underpinning research data. Compared to previous approaches, our workflow utilises a more versatile modelling framework, which grants the researcher greater control in assembling individual objects into a 3D reconstruction; this facilitates their work of interpretation and increases the possibility of more nuanced decisions and comparisons between alternative layouts before reaching a polished outcome. A greater digital proficiency is demanded of all team members, as well as repurposable digital skills to be adapted to different use-case scenarios.

Michela Young has recently completed her PhD in History of Art at the University of Cambridge, after earning her BA from the Courtauld Institute of Art in 2018. Her thesis examined the Florentine urban churches of the Vallombrosan congregation, Santa Trinita and San Pancrazio, exploring issues of neighbourhood, patronage, and identity, and their impact on the devotional interior. Her research has been supported by pre-doctoral fellowships at the Dutch Institute for Art History and at the Medici Archive Project in Florence.

Luca Brunke is a PhD student at the University of Exeter and the National Gallery in London. His research focuses on methods for 3D reconstructions in art history, with a particular emphasis on collaborative workflows between the art historian and more technical oriented researcher, as well as the integration of art historical research data into 3D reconstructions itself. He is exploring these issues through two case studies of Renaissance built environments in Florence. Previously, he has contributed to museum exhibitions and worked as a 3D modeller on the *Florence4D* research project. He has also provided digital services for archaeology projects at the *eScience Centre* in Tübingen and has an academic background in digital archaeology.

Spatial Voids: Modeling the Gray Zones (II)

Chair: Kris Racaniello (Bibliotheca Hertziana – MPI/CUNY, GC)

Charles van den Heuvel (Huygens Institute–KNAW, University of Amsterdam)
Sofia Baroncini (Leibniz-Institut für Europäische Geschichte (IEG)-DH lab)

A Saint on the Move: Modeling and Representing the Ephemeral and Uncertainties in the History of the Procession of the Holy Relics of St. Servatius

The distinction between tangible and intangible cultural heritage is problematic for the modeling of interactions between material and immaterial expressions of the arts. This hinders capturing changes in artworks in their cultural contexts necessary to understand their social functions and symbolic meanings. To solve this problem a model of historical frames is created that allows analysing spatial-temporal interactions between tangible and intangible cultural heritage. As most of such interactions are less defined in time and move in space, particular attention is paid to the modeling of ephemeral events. The model is designed using five types of such interactions in a case study of the late 12th century reliquary shrine of St Servatius in Maastricht (Netherlands) and festivities around it. The fuzziness of ephemeral events in tangible and intangible cultural heritage made us realize that the next step would to be to model uncertainty. Particular attention is paid to the contextualization of a 3D scholarly edition of the restoration of the reliquary shrine of St Servatius between 1958 and 1962. It explains the impact of the restoration on religious popular function of the shrine and its iconographical program.

Charles van den Heuvel was trained as an art historian with a specialization in the history of architecture and town-planning. He is emeritus professor at the University of Amsterdam [chair Digital Methods and Historical Disciplines] and former head Knowledge and Art Practices at the Huygens Institute for Dutch Art and Culture of the Royal Netherlands Academy of Art and Sciences. He has worked in several cultural heritage institutions, as an Inspector of Cultural Goods of the Ministry of Education, Culture and Sciences, as a librarian at the Dutch Institute for History of Art in Florence and as a map-curator at the Leiden University Libraries. Recent research interests are history of knowledge, the history of library and information sciences in particular the history of classification and the development of infrastructures, interfaces and ontologies for cultural heritage and history of art. He acted as the principal investigator of the NWO-Large Investment Project: Golden Agents: Creative Industries and the Making of the Dutch Golden Age, The NWO-Smart Culture, Big Data and Digital Humanities Project: Virtual Interiors as Interfaces for Big Historical Data Research and the NWO-NWA Dutch science communication project: Through the lens of Antoni: How do you represent what you cannot see?

Sofia Baroncini is a postdoctoral researcher in Digital Humanities at the Leibniz Institute of European History in Mainz. Her research interests are knowledge organization and computational methods applied to Arts, focusing on iconography and iconology studies, with a particular interest in the interaction of artworks with their socio-cultural context(s). She has a PhD in Digital Humanities from the Department of Classical Philology and Italian Studies, University of Bologna (Italy). Her thesis focused on modeling iconographical-iconological art historians' interpretations, quantitatively addressing traditional questions on an ad-hoc created semantic dataset. Previously, she graduated with a master's in visual arts from the University of Bologna with a master's thesis on iconological aspects in ontology design.

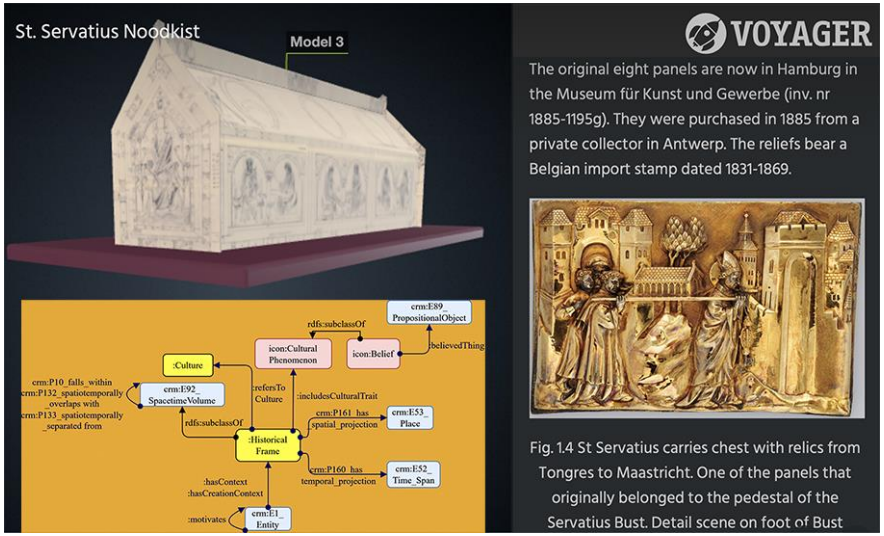


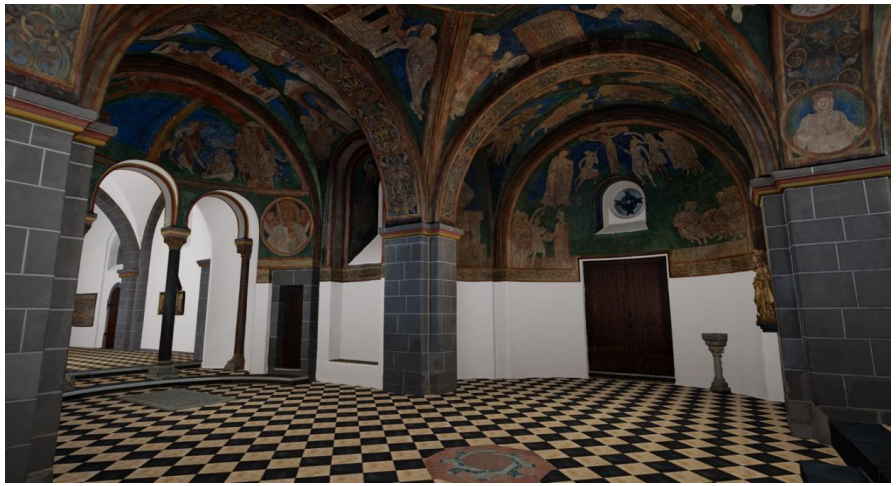
Fig. 1.4 St Servatius carries chest with relics from Tongres to Maastricht. One of the panels that originally belonged to the pedestal of the Servatius Bust. Detail scene on foot of Bust

Hanna Christine Jacobs (Universität Bonn)

Remodeling the High-Medieval Double Chapel of Bonn-Schwarzrheindorf: Chances and Pitfalls of a VR-Environment in Research and Teaching

During the last three years a reliable 3D-Model of the high medieval double church of Bonn-Schwarzrheindorf (Germany) was designed as a Virtual Reality surrounding under my art historical guidance at the University of Bonn. It was realised for teaching purposes, but it also is an apt tool for research questions, particularly concerning perceptional viewpoints and ephemeral stagings that take into account architectural elements and furnishings no longer existant inside the present state of the real double chapel (such as the original western façade, a gallery once placed in the upper storeys westwing, original sidealtars and choirscreens or liturgical objects that might have been used in a medieval church of the mid 12th century). These partly uncertain elements can be retraced, hypothetically reconstructed, re-enacted, re-experienced and thus understood better in VR.
By modeling these “Gray Zones” we constantly had to face decisions of how to transparently convey the hypothetical character of the re-established sacral topography and the pars-pro-toto function of the liturgical vessels, which we tried to solve by zones literally flecked with grey. The chances the Medium VR offers for filling spatial voids are thus bothered by scientific prudence.
Some ephemeral stagings such as changing daylight and choir-singing have been integrated inside the VR-surrounding. For example, on July 11th 2024 a Gregorian choir from Cologne was recorded within the chapel at several different places, singing antiphones from the 12th century (offices for Anno from Siegburg and Cologne). The acoustics of the actual altered space can thus be re-experienced inside the virtual original surrounding, creating another sort of hybrid “Gray Zone”.
The presentation will focus on research questions solved and raised by modelling the lost and the ephemeral with help of the VR-surrounding Schwarzrheindorf, reflecting on some of the chances and pitfalls of the medium in research and teaching.

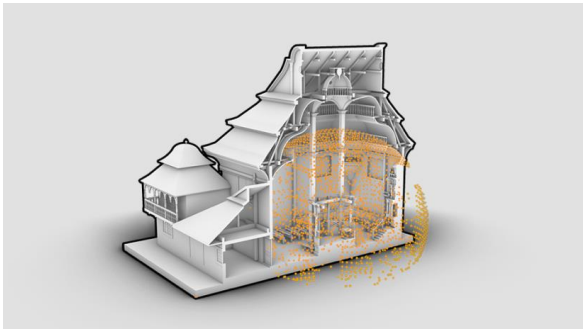
Hanna Christine Jacobs is a Post-Doc research assistant to Prof. Dr. Harald Wolter-von dem Knesebeck, Professor of Art History with a special focus on the Middle Ages at the art historical department of the University of Bonn, since October 2020. Her current research deals with the complex building-picture-scripture-system of the double chapel of Bonn-Schwarzrheindorf in its historical context of the mid 12th-century. From 2002-2009 she studied Art History, Classical Archaeology and English at the University of Bonn and the University of Tor Vergata in Rome. After graduation she was scientific assistant at the University of Bonn (2009-2010) and at the Fototheca of the Bibliotheca Hertziana Max-Planck-Institut für Kunstgeschichte in Rome (2010-2011). From 2014-2018 she was lecturer at the University of Cologne. She held fellowships from the Studienstiftung des Deutschen Volkes (2011-2014) as well as the Gielen-Leyendecker-Stiftung (2018-2020). Her PhD in Bonn 2016 was on narrative mural painting in private chapels of the italian Renaissance ("Raumerzählung. Narration und räumliche Disposition hagiographischer Bilderzyklen in Privatkapellen des Tre- und Quattrocento", München 2019).



Piotr Kuroczyński (Hochschule Mainz)
Jakub Franczuk (Warsaw University of Technology)
Marta Gospodarek (Chopin University of Music, Warsaw)

Immersive Heritage: Combining Digital Reconstruction and Game Technology for Sacred Spaces

This paper presents the digital 3D reconstruction of destroyed wooden synagogues using the Scientific Reference Model methodology, which ensures scientific traceability, accuracy, and reusability. Through standardized data formats and detailed documentation, the project supports collaborative research and long-term digital preservation.



The reconstructions function as more than visual representations; they are tools for investigating historical perceptions of space and ritual. Acoustic ray tracing and global illumination rendering simulate how sound and light behaved within these sacred interiors, generating measurable data that inform historically accurate visualizations. These simulations help reconstruct not only the architecture but also the atmospheres in which rituals took place, offering deeper insight into how such spaces were experienced. A central innovation is the collaboration with the game industry. By incorporating their expertise in animation and interactive design, we bring these reconstructions to life with realistic light, sound, and ritual movement. This interdisciplinary approach—linking digital humanities, cultural studies, and engineering—transforms static models into immersive environments. The result is both a research tool for scholars and an accessible experience for broader audiences. The animated reconstructions allow for the exploration of complex questions about spatial and temporal perception while making lost heritage more tangible and engaging. Through scientifically grounded digital environments, the project enhances both academic inquiry and public understanding. Ultimately, this work demonstrates the power of 3D reconstruction in cultural heritage preservation and interpretation. By combining rigorous methodology with advanced simulation and creative collaboration, it provides a compelling model for how digital tools can revitalize lost historical spaces. The result is a dynamic, immersive form of historical storytelling that preserves cultural memory while expanding the ways we study and experience the past.

Piotr Kuroczyński is an architect specializing in the field of digital 3D reconstruction, documentation and visualization of cultural heritage. Since 2005, he has been researching and teaching at the unit Information and Communication Technology in Architecture of Professor Manfred Koob at the Technische Universität Darmstadt. After his doctorate in architecture in 2010 he has also been a lecturer at the unit Computer Aided Design at the Warsaw University of Technology and at the Digital Design Unit at the Technische Universität Darmstadt. Since 2013 he has been a scientific staff member and project coordinator at the Herder Institute for Historical Research on East Central Europe. He is co-founder and convenor of the Digital 3D-Reconstruction Working Group in the Digital Humanities in German-speaking Region Association. Since 2017, he has been a Professor for Computer Science and Visualization in Architecture at the Hochschule Mainz – University of Applied Sciences Mainz. Since 2018, he has been the head of the Institute of Architecture and the chief-in-editor of the book series Computing in Art and Architecture at the Heidelberg University Library. His interests include Virtual Research Environments, semantic data modeling, (Heritage/Historic) Building Information Modeling, 3D modeling, documentation and visualization standards for digital 3D reconstruction of cultural heritage.

Jakub Franczuk is an architect, Ph.D. candidate, tutor, and research fellow at the Warsaw University of Technology's Faculty of Architecture. Since 2018, he has been coordinating courses in information and communication techniques, computer modeling, digital descriptive geometry using visual programming tools, and information processes in architectural heritage project. Since 2019, he has been a lecturer at the Interdisciplinary BIM postgraduate studies, teaching visual programming. He also teaches at Warsaw SWPS University, where he integrates robotic fabrication into parametric design education. Since 2021, he has been a research member of the international Erasmus+ grant 'CoVHer - Computer-based Visualisation of Cultural Architectural Heritage'. Since 2022, he has collaborated with the Institute of Archeology at Warsaw University and Institut National du Patrimoine in Tunisia on an archaeological excavation research project (AFRIPAL). His expertise spans Historic Building Information Modeling (HBIM), digital reconstruction, extended reality, visualization, and visual programming. His research focuses on using integrated digital environments to map and interactively share knowledge about architectural heritage, with a significant emphasis on HBIM for managing information in digital models of historic buildings.

Marta Gospodarek is an Assistant Professor at the Fryderyk Chopin University of Music in Warsaw at the Sound Engineering Department. She specializes in the areas of spatial audio, sound design, and psychoacoustics, with a focus on augmented reality (AR) and virtual reality (VR). She earned her Ph.D. in Music Technology from New York University, where her research explored the acoustic and perceptual factors influencing the plausibility of sound design in AR environments. Dr Gospodarek has worked as a spatial audio researcher at IRCAM in Paris, where she led perceptual studies and developed AR audio systems with real-room acoustic simulations. Her innovative work in immersive audio has contributed to the development of spatial sound technologies for collaborative music performance in virtual environments and the advancement of VR-based therapeutic applications. Her experience also includes contributing to VR/AR projects at NYU's Future Reality Lab, where she designed sound for collocated XR projects showcased at events like the Tribeca Film Festival and SIGGRAPH. She has received numerous accolades, including the STEM Chateaubriand Fellowship and the AES Educational Grant.

John Jenkins (University of York)

“Is That a Photograph?” Responses to the Modeling of St Thomas Becket’s Shrine at Canterbury Cathedral

Between 2014 and 2017 a team at the University of York created a set of digital models of the interior of medieval Canterbury Cathedral, focusing on the sites which were particularly sacred to St Thomas Becket. The remit of the project was not to recreate the medieval architectural spaces per se, but to recreate the experience of pilgrimage at these sites. While the surrounding architecture of the areas has remained largely unchanged, their central features in each case were destroyed in 1538.

The sites were not only reconstructed in photorealistic detail but were animated with figures, rendered through motion capture, making an argument for how each site would have typically been experienced by pilgrims. The models were made with two clear objectives in mind. Firstly they were to be a way in which modern-day visitors to the cathedral could make sense of spaces in which the focal points of the building - the shrines and altars - no longer existed. Secondarily they were research tools, challenging historians, art historians, and archaeologists to reconsider not merely the appearance of lost (and in this case obliterated) elements of the cathedral church, but how repositioning these within the space changed how we should think about the space itself.

Responses to the reconstructions have largely confirmed the utility of our approach, although there have been many issues of process and reception. This paper focuses on the linked issues of paradata, interpretation, and reception, arising from a successful digital modelling projects concerning a medieval site. It addresses some fundamental questions at the heart of digital reconstruction. How can design choices be captured when decisions are often made at speed? If a model is intended to be immersive, how do you provide users with the explicative material they need? Is there such a thing as a model which is 'too good', presenting the public with an unrealistically photorealistic reconstruction?

Project link: https://thebecketstory.org.uk

John Jenkins is a historian of medieval religion, specialising in saints' cults and pilgrimage in the later Middle Ages. After receiving his doctorate from the University of Oxford in 2010, He joined the University of York as a researcher on the 2014-2017 AHRC project 'Pilgrimage and England's Cathedrals'. He has been a researcher on several other high-profile projects, working with a team of digital archaeologists to create research tools and visitor interpretation schemes for historic churches through focused archival research. He has published widely on the cult of St Thomas Becket, including an edition and English translation of the 1428 'Customary of the Shrine of St Thomas Becket at Canterbury Cathedral' with Arc Humanities Press in 2022. He is a Fellow of the Royal Historical Society and of the Society of Antiquaries.

Digitally Reconstructing the Ephemeral: Music, Sound, and Textile Architectures (I)

Chair: Vera Grund (Deutsches Historisches Institut in Rom)

Hasan Baran Fırat (University of Antwerp)

"A Fool's Errand"? Reconstructing Historical Soundscapes: Challenges, Problems, and Methods

The growing interest in sound studies is reflected in its various subtopics, such as historical soundscape reconstructions. However, the multidisciplinary nature of these studies—encompassing fields like engineering, acoustics, musicology, history, psychology, and performance—results in a lack of grounded support, leaving aural reconstructions as an ambiguous and insubstantial scholarly pursuit. A scientifically reliable method for working with past sounds and acoustic environments is still under development. As challenges faced in visual modelling and reconstructions, the qualifications required for aural recreations need to be elucidated. The methods to recreate the acoustic features of historical buildings or historical soundscapes needs a theoretical framework and require further elaboration. In addition to discussing the scholarly importance of reconstructions and justifying it theoretically and philosophically, as well as examining whether it is indeed a fool's errand as Mark Smith suggested, this paper will begin by addressing the fundamental challenges in creating historically accurate sound scenarios. This includes emphasizing the difficulty in documenting sound events in detail and collecting sound-related historical information. The process of spatializing sound events within their original urban contexts will be explored, highlighting the importance of accurately placing these sounds to reflect their historical reality. Following this, the paper will delve into the intricacies of revoicing historical sound sources, detailing the artistic and technical efforts involved in managing studio recordings to authentically recreate past soundscapes. The use of digital techniques for constructing simplified 3D urban models will be examined, demonstrating how these models serve as essential frameworks for acoustic simulations. The complexities of outdoor acoustic modelling will be discussed, focusing on the challenges of dynamic acoustic calculations. Furthermore, the paper will explore various sound reproduction methods, including the use of multi-speaker arrays, immersive cave systems and binaural audio. These technologies will be evaluated for their effectiveness in delivering a convincing and immersive auditory experience. Finally, the paper will present strategies for the effective presentation of reconstructed soundscapes. This will include an analysis of diegetic and non-diegetic sounds, explaining how each type can be utilized to enhance the listener's experience. The integration of supplementary guiding information will also be discussed, outlining how additional context can be provided to help audiences understand and appreciate the historical significance of the reconstructed soundscapes. By addressing these diverse aspects, the paper aims to provide a comprehensive overview of the current challenges and methodologies in the field of historical soundscape reconstruction, offering insights into both the theoretical and practical considerations.

Hasan Baran Fırat is dedicated to researching the aural traditions and urban musical culture of early modern Ottoman Istanbul and Naples. His primary interests lie in Urban Musicology, Sensory History, and Architectural Acoustics. His master's thesis examined the acoustical features of Mevlevi lodges in Istanbul. He holds a Ph.D. in Architecture from the University of Campania Luigi Vanvitelli, where he completed his dissertation titled "Historically Informed Soundscape Design: A Method for the Digital Reconstruction of Historical Soundscapes." This work focused on the soundscape of 18th-century Naples and was awarded the Telestes Award for Material Culture Research in Ancient Music and Dance by the American Archaeological Institute. His research emphasizes fostering scholarly dialogue between Urban Musicology and Architectural Acoustics, with a focus on integrating Digital Humanities methods. His work has been supported by Koç University's Research Center for Anatolian Civilizations (ANAMED) and the Istanbul Research Institute (IAE). He is currently a Marie Skłodowska-Curie postdoctoral fellow at the University of Antwerp (ARCHES), with a project focused on reconstructing the early modern soundscapes of Naples and Antwerp. In addition to his academic work, Fırat is the art director of Ensemble Rûm, an early Ottoman music group, and an editor at Anakronik, an e-magazine for Turkish music criticism.

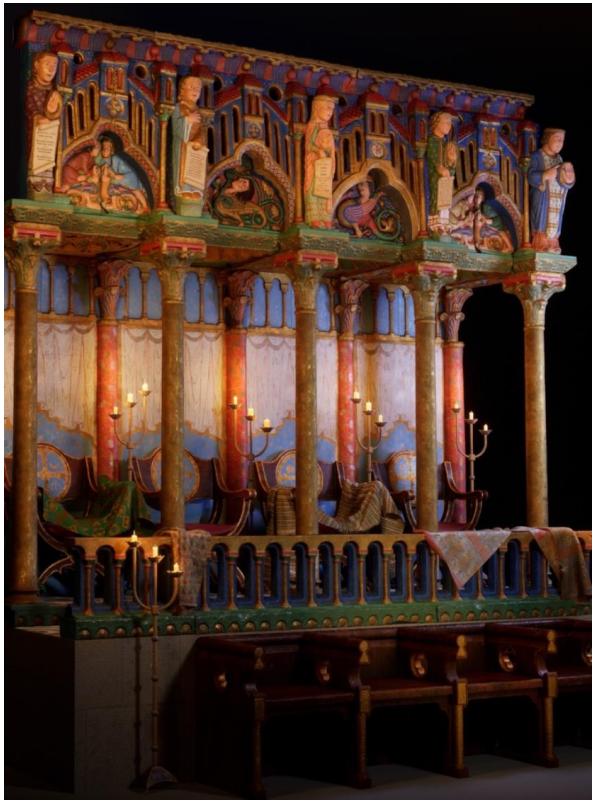
Francisco Prado-Vilar (Universidade de Santiago de Compostela)

Cosmos/Chorus: Ekphrastic Architecture, Immersive Technologies, and the Emergence of the Polyphony in the Horizon of the Year 1200

"The most beautiful old choir that existed in Spain has been destroyed," lamented historian M. Castellá in 1604, upon witnessing the dismantling of the medieval stone choir of Santiago Cathedral, built in the late twelfth century by the same workshops responsible for the famed Portal of Glory. Fortunately, many fragments were reused in later constructions and recovered during 20th-century archaeological campaigns. Recently, new significant pieces were unearthed, including a series of reliefs depicting the Massacre of the Innocents which originally formed part of a cycle of the Infancy of Christ decorating the jubé, revealing that this structure probably served as a backdrop for the performance of liturgical theater. Additionally, new research on the iconographic program of the choir stalls, featuring cantors exhibiting the use of mnemonic techniques to learn, compose, and perform liturgical chant, such as the Guidonian hand, reveals this choir to be an exceptional example to investigate the technologies of memory, perception, cognition, and transmission of knowledge that facilitated the development of early polyphony (organum).
The Santiago choir constitutes the principal case study of the project KosmoTech_1200 which seeks to investigate, from the perspective of art history, musicology, phenomenology, and cognitive neuroscience, in particular MET (Material Engagement Theory), the construction and functioning of these sophisticated performative spaces considering them in their dimension as immersive "machines" designed to generate multisensory cognitive experiences. As we will show in this paper, a key component of the project is the creation of a state-of-the-art digital reconstruction of the choir, enabling the retrieval of the multidimensional experience of its structure in its original conception.

Francisco Prado-Vilar is Professor of Medieval Art at the University of Santiago de Compostela and Distinguished Researcher at CISPAC (Inter-University Research Center for Atlantic Cultural Landscapes) in Santiago, Spain. He received his Ph.D. from Harvard University and subsequently held teaching and research positions at Princeton University, Birkbeck (University of London), and the Complutense University of Madrid. Prior to joining the University of Santiago, he served as Director of Projects at the Royal Complutense College at Harvard. Over the past decade, he has been actively involved in projects dedicated to the study and preservation of cultural heritage, including his service as a member of the panel of the European Heritage Label (EHL) and as Coordinator of the scientific committee overseeing the restoration of the Portal of Glory at Santiago Cathedral. In that role, he led a multidisciplinary team of art historians, architects, and conservation scientists

funded by the Mellon Foundation. He is currently the P.I of the project *KosmoTech_1200: Experience, Cognition, and Technology in Historic Built Environments. The Horizon of 1200 and Their Projection in Time*, funded by the Spanish Ministry of Science and Innovation. His research and publications focus on diverse aspects of the arts of medieval and early modern Europe, covering topics of wide chronological, thematic, and methodological range such as the afterlife of Antiquity; the intercultural relations among Christians, Muslims, and Jews; the interconnections between medievalism and modernity; photography and the archaeology of archives; intermediality, cognition and the lives of objects; historical memory and the restitution of cultural heritage.



Camilla Cavicchi (CNRS)
Philippe Vendrix (CNRS and Centre d'études supérieures de la Renaissance)

MusHerMes – Musical Heritage Messenger. Musical Heritage, Non-Spaces and Sustainable Tourism

Two recent initiatives promoted by RicercarLab (Centre d'études supérieures de la Renaissance, Tours) intend to renew experimentation on immersive audiovisual installations specifically designed to reintegrate the musical heritage — forgotten or lost — to the sites where it was produced.
Supported by the CNRS and the SNCF (National Railway in France), the project *Cubiculum musicae • Châteaudun* aims to invent a new system for sound immersion – musical umbrellas and *Cubiculum musicae*–which will be installed in the Paris-Austerlitz station to promote visits to the Châteaudun Castle, near Chartres. When in the castle, the tourist can live an immersive experience, specifically conceived to understand the heritage site of the castle through the music by Eloy d'Armeval (1455 – 1508), composer and canon of Châteaudun.
A second initiative *MusHerMes - Musical Heritage Messenger* — developed thanks to the *COST EarlyMuse* project (directed by Philippe Vendrix) — experiments, at a European level, new strategies and audiovisual tools for experiencing musical heritage in different typologies of sites, from writers' houses to Renaissance Italian residences, to the major European centers of culture.
Both projects intend to strengthen the presence of music (and musicology) in heritage sites through the restitution of their remarkable musical past, to promote a sustainable tourism of reflection, concentration and listening — against the I like-mass tourism, to experiment new tools conceived by specialized laboratories, to develop economic models for new job opportunities for applied musicology. This paper will discuss a selection of key-aspects, strategies and perspectives for the musical experience connected with sacred spaces.

Camilla Cavicchi is a musicologist, CNRS Research engineer at the Centre d'études supérieures de la Renaissance in Tours (France). She has worked at the universities of Bologna, Padua, Montpellier and Brussels, and the CESR in Tours. She was Berenson Fellow at Villa I Tatti — The Harvard Center for Renaissance Studies, and Research Scholar at the Italian Academy, Columbia University. Her publications take a multidisciplinary approach to researching the history of music in Renaissance Europe, in the Mediterranean and in West-Africa, drawing from archives, prosopography, music iconography, organology, ethnomusicology and orally transmitted musical repertoires. Her monograph *Maistre Jan. La carriera di un cantore francese alla corte degli Este di Ferrara* (1512-1538) is published by Brepols

(2024). She co-founded with Janie Cole the study group *Early African Sounds Worlds* of the International Musicological Society.

Philippe Vendrix is CNRS Research Director in musicology and director of *Ricercar Lab*. He has served as Director of the Centre d'études supérieures de la Renaissance (2008–2016) and President of the Réseau National des Maisons des Sciences de l'Homme (2014–16). He has published on music theory, notation, and territoriality in music during the Renaissance, and on opéra comique and seventeenth-century music. He has also created digital resources for musicology to develop new research perspectives for historical repertoires and practices, with various projects supported by the Mellon Foundation, the National Endowment for the Humanities, and Huma-Num in France. He is currently chair of the *Cost Action EarlyMuse*: https://earlymuse.eu/ His publications include: Aux origines d'une discipline historique. La musique et son histoire en France aux XVIIe et XVIIIe siècles (Genève, Droz, 1993) ; Vocabulaire de la musique à la Renaissance (Paris, Minerve, 1994) ; La musique à la Renaissance (Paris, Presses Universitaires de France, 1999).

Simulating Sensoriums: Virtual Experiences and the Problem of Sensory Archiving

Chair: Klaus Pietschmann (Universität Mainz)

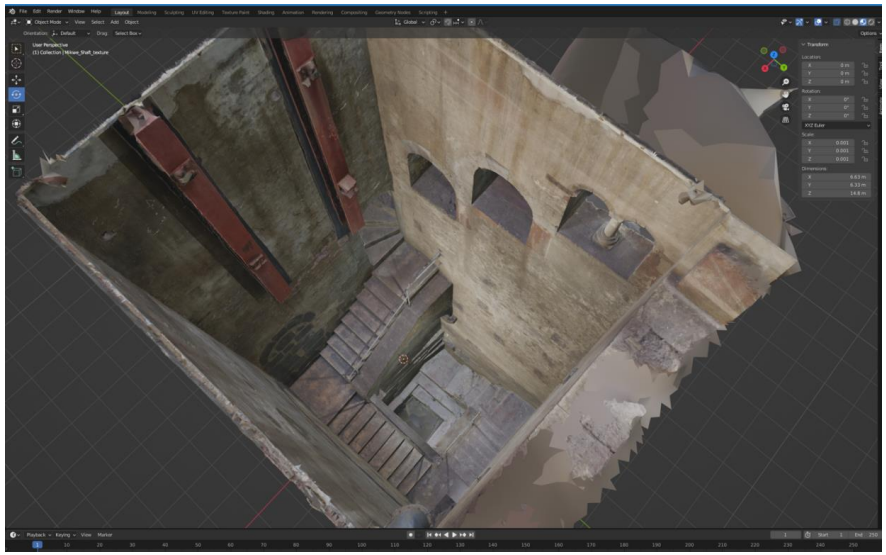
Neta Bodner (The Open University of Israel)
Amir Winer (The Open University of Israel)

Simulating Sensoriums in the Medieval Jewish Ritual Bath of Cologne: Real and Virtual Immersive Experiences

Sometime after 1150 a massive underground Jewish ritual bath (mikveh) was built in the city of Cologne in North Rhine-Westphalia. This was a large and decorated underground space designed for immersion ceremonies by men and women in naturally welling ground-water. In a collaborative research including an architectural historian, environmental historian, archaeologists excavating the site, a 3D architectural and acoustic modeling expert and a digital innovations expert we have tried to explain the various motivations behind the unique design. Experimenting with different lighting conditions at the site, and following changing water levels to its immersion pool, we have been looking at the ways in which the building's design facilitated symbolic associations of the rite (gleaned from primary sources) and maximized the potential for unique subjective experience. To do that we added post-production layers of sound, light, movement, changing water levels and info-graphics onto a 3D photogrammetry model of the mikveh made by the collaborative team. The model therefore includes a combination of environmental analysis, information on ceremonies based on the manuscript descriptions, soundscapes sampled in situ to simulate the auditory experience and interactive variables (such as flame or changing natural lighting) that users can manipulate within the model to see their impact on the space. In this talk we will present the use of the 'digital twin' both as a tool for analysis and as a means for presenting conclusions. In the presentation we shall show our process for creating layers of sensory data and reconstructed action onto the photogrammetry model of the mikveh based on a combination of primary sources and architectural analysis. Ultimately, we envision the model and its VR embodiment as a dynamic database within which primary sources can be accessed by users within the immersive experience, and as a virtual meeting place for multi-disciplinary research.

Neta Bodner is a senior lecturer at the Open University of Israel at the department of literature, languages and the arts. She is an art historian who completed her PhD at the Hebrew University of Jerusalem in 2016 under the auspices of an ERC funded project on architectural copying in the Middle Ages. She has recently completed a monograph on medieval mikvaot, a project she began as a postdoctoral fellow in an ERC funded project on Jewish daily life in medieval Europe at the Hebrew University of Jerusalem and as a Rotschild postdoctoral fellow at the University of Oxford. Bodner is PI of the collaborative research project on the Jewish ritual bath of Cologne funded by the Israeli Science Foundation with colleagues from Cologne and Bar Ilan University. She also heads a project on Immersive Experiences, Photogrammetry and the History of Religious Architecture funded by the Digital Humanities and Social Sciences Hub at the Open University in collaboration with Amir Winer and Beni Zaks.

Amir Winer directs the Digital Learning Innovations Studio at the Open University of Israel and serves as an MBA teaching fellow in the Department of Management and Economics. His interdisciplinary research examines how Learning Analytics, Generative AI, Phenomenology, and Hermeneutics inform the design of next-generation distance-education models. He currently leads the development of an organizational RAG (Retrieval-Augmented Generation) infrastructure to power AI agents that support both faculty instruction and student learning.



Bissera Pentcheva (Stanford University)

Film, Digital Reconstructions, and Chant in Staging the Spiritual Seeing of the Golden Statue of Sainte Foy at Conques

The late ninth-century *golden statue* of Sainte Foy (Holy Faith) is the earliest surviving three-dimensional image in the medieval Latin West. It was originally set in the sanctuary at its eponymous church in Conques, in Occitania, Southern France. It was placed with its back towards the light streaming from the apse. The current museum display of the statue of Sainte Foy is exactly the opposite of the medieval. Steady electric lights target the front of the statue. This illumination makes the effigy fully readable, but it prevents the formation of both shimmer and shadow. The steady light thus destroys the liveliness of the *imago*. Similarly, setting the statue at eye-level with the viewer takes away the effigy's indomitable presence, which came as a result of its original raised position, set on an altar or on a column above the eye-level of the beholders. The current setting dispossesses the statue from its subjecthood and agency. Rather than the effigy overpowering the modern viewer with its gaze, it finds itself under the gaze of the visitor. The *imago* is objectified rather than objectifying its viewers.

As the PI of the multi-disciplinary project "EnChanted images" at Stanford University (https://enchantedimages.stanford.edu/), I have sought permission from the local, regional, and state authorities to reverse some of the effects of the current visual regime of viewing the statue. Coordinating with DRAC (La Direction régionale des affaires culturelles) for Occitanie, the mayor of Conques, and the local museum, I was granted the possibility in 2019 and 2022 to study the *imago* outside its glass case and to film it using LED lights that simulate the conditions of flickering candles. Drawing on this film and the computer animation I have produced in 2023, this paper explores the interaction between the movement of natural light in the sanctuary and the changing appearance of the golden statue. My analysis also turns to the *Liber miraculorum*, the eleventh century *Book of Miracles* produced at Conques, in order to cull evidence on how the participants of the ritual engaged with the statue; how they perceived the ideal response to its gaze. I suggest that the sfumato contours created by the optical shimmer harmonized with the proscribed ideal state of viewing theof Sainte Foy through the veil of repentant tears. This "liquid/lachrymose" vision was cultivated in the faithful. The process started by self-reflection, examination of one's sins, compunction, and repentance, all together leading to the melting of one's stony heart. Turning to the chants for the Office, specifically the last responsory of the Third Nocturn and the antiphons for the smaller hours (prime, terce, sext and nones) which my team has transcribed, performed, and recorded in 2021-2024, reveal further how these songs synthesize and adumbrate the same set of ideas: softening of stony hearts, lachrymose vision, ardent intercession, and effusive mercy. The chants recognize Sainte Foy as the mediator between the faithful and God, wielding the power to elicit divine mercy through effective intercession.

Bissera V. Pentcheva's innovative work in acoustics, art, and music has redefined the field of Byzantine architecture; she has expanded this research into Western medieval art with her project exploring the interface of medieval chant, image, and architecture in the cult of Sainte Foy at Conques. She has published three books with Pennsylvania State University Press: Icons and Power: The Mother of God in Byzantium, 2006 (received the Nicholas Brown Prize of the Medieval Academy of America, 2010),The Sensual Icon: Space, Ritual, and the Senses in Byzantium, 2010, and Hagia Sophia: Sound, Space and Spirit in Byzantium, 2017 (received the 2018 American Academy of Religion Award in excellence in historical studies) and edited two volumes: Aural Architecture in Byzantium: Music, Acoustics, and Ritual, Ashgate 2018 and Icons of Sound: Architecture, Music and Imagination in Medieval Art, Routledge, 2020. Pentcheva has also published an exhibition catalogue: AudioVision in the Middle Ages: Sainte Foy at Conques (distributed by Stanford University Press, 2023). Her work is informed by anthropology, music, sound studies, and phenomenology.

Sainte Foy at Conques, late 9th cent.: gold, enamel, gems and pearls. Photo: Miguel Novelo for Stanford University's Enchanted Images Project 2022.

Digitally Reconstructing the Ephemeral: Music, Sound, and Textile Architectures (II)

Chairs: Chiara Capulli, Elisabetta Scirocco (Bibliotheca Hertziana – MPI), Kris Racaniello (Bibliotheca Hertziana – MPI/CUNY, GC)

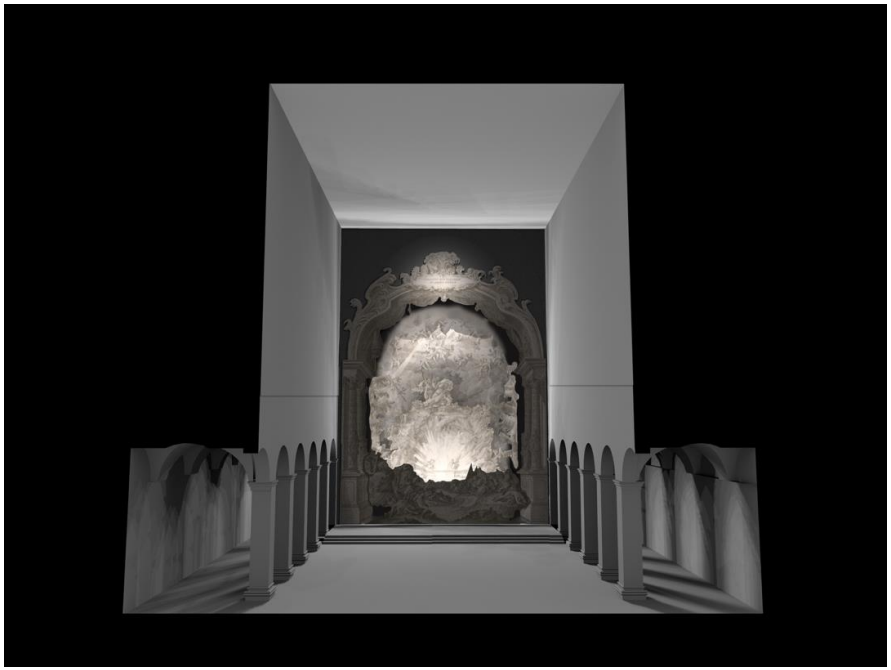
Margherita Antolini (Independent Scholar)

Staging Quarantore Devotion: A Holistic Approach to Festival Studies Through 3D Modeling

The importance of multisensory stimulation in Baroque festival has been long recognized by scholarship as the key to understand this social an artistic phenomenon. Nevertheless, disciplinary boundaries have prevented trans disciplinary research, given the erudition necessary to understand the individual components of music, figurative arts and architecture, and to this day there are very few successful examples integration.
This research aims at using 3d modeling and rendering to visualize the material aspect of sacred scenography through the case study of those promoted by cardinal Ottoboni in the church of San Lorenzo in Damaso in Rome in 1728.
Cardinal Pietro Ottoboni is a key figure in artistic culture for the XVIII century, especially when it comes to spectacle and music. The large number of account reports surviving in the Computisteria Ottoboni allow us to read the different facets of staging a spectacle – be it a play, a oratorio, a jubilee or a sacred theater – through detailed technical documents compiled by architects, masons, carpenters, musicians and all sort of artisans.
Starting from the analysis of the print of the scenography designed by Alessandro Mauri for that occasion, the reconstruction is enriched by an in-depth study of light artifices deployed for both lighting the space and creating illusory effects, which were fundamental to ensure an atmosphere of other-worldly sacredness. The reconstruction is not limited to the "stage" but takes into account the space for the large crowds that famously flooded the church during these occasions; the nave would have been covered with an array of textiles, different both in color and consistency, whose visual and acoustic effect has still been overlooked, despite being one of the main sources of praise by the visitors. Furthermore, a 3d reconstruction allows to explore questions relating to the space reserved for musicians and the temporary stages built for them, which, Given Ottoboni's involvement in music patronage, and the changes in performance practice of sacred music between the XVII and XVIII century, seem to be crucial to understanding such events as Quarantore.

Starting from a somehow traditional research on archival sources, this paper presents an attempt to use 3d modeling technology to integrate visual, spatial and auditory components of Baroque liturgical festivals with a focus on scenography, textiles, light and performative practices.

Margherita Antolini is an architect and PhD. After graduating in Architecture from IUAV (BA) and La Sapienza University (MA) with a thesis on the reconstruction of Baroque ephemeral apparatuses, they have collaborated with various research institutions and architecture firms focused on heritage and conservation in Rome and Seoul. They're part of the editorial committee of *Ardeth* and currently collaborating with several digitization projects at Bibliotheca Hertziana. They were recently awarded a PhD in history of architecture from Politecnico di Torino with the research "Un bellissimo Teatro, che mai vi fù fatto da Vicecancellieri: Quarantore, Sacred Theaters and other liturgical apparatuses sponsored by cardinal Ottoboni between 1689 and 1740", which proposes a holistic approach to festival studies, merging questions of liturgy, patronage, stagecraft, music and evolution of models and typologies.



Janie Cole (University of Connecticut)

Music, Acoustics, and Space in the Christian Kingdom of Ethiopia: Modeling Gorgora Iyäsus Re-Imagined (1626-32)

Music was central to the articulation of faith, liturgy, and power in the early modern Christian kingdom of Ethiopia, and the Jesuit period of expansion on the highlands (1557-1632) was no exception. New and bold Afro-Eurasian architectural projects were developed as symbols of religious renewal that served as sacred Catholic spaces of the divine and were underlaid by royal Ethiopian patronage that shaped these cultural dynamics. Encountering an ancient Ethiopian Orthodox Tewahedo Christianity and a vibrant royal court culture, European Jesuit missionaries sought a theological mechanism of inculturation whereby music and ritual sounds created spatial dimensions and reverberant acoustics to activate the architectural auralities of these sacred spaces and to create profound transcendent spiritual experiences. Drawing on new archival documentation, 16th- and 17th-century travelers' accounts, and indigenous sources, this paper centers on a virtual acoustical modeling of the key Ethiopian archaeological site of Gorgora Iyäsus that combines an examination of the materialities of the space, potential acoustic data, and its sonic manifestations in the form of Jesuit Catholic service, multisensorial ceremonies with indigenous Ethiopian and Asian components at the intersections of sacred space, sound and rite. It addresses the challenges of 3D reconstructions and virtual auralizations 'in the void' when architectural sites, such as Gorgora Iyäsus, are largely lost, and proposes a new innovative solution for a virtual acoustical modeling of Gorgora Iyäsus, combining the incorporation of potential acoustic data into a spatial model, historical performance practices and repertories, and interpretative choices that can enable an immersive simulation of its multi-sensorial experience. The study of sacred sound at Gorgora Iyäsus puts a focus on an embodied experience which can more fully explain the physical appearance of this exceptional Ethiopian monument by combining acoustical, visual and sonic considerations from an entangled early modern Indian Ocean world.

Janie Cole (PhD University of London) is Assistant Professor of Musicology at the University of Connecticut and a Research Affiliate of the Council on African Studies at Yale University. She was a Research Scholar at Yale University's Institute of Sacred Music and Visiting Professor in Yale's Department of Music (2023-24) and a Research Associate at Stanford University's Center for Computer Research in Music and Acoustics (2022-). Prior to this, she was a Senior Lecturer (adjunct) at the University of Cape Town's South African College of Music for nine years (2015-23) and Research Officer for East Africa on the University of Cape Town's multidisciplinary Mellon-funded project Re-Centring AfroAsia (2018-). Dr. Cole's specialty research areas are three-fold, focusing on musical practices,

instruments and thought in early modern African kingdoms (Ethiopia and Kongo) and Afro- Eurasian encounters; music, poetry and spectacle in late Renaissance and early Baroque Italy and France; and music, social change and prisons in the anti-apartheid struggle in 20th-century South Africa. She is the author of two books, as well as numerous articles in peer-reviewed journals and book chapters. Notable fellowships and awards include from The Harvard University Center for Italian Renaissance Studies (2005-06), the Getty Foundation (2007-9), the Janet Levy Prize from the American Musicological Society (2010), the Author Grant Award from the Academic and Non-Fiction Authors Association of South Africa (2015), and the Claude V. Palisca Fellowship Award in Musicology from the Renaissance Society of America (2020). She is the founding Discipline Representative in Africana Studies at the Renaissance Society of America (2018-), serves on the Yale Institute of Sacred Music Fellows' Committee (2024-), is co-founder of the International Musicological Society Study Group Early African Sound Worlds (2023-), and the founder/executive director of Music Beyond Borders.

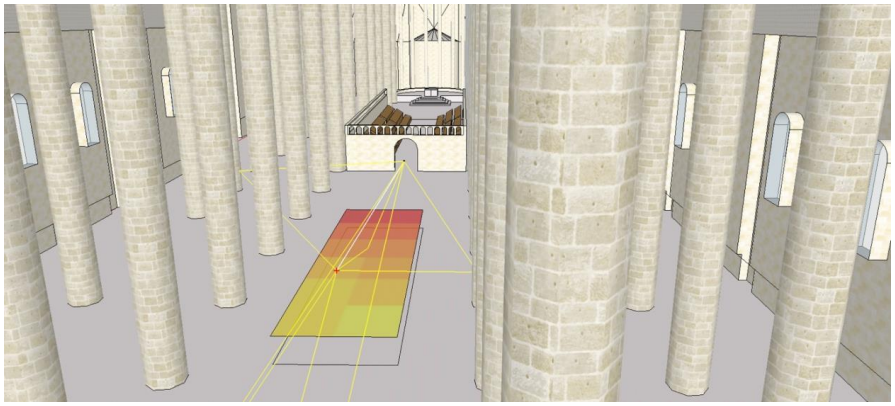
Stefan Morent (Universität Tübingen)
Lukas Aspöck (Universität Aachen)

Sacred Sound/Sacred Space – Virtual Acoustic-Visual Reconstruction of Sacred Spaces of the Middle Ages: Towards Virtual Performance Scenarios

The subproject "Sacred Space" within the research project "Sacred Sound - Musical Manifestations of the Sacred between Theory and Practice" at the University of Tübingen (in cooperation with University of Aachen) investigates the interactions between sacred architecture and sacred sound and which relationships between sacred spatial concepts and their socio-cultural construction and religious experience and the development of liturgical forms can be discerned.
The underlying thesis is that Gregorian chant was embedded in a complex network of relations between movement in the sacred space within the liturgy and the acoustic conditions of the space. Special methodological and technical challenges arise when the corresponding sacred spaces no longer exist or exist only in part. In the context of the question of the connection between musical-liturgical tradition, notation, performance practice and sound and space in monastic reform movements of the Middle Ages, this applies to numerous church rooms that are central to the investigation.
New possibilities arise from the virtual reconstruction of the architecture as well as its acoustics. The Cistercian monastery church of Maulbronn and the former monastery church Cluny III serve as a pilot project: recordings with singers in the real church space are compared to recordings in its virtually acoustic-visual reconstructed model. In August 2023 recordings with ensemble *Ordo Virtutum* of the Offices for St. Gall and St. Othmar took place in the reconstructed acoustic of the 9th century Gozbert church of the of St. Gall monastery. Research questions are to what extent relationships can be established between room acoustics, liturgical and theological norms (laid down, for example, in *Consuetudines* or *Libri Ordinarii*) of (Western) monastic communities and their liturgical singing (handed down in corresponding sources) and the perception of liturgical singing in relation to performance spaces.
Concerning historical performance practice, the project now is about to investigate how (concert) performances in these virtual reconstructed spaces could be set up. For singers and audiences several technical challenges for realizing such virtual scenarios (f. ex. effects of the performance space, different hearing positions, movement of singers during processions) will have to be met.
The talk will present the project as work-in-progress: possibilities and limitations, potential next steps and challenges for the future.
https://www.ardmediathek.de/video/kulturmatinee/sacred-sound/swr/Y3JpZDovL3N3ci5kZS9hZXgvbzE4NDA2MDA

Stefan Morent studied musicology and computer science in Tübingen, recorder and historical performance practice in Trossingen, music of the Middle Ages with Andrea von Ramm and Sterling Jones. He received his PhD with "Studies on the Influence of Instrumental on Vocal Music in the Middle Ages" and his Habilitation with "The Middle Ages in the 19th Century. A Contribution to the History of Composing in France" in Tübingen. He held teaching assignments and professorships in Trossingen, Vienna, Hamburg, Heidelberg, Detmold, Saarbrücken, Mannheim, Cologne, and Berkeley. In 2020 he has been appointed to the new professorship/chair of musicology with focus on Digital musicology/Music before 1600 at the University of Tübingen. Since April 2021 he serves as Head of Department of the Institute of Musicology and since 2023 as vice dean for Digital Humanities at the Faculty for Philosophy. He is project leader of a research project on medieval music fragments from Württemberg monasteries funded by the German Research Foundation and speaker of the "Sacred Sound" project. His research interests are Music of the Middle Ages, Historical Performance Practice, Music History in the German Southwest, Music and Religion and Digital Musicology. He also performs an extensive international concert activity with his ensemble *Ordo Virtutum* for music of the Middle Ages.

Lukas Aspöck studied computer science and media technologies at Aachen University and received his PhD with “Validation of room acoustic simulation models”. He has been active from 2013-2020 as research assistant and PostDoc-researcher and has been appointed in 2023 Senior Researcher at the Institute of Hearing Technologies and Acoustics at Aachen University. His research interests are room and building acoustics, acoustic virtual reality and auralization techniques and he contributed to the Sacred Sound research project in collaboration with the University of Tübingen. He is a member of ASA (Acoustical Society of America) and DAGA (Deutsche Gesellschaft für Akustik and organized major conferences (DAGA 2016, ICA 2019). Last publication within the *Sacred Sound* project: Lukas Aspöck, Stefan Morent und Michael Vorländer: *Simulated reverberation for choir recordings in virtual churches*, in: *Proceedings of the 49th Annual Conference on Acoustics (DAGA) in Hamburg*, 2023. http://dx.doi.org/10.13140/RG.2.2.11702.16963



Augustus Wendell (Duke University)

Tracing Space: Computational Approaches to Studying the Ephemeral with Real Time Game Engines

Computational approaches provide unique means of studying the ephemeral in sacred architectural space. With the integration of sophisticated digital 3D modeling into researchers' toolkits, spatial simulations are becoming increasingly common resources. The ability to compute research questions within these models at high scale and efficiency affords the asking of new and important questions: How can the modeling of perception be applied to issues of semantic vision, acoustic shaping, and movement?

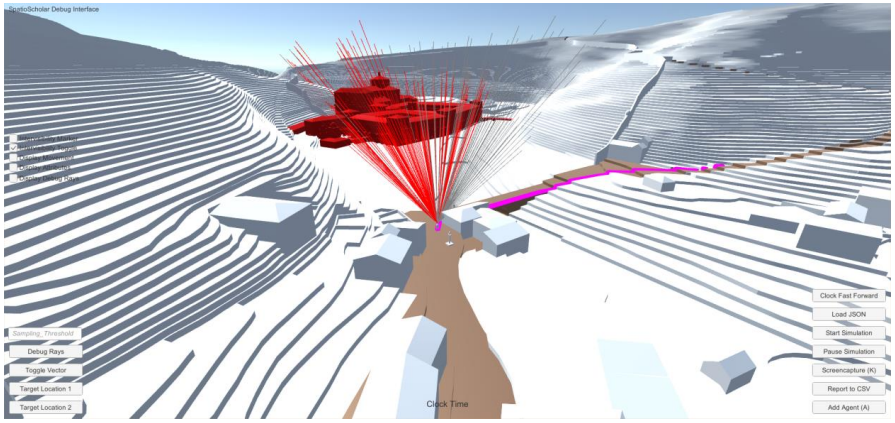
While the computational methods required to ask such questions are documented and available, a challenging chasm exists in disciplinary familiarity with, and access to, these tools. Spatial researchers working in the humanities have long adopted digital tools through a process of co-opting software from adjacent disciplines such as architecture and design, often introduced via interdisciplinary collaboration. The histories of accessibility within these disciplines have deeply influenced the tools adopted—limiting and shaping the computational approaches used in spatial studies. For example, the architectural design industry has made modeling software freely available to university students, including tools like AutoCAD, Maya, and 3ds Max. These tools, developed primarily for visual simulation from a single viewpoint, evolved to enable complex spatial modeling, but offer relatively simplistic methods for phenomenological simulation. For decades, these tools prioritized photographic visual material properties and realistic lighting calculations. Meanwhile, computational methods for acoustic and movement modeling—though existent—have remained the domain of specialized design engineering software, often inaccessible due to high costs and limited availability outside of specific educational programs.

This paper presents approaches to phenomenological modeling of spatial ephemera using real-time simulation software. The specific platform discussed is Unity, a system originally developed for the digital game design industry. Unity integrates the C# programming language directly into its simulation environment, allowing users to develop and incorporate custom code that extends computational simulations beyond photographic visual primacy. With an accessible API (Application Programming Interface), Unity supports the implementation of computational methods related to sightlines, energy transmission, and absorption within 3D models. This makes it possible to simulate visual, acoustic, and semantic spatial studies using widely available digital models.

By exposing functions such as pathfinding and turn-based movement, computational agents can be simulated to assess movement, interaction,

visibility, and spatial restrictions of populations and roles within hierarchical sacred spaces. This paper will present technical approaches to these questions, alongside open-source code and example outcomes developed within the Unity Game Engine.

Augustus Wendell is an Assistant Professor of the Practice in the Department of Art, Art History and Visual Studies at Duke University. He is the Visual Arts Program Coordinator and Core Faculty in the Computational Media Major and the Computational Media, Arts & Cultures Graduate Program. He completed his MFA in Computer Art at the School of Visual Arts and his undergraduate studies at Northeastern University. Augustus has held appointments at Parsons School of Design, the New York School of Interior Design, Virginia Tech, and the New Jersey Institute of Technology, where he coordinated the undergraduate Digital Design program. His research explores the application of computational processes to design, fine and performing arts, and historical inquiry. He concentrates on the use of image- and model-based workflows to investigate complex geographic, historical, and spatial conditions. Through modeling, simulation, and ethnographic field research, Augustus has developed a diverse body of work that questions the relationship between the post-human and the cultures of perception, control, and mediation. His artwork has been exhibited and performed internationally. Augustus is the director of the *Culture I/O Lab* and co-director of the *Dig@ Lab* at Duke University. The *Culture I/O Lab* engages in practice-based research at the intersection of culture, technology, and art. Current projects include the application of commercial computer vision algorithms in portrait studies, virtual reality experience design that materializes architectural theories of indeterminacy, and a media archaeology archive of early generative AI model outcomes. The *Dig@ Lab* creates immersive, interactive experiences that communicate archaeological history in international museum exhibitions. The lab collaborated with the Institute for the Study of the Ancient World on the current Spring Exhibition *Rethinking Etruria* bringing to the exhibition 3D printed tangible models, AI generated cinematic sequences and an interactive touchscreen interface.



Round Table Discussion

Chair: Tanja Michalsky (Bibliotheca Hertziana – MPI)

Participants:

Stefano Campana (Università degli Studi di Siena) link
Simone Caputo (Sapienza Università di Roma) link
Angelica Federici (Fondazione Bruno Kessler) link
Manuela Gianandrea (Sapienza Università di Roma) link
Giacomo Landeschi (University of Lund) link
Ruggero Longo (Università degli Studi di Siena) link
David Merlin (Deutsches Historisches Institut in Rom) link
Ana Plosnić Škarić (Institute of Art History, Zagreb) link

Concept and Scientific Organization:
Chiara Capulli (Bibliotheca Hertziana – MPI)
Vera Grund (Deutsches Historisches Institut in Rom)
Klaus Pietschmann (Universität Mainz)
Kris Racaniello (Bibliotheca Hertziana – MPI/CUNY, GC)
Elisabetta Scirocco (Bibliotheca Hertziana – MPI)
Tobias C. Weißmann (Universität Mainz and Universität Zürich)

Executive assistance:
Raffaele Rossi (Bibliotheca Hertziana – MPI)
Ornella Rodengo (Bibliotheca Hertziana – MPI)

Promoting Institutions:
Bibliotheca Hertziana – Max Planck Institute for Art History (*Mapping Sacred Spaces* Project)
Deutsches Historisches Institut in Rom
Research Project CANTORIA – Music and Sacred Architecture
Johannes Gutenberg-Universität Mainz
Universität Zürich