

PROGRAM BOOK

23-25 SEPTEMBER 2026|
BRAGA, PORTUGAL

Artificial Intelligence
and Geotechnologies
for Human
Experiences



Laboratory of Landscapes
Heritage and Territory



Universidade do Minho
Instituto de Ciências Sociais

FLAD
FUNDAÇÃO LUSO-AMERICANA
PARA O DESENVOLVIMENTO



Welcome to the SH26 Congress

The local organizing committee for spatial humanities hopes that your involvement is both enjoyable and energizing!

PROGRAM: 2nd version 14 of September 2026

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The overall concept

“Artificial Intelligence and Geotechnologies for Human Experiences”

SH26 international conference is guided by the theme “Artificial Intelligence and Geotechnologies for Human Experiences”. We welcome submissions on all aspects of using geospatial technologies in humanities research by different research fields, including (but not limited to) geography, history, literature, archaeology, economy, geology, sociology, education, literary studies, classics, linguistics, art history, anthropology and religious studies. The main aim is to explore and demonstrate the contributions to knowledge enabled by geospatial technologies, approaches and methods within and beyond the digital humanities.

General Topics

1. Geospatial Technologies Applied to the Humanities
2. Methodological Innovation and Computational Approaches
3. Heritage and Spatial History
4. Spatialized Narratives, Mobility, and Networks
5. Spatial Data, Digital Collections, and Infrastructure
6. Environmental Humanities, Landscape Studies and Sustainability
7. Education, Digital Literacy, and Scientific Dissemination
8. History and Study of Social Phenomena
9. Spatial Cognition and Representation of Space
10. Urban Space and Mobility
11. Interdisciplinarity and Integration in Spatial Humanities
- 12 - Workshop

Plenary Sessions' Topics

PS01 – Thursday, 12:00-13:00

Anne Knowles

PS02 – Friday, 12:00-13:00

Ignatius Ezeani

Committees

Executive Committee

Ian Gregory, Lancaster University, UK
Carmen Enss, University Bamberg, Germany
Daniel Alves, Universidade NOVA de Lisboa, Portugal
Joana Paulino, Universidade NOVA de Lisboa, Portugal
Klaus Stein, University Bamberg, Germany
Lise Foket, Ghent University, Belgium
Seraphim Alvanides, TU Dortmund University, Germany
Vincent Ducatteuw, Ghent University, Belgium

Programme Committee

Iason Jongepier, University of Antwerp, Belgium
Katie McDonough, Lancaster University, UK
Carmen Brando Lebas, l'EHESS, France
Christophe Verbruggen, Ghent University, Belgium
Ruth Mostern, University of Pittsburgh, USA
Tiffany Earley-Spadoni, University of Central Florida, USA
Jitka Močíčková, Czech Academy of Sciences, Czech Republic
Don Lafreniere, Michigan Technological University, USA

Ana Plosnić, Institute of Art History in Zagreb, Croatia
Zef Segal, College of Management Academic Studies, Israel
Ma Zhaoyi, Nanyang Technological University, Singapore
HE Jie, Harbin Institute of Technology, Shenzhen, China
Andrea Ballatore, King's College London, UK
Jyothi Justin, Indian Institute of Technology Indore, India
Johannes Sibeko, Nelson Mandela University, South Africa
Elton Barker, Open University, UK
Leif Isaksen, University of Exeter, UK
Mustafa Erdem Kabadayı, Koç University, Istanbul
Carol Ludwig, Saarland University, Germany

Local Organizing Committee

Vitor Ribeiro, University of Minho, Portugal/Lab2PT
Paula Remoaldo, University of Minho, Portugal/Lab2PT
Flávio Nunes, University of Minho, Portugal/CECS.UMinho
Hélder Lopes, University of Minho, Portugal/Lab2PT
Alexandra Esteves, University of Minho, Portugal/Lab2PT
Joana Sequeira, University of Minho, Portugal/Lab2PT
Filipe Brandão, University of Minho, Portugal/Lab2PT
Juliana Alves, University of Minho, Portugal/Lab2PT

Organization and Support

Staff: Carla Xavier, Tomás Cana, Diana Mendes, Ângela Calisto, Virginia Abreu, Sara Cunha, Cláudia Novais, Rúben Melo, Inácio Ribeiro, Ângela Ferreira, Carla Rouceiro, Leonardo Silva, Cátia Faria, Maria João, Alice Cunha, Maira Fortunato, Mathilde Castro, Ana Novais, Carolina Marinho.



ACKNOWLEDGMENTS: This initiative was supported through the Multiannual Funding of the Landscape, Heritage and Territory Laboratory (Lab2PT), Ref. UID/04509: Laboratório de Paisagens, Património e Território (Lab2PT/UM), financed by national funds (PIDDAC) through the FCT/MCTES.

Congress Venue

University of Minho

Campus de Gualtar, Braga, Portugal

Coordinates: 41.560609, -8.400012

Map: <https://maps.app.goo.gl/e1svxFrRyMsjkjgN8>

Access to Wi-fi

Wi-fi name: SH26@guest

Password: 2026!!SH26

Instructions to Chairs and Presenters

The Organizing Committee thanks a lot your participation and support in SH26 Congress. Please be aware of the following issues and rules.

1. Sessions will last mostly 1:15 hours. Please stick to the times shown in the program.
2. If you have a missing presentation in your session, please use the time for a discussion of the precedent paper(s) or for a recess. Do not shift papers to fill voids, as individuals may want to attend a particular paper.
3. The majority of sessions have 3 papers. Each presenter has 15 minutes to present his/her paper. Each session has 30 minutes of discussion at the end.
4. If a speaker continues after time has expired, please let her/him know that time has expired. The audience and the other speakers will respect and support your decision.

We recall the duties of a Session Chair:

- To promote compliance with schedules and the fair distribution of time available for all communications;
- To manage the debate time;
- To report to the secretariat the papers that were not presented in the session.

To create some memories of the Congress, there will be a staff member that will invite all presenters to take a photo at the end of the session.

Paperless conference

SH26 is committed to acting sustainability and environmentally responsible in as many ways as possible.

Daily program

version 3

Wednesday, 23 September 2026

Venue: Campus de Gualtar, Braga, University of Minho

Registration

9:00-11:00 Building 16 - Engineering School - Hall

WORKSHOP I

09:30-12:30 | Wednesday, 23 September 2026

Building 15 - Institute of Social Sciences - Laboratório Pedagógico I (Computer Room 0.04)– limited places

Ignatius Ezeani, Lancaster University, UK: AI and NLP for Spatial Humanities: From Manual Annotation to LLM-Assisted Interpretation

WORKSHOP II

09:30-12:30 | 23 September 2026

Building 15 - Institute of Social Sciences - Sala de Atos (room 0.02, floor 0)

Ruth Mostern, University of Pittsburgh, USA: From Locations to Places: Modeling and Visualizing Regions and Neighborhoods

Region and neighborhood are fundamental topics in cultural geography. As named places that are sites of human meaning and experience, regions and neighborhoods are appropriate candidates for historical gazetteers and other spatial humanities projects. However, they often lack formal boundaries or official designations. There are few good exemplars or standards for how to model and represent them in spatial humanities and historical GIS projects. This workshop is an opportunity to scope the problem, examine the state of the field, and discuss future steps.

Organizers of this workshop are affiliated with the University of Pittsburgh's Institute for Spatial History Innovation (ISHI), the World Historical Gazetteer, and representatives of the Pelagios Place Working Group. At the conclusion of the sessions, the organizers will write up a summary of the findings that we will disseminate through Pelagios Place Working Group.

The first session will consist of opening framing remarks from the organizers followed by short presentations by invited speakers that explore how current projects represent informal, fluid, unbounded, and vernacular regions and neighborhoods at scales ranging from the very local to the continental, and from the highly persistent to the ephemeral. The final hour will consist of open discussion where we will ask participants to consider questions like how to describe, model, and visualize regions and neighborhoods of multiple spatial and temporal scales, and how to tackle the many kinds of uncertainty inherent to such entities, especially in light of the affordances offered by linked data. Participants will consider the methodological and interpretive challenges that arise when modeling at different resolutions.

The workshop also aims to surface best practices for working across spatial and temporal scales; strategies for communicating imprecision, uncertainty, and contestation, and opportunities for more robust, transparent, and context-sensitive digital representations of regions, neighborhood, and place in general.

COFFEE-BREAK

11:00-11:30 | Wednesday, 23 September 2026

Venue: Building 15, Institute of Social Sciences (Hall)

LUNCH BREAK

13:00-14:00 | Thursday, 23 September 2026

Venue: Building 11, Grill Restaurant

Visit to the city center

14:00-18:00 | Wednesday, 23 September 2026

Meeting Point: Building 15 - Institute of Social Sciences - Sala de Atos (room 0.02, floor 0)

[Roteiro histórico de Braga](#)

With over 2000 years of history, Braga is the oldest city in Portugal and one of the world's oldest catholic cities.

Founded by the Romans in the year 16 b.C. and named "Bracara Augusta" in honor to the emperor Cesar Augusto. It was the capital of Galécia, from where derived five Roman Roads, with a vast territory that went from the North Douro until the Cantabrian. After conquests and re-conquests from several people, the king of Leon, D. Afonso IV donated it as a dowry to his daughter D. Teresa at a time of her wedding with the Count D. Henrique of Burgundy.

The long history of Braga is visible in its monuments and churches, being the Cathedral the most imposing and displaying several different styles, from roman to baroque, also being proud of the splendid houses, particularly the XVIII century ones.

A young, cosmopolitan and multicolor city, Braga shows with confidence a wide range of success and prosperity scenarios, extending its tutelary and entrepreneur arms to areas as vital as the culture, the commerce, industry and services. The ones who visit us have the possibility to attend a diversified touristic and cultural program, taking a civilizational route documented since the Prehistory to the current days and live the real Minho culture, engraved in the vast heritage, in the ethnographical groups, village festivals, fairs and pilgrimages, as well as in the rich and diverse handicraft.

Source: <https://www.cm-braga.pt/en>

Thursday, 24 September 2026

Venue: Campus de Gualtar, Braga, University of Minho

Registration

9:00-11:30 Building 16 - Engineering School - Hall

OPENING SESSION

9:30-10:15 | Thursday, 24 September 2026 Room: **Building 13 – Institute of Education - Multimedia Auditorium (room 0.28, floor 0)**

Session and Room Staff: Leonardo, Rúben, Inácio and Sara

Welcome Speeches



PEDRO AREZES
RECTOR OF THE UNIVERSITY OF MINHO
University of Minho



IAN GREGORY
SPATIAL HUMANITIES ASSOCIATION
Lancaster University



JOÃO CABELEIRA
DIRECTOR OF Lab2PT
University of Minho



SARA BALONAS
VICE-PRESIDENTE DO ICS
University of Minho



VÍTOR RIBEIRO
LOCAL ORGANIZATION COMMITTEE
University of Minho

PARALLEL SESSIONS

10:15-11:30 | Thursday, 24 September 2026

1 - Spatial Data, Digital Collections, and Infrastructure

10:15-11:30 | Thursday, 24 September 2026

Building 15 - Institute of Social Sciences - Sala de Atos (room 0.02, floor 0)

Chair: Paula Remoaldo

EXPLORING GEOGRAPHIC INFORMATION SERVICES IN EUROPEAN UNIVERSITY LIBRARIES

Lisandra Otero Borges; Sara Martínez-Cardama; Nuria Bautista-Puig

MAPPING DEATH: SUICIDE, URBAN SPACE, AND HISTORICAL GIS IN SÃO PAULO

Monaliza Caetano

SAFEGUARDING AND VALUING HERITAGE THROUGH COMMUNITY MAPPING AND DIGITAL NARRATIVES

Diana Mendes; Alexandra Esteves; José Gabriel Andrade

Session and Room Staff: Ângela Calisto, Diana Mendes

2 - Geospatial Technologies Applied to the Humanities

10:15-11:30 | Thursday, 24 September 2026

Building 16 - Engineering School - Pedagogical Amphitheatre (room 0.55, floor 0)

Chair: Vítor Ribeiro

AUTOMATED EXTRACTION OF SPATIAL INFORMATION FROM COLD WAR OPERATIONAL DOCUMENTS USING LARGE LANGUAGE MODELS

Mads V. Perner; Stig R. Svenningsen; Steen Andersen; Anna Werenberg

RE-INHABITING A ROMAN SPACE: AUGMENTED REALITY AND DIGITAL TWINS FOR EXPERIENCING ARCHAEOLOGICAL HERITAGE

María Gabriela Moreno; António Medeiros; Márcia Vilarigues; Nuno Correia

MAPPING THE LANGUAGES IN KRĀSLAVA (LATVIA) ACCORDING TO 1935 CENSUS DATA

Melchior Jakubowski

Session and Room Staff: Rúben and Leonardo

3 - Geospatial Technologies Applied to the Humanities

10:15-11:30 | Thursday, 24 September 2026

Building 13 – Institute of Education - Multimedia Auditorium (room 0.28, floor 0)

Chair: Daniel Alves

BUILDING BACKSTORIES FOR BRITAIN'S CONSTITUENCIES WITH GIS

Paula Aucott; Humphrey Southall; Oliver Heath; Chris Prosser

ASSESSMENT AND IMPACT OF A NATIONAL HISTORICAL-GIS PROJECT: THE ATLAS, HISTORICAL CARTOGRAPHY BETWEEN 1993 AND 2025

Daniel Alves

MODELING PLACE BEYOND POINTS: REFLECTIONS FROM THE WORLD HISTORICAL GAZETTEER ON SCALE, AMBIGUITY, AND HUMAN EXPERIENCE

Ruth Mostern, Palak Vashist, Alexandra Straub, Stephen Gadd

Session and Room Staff: Inácio and Sara

COFFEE-BREAK

11:30-12:00 | Thursday, 24 September 2026

Venue: Building 15, Institute of Social Sciences (Hall)

PLENARY SESSION I

12:00-13:00 | Thursday, 24 September 2026 Room:

Building 13 – Institute of Education multimedia Auditorium (room 0.28, floor 0)

Keynote Speech



What Do We Want to Say? To Whom? And How?"

Anne Knowles

Anne Kelly Knowles is an historical geographer from the University of Maine (USA). Co-founder of Holocaust Geographies Collaborative her main research interests are Historical Geography, Historical GIS, Geovisualization, and Digital Humanities. Also, the Holocaust Nineteenth-century United States and the intersections of economy, technology, and culture and their expression in the landscape.

Chair: Jitka Močíčková

Session and Room Staff: Rúben, Sara and Inácio

LUNCH BREAK

13:00-14:00 | Thursday, 24 September 2026

Venue: Building 11, Grill Restaurant

Poster Exhibition

14:00-14:30 | Thursday, 24 September 2026

Building 15 - Institute of Social Sciences - Hall

PARALLEL SESSIONS

14:30-15:45 | Thursday, 24 September 2026

4 - Spatialized Narratives, Mobility, and Networks

14:30-15:45 | Thursday, 24 September 2026

Building 15 - Institute of Social Sciences (room 0.02, floor 0)

Chair: Greta Hawes

DEEP MAPPING PLANTS IN THE CITY: A CASE STUDY

Noel Castro-Fernández

MAPPING DETACHMENT: GEOLOCATIONS IN PANDEMIC DIARIES

Haralds Matulis; Ilze Ļaksa-Timinska; Viesturs Vēveris

MAPPING SPACE AND TIME IN THE GREEK MYTHIC STORYWORLD

Greta Hawes; Cian Colgan; **Chiara Palladino**; Scott Smith;

Session and Room Staff: Virginia and Cátia

5 - Spatialized Narratives, Mobility, and Networks

14:30-15:45 | Thursday, 24 September 2026

Building 16 - Engineering School - Pedagogical Amphitheatre (room 0.55, floor 0)

Chair: Jackie Olson

THE ANATOMY OF DIGITAL HAUNTING: EXTRACTING THE UNIVERSAL MECHANISM OF FEAR FROM A CASE STUDY OF NORTHEAST CHINA'S DREAMCORE

Wanshu Zhang; Mingyi Liao; Yining Wang

DEPTH IN THE SILENCE: THE NON-SEMANTIC TEXT IN HOLOCAUST SURVIVOR INTERVIEWS

Jackie Olson; Tim Cole; Erik Steiner

SPATIAL AND SOCIAL CONSEQUENCES OF POND BREAKS IN EARLY MODERN BOHEMIA

Michal Vokurka

Session and Room Staff: Leonardo and Rúben

6 - Spatialized Narratives, Mobility, and Networks

14:30-15:45 | Thursday, 24 September 2026

Building 13 – Institute of Education - Multimedia Auditorium (room 0.28, floor 0)

Chair: Filipe Brandão

USING AI AND QUALITATIVE SPATIAL REPRESENTATION (QSR) TO UNDERSTAND THE PERCEPTION OF GEOGRAPHIES IN TEXTS: PICTURESQUE AND WILD LANDSCAPES IN THE ENGLISH LAKE DISTRICT

Ian Gregory; Ignatius Ezeani; Erum Haris; Joanna Taylor

COMPARATIVE ANALYSIS OF NEURAL METHODS FOR CULTURAL ASSETS REPRESENTATION

Filipe Brandão; Paulo Bernardes

DEEP MAPPING IRELAND'S PLACES WITHIN AN OBJECT-RELATIONAL DATABASE

Humphrey Southall; Paula Aucott

Session and Room Staff: Inácio and Sara

PARALLEL SESSIONS

16:00 - 17:15 | Thursday, 24 September 2026

7 - Spatialized Narratives, Mobility, and Networks

16:00 - 17:15 | Thursday, 24 September 2026

Building 15 - Institute of Social Sciences - Sala de Atos (room 0.02, floor 0)

Chair: Helder Lopes

SHAPING THE COLONIAL PORT CITIES: TRADE NETWORK AND SPATIAL STRUCTURE IN THE PRE-COLONIAL ERA

Chaoqun Wang; Jie He

SPATIAL NARRATIVES OF FRONTIER MEMORY: A DIGITAL HUMANITIES RECONSTRUCTION OF XINJIANG RECLAMATION MOBILITY (1949–1965)

Yu Baoyuan; Jie He

LINKING NARRATIVE TO NETWORK: SPATIALIZING FINANCIAL TRUST AND CAPITAL FLOWS OF THE CHAOSHAN CHINESE DIASPORA VIA QIAOPI DOCUMENTS

Shao Tong; Jie He

Session and Room Staff: Virginia and Ângela

8 - Geospatial Technologies Applied to the Humanities

16:00 - 17:15 | Thursday, 24 September 2026

Building 16 - Engineering School - Pedagogical Amphitheatre (room 0.55, floor 0)

Chair: Filipe Brandão

INTERPRETING PLACE THROUGH DEEP MAPPING: SPATIO-TEMPORAL NARRATIVES OF AUREL STEIN'S CENTRAL ASIAN ARCHAEOLOGICAL EXPEDITION TEXTS

Tong Liu; Linru Xu; Jie He

PARTICIPATORY MAPPING OF ART DECO ARCHITECTURE THROUGH AI-GENERATED PODCAST

Cristina Goldschmidt; Robert, G Harland

DEVELOPING A DEEP MAP IN A HISTORICALLY DENSE LANDSCAPE: THE SPATIAL HISTORY OF CHARLESTON, SOUTH CAROLINA

Douglas Rivet; James Newhard; Danielle Cox; Jennifer Comer; Laurel Fay; R. Grant Gilmore; Madison Lee; Jennifer Randall; Chloe Stuber

Session and Room Staff: Leonardo and Rúben

9 - History and Study of Social Phenomena

16:00 - 17:15 | Thursday, 24 September 2026

Building 13 – Institute of Education - Multimedia Auditorium (room 0.28, floor 0)

Chair: Joana Sequeira

MAPPING MULTILEVEL HISTORICAL BORDERS IN CENTRAL EUROPE: ETHNICITY, CONFESSION, AND STATE ADMINISTRATION IN LONG-TERM PERSPECTIVE (1880–1930)

Jitka Močíčková; Petra Justová

DECIPHERING CARTOGRAPHIC REPRESENTATIONS OF THE DESTRUCTION OF NUREMBERG (NÜRNBERG) DURING AND AFTER THE SECOND WORLD WAR (WWII)

Seraphim Alvanides; Carmen Maria Enss; Klaus Stein

MEDIEVAL LANDSCAPES, GIS AND SETTLEMENT DYNAMICS ON THE OUTSKIRTS OF BRAGA

Francisco Andrade

Session and Room Staff: Inácio and Sara

COFFEE BREAK

17:15-17:30 | Thursday, 24 September 2026 Venue:

Building 15, Institute of Social Sciences (Hall)

PARALLEL SESSIONS

17:15 - 19:00 | Thursday, 24 September 2026

10 - Spatialized Narratives, Mobility, and Networks

17:30 - 19:00 | Thursday, 24 September 2026

Building 15 - Institute of Social Sciences - Sala de Atos (room 0.02, floor 0)

Chair: Hélder Lopes

PROPERTY EXPROPRIATION AND ITS ARCHITECTURES: A STUDY IN SPATIAL HUMANITIES ON THE LAND REGIME IN PALESTINE/ISRAEL

Elad Horn

SPATIAL HUMANITIES OF CONSTRUCTION: ML DERIVED BUILDING LIFECYCLES FROM MUNICIPAL RECORDS

Elad Horn; Elad Granot; Or Aleksandrowicz

HISTORICISING URBAN HEAT: URBAN SHADE MAPS FOR EXCAVATING THE CLIMATIC LEGACY OF PLANNING

Or Aleksandrowicz

CASTING, MELTING, GRINDING: A SPATIAL GENEALOGY OF ISRAEL'S BUILDING-MATERIALS INDUSTRY, 1923 - 1967

Hadar Porat; Or Aleksandrowicz

Mapping a Threshold City Critical GIS and Historical Mapping of al-Bassa's Urban Transformation

Samadar Aukal

Session and Room Staff: Virginia and Ângela

11 - Spatialized Narratives, Mobility, and Networks

17:30 - 19:00 | Thursday, 24 September 2026

Building 16 - Engineering School - Pedagogical Amphitheatre (room 0.55, floor 0)

Chair: Paula Remoaldo

ANALYSIS OF THE CENTRAL PORTUGUESE WAY OF ST. JAMES USING GEOTECHNOLOGIES FROM THE WIKILOC TOOL

Leida Costa; Paula Remoaldo; Hélder Lopes

THE PILGRIMAGE IN A RELÍQUIA BY EÇA DE QUEIROZ: A STORY MAP ANALYSIS

Giorgia Bressan

RECONSTRUCTING DEPORTATION TRAJECTORIES THROUGH TRAIN NARRATIVES IN THE ISRAELKORPUS

Mariella Rivelli

THE THIRD DIMENSION OF THE 1830 HABSBURG CADASTRAL MAP OF TROGIR AND THE MEDIEVAL ORIGINS OF THE PRIVATE PROPERTY DISTRIBUTION WITHIN A CITY BLOCK

Ana Plosnić Škarić*

Mapping Istanbul's Urban Metabolism: Interactive Visualizations of Metabolic Flows

ESRA Sert*

Session and Room Staff: Leonardo and Rúben

12 - Urban Space and Mobility

17:30 - 19:00 | Thursday, 24 September 2026

Building 13 – Institute of Education - Multimedia Auditorium (room 0.28, floor 0)

Chair: Vítor Ribeiro

ACTIVE AND INDEPENDENT SCHOOL MOBILITY: CHILDREN'S USE AND EXPERIENCES IN THE CITY OF BRAGA, PORTUGAL

João Monteiro; Vítor Ribeiro; Ana Francisca, Miguel Bandeira

SPATIAL METHODS TO ANALYSE THE CHALLENGES FACED BY INDIVIDUALS WITH PHYSICAL DISABILITIES IN THE URBAN AREA OF BARCELOS

Miguel Afonso Martins; Paula Remoaldo; Hélder Lopes

UTOPIC VERSUS DYSTOPIC CITY: AN ANALYSIS BASED ON VERTICAL MOBILITY

Iuria Betco; Cláudia M. Viana; Jorge Rocha

MAPPING ANTIQUITY: LOCAL PERCEPTION OF ANCIENT LEGACIES IN THE RELACIONES TOPOGRÁFICAS DE FELIPE II

Nadezda Konyushikhina

HGIS FOR EXAMINING EVOLUTION OF MARKED HIKING TRAILS: ISRAEL, 1950'S – 1995

Aviv Oppenheim; Assaf Selzer; Motti Zohar

CONSISTENCY AND CHANGE: THE SHAPE AND USES OF LISBON'S CITY MARGINS

João Paulo da Costa Amado*

Session and Room Staff: Inácio and Sara

OFFICIAL DINNER

20:00-23:00 | Thursday, 24 September 2026

Venue: Panoramic Restaurant

Address: Campus de Gualtar, University of Minho, Braga, Portugal



Menu

Soup: Asparagus cream soup

Hot Dishes: “Lagareiro” Cod And Roast turkey with potatoes and vegetables

Desserts: Sliced Fruit And Tiramisu

Music: Traditional Portuguese instrument called “viola braguesa” or “viola de Braga”, typical of the Portuguese Minho region.

Friday, 25 September 2026

Venue: Campus de Gualtar, Braga, University of Minho

Registration

8:30-9:30 Building 16 - Engineering School - Hall

Session and Room Staff: Ângela, Cláudia and Diana

PARALLEL SESSIONS

9:00 - 10:15 | Friday 25 September 2026

13 – Posters Presentation

9:00 - 10:15 | Friday 25 September 2026

Building 15 - Institute of Social Sciences - Sala de Atos (room 0.02, floor 0)

Chair: Alexandra Esteves, Filipe Brandão and Carmen Ess

MOVING GIS TO ANIMAL WELFARE MANAGEMENT

Daniela Cardoso; Sara Cunha; Vítor Ribeiro

ONLINE GIS TOOLS TO CREATE A MORE EFFICIENT TOOL TO LEAD WITH VESPA VELUTINAEXPLORING

Beatriz Moreira; Vítor Ribeiro

DECIPHERING THE URBAN LANDSCAPE OF EARLY 15TH-CENTURY PRAGUE

Petra Justová; Jitka Močíčková

SOCIAL EXCLUSION AND GIS-T: THE CASE OF GUIMARÃES MUNICIPALITY

Gonçalo Cunha; Vítor Ribeiro

DIGITAL HUMANITIES, GEOGRAPHY AND SUSTAINABILITY: A SYSTEMATIC REVIEW OF RESEARCH TRENDS, METHODS AND DATA

Cláudia M. Viana

INTERPRETING URBAN LANDSCAPES THROUGH GIS: A SPATIAL ANALYSIS OF INDUSTRIAL LAND USE

Ferim Gashi; Edon Shemsedini, Shkumbin Lushaj

DIGITAL COMMUNICATION OF CREATIVE EXPERIENCES DEVELOPED IN A UNESCO CREATIVE CITY

Cátia Faria; Paula Remoaldo; Juliana Alves; Hélder Lopes

RECONSTRUCTING COLONIAL LAND USE IN SRI LANKA

Linu Danielkutty; Brian Dermody, Kees Klein Goldewijk and Stefan Dekker

Session and Room Staff: Cátia and Virginia

14 - Spatialized Narratives, Mobility, and Networks

9:00 - 10:15 | Friday 25 September 2026

Building 16 - Engineering School - Pedagogical Amphitheatre (room 0.55, floor 0)

Chair: Douglas Rivet

THE PROJECT "MINORS ON THE MOVE: MAPPING FORCED MIGRATION FROM NAZISM AND ITS TESTIMONIES"

Vincenzo Amendolara; Chiara Arnone; Barbara Häußinger; Simona Leonardi; Rita Luppi; Ramona Pellegrino; **Mariella Rivelli;** Martin Ruskov; Eva-Maria Thüne; Salvatore Varriale

SPURRING SPATIAL KNOWLEDGE: VISUALIZING, ENRICHING AND INTEGRATING PLACE-BASED KNOWLEDGE IN THE VOC ARCHIVES

Leon Van Wissen; Jona Schlegel; Manjusha Kuruppath

ARTIFICIAL INTELLIGENCE AND ELECTORAL DISTRICTING IN PORTUGAL: SPATIAL APPROACHES TO REPRESENTATION, TERRITORIAL JUSTICE, AND DEMOCRATIC REFORM

Jorge Garrido

Session and Room Staff: Rúben and Leonardo

15 - History and Study of Social Phenomena

9:00 - 10:15 | Friday 25 September 2026

Building 13 – Institute of Education - Multimedia Auditorium (room 0.28, floor 0)

Chair: Ruth Mostern

MAPPING INVISIBLE NETWORKS: DIGITAL ARCHAEOLOGY AND SPATIAL ANALYSIS OF BRAZILIAN WOMEN SCIENTISTS' INTERNATIONAL CIRCULATION (1950-1970)

Daiane Rossi

CARTOGRAPHIES OF MEMORY: APPROPRIATION OF EARLY MODERN URBAN SPACE IN A FEMINIST PERSPECTIVE (LISBON, 17TH CENTURY)

Ana Sofia Ribeiro; Mariana Maria do Meneses Muñoz

LOW-COST DIGITAL HERITAGE: A GOOGLE MY MAPS APPROACH TO PORTO'S IRON FOUNDRY HISTORY 1880-1980

Diana Felícia

Session and Room Staff: Sara and Inácio

PARALLEL SESSIONS

10:15 - 11:30 | Friday 25 September 2026

16 - Heritage and Spatial History

10:15 - 11:30 | Friday 25 September 2026

Building 15 - Institute of Social Sciences - Sala de Atos (room 0.02, floor 0)

Chair: Seraphim Alvanides

TOO BIG TO IGNORE: UAV, GIS, AND PREVENTIVE ARCHAEOLOGY OF SALENTO'S SPECCHIE

Raffaele Rizzo*

COUNTER-CARTOGRAPHIES OF THE PAULICEIA: DEEP AND COMMUNITY-BASED MAPPING OF THE HISTORY OF SÃO PAULO

Luis Ferla; Raony Almeida; Larissa Arruda; Andrew Britt; Tamires Camargo; Duarte, Mauricio Duarte; Jeffrey Lesser; Daniela Musa; Luanna Nascimento; Rayza Paiva; Fabiana Pinotti; Vanessa Rodrigues; Tiago Salgado; Beatriz Santos; Laura Santos; Monaliza Santos; Gabriela Silva; Raphael Silva; Nandamudi Vijaykumar

MAPPING THE "ILLEGAL CITY": METHODOLOGICAL STRATEGIES FOR OVERCOMING SPATIAL INVISIBILITY IN HISTORICAL GIS (SÃO PAULO, 1920-1940)

Raony Augusto de Almeida

Session and Room Staff: Cátia and Virgínia

17 - Education, Digital Literacy, and Scientific Dissemination

10:15 - 11:30 | Friday 25 September 2026

Building 16 - Engineering School - Pedagogical Amphitheatre (room 0.55, floor 0)

Chair: Joana Sequeira

ENHANCING SPATIAL-TEMPORAL REPRESENTATION AND KNOWLEDGE IN THE ARCHITECTURE CURRICULUM

Patricia Ferreira-Lopes*; Jorge Moya-Muñoz

USING AI SERVICES TO CREATE SHORT VIDEOS FROM HISTORICAL SPORTS PHOTOS

João M. Fernandes; Vasco Rito; Gonçalo Fernandes

THE STORY MAP IN THE TRAINING PATH OF TEACHERS OF THE 1ST AND 2ND CYCLES OF BASIC EDUCATION

Isilda Monteiro; Margarida Quinta e Costa; Vítor Ribeiro

Session and Room Staff: Rúben and Leonardo

18 - Geospatial Technologies Applied to the Humanities

10:15 - 11:30 | Friday 25 September 2026

Building 13 – Institute of Education - Multimedia Auditorium (room 0.28, floor 0)

Chair: Paula Accott

ARTIFICIAL INTELLIGENCE MEETS HISTORICAL CARTOGRAPHY: MODELLING URBAN BLUE-GREEN INFRASTRUCTURE FOR CLIMATE ADAPTATION

Bárbara Polo-Martín; Ana Luna-San Eugenio; Concepción Camarero-Bullón

From Historical Maps to 3D Models: Leveraging Digital and Geospatial Tools with Elevation Data

Diego Siqueira; Jeremy Bottmeyer

RADICAL COUNTER-POLICY: ROOTS OF PARTICIPATION IN NATIONAL FILM BOARD INTERACTIVE CINEMA

John Bessai*

Session and Room Staff: Sara and Inácio

COFFEE-BREAK

11:30-12:00 | Thursday, 24 September 2026

PLENARY SESSION II

12:00-13:00 | Friday, 25 September 2026

Building 15 - Institute of Social Sciences - Sala de Atos (room 0.02, floor 0)



Keynote Speech

From Coordinates to Context: Rethinking Spatial Humanities in the Age of Large Language Models

Ignatius Ezeani

Ignatius is a Research Fellow at the School of Computing and Communications, Lancaster University (UK) and a visiting Senior Lecturer at Nnamdi Azikiwe University (Nigeria). His main research interests are on the efficient adaptation of existing natural language processing tools and techniques to deal with the challenges of integrating the majority of the low-resource languages in a globalized world for task-oriented systems.

Chair: Daniel Alves

Session and Room Staff: Sara, Cátia, Virginia, Leonardo, Rúben and Inácio

13:00-13:30 | Friday, 25 September 2026

Building 15 - Institute of Social Sciences - Sala de Atos (room 0.02, floor 0)

CLOSING SESSION and Cocktail Hour: Portuguese wine experience

LUNCH BREAK

13:30-14:30 | Friday 25 September 2026 Venue:

Building 11, Grill Restaurant

Workshop 2.2

14:30 - 17:00 | Friday 25 September 2026

Building 15 - Institute of Social Sciences - Sala de Atos (room 0.02, floor 0)

Building on insights generated during the first session, a follow-up, will focus on developing a shared conceptual framework for modeling and visualizing regions and neighborhoods that are consistent with existing standards and best practices while attending to the particular requirements of regions and neighborhoods. Participants will work collaboratively to identify core concepts, relationships, and vocabularies that could support ontologies and standards. The goals of this session are to:

- Develop a shared vocabulary for describing uncertainty, scale, evidence, provenance, and interpretation for regions and neighborhoods across diverse forms of digital place-based research.
- Identify the concepts, relationships, and metadata requirements needed to support a cross-disciplinary ontology for regions and neighborhoods that is well aligned with historical research and human geography concepts.
- Consider the implications for projects involving colonial, contested, Indigenous, and community-based place histories, where representational decisions have significant interpretive consequences.
- Evaluate interface and visualization strategies for communicating context and limitations to users, including confidence indicators, provenance trails, fuzzy boundaries, layered visualizations, distinguishing between computational uncertainty arising from the approximation of otherwise well-defined geometries and cultural forms of fuzziness.
- Sketch the foundations of a shared ontology that supports transparent, context-aware, and ethically grounded digital representations of region and neighborhood.

Abstracts

SESSION 1

Exploring Geographic Information Services in European University Libraries

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Background

Spatial Humanities (SH) is an interdisciplinary field focused on the study of place and space in human history and culture, whose development has been closely linked to technological advances such as Geographic Information Systems (GIS) and web mapping tools (Dunn, 2016). In this context, university libraries play a strategic role by supporting research through the digitization, preservation, and description of cartographic and spatial collections, enabling their transformation into geospatial data accessible via library platforms (Thomas, 2013).

The expansion of web-based GIS has facilitated the development of geographic information services in university libraries, shifting their role from primarily technical support to active participation in academic research (Quill & Sadvari, 2023). Previous studies have shown that, although such services are increasingly present in academic libraries. Vardakosta & Kapidakis (2012) analyzed the types of digital geographic data available in academic libraries worldwide and found that 136 university libraries offered geographic information services on their websites, although in many cases they lacked clearly structured policies for their management and handling.

The present study analyzes geographic information services in European university libraries, based on the analysis of their websites and platforms developed in collaboration with other institutions. With that aim in mind, the following research questions are proposed: Do European university libraries provide geographic information services independently or in collaboration with other institutions? What characteristics and components define geographic information services in European university libraries? Are these geographic information services accessible in accordance with

web evaluation criteria?

The purpose is to advance the identification of models and best practices that strengthen university libraries' role in supporting research and the development of SH.

Methods

This study used a content analysis approach based on a previously developed methodological framework by the authors of this study (2024). The dimensions considered in this study include magnitude of collaboration, degree of integration, identity, accessibility, information architecture, thematic scope of the collections, interface design, and information retrieval system.

To select the sample, the list of LIBER Libraries from the Ligue des Bibliothèques Européennes de Recherche (Association of European Research Libraries) was used. The network includes 453 national, university, and research libraries. From these, university libraries in European countries were selected, resulting in a total of 163.

The final sample consists of 16 geographic information service platforms. These services are developed and implemented by 20 European university libraries. The analysis was based on publicly available information, and the search process was complemented with bibliographic references associated with the projects.

Results

The analysis of 16 platforms reveals recurring patterns across the dimensions examined. Regarding the magnitude of collaboration, 95% of the services are supported through collaboration either with entities within the university itself, such as geography departments or DH research groups, or with governmental institutions or other types of libraries. Several projects are interinstitutional. As an example, Gent Gemapt integrates the university, the library, museums, and local associations; Dúchas is composed by Irish archives, museums, and libraries; and Cronica (Catalonia) aggregates contributions from the Consorci de Serveis Universitaris de Catalunya (CSUC) and various cultural institutions.

In terms of thematic scope, many projects focus on cultural heritage and historical collections, such as Hungaricana (Hungary), which offers historical maps and georeferenced collections; Dúchas (Ireland), with cultural and territorial materials; and the Amsterdam Time Machine, which enables the exploration of urban history through temporal and spatial layers. Other initiatives are oriented toward academic GIS applications, such as Gent Gemapt (Ghent), or platforms developed by the Polytechnic University of Catalonia, such as GeoCommons and GeoUP4, which

facilitate the visualization and geospatial analysis of scientific data in Spain.

The map as a central navigation interface emerges as a distinguishing feature of the most interactive services. Projects such as Gent Gemapt, Amsterdam Time Machine, Hungaricana, GeoCommons, and the CSUC herbarium applications position the map as the primary axis, allowing users to explore collections, historical data, or scientific information through spatial and temporal layers. In contrast, catalog or digitized repository platforms, such as Universität Wien or GEO-LEO, use georeferencing as a support for information retrieval rather than as the main navigation interface. In the case of repositories, geolocation functions as a complementary search feature rather than the primary axis of interaction, with maps remaining at a secondary level of navigation.

Conclusion

The results show that several European university libraries provide digitized, and in some cases georeferenced, maps as documentary objects. However, these resources are not consistently integrated into library-based web mapping or GIS services that enable interactive spatial visualization of collections. The analysis indicates that 26.3% of the university libraries analysed mention geographic data infrastructures and support services on their websites. However, these services are mainly presented as guidance for geospatial data management, recommendations on the use of licensed software, or links to external cartographic and geographic repositories, rather than as proprietary visualization or web mapping platforms.

European university libraries have not systematically adopted geolocation as a discovery tool. Thirteen years after Vardakosta and Kapidakis (2012) study, a lack of standardization and limited integration with library catalogs persists, particularly in university map collections. As a result, geographic information services in university libraries remain exceptional rather than a widespread practice.

Keywords: GIS; library service; geolocation tools; spatial humanities; european university libraries

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Mapping Death: Suicide, Urban Space, and Historical GIS in São Paulo

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Background

This paper is situated within the field of urban and social history of the city of São Paulo and focuses on the analysis of suicides that occurred during the first half of the twentieth century. It is grounded in the assumption that suicide, far from being merely an individual act, constitutes a socially situated phenomenon, deeply shaped by urban transformations, mass immigration, the precarization of housing conditions, and new forms of sociability produced by an expanding city. Boarding houses, hotels, tenements, and central urban areas emerge in the sources as recurrent settings for these episodes, enabling reflections on the relationships between urbanization, poverty, population mobility, and violence.

Methods

The research combines the analysis of statistical sources and police records with methods from Historical GIS. Suicide cases were identified in state-produced documentation, catalogued, and spatialized using Geographic Information Systems (GIS), taking into account transformations in the urban fabric over the period under study.

A central methodological component is the use of the Pauliceia 2.0 platform, a collaborative environment developed for the historical analysis of the city of São Paulo. The platform enables the visualization of diverse historical datasets across different

cartographic bases, as well as the creation and management of thematic layers and the integration of spatial and textual information within a shared digital infrastructure. Its collaborative architecture allows for the aggregation of datasets produced by different researchers, while its temporal dimension supports the visualization of urban transformations over time. In this study, the platform was used to map suicide occurrences, correlate them with urban features, and analyze their spatial distribution within a constantly changing urban grid.

In addition, artificial intelligence tools were employed to process and organize large volumes of textual data, particularly police records of suicide deaths and statistical reports. Their applications included supporting the digitization of historical documents, data transcription, the structuring of information into dynamic tables, as well as keyword extraction and thematic classification.

The performance of these tools was assessed through an iterative validation process combining automated outputs with manual verification, with particular attention to accuracy in entity recognition and consistency in analytical categorization. These procedures enabled the identification of recurring spatial and discursive patterns while maintaining critical control over both the data and their construction processes.

Results

The use of geoprocessing tools and the Pauliceia 2.0 platform made it possible to formulate hypotheses regarding the concentration of suicides in specific areas of the city. When analyzed in series, these cases cease to appear as isolated events and instead become intelligible as part of broader urban dynamics. The integration of AI-assisted text processing further contributed to the identification of recurring categories and spatial correlations within the dataset.

Conclusion

By articulating urban history, GIS, and digital methods, this paper proposes an understanding of suicide as a phenomenon that reveals the structural tensions of a city undergoing modernization. Spatial analysis not only broadens the understanding of patterns of occurrence but also highlights how the city itself produced and recorded its own forms of violence. The combined use of collaborative GIS platforms and critically applied artificial intelligence tools constitutes a promising methodological approach for investigating complex historical phenomena, particularly in contexts involving large volumes of heterogeneous data.

Keywords: Social History; Historical GIS; Urban

History; Deep Mapping.

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Safeguarding and Valuing Heritage through Community Mapping and Digital Narratives

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Background

The safeguarding and valuing of cultural heritage increasingly depend on participatory and digitally mediated approaches that promote inclusion, collaboration, and civic engagement. This paper examines how community mapping and digital narratives can strengthen collective awareness of heritage and stimulate new forms of social participation in the preservation of cultural and historical landscapes.

In Portugal, recent scholarship has explored how digital platforms and collaborative mapping processes contribute to the sustainability and democratization of heritage practices. Cabeça (2018) highlights the potential of cultural mapping as a methodological and ethical tool for documenting and transmitting intangible heritage through community participation. Similarly, Velhinho (2023) analyses how cultural digitization and co-creation practices enable the articulation of collective memory in the digital age, reinforcing the social relevance of heritage narratives.

Complementary research emphasises the role of public policy and cultural institutions in supporting participatory safeguarding processes. Carvalho (2022) examines the evolution of intangible heritage policies in Portugal, pointing out the need for collaborative governance and digital inclusion. Gago (2022) further demonstrates how artistic residencies and curatorial practices can reframe heritage as a living and co-created process rather than a static legacy.

Building on these perspectives, this study situates community mapping and digital storytelling within the interdisciplinary framework of the Spatial Humanities. By combining geotechnologies, participatory methodologies, and heritage education, the project proposes an integrative model for valuing cultural heritage through

collective engagement, spatial awareness, and digital creativity.

Methods

The research adopts a mixed conceptual and applied methodology, combining theoretical reflection with the development of a participatory digital heritage project. It follows a qualitative, interpretative design inspired by participatory action research (Reason & Bradbury, 2008) and community-based research traditions within heritage studies (Waterton & Smith, 2010).

The applied component focuses on the creation of an interactive community map that integrates digital storytelling and georeferenced heritage elements. Using open-source geotechnologies such as ArcGIS StoryMaps and QGIS, the project aims to co-produce a digital representation of local heritage through community participation. Citizens, students, and cultural agents collaborate in the identification, documentation, and interpretation of places of memory and identity.

Data collection combines participant observation, semi-structured interviews, and digital workshops held in collaboration with local institutions and schools. These sessions encourage reflection on heritage meanings, spatial belonging, and the relationship between technology and collective memory. The process is supported by collaborative sessions where participants create narrative layers—texts, images, oral testimonies, and micro-histories—that are later integrated into the interactive map.

The methodological design also includes an educational dimension, linking heritage safeguarding to historical awareness and digital literacy. This approach draws on contemporary debates in Portugal about heritage education and participatory digital culture (Velhinho, 2023; Cabeça, 2018). The research therefore seeks to bridge academic inquiry, local knowledge, and community engagement through spatial humanities tools and collaborative storytelling.

Results

The project is currently ongoing, and the results presented here are preliminary. Early observations from the participatory workshops and mapping sessions suggest that the collaborative use of geotechnologies fosters meaningful dialogue between community members, educators, and researchers. Participants demonstrate a growing awareness of the cultural and emotional significance of local heritage, often reinterpreting

familiar places as part of broader historical and social narratives.

Initial stages of the mapping process indicate that community mapping serves not only as a documentation tool but also as a catalyst for reflection and learning. Participants actively engage in collecting data, sharing stories, and negotiating which memories and sites are included on the digital map. This process enhances collective understanding of heritage as a living, negotiated, and multifaceted construct (Waterton & Smith, 2010).

Moreover, the integration of digital storytelling allows participants to connect visual, spatial, and narrative dimensions of heritage. The combination of spatial visualization and oral or written testimonies promotes intergenerational dialogue and reinforces the perception of heritage as both a tangible and intangible phenomenon. Early feedback from participants and educators suggests that this model may also contribute to developing digital literacy and spatial awareness in educational contexts (Cabeça, 2018; Velinho, 2023).

Ongoing data analysis aims to identify how participatory mapping practices influence community belonging, digital inclusion, and historical understanding. The results will inform future iterations of the project, including the design of interactive resources for schools, local museums, and cultural initiatives that promote shared responsibility in heritage safeguarding.

Conclusion

The ongoing research demonstrates the potential of community mapping and digital narratives to reposition cultural heritage as a living, participatory process. By integrating geotechnologies, storytelling, and community engagement, the project proposes a framework in which heritage safeguarding becomes not merely a task of preservation, but a space for dialogue, reflection, and co-creation.

Preliminary findings suggest that participatory digital tools can enhance both community belonging and collective responsibility towards local heritage. The combination of mapping and storytelling fosters intergenerational connections and strengthens the sense of shared identity, while simultaneously promoting digital literacy and critical historical awareness.

From a broader perspective, this approach situates the Spatial Humanities as a fertile ground for rethinking the relationships between people,

places, and memories. It contributes to the democratization of heritage practices by valuing diverse narratives and voices, thereby supporting cultural sustainability and inclusive governance.

As the research progresses, the next stages will focus on consolidating the interactive platform and analysing how digital co-creation processes can be integrated into heritage education and local policy strategies. Ultimately, the study aims to show that digital mapping is not only a representational act but also an ethical and civic gesture—an invitation to safeguard, reinterpret, and co-create heritage in a shared spatial future.

Keywords: Community mapping; Participatory heritage; Digital storytelling; Spatial humanities; Cultural sustainability; Historical education.

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Acknowledgements

This work is part of an ongoing PhD research project supported by the Portuguese Foundation

for Science and Technology (FCT) under the grant reference 2024.01190.BDANA, developed within the University of Minho, in collaboration with the Lab2PT – Landscape, Heritage and Territory Laboratory, the CECS – Communication and Society Research Centre, and the Casa do Conhecimento de Vila Verde.

A word of acknowledges to Prof. Alexandra Esteves, Prof. José Gabriel Andrade, and Eng. José Ismael Graça, whose guidance and insights have been fundamental to the development of this research.

SESSION 2

Automated extraction of spatial information from Cold War operational documents using Large Language Models

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During the Cold War military forces of both NATO and the Warsaw Pact spent years on preparing for a potential confrontation between East and West. The result of this preparation for war now rests as extensive collections of operational planning documents in archives across Europe. Until now, these documents have only to a limited degree been studied. This is partly due to the fact that access to Cold War Military archives has been difficult; some are still classified and inaccessible, and others have been destroyed during the reduction of military forces in the 1990s and 2000s after the end of the Cold War. We examine some of the archives that still survive, from the Polish, Danish and German military, the combination of which offer rich opportunity to study and compare operational plans from both sides of the Cold War.

Poland's position was unique within the Warsaw Pact, as the Polish military, the only non-Soviet member of the Warsaw Pact, was charged with independently planning the military operation of a front (army group in NATO terms), in form of the so-called Coastal Front. This front was to lead the attack on West Germany,

Denmark, and through to The Netherlands and Belgium along the Baltic coast. From the other side, German and Danish plans from the NATO commands COMLANDZEALAND and COMLANDJUT have survived in the archives. Together with the Polish sources, this case offers a unique chance to empirically examine the development of Cold War military planning and the potential impact of the plans, should war have erupted.

Two factors make this an interesting methodological challenge. First, the operational plans are complex spatio-temporal sources as they consist of both text, tables, diagrams and cartographic documents. In the Polish case, the maps themselves are the backbone of the plans, but the supplementary texts are full of important contextual information. Second, the archives are very extensive due to the sheer size of the forces involved and long period (> 30 years) during which the plans were continually updated. Conventional close-reading is not a feasible approach to study the tens of thousands of pages that are available

We have employed a multi-method approach that combines traditional GIS-analysis of maps with a distant reading of the textual data, based on automatic extraction of spatial information from the source material. With the rapid advances in OCR-capabilities of Large Language Models such as Google's Gemini 3.0, we have been able to rely on the model to transcribe and structure a dataset around spatial entities and their contexts, allowing us to build and interpret a multi-layered GIS database on military planning around the Coastal Front. The project is recently funded and a work in progress, and this paper reports the first preliminary results.

Keywords: Cold War; military geographies; GIS; distant reading.

Acknowledgements

We are grateful to the Augustinus Foundation for funding the project.

Re-inhabiting a Roman Space: Augmented Reality and Digital Twins for Experiencing Archaeological Heritage

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Background

The Roman Ruins of Milreu (RRM) represent one of the most significant testimonies of Roman occupation in the Iberian Peninsula. The site comprises a *villa rustica*, consisting of a *pars urbana* (residential area) and a *pars rustica* (agricultural production area), with evidence of continuous human occupation from the 2nd to the 10th centuries. Archaeological remains attest to pagan cult practices, subsequent Christian transformations of the built infrastructure, and traces of Islamic presence [1]. Located approximately 9 km from the Roman city of Ossonoba (present-day Faro), the permanent settlement in this region is closely linked to the villa's privileged geographical position, combining fertile soils, proximity to marine resources, and access to strategic commercial routes [2,3]. During the 4th century, the villa was embellished with decorative wall coverings and mosaic pavements featuring geometric and zoomorphic motifs [1]. Particularly noteworthy are the thermal complex and an aquatic sanctuary/cult building (*aula*), whose scale and spatial configuration remain central to the interpretation of the site.

Today, the archaeological site is preserved as a National Monument (since 1910) and faces the cumulative effects of time, environmental exposure, and the inherent challenges of long-term heritage management, conservation, and public engagement. This situation, common to many archaeological sites, highlights the need for innovative tools that support the material preservation of cultural heritage materials, their interpretation, accessibility, and experiential dimension.

Within this framework, emerging methodologies such as high-resolution 3D digitisation, Digital Twins (DT), Heritage/Historical Building Information Modelling (HBIM), and Augmented Reality (AR) offer new possibilities for experiencing heritage *in situ* and remotely. These approaches enable cultural heritage to be both documented and *experienced*, fostering deeper cognitive and emotional engagement with historical spaces [4].

Building on the digital survey of the RRM conducted within the context of project Digital Twins for Smart, Sustainable Tourism and Cultural Heritage Preservation (DT4SST-CH.PT), with focus on the partially preserved aquatic sanctuary/cult building

(*aula*), this work combines detailed 3D modelling and interpretative reconstruction with a georeferenced DT. These models form the basis of an AR environment in which reconstructed architectural volumes are overlaid onto the existing ruins and enriched by a narrative layer that contextualises daily life, ritual practices, and spatial use within the villa, creating an immersive and historically informed visitor experience.

Methods

Data Acquisition

The methodological workflow began with the systematic acquisition of spatial data for the RRM, aiming to ensure high geometric accuracy and visual fidelity. A hybrid survey strategy was adopted, combining aerial photogrammetry using Unmanned Aerial Vehicles (UAVs) with terrestrial LiDAR scanning [5]. Ground Control Points (GCPs) were established and georeferenced to guarantee spatial accuracy and alignment between datasets. The resulting point clouds and image sets constitute a metrically reliable basis for subsequent modelling, analysis, and geospatial integration.

Data Processing and 3D Modelling

The collected imagery and terrestrial LiDAR data were processed using Agisoft Metashape for image alignment, dense point cloud generation, mesh construction, and texture mapping. Particular attention was given to preserving chromatic consistency and geometric precision, ensuring that the model could support both interpretative reconstruction and technical analysis.

Post-processing and virtual reconstruction were conducted in Blender. This phase involved mesh optimisation, texture refinement, and the interpretative reconstruction of missing architectural elements. Scientific validation of reconstructed components relied on the cross-analysis of archaeological documentation, including plans, elevations, historical photographs, orthophotos, reconstruction drawings, and comparative typological references. The resulting 3D models thus integrate empirical data with validated interpretative hypotheses.

The Digital Twin, based on the high-resolution point cloud, was semi-automatically segmented in CloudCompare, enabling decomposition of the structure into its constituent architectural elements (e.g., walls, columns, arches, openings) in future work.

Creation of the Augmented Reality Experience

The final phase involved creating an interactive AR experience to enhance public engagement and

professional consultation. Validated 3D models and interpretative reconstructions were incorporated into a real-time AR pipeline, enabling spatial alignment, interactive visualisation, and multimodal user interaction across multiple device classes.

This integrated workflow demonstrates how spatial data acquisition, DT development, and AR experiences can be combined into a coherent framework that supports heritage documentation, conservation management, and experiential interpretation.

Results

The present work delivers an interpretative virtual reconstruction of the RRM, enabling the recovery of lost architectural heritage in a digital context. High-resolution point clouds and georeferenced spatial data captured the site's geometry and surface textures, forming the foundation for detailed 3D modelling and post-processing. This workflow produced dense 3D mesh models and a georeferenced DT, integrating reconstructed elements based on validated archaeological evidence to create a representation that is both technically accurate and historically informed.

These models were integrated into an AR environment, where reconstructed architectural volumes are superimposed onto the existing ruins. A narrative layer contextualises daily life, ritual practices, and spatial use within the villa, while additional layers provide conservation information for specialist audiences. Following the established visitor route, the AR experience enables immersive exploration of the villa's monumentality and supports an informed understanding of its social, economic, and ritual dimensions.

Embedding these models in an AR platform demonstrates the potential of augmented reality for public engagement and professional consultation, bridging experiential understanding and technical analysis. The narrative-driven environment also fosters interdisciplinary collaboration among computer scientists, archaeologists, conservators-restorers, historians, and digital heritage specialists, contributing to a shared, evolving interpretative framework.

Conclusion

Overall, the project demonstrates that the convergence of geotechnologies, DT, and AR constitutes a powerful framework for both the management and experiential interpretation of archaeological heritage. AR emerges not merely as a visualisation tool, but as a spatial interface that connects material remains, digital reconstructions, and human experience in situ. By embedding

scientific data, conservation diagnostics, and historical narratives within an augmented environment, the approach enhances public understanding while simultaneously supporting evidence-based decision-making in heritage conservation. This integrated model is transferable to other archaeological contexts and contributes to the broader discourse of Spatial Humanities by foregrounding experience, embodiment, and interaction as central dimensions of digital heritage practice.

Keywords: Photogrammetry; Augmented Reality; Digital Twin; Conservation and Restoration; Archaeology

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Funding for this research was partially provided by the DigitalTwins4SmartTerritories (DT4ST) programme under the Portuguese Recovery and Resilience Plan (investment TD-C19-i08 "Smart Territories"), project Digital Twins for Smart, Sustainable Tourism and Cultural Heritage Preservation ([DT4SST-CH.PT](https://www.digitaltwins4st.pt)). This research was also supported by NOVA LINC (UID/04516/2025), UID/00729/2025, LA/P/0008/2020 (LAQV).

Mapping the languages in Krāslava (Latvia) according to 1935 census data

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Background

It is rare that geotechnologies and historical sociolinguistics intersect. Research on the linguistic history and past multilingualism has tended to focus either on general processes or on singular cases of exceptional individuals, with maps being rarely included (Burke, 2004; Hüning, Vogl & Moliner, 2012; Bömelburg & Kersken, 2020). On the other hand, recent studies have demonstrated the potential for mapping contemporary linguistic diversity with an exceptional level of detail (cf. Perlin et al., 2021; Väisänen et al., 2022). However, historical sources also facilitate the reconstruction of the linguistic competences of individuals, families, households and neighbourhoods. The present paper provides a spatial analysis of the languages spoken in Krāslava, a small town in Latgale (eastern Latvia), in the 1930s. The selection of Krāslava as a case study is attributable to its exceptional ethnic, confessional and linguistic diversity (Németh, 2013). The languages spoken locally included Latgalian, Latvian, Lithuanian, Polish, Belarusian, Russian and Yiddish, as well as various mixed or transitional varieties. (Jankowiak, 2017). The reach data from the Latvian 1935 census has hitherto been utilised to analyse ethnic relations (Mežs & Németh, 2014), yet its potential with regard to languages has been overlooked.

Methods

The 1935 questionnaire comprised three points concerning languages: the knowledge of a state language (i.e. Latvian), knowledge of other languages, and the language used in the family. Initially, it was imperative to transcribe the data from personal cards of Krāslava inhabitants (a number exceeding 4,000) into a prepared spreadsheet. Concurrently, the houses were mapped in GIS. The utilisation of a cadastral map from 1927, in conjunction with an archival file indexing cadastral numbers of the plots of land with addresses of the houses, facilitated the correlation of addresses on a map with addresses as documented on personal cards from the 1935 census. This process enabled the geographical referencing of all census data. Moreover, the 1897 Russian census streets were mapped to allow for diachronic comparison.

Results

The spatial analysis of census data facilitates the identification of linguistic knowledge, potential contacts, and degrees of multilingualism across multiple levels. The present study is still in progress; therefore, only preliminary observations are available at this time. However, the entire analysis will be completed prior to the conference date. Firstly, we are able to provide detailed statistics for the entire town,

whilst also delineating its districts according to their linguistic characteristics. Secondly, an analysis of each street as a distinct linguistic microcosm can be conducted. In this respect, it is possible to notice the changes occurring in time by comparing 1935 languages with the data from 1897 (much more limited, though). Thirdly, an analysis of the languages recorded for each house and each flat can be undertaken, thus demonstrating that the households were often linguistically diverse and people had to use more than one language in their family life. These phenomena are intercorrelated with other characteristics of the individual, including ethnic and confessional affiliations, social class, occupation and workplace. Despite acknowledging the biases of the census (e.g. the lack of distinction between Latgalian and Latvian languages, the pressure to maximise the number of Latvians), it is nevertheless an extraordinary set of data, and georeferencing uncovers its spatial potential.

Conclusion

The analysis of the 1935 Latvian census in Krāslava demonstrates the complexity of the linguistic situation in an Eastern European small town before the Holocaust and the Soviet persecutions, providing an exceptional window into the past. Furthermore, the approach outlined may prove beneficial in the further study of the spatial dimensions of past multilingualism on a global scale.

Keywords: multilingualism; GIS; Latvia; census data.

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Acknowledgements

The study is part of the ERC-funded project “Multilingual worlds – neglected histories. Uncovering their emergence, continuity and loss in past and present societies”.

SESSION 3

Building backstories for Britain’s constituencies with GIS

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Background

“Constituencies” are the electoral districts for the United Kingdom’s Parliament, and therefore the foci for research into political life; we have assembled data on the number of votes for each candidate in each constituency in every General Election since 1833. Researchers want to relate voting behaviour to social change, and characteristics of particular areas, both as recorded by decennial censuses since 1801. The potential for very long-run analysis is obvious, but there are several large obstacles which GIS can overcome. Firstly, constituency boundaries are regularly redrawn, reflecting population shifts; this happened most recently in 2024, so most current constituencies have no clear history. Secondly, these changing boundaries were made available digitally only from 1983 onwards. Thirdly, until 1966 the UK census published socio-economic data only for administrative geographies, not constituencies. Earlier research addressed this problem by either simply asking readers to visually

compare election and census maps drawn on different bases (Pelling, 1967) or selectively merging adjacent constituencies while ignoring smaller boundary changes (Wald, 2014).

Methods

Digital boundaries for all British Constituencies from the 1970s back to 1832, an essential foundation for the data manipulations reported here, were created from the maps and textual descriptions in the reports of the Parliamentary Boundary Commissions.

Census data were re-districted to constituencies using multiple methodologies. From 2001 onwards, data for census Output Areas (OAs) were aggregated based on which constituency contained each Areas’ population-weighted centroid, as supplied by the census offices. Between 1971 and 1991 we also work with census small area statistics and matching boundary data, but these now “historical” data had to be assembled from sometimes problematic sources. For 1931 and 1951, the censuses provide constituency definitions in terms of whole districts, or if necessary whole parishes that were the parts of districts or, sometimes, parts of parishes: districts were simply being assigned to constituencies; district social statistics were assigned to parishes *pro rata* to population, then the parishes assigned to constituencies; and where necessary, data for parts of a parish were estimated *pro rata* to area, overlaying vector boundaries. For 1911 and earlier, census microdata from the I-CeM project enable the creation of new social statistics at parish and sub-district level.

Redistricting election results from historical to current constituencies is more problematic, as the geographies are of similar size, and is limited to 1970 onwards. For 2001-2019, the census offices’ Mid-Year Estimates provide voting age populations for each general election year for 227,759 OAs (Office for National Statistics, 2021). Each OA was assigned to both a historical and a post-2024 constituency using its population-weighted centroid, and redistricting weights computed as the proportion of each historical constituency’s population falling into each 2024 constituency. For 1970 to 1997, three distinct vector overlays were needed: first, population counts from the census previous to the relevant general election had to be redistricted to a later such geography, as each census used a different small area geography. This later geography was then overlaid on the historical constituency geography and a new set of intersection polygons generated. Finally, those intersection polygons were overlaid on the 2024 constituencies. Discrepancies in the diverse boundary datasets created “sliver” polygons, but these were reduced by excluding very small areas from the intersection layer.

Results

Using a dataset comprising 22,108 constituency-level election results across 37 general elections from 1885 to 2024, each with linked census data, we explore four “cleavages” hypothesised as influencing British voting habits (Lipset and Rokkan, 1967; Ford and Jennings, 2020): the “centre-periphery cleavage” which manifests most clearly in the devolved nations; the “religious cleavage” which dominated the late nineteenth century; the stable “class cleavage” which replaced it through most of the twentieth century; and the “rural-urban cleavage” that has now become the dominant cleavage.

Redistricting of election results to 2024 Constituencies enabled analysis of, for example, how support for the Reform UK party in 2024 closely resembled support for the UK Independence party in 2015 (Heath, et al., 2024). However, the main value of redistricting the election results is what it reveals about individual constituencies. To take as an example, the new 2024 London constituency of Beckenham and Penge combined parts of the former constituencies of Beckenham, a Conservative stronghold, and Lewisham West and Penge, where Labour led the way. Our re-districting process identified the Conservatives as the likely winners for the constituency if it had existed from 1970-2015, and but Labour in 2017 and 2019: it actually went Labour in 2024.

Conclusion

We have successfully overcome the three challenges identified in the introduction. While we are applying normal re-districting methods the scale is key here. This work will feed into a collaboration with the House of Commons Library.

Keywords: Time Series; Data visualisation; Statistics; Elections, Census.

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Acknowledgements

Thanks to the Economic and Social Research Council grant ‘Democracy and Social Change in Britain, 1851–2024’ (ES/Z503344/1), led by Professor Oliver Heath, Royal Holloway University of London.

Assessment and impact of a national historical-GIS project: the Atlas, Historical Cartography between 1993 and 2025

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Background

Since its creation in the 1990s, the *Atlas, Historical Cartography* was conceived has a geographic information system and historical data modeling platform (SIGMA) comparable to what was then the nascent movement of so-called Historical-GIS. The initial objective was to address a concrete historiographical problem: the transposition of georeferenced information between two historical moments in the evolution of Portuguese administration in the 19th century. The project quickly evolved into a more complex system, incorporating innovative digital solutions for the time. Using open-source software for relational databases, geographic information systems, and online geographic data distribution and visualization platforms, the team coordinated by Luis Espinha da Silveira (between 1993 and 2021) was able to develop SIGMA and make an effective tool available to the scientific and student community.

Methods

The project used the country's first digital map of parishes, from 1991, provided by the CNIG (National Center for Geographic Information), to reconstruct 19th-century administrative maps. This was done through a two-pronged process, always starting from the most disaggregated level, that of the parish. First, the identification and recording of differences and continuities in the territories of the old parishes compared to the current ones. With all these relationships recorded in the database, it was not only possible to reconstruct the map of the parishes in a

given year, but also to transfer (interpolate) the historical data associated with them, by simple division, addition, or transposition, as the case may be. For urban parishes that had undergone changes (this was essentially the case for the large cities of Lisbon and Porto), it was necessary to reconstruct these territorial units, consulting cartography from the period and redrawing the boundaries.

The methodology used by the Atlas project for the vast majority of the territory is similar to other geographic data interpolation techniques, but it employs a combination of approaches that varies depending on whether we are dealing with more rural or more urban territorial units. More technical details of the methodologies can be found in two articles already published by the Atlas team in 2011 and 2013.

Results

Currently, the system created with this methodology covers all administrative changes, for all levels of territorial organization of mainland Portugal (between 1758 and 2001) and the archipelagos of the Azores and Madeira (between 1849 and 2001). It also includes the religious divisions of 1801 and 1882, as well as maps with census data for the Iberian Peninsula (Portuguese parishes and Spanish municipalities) between 1878 and 2001. Based on this infrastructure, the project provides demographic, economic, political, and religious historical data at various timestamps throughout these 250 years.

Furthermore, it has been the methodological basis and the source for georeferenced data for multiple studies, among which we can highlight the following: the study and publication of the so-called Parish Memoirs of 1758, which constitute one of the richest and most used geographical sources for knowledge about Portugal in the 18th century; studies on the evolution of the railway in Portugal, from its origin to 2001, and on the analysis of the population distribution of the Iberian Peninsula, between the end of the 19th century and the beginning of the 21st century; studies on accessibility to railways and their social and economic impact in the Beira region between the end of the 19th century and the first third of the 20th century and on the Cascais line throughout the 20th century; studies of economic history on mutual banking in Portugal in the 20th century or on the exploitation of quarries in Portugal in the second half of the 19th century; studies in the field of social history, such as the profile of the municipal councils in Viseu or a prosopography of the Portuguese episcopate throughout the Constitutional Monarchy; finally, special mention should also be made of studies about the city of Lisbon, specifically on shopkeepers, abandoned children, the working class, basic

sanitation, or elections, among other topics.

Conclusion

Currently, the Atlas is the only active Historical-GIS project in Portugal. Beyond its initial function of studying the administrative evolution and the analysis of long series of population or economic data, the Atlas is now useful for scientific production in multiple disciplinary areas that go far beyond History. It has contributed to studies on multiple topics and incorporates data from other territories and countries. At this moment, the project seeks to incorporate the new trends of Spatial Humanities and the most modern and adaptable software solutions for Web 4.0 and emerging technologies.

Keywords: Portugal; Historical-GIS; Territory; Social History; Economic History

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Modeling Place Beyond Points: Reflections from the World Historical Gazetteer on Scale, Ambiguity, and Human Experience

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Background

Place is one of the primary ways human experience enters the historical record. Across the humanities, sources refer to places that differ widely in scale and form, from settlements and neighbourhoods to regions, cities, and political formations. These places often change names, overlap with one another, or acquire new meanings over time. Such instability is not a problem to be corrected but a historical condition that reflects governance, movement, social relations, and everyday life.

Over the past eight years, the World Historical Gazetteer (WHG) has focused on building shared spatial infrastructure for humanities research. With more than 2.2 million place names indexed and linked, the project has developed an ontology, workflows for linking place records, and tools for integrating and visualizing spatial data. This work has demonstrated the value of treating place as historically situated and grounded in human experience rather than as a fixed coordinate on a map.

At the same time, sustained use of the Gazetteer has clarified important limits in prevailing spatial approaches. WHG has proven most effective for places that can be reasonably represented as points, particularly named settlements. It has been less successful for places that are very small, very large, spatially diffuse, or difficult to define as discrete objects. Many historically meaningful places resist stable geometric representation not because of missing data, but because their significance lies in scale, overlap, uncertainty, and relational meaning. These limitations have prompted growing interest within the World Historical Gazetteer in relational and graph-based ways of thinking about place, not as a settled solution, but as a potential direction for addressing scale, ambiguity, and historically variable

relationships.

Reflecting on these limits provides an opportunity to reconsider how place is modeled in spatial humanities research and what kinds of human experience such models are able to capture.

Methods

This paper reflects on the design and use of the World Historical Gazetteer as a long-running scholarly infrastructure. WHG links historical place records contributed by individual scholars and research teams, preserving variant names, temporal information, and source-based descriptions. Its underlying data model has relied primarily on relational tables that support linking, aggregation, and reuse across projects.

In parallel, conversations within the Pelagios Network, particularly through the Place Activity Group, have provided a broader forum for comparing approaches to place across spatial humanities projects. These discussions have sharpened awareness of how different modeling choices privilege certain kinds of places and marginalize others.

Together, these experiences provide a basis for assessing both the strengths and constraints of point-based and table-oriented approaches as they are applied across heterogeneous historical datasets.

Results

Looking across eight years of development reveals two recurring challenges. First, scale matters. Very small places, such as neighborhoods known through social practice, and very large places, such as regions or political formations, do not fit comfortably within existing spatial frameworks. Second, ambiguity matters. Many historically meaningful places are multi-vocal, overlapping, and temporally unstable, and cannot be reduced to singular spatial objects without loss of meaning.

Early modern port cities such as Venice illustrate these tensions clearly. Venice can be understood simultaneously as a settlement, a city-state, a maritime empire, and a node within wider commercial and diplomatic networks. Its spatial identity shifts depending on period and perspective, and its boundaries are experienced through relationships rather than fixed outlines. At the same time, many places central to everyday urban life, such as parishes, neighborhoods, marketplaces, or harbor districts, were never clearly bounded spatial units and are difficult to locate precisely.

Modeling places at either of these extremes, whether expansive political formations or small sites of social activity, as single points or stable polygons obscures the layered and relational ways they functioned

historically. These findings suggest that limitations in existing models are not merely technical constraints but reflect deeper mismatches between spatial representation and lived historical experience.

Conclusion

This paper argues that the limitations encountered by the World Historical Gazetteer are analytically productive rather than simply technical. They expose tensions between how place is lived, narrated, and understood historically and how it is commonly represented in spatial infrastructures.

Rather than presenting a finished solution, the paper uses the WHG experience to invite discussion about next steps. It seeks feedback from the spatial humanities community on how best to model places that resist clear spatial definition, and on whether graph-based approaches offer a promising path for representing scale, ambiguity, and relational meaning. In doing so, it positions the World Historical Gazetteer as a site of ongoing experimentation, where questions about place and human experience remain open and collective.

Keywords

Spatial Humanities; Place Modeling; Gazetteers; Human Experience; Knowledge Graphs

SESSION 4

Deep Mapping Plants in the City: A Case Study

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Background

This paper presents a case study in deep mapping through the design and development of an interactive digital prototype that maps forms of urban nature and its spatial, historical, and infrastructural contexts, with a particular focus on weeds and other unintentional plants. The project, titled *Wild Digital Bouquets*, is situated within digital environmental humanities and explores how digital media and mapping tools can foreground urban vegetation as agents for thinking about urban environments. Recent work in digital environmental humanities and critical plant studies has emphasized the capacity of digital projects to reshape how plant-centered stories are noticed, engaged with, and disseminated across time and place (Rogers & Berger, 2024). The

project, presented to the conference as a prototype, builds on this idea by examining how different practices, such as AI-assisted plant identification, digital photography, sound recording, fieldnote writing, data structuring, interface design and interactive mapping might support the representation of entangled ecological, infrastructural, and cultural dimensions of place.

The project focuses on weeds and non-ornamental plants growing in diverse spaces across the medium-sized city of A Coruña, in northwestern Spain. These sites are selected to reflect processes of maintenance and neglect, regulation and persistence, and visibility and marginalization that characterize contemporary urban nature (Gandy, 2006; Gandy, 2013; Jasper, 2020; Cooke, 2020). Central to the project is the notion of deep mapping, understood as a methodological and conceptual approach that seeks to represent places as layered and relational assemblages of histories, narratives, materialities, and sensory experiences, foregrounding affect, multiplicity, and the contested meanings of space rather than cartographic objectivity (Bodenhamer, 2015). Deep mapping responds to a key tension in spatial humanities between cartographic abstraction and lived experience (Harner et al., 2017) and resonates with Doreen Massey's understanding of place as relational and processual rather than fixed or bounded (Massey, 2005). Within the project, deep mapping provides a framework for "thinking with weeds" (Van Dyk & Schuster, 2022), foregrounding marginalized vegetation as sites of interstitiality and contested value.

Methods

The project adopts a research-creation methodology combining field observation, digital photography, AI-assisted plant identification, geolocation, data structuring and visualization, and multimodal digital design. Knowledge production unfolds through iterative processes that connect situated field encounters with ethnobotanical research and the building of digital interface.

Fieldwork is conducted through repeated walks across different areas of the city of A Coruña, focusing on liminal and infrastructural spaces. During these encounters, ambient sounds are recorded, digital photographs document plants in place and surrounding infrastructures, and fieldnotes are written *in situ* or shortly after each encounter. These notes record observations and reflections on practices of maintenance and neglect, everyday spatial use, and contextual conditions. Plant species are identified using AI-assisted plant

recognition software. This process is treated as provisional and situated rather than authoritative, acknowledging the probabilistic nature of machine-learning-based classification and its role in shaping attention and categorization.

Field encounters are followed by archival and online research. Digital archives, historical sources, and ethnobotanical accounts are consulted to trace site histories and uncover narratives and practices associated with the plants and spaces in which they are found. This information is organized into a structured dataset that functions as an intermediate data layer for further processing and interface design.

Results

The current stage of *Wild Digital Bouquets* is an interactive prototype that assembles the project's materials into a multimedia environment, composed of an interactive map, a gallery of digital bouquets, a dynamic species gallery, and a digital field diary. Photographs, sound recordings, geolocation data, and brief contextual notes are incorporated into an interactive map built using the Leaflet JavaScript library. Plants are assembled into digital bouquets by grouping species encountered within the same urban area and positioned on the map according to their spatial location. The map functions as the main spatial interface, through which users might navigate the city and encounter bouquets in relation to specific urban areas, infrastructures, and sensory conditions.

Written fieldnotes are selectively incorporated into a digital field diary, providing a reflexive layer that foregrounds the nature of observation and the research process. The species gallery focuses on ethnobotanical and historical information about plants, including vernacular names, uses, and cultural references. Structured through CSV and JSON datasets and rendered as a clickable interface, the gallery supports comparative and associative exploration across species and sites.

Together, these components produce a form of digital narration that privileges exploration, juxtaposition, and relational interpretation, inviting users to move between spatial, sensory, and narrative registers.

Conclusion

This paper contributes to spatial humanities and digital environmental humanities by advancing understandings on how multimodal and interactive digital practices can interpret the cultural histories of plants and urban environments.

In line with arguments in visual anthropology and digital ethnography, the project foregrounds the

potential of multimodal forms to preserve openness and alternative ways to engage with the world. As Favero (2017) suggests, digital and interactive formats can help resist the tendency to subordinate sensory and experiential dimensions to thick textual explanation, allowing the "thin" qualities of observation to remain visible. Similarly, following Pink's (2006) work on multimodality and hypermedia, images, sounds, and spatial interfaces are treated as constitutive elements of knowledge production rather than illustrative supplements. In this sense, *Wild Digital Bouquets* can also be understood as an example of an artisanal approach to digital spatial humanities. Rather than aiming for scalability, automation, or comprehensive coverage, the project operates at a small, situated scale, where data collection, coding, and interface design are closely intertwined. Mapping, data structuring, and narrative composition are treated as handcrafted and interpretive practices, making visible the choices, limits, and partialities involved in representing urban environments.

Keywords: Spatial humanities; Digital environmental humanities; Urban nature; Deep mapping; Plant humanities

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Mapping Detachment: Geolocations in Pandemic Diaries

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Background

This paper examines experience of space during Covid Pandemic, as documented in the Latvian Pandemic Diaries corpus.

Personal diary, as a form of “ego document”, occupies the domain between literature and history. Diary as a factual day by day account records the time as it was experienced. Diary as a personal literary writing allows the author to create idiosyncratic space, where factual mixes with imaginary, present events with memories of past and plans for the future.

Restrictions of movement during Covid strongly inhibited movement in the physical space, at the same time making people acutely aware of the space. The shared time frame and the shared situatedness in the events of Pandemic provide a rare chance to map shared experience of a life writing corpus.

Researching a corpus of 238 Latvian Pandemic diaries (see Reinsone et al 2025 about corpus

creation and composition), this paper aims to achieve two goals:

(1) Distinguish between geolocations where the author is “present now” and where the author is “not present now”. For operationalization of “now” we use a slightly wider temporal period, “current time frame”, – e.g., allowing also recounts of the recent events in the past linguistic tense, and other situations where author is describing recent events as current, which is typical in diaries. In the context of this research, we denote all instances of places where author is not present, as “referenced” – e.g., past memories, future plans, reflections on experiences of others, media news, etc.

(2) Explore how well large language models (LLMs) can tackle classification of geolocations, especially when it has to consider a wider context, discourse and inferred presence.

Methods

Pandemic Diaries corpus was collected by ILFA (Institute of Literature, Folklore, and Arts of the University of Latvia) in 2020/2021, by issuing a public call to document Covid Pandemic experience, as it was unfolding, in diaries and share them publicly. Most of the diaries were digital-born, the rest were digitized by authors before submitting. Full Pandemic Diaries corpus is available at: <https://garamantas.lv/en/collection/1415829/Pandemijas-dienasgramatas-2020>.

Then, in 2021, Pandemic Diaries corpus, was manually tagged for geolocations, gaining 3758 geolocations. Each location has geographical coordinates of latitude and longitude and other fields which allow different layers of mapping and cross-comparison. For this research paper we treat the manual expert annotations of geolocations as “ground truth”.

To distinguish between “present” and “referenced” places, 3 human annotators annotated a sample of 406 geolocations (10.8 % of total geolocations), with labels – 1 (present place), 0 (referenced place), NA (not applicable). Human inter-annotator agreement was assessed to evaluate the reliability of the annotation task. “Strict consensus” – defined as all three human annotators agreeing on either 1 or 0 – was achieved in 276 cases, representing 67.98% of the dataset. “Majority consensus” – defined as at least two annotators agreeing on a binary label 1 or 0 – covers 397 cases, or 97.78% of the dataset. Then 3 LLMs were employed for the sample dataset (406), using the same annotation schema and instructions.

Results

All three tested LLMs show strong alignment with

human judgments, but with performance differences. Mistral Medium 3.1 achieves the highest agreement, matching strict human consensus in 254 of 276 cases (92.03%), Claude Sonnet 4 (234/276; 84.78%), Gemini 2.5 Flash (229/276; 82.97%).

A more nuanced picture emerges when separating positive consensus (1) from negative consensus (0). Human annotators reached consensus on 172 positive cases and 148 negative cases. Tested LLMs show following alignment with human annotations. For positive consensus (1): Mistral Medium 3.1: 81.4%; Claude Sonnet 4: 69.2%; Gemini Flash 2.5: 68.0%. For negative consensus (0): Mistral Medium 3.1: 100.0%; Claude Sonnet 4: 98.7%; Gemini Flash 2.5: 96.0%.

All 3 models perform very strongly on negative cases (referenced place). As this is a linguistic task with discourse-level inference, which often requires temporal reasoning, deixis inference, narrative stance detection, and implicit presence detection, achieved LLM results could be considered good performance in natural language processing research and annotation workflows.

Conclusion

(1) Pandemic diaries are very different regarding experience of space. Of 238 diaries, 62 do not have even a single geolocation mentioned, pointing to very different practices of life writing.

(2) Differentiating “present” and “referenced” geolocations proved to be a doable task, albeit harder as expected, as 3 human annotators could reach a common classification (present or referenced place) only in 68% of cases. Two of the main factors for this ambiguity is wide use of past tense in life writing to recount recent events, and fluid narrative structures of life writing where author merges different times and writing modes in one diary entry.

(3) LLM classification of geolocations proved to be a viable choice in the workflow. Given the scores of human annotator agreements, LLMs performed comparably well and provided consistent classifications; on average LLMs that we tested tended to be stricter in assigning “presence” of author than human annotators, assigning “referenced” place more often.

Keywords: geolocations classification by LLMs; present and referenced space; life writing; Pandemic diaries.

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Mapping space and time in the Greek mythic storyworld

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Greek myths describe a storyworld that is richly detailed with both spatial and chronological information. While some of these stories take place in an amorphous “Beyond”, most of its geography in fact corresponds, or closely relates, to the historical landscape of the Mediterranean. Its “history” fleshes out the distant past, with heroic genealogies and events marking the passing of time. Emic conceptions of Greek myth thus bear close comparison with historical concepts of time and space, as we can well observe from texts like Pausanias’ *Guide of Greece* (2nd c. CE), in which past events – both mythic and historical – are used to illuminate the significance of Greek places. While mythic information is obviously not conceived by the ancient Greeks through standard cartographical representation, the discourse around it clearly displays normative modes of understanding and organising this material spatially and temporally. “Mapping” Greek mythic space should thus be possible, as should showing how mythic space evolved through mythic time. There are, however,

two central challenges. The first is practical: the collation of the enormous amount of data available in our sources that provides information about Greek mythic time and space. The second is conceptual: how to visualise this information to best convey the nature of mythic thinking, and to represent both the notional mythic space and the chronological structures that underlie that storyworld. In this sense, mapping and other methods of digital representation are not intended as reproductions, but as heuristic tools to investigate the mythic storyworld as a dynamic interaction of space and time.

This paper presents a collaborative project centered on MANTO, an LOD gazetteer of Greek myth (<https://www.manto-myth.org/manto>). Using the subset of MANTO representing Pausanias' descriptions of mythic events, we used GIS and mixed media methods, to investigate how myths attached to places, how different places become foci of mythic activity, and how mythical storytelling "takes shape" through the interaction of spatial and temporal dimensions, the former expressed as places of different depth, the latter as generations of heroic history. Our visualisations explore the connections between the 26 heroic generations delineated by Pausanias and the geographic locations they interact with, and how the interactions between the mythic storyworld and the places connected to it (as locations of events, sites of relics, etc.) can provide a different perspective to understand the Mediterranean not as a connected world, but as "islands of myth" (Clarke, 2017, p. 19) in a sea of darkness.

Keywords: Classics; Greek Mythology; Linked Open Data; Pausanias

SESSION 5

The Anatomy of Digital Haunting: Extracting the Universal Mechanism of Fear from a Case Study of Northeast China's Dreamcore

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Background

The pervasive sense of the uncanny (das Unheimliche) in "Chinese Dreamcore" (Cheng, 2023; Lin, 2022) echoes Freud's (1919) foundational analysis, yet its precise psychological mechanism within the digital Chinese context remains opaque. This study posits that this digital haunting can be further understood through Gordon's (2008) framework of *Ghostly Matters*—as a social symptom—and is materially anchored in the liminal spaces (Turner, 1969) of regional memory. This study posits that a universal mechanism of fear—rooted in cognitive dissonance, temporal disorientation, and existential anxiety, and tied to the memory of place (Trigg, 2012)—is catalyzed and intensified by specific, dense reservoirs of collective memory. To dissect this interplay between the universal and the particular, we employ Northeast China as a paradigm case, a region whose post-industrial identity forms a potent "memory site" (Zhang, 2021). The region's iconic post-industrial landscape and deeply ingrained narratives of transition provide a potent, culturally-specific "memory catalyst". We hypothesize that for the local Z-generation, Dreamcore imagery triggers a more acute and narratively rich form of fear, making the underlying mechanism starkly visible. By comparing their responses to a control group, we aim to isolate and model the core fear-generating algorithm that operates across contexts.

Methods

This research employs a comparative experimental design powered by AIGC. First, a digital ethnography of Northeast online communities informs the creation of a region-specific visual lexicon. Using Stable Diffusion, we generate a standardized set of image stimuli that embed these Northeastern memory symbols into classic liminal space compositions.

To decisively separate the effects of generational cohort from regional memory, participants are recruited into three groups: (1) the Core Case Group: Z-generation (born 1995-2009) raised in Northeast China; (2) Control Group 1 (Regional Control): Z-generation from other Chinese regions; and (3) Control Group 2 (Generational Control): Non-Z-generation (born 1970-1989) raised in Northeast China. A minimum of 70 valid responses per group (N ≥ 210 total) will be collected, ensuring a robust basis for both statistical comparison and in-depth qualitative analysis.

All participants will complete a survey after viewing the stimuli, featuring quantitative scales (e.g., for uncanniness and nostalgia) and in-depth qualitative prompts. Data analysis will employ a mixed-methods approach: Two-way ANOVA will be used to examine the main and interactive effects

of Region and Generation on fear ratings. Subsequently, a focused thematic analysis of the qualitative responses from the Core Case Group will be conducted to model the detailed cognitive-emotional pathway to fear. The responses from the two control groups will serve as critical filters to distinguish universal eerie reactions from those specifically potentiated by localized, generational memory.

Results

We anticipate results that delineate distinct contributions of region and generation. First, we predict a significant interaction effect between region and generation: the Core Case Group (Northeast Z-generation) will report the most intense and complex fear, explicitly linked to narratives of post-industrial transition and familial memory. This will confirm the unique catalytic power of this cohort's specific memory reservoir.

Second, comparisons with the control groups will isolate the mechanism's components. Control Group 1 (Non-Northeast Z-generation) is expected to show milder, more generic unease, highlighting that the mechanism requires specific cultural content to reach high intensity. Control Group 2 (Northeast Non-Z-generation) is crucial for testing generational specificity; their responses—whether strong nostalgia devoid of digital-age dread, or a different form of anxiety—will clarify whether the core fear mechanism is a distinctly Z-generation phenomenology or a more universal response to images of regional decline that is merely expressed differently across ages.

Conclusion

This study employs a three-group design to dissect the Dreamcore uncanny into its constituent parts. By isolating the variables of region and generation, we aim to construct a nuanced model that distinguishes a potentially universal core of the uncanny from its culturally and generationally specific amplifiers. The resulting framework will demonstrate how digital aesthetics selectively activate particular layers of collective memory to produce fear, moving beyond generic nostalgia (Boym, 2001) to interrogate the uncanny (Trigg, 2012) within digitally constructed non-places (Augé, 1995). This offers a replicable methodological blueprint for cross-contextual research in digital memory studies and for understanding how *Ghostly Matters* (Gordon, 2008) manifest in localized, algorithmic forms.

Keywords: Chinese Dreamcore; Northeast China; Digital Uncanny; AIGC Experiment; Intergenerational Memory.

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Acknowledgements

The research presented herein was undertaken as an independent scholarly initiative without dedicated external funding.

Depth in the Silence: The Non-Semantic Text in Holocaust Survivor Interviews

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Background

The project uses natural language processing and machine learning tools to uncover how the non-

semantic narrative and auditory dimensions of large oral history archives inform the distant and close analysis of the text. Working with a random sample of 998 interviews from the USC Shoah Foundation archive (VHA), our project focuses on the interviewee's silences as indicated in the oral transcripts with the marking: "[Pauses]" followed by the length of time of the pause. We are particularly interested in how "pause," which occurs over 70,000 times in the 998 interviews, demonstrates both similarity and individuality in the interviewees' testimonies. Our project looks at the distribution of pauses across interviews, paying attention to pause location and the type of pause. We are interested in how the spatiality of the pause in the narrative maps onto the actual lived spatial experience of the interviewee; which places are harder to describe and where then does the silence occur?

The USC Shoah Foundation's repository of over 54,000 interviews is the largest oral history archive in the world. There are other collections including the Yale Fortunoff Archive and USHMM databases that attempt to document the first-hand experience of the Holocaust (Shenker, 2015). Scholars have utilized Holocaust testimonies to do a "close reading" of the Holocaust. Looking into factors such as gender, region, nationality, and age, scholarship has woven testimonies into analyses of official wartime policies, searching for experiences—and most importantly human behaviors—that exclusively reading official documents would miss.

Recently, scholars in the digital humanities have started to consider the merits of using machine learning processing, and artificial intelligence to analyze survivor testimonies. In part, scholars have hesitated using technology on such sensitive material, noting that inevitably these technologies would render individual trauma in the abstract, a chilling parallel to the bureaucratic nature of death in the Second World War that rendered victims into quantitative data (Presner, 2024).

At first glance, using machine learning encourages just this: the division of interviews into tiny quantitative data points that stress characterizations of the interviewer's speech and semantics. Yet ironically, these technological tools have yielded results that enforce the individuality of the testimonies, preserving the subjective qualities from becoming mere quantitative statistics. The use of DH tools has confirmed the need for both close and distant readings, forming a hybrid method to approaching the testimonies.

Methods

Our project utilizes this hybrid approach to better

understand the spatial aspects of the pause. We look at the distribution of pauses, visualizing the silence normalized by percentage of total interview length. In this analysis, the project views major clustering of pauses in the interviews, considering how these clusters individualize the interviewee's testimony. In other words, not all pauses are equal: while some clusters suggest a heavily traumatic part of the testimony resulting in the interviewee pausing in emotional reflection, other clusters indicate moments of struggling to remember information or a certain hesitation in recording parts of their experiences.

We therefore classify pauses into six different categories: emotional processing, shift in narrative scope, hesitation or uncertainty, memory recall, rhetorical emphasis, and aside (shift to conversation with the interviewer). Working with large language models, we determine the type of pause, considering patterns of pauses. The project is interested in how the nature of the interview, which approximately allocates 20% of the time to the prewar, 60% to the war, and 20% to the postwar, influences the distribution of pause category. Furthermore, the project aims to uncover how gender plays a role in pause distribution considering the gendered experiences of war.

With these parameters, our work explores how the distribution of pauses maps onto the geonouns in the testimonial descriptions, making a connection between the narrative and remembered and reported spatial experiences.

Results

The project found two interesting discoveries. First, there was no clear sense of uniformity in pause distribution: some survivors told fragmented stories with multiple pauses, others had clusters of pauses with long spans of fluency, and for one, one individual never paused in retelling his story of over two hours. Second, when pauses did occur, they concentrated around specific geonouns of wartime experiences such as ghetto, camp, and cattle car: places of increased traumatic processing.

Conclusion

Our project further affirms the value of mixed methods—close and distant readings—when analyzing Holocaust survivor testimonies, or oral history archives in general. Furthermore, there is merit to utilizing large language models alongside more traditional natural language processing and computational linguistic methods. Not only do large language models recognize patterns within a large corpus but demonstrate the lack of uniformity, emphasizing the individuality of the survivor's lived

experience and their presentation of their story. The non-semantic speech, particularly the silences, are evidence of survivor agency vis-à-vis the interviewer, their questions, and the institutional archive that oftentimes has a formal set of protocols (Shenker, 2015). Additionally, the use of LLMs to classify pauses signals the predominance of silence accompanying emotionally challenging narratives, fitting into ideas of the 'unspeakable' (Greenspan, 2014) within testimony. Considering non-semantic aspects opens the archive to new inquiries, enabling analysis of the seemingly insulated exchanges within one interview to new understandings of the entire collection.

Keywords: Non-Semantic Text; Pauses; Holocaust; Oral Archives

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Acknowledgements

The authors acknowledge support from the "Understanding imprecise space and time in narratives through qualitative representations, reasoning, and visualisation" grant funded by the UK's Economic and Social Research Council (ES/W003473/1) and US National Science Foundation (NSF#2225179)

Pond breaks in early modern Bohemia

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Background

In early modern Bohemia (present-day Czechia), fish farming was a profitable industry. The number of artificial water bodies changed the character of the landscape with significant cultural impact (Bijker, 2012). While there were no particular difficulties with ponds in lowland regions, in more hilly areas with steeper slopes and higher stream dynamics, ponds were more vulnerable to the changing climate conditions of the Little Ice Age, floods, and neglected maintenance. Thus, after the so-called 'golden age' of

the 16th century (Vorel, 2008), the history of ponds varies according to region and other factors, with pond breaks also occurring. My paper aims to explore how contemporaries reacted to the pond breaks and how they dealt with local disasters. A key question is the spatial relationship between bodies of water (that broke or could break in the future) and the location of other structures and activities.

Methods

Over the past few years, I have collected around 30 well-documented examples of pond breaks from the 16th to the 18th century (Vokurka, 2022). I studied the causes and course of these catastrophic events, their short-term consequences (e.g. damage and social resilience) and their long-term consequences (e.g. land-use changes and risk prevention), as well as their cultural impact. To analyse the environmental and social aspects, I worked with archival material and old prints to study contemporary reactions to and reflections on the events. I also used hydrological data (historical floods and flood maps) and a database of slope deformations to assess the nature and scale of the events (ČGS, 2026). To inspect some of the pond breaks and the course of a flood wave more closely, I mapped the events using a digital terrain model (DTM) and a digital elevation model (DEM) in GIS. However, these methods are only illustrative for the long time lag and possible changes in terrain morphology.

Results

Historiography paid surprisingly little attention to pond breaks (David, 2020). While the individual events had limited impact, the large number of ponds in the region posed a serious threat to people, animals, buildings and agricultural soil.

Following pond breaks, a change in attitude towards ponds and fish farming was observed (pamphlet polemics, a smaller volume of renovated ponds and a change in land use). As with any other disaster, pond breaks were reflected in songs and folk tales. In several cases, victims were compensated and new houses were built in safer areas. Links to baroque devotion were also noted, namely in the form of votive gifts of gratitude for lives saved.

Conclusion

Pond breaks posed a significant challenge to pre-modern rural societies. While people could mostly enjoy the benefits of fish farming and water retention, the ponds became a source of serious danger in the event of a large volume of water leaking out. The flood wave demolished buildings and killed people; other damage and threats were connected with the mud that remained after the water flowed away (Parinello & Kondolf, 2021). Dealing with the disaster, including helping those in need and preventing recurrence,

provides unique insight into the complex relationship between humans and nature in early modern history. Last but not least, many historical ponds, where breaks can occur, are part of today's landscape and are mostly protected as cultural and/or natural heritage sites.

Keywords: ponds; pond breaks; risk; water; early modern history ([Maximum 5](#)).

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SESSION 6

Using AI and Qualitative Spatial Representation (QSR) to understand the perception of geographies in texts: Picturesque and Wild landscapes in the English Lake District

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Background

In previous work we have developed a set of techniques called geographical text analysis (GTA) that can be used to help understand the geographies described in texts. This approach identifies and georeferences place-names in the text found near to a search-term allowing the places associated with the search term to be mapped and spatially analysed. While this approach has been widely applied (e.g. Donaldson et al 2017; Paterson & Gregory 2019; Murrieta-Flores et al. 2015; Taylor & Gregory 2022), it has two major limitations that this paper will address. 1) From a textual perspective does not explore how the geography of the search-term is related to other terms in the corpus. 2) Spatially, GTA uses coordinate-based geographies and the Euclidean distances between location but is unable to account for the perception of distance and how this changes over time.

In this paper we examine these issues using the changing description of landscape in the English Lake District. We are particularly interested in the uses of the adjectives 'picturesque' and 'wild.' These two words are widely used to describe the Lake District were significant in the national park's designation as a UNESCO World Heritage Site, however, their meaning is contested and has changed over time. It is generally assumed by heritage organisations and others that these two terms are likely to be used to define very different landscapes: picturesque places are associated with touristic landscapes that represent a perceived rural idyll, while wild landscapes are more remote and less tamed. Our aim is to explore the geographies associated with these two concepts in detail and how they changed as the Lake District became more accessible and more of a touristic destination.

Methods

The paper is based on the Corpus of Lake District Writing (CLDW)¹, a collection of 80 texts written about the Lake District primarily through the 18th and 19th centuries. The corpus consists of work by well-known writers such as William Wordsworth, and lesser works and tourist guides. Under previous work we have identified and georeferenced the place-names within the corpus.

We have three aims:

- 1) to identify Lake District geographies of places described as 'picturesque' or 'wild' at three key periods: the late 18th century; the Romantic era; and the Victorian era.
- 2) to explore how these geographies vary

¹ <https://github.com/UCREL/LakeDistrictCorpus>

according to how 'picturesque' and 'wild' are defined using three approaches: first, the two words as individual search-terms with conventional GTA. Second, enhancing a principal components analysis (PCA) developed by Millar & Hunston (2015) allows is to define wider sets of words defined that contribute to places being defined as 'picturesque' or 'wild', and third, using Large Language Models (LLMs) to define the extent to which places are defined as 'picturesque' or 'wild'.

3) to explore the relationship between places defined as 'picturesque' or 'wild' and distance from the major tourist centres comparing Euclidean distance, which is easy to implement in GIS but is problematic in a mountainous landscape, with perceptions of distance as accessibility changes over our period. We explore this using qualitative spatial representation (QSR) to measure the relative accessibility of places defined using how frequently they are defined as in close proximity to each other in the text. Defining proximity again involves the use of LLMs combined with network analysis.

Results

Our results, best demonstrated graphically, fall in two key areas: the methodological and the applied. Methodologically, we are able to show that we can move significantly beyond GTA using PCA and LLMs to explore the geographies associated with particular themes. All three approaches complement each other but measure somewhat different things. GTA is researcher-led, as the researcher defines the search-term of interest and the results are based on this, and only this. PCA is much more data driven. We include all Lake District place-names that occur more than ten times in the corpus and all adjectives that co-occur with these more than 20 times. PCA allows us to simplify this to identify adjectives that follow similar patterns of co-occurrence with the place-names and map their geography. From here, we can identify which adjectives follow a similar geography to our search-terms and how this changes over time. LLMs fall somewhere between the two. We specify the search-terms at the start of the analysis and they are able to identify both the place-names and adjectives that these tend to co-occur with.

From a QSR perspective, we extract pairs of place-names that writers identify as being near to each other using LLM approaches. These can then be extracted to show the changing networks of how distance was perceived. Comparing these with Euclidean distance

shows how the perceptions of relative proximity changed over time and reveals the places that become more accessible over time while others remain peripheral to the travellers' experience.

Conclusion

Comparing these perceptions of distance with the perception of picturesqueness and wildness and the changing language allows us to draw conclusions about the ways that the perception of landscape changes both in terms of the changing use of language and the changing accessibility of place. The paper has a range of wider implications: it provides examples of how LLMs and more conventional statistical approaches can be used to understand the language about place and how it changes. They also allow us to explore the changing perception of distance between places rather than having to use the GIS model of an isotropic plain. Bringing these together allows us to develop a model of the perceptive geography of place based on both the attribute side of place – how it is perceived itself – and the spatial side – how it is perceived as relating to other places. In this way we are able to significantly improve the way we represent and understand what Bushell (2012) terms the 'slipperiness' of geographical information in literary sources.

Keywords: Geographical Text Analysis; Large Language Models; Qualitative Spatial Representation and Reasoning (QSR); travel writing.

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Acknowledgements

We acknowledge support from the “Understanding imprecise space and time in narratives through qualitative representations, reasoning, and visualisation” grant funded by the UK’s Economic and Social Research Council (ES/W003473/1) and US National Science Foundation (NSF#2225179). We would like to thank the other team members for their support with this paper and the ideas that underlie it.

Comparative Analysis of Neural Methods for Cultural Assets Representation

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Background

The integration of artificial intelligence (AI) in the documentation and preservation of cultural heritage (CH) has gained increasing relevance, particularly through the application of neural-based representation methods. Techniques such as Neural Radiance Fields (NeRF) (Mildenhall et al., 2020), 3D Gaussian Splatting (3DGS) (Kerbl et al., 2023) and more recent 2D Gaussian Splatting (2DGS) (Huang et al., 2024) introduce new paradigms for the representation and interpretation of complex cultural assets. These approaches complement traditional digital survey techniques by enabling new forms of visual analysis and dissemination, especially where geometric complexity or material properties limit conventional workflows (Condorelli et al., 2019).

In CH contexts, Structure-from-Motion and Multi-View Stereo (SfM-MVS) remain the reference methodology for metric and reproducible 3D documentation, supporting tasks such as measurement, conservation assessment and integration into GIS or HBIM environments (Croce et al., 2021; Remondino et al., 2023). However, its limitations are well documented, particularly when dealing with homogeneous textures, reflective or translucent materials, or fine surface details below the effective spatial resolution of the image dataset (Lang & Salcedo Paparoni, 2025).

Recent reviews have explored the potential of NeRF (Croce et al., 2024; Mazzacca et al., 2023; Remondino et al., 2023) and 3DGS (Khedr et al., 2025) to CH applications, showing they outperform SfM-MVS in specific scenarios, particularly for objects with challenging optical properties. However, several gaps remain. First, existing reviews have not yet

covered 2DGS. Second, the applicability of neural methods to museum artifacts with complex materials, such as fur, hair, mother-of-pearl, has not been systematically reviewed. Lastly, comprehensive comparative analysis encompassing SfM-MVS and all other methods are still lacking.

Methods

This study evaluates the adequacy of neural-based representation methods for the digitization of museum objects. The methodology combines (1) a structured review of recent literature on neural representations applied to CH and (2) exploratory case studies drawn from a museum’s collection. The comparative analysis focuses on SfM-MVS, NeRF, 3DGS, and 2DGS with respect to (1) geometric fidelity and metric reliability, (2) visual quality and view-dependent effects, (3) robustness to challenging material properties, (4) and suitability for documentation, analysis and dissemination. The selected case studies include objects exhibiting diverse geometric complexity and optical behavior, allowing evaluation under comparable acquisition conditions.

Results

Recent studies provide valuable insights into the performance of neural methods in CH contexts. Croce et al. (2024) report that NeRF can outperform SfM-MVS when image datasets are sparse and that it better captures view-dependent material characteristics, intricate objects and homogeneous textures, although with increased noise sensitivity (Croce et al., 2024; Mazzacca et al., 2023).

Remondino et al (2023) compared several NeRF frameworks and found Instant-NGP to outperform others in accuracy metrics and computational performance. They found SfM-MVS to be better in well textured and partially textured objects, while NeRF to outperform in texture-less, transparent, metallic and highly reflective surfaces.

Within CH applications, 3DGS is best interpreted as a representation and rendering method rather than a metric reconstruction technique. Its strengths lie in visual communication, immersive exploration and dissemination, while explicit geometric analysis remains outside its primary scope (Kerbl et al., 2023; Khedr et al., 2025; Remondino et al., 2023). However, no published studies to date explicitly address neural reconstruction performance for artefacts composed of mother-of-pearl, fur, hair, or light-emitting materials.

Conclusion

This study highlights the complementary nature of SfM-MVS and neural methods for the digitization of museum objects. Preliminary results indicate SfM-MVS remains indispensable for metrically reliable documentation of objects with Lambertian reflectance,

yet neural methods enable capturing objects previously impossible with classical surveying approaches, particularly transparency and view-dependent textures. 2DGS, although recent, appears particularly promising as it combines geometric accuracy with high-quality rendering.

Keywords: NeRF; 2DGS; 3DGS; Cultural Heritage; Neural Networks

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Deep mapping Ireland's places within an object-relational database

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Background

Bodenhamer *et al* (2024) define a deep map as “a finely detailed, multimedia depiction of a place ... Deep maps ... include the discursive and ideological dimensions of place . They are also topological and relational, revealing the ties that places have with each other.” This clearly should mean something different from a traditional GIS, a technology originally developed to manage utility networks and suchlike, where physical presence and location are paramount. In practice, however, “deep maps” often turn out to be familiar ArcGIS implementations; for example, in “Layers of London” (<https://www.layersoflondon.org/>) or the Welsh “Deep Mapping Estate Archives” project (<https://deep-mapping-estate-archives-rcahmw.hub.arcgis.com/>).

This paper presents a true alternative. The Great Britain Historical GIS project’s Vision of Britain system has always been built around a systematic enumeration of places within an object-relational database (Postgres/PostGIS). Critically, while ArcGIS requires that coordinate data provide the core framework, an object-relational system lets us define our own information architecture, including much coordinate data but with a semantic core. Here we

demonstrate this approach through recent work to add diverse Irish historical content.

Methods

Vision of Britain was originally conceived, like other national historical GISs, as primarily about historical statistics for administrative areas. Pre-launch usability testing showed users were confused by there being both many settlements with the same name, and multiple administrative units named after the same settlement; so administrative units were grouped into “places”, enabling a two-stage search. This also enabled integration of the historical travel writing, a significant content type (Southall, 2014).

Irish content was broadly similar to British content: census transcriptions, especially of the detailed parish-level tables between the first Irish census in 1821 and the last census of a united Ireland in 1911; a comprehensive census gazetteer of administrative areas (Census of Ireland, 1861); two systematic descriptive gazetteers, Lewis (1837) and Bartholomew (1887); and, for travel writing, Irish chapters within existing transcriptions, but adding Young (1780), a systematic survey.

However, constructing Irish places began with literary sources, and particularly 3,315 entries in Lewis (1837), assumed to refer to a unique place. Equivalents in Bartholomew were matched largely algorithmically. The census gazetteer had already been used to add counties, baronies and parishes to our administrative unit ontology, the framework for holding statistical data. Automated matching again linked most units to Lewis entries.

The result was extracted as a large spreadsheet and much manual editing followed. Each row from this spreadsheet was used to insert new and minimal entries into the Vision of Britain “places” table: a generated ID number, a master place name, the ID of a containing higher-level place and, as discussed below, a point coordinate. These IDs exist to link diverse content held elsewhere, so place IDs were simultaneously added to the descriptive gazetteer and administrative unit tables; and to the single searchable table of geographical names, spanning gazetteers, units and travel writing.

All these sources are purely textual, but each place needs a point coordinate, used mainly to locate “places” on an outline map. Three main sources were used: centroids from linked parish boundary data (see <https://townlands.ie/>); linked Wikipedia entries; and GSGS 4127 mapping, another system component.

“Places” were then extended by, firstly, adding the census’s “towns”, defined as collections of twenty houses and upwards, where named differently from their containing parish; and, secondly, by defining

places from mentions in travel writing, including many landed estates and some physical features.

Results

Overall, the system defines 3,647 Irish places. Of these 3,081 link to Lewis entries and 3,288 to Bartholomew. 3,383 are linked to at least one unit, including 2,425 linked to one of the 2,508 parishes, and 1,163 linked to one of the 1,285 towns. A total of 1,065,048 statistical data values are indirectly linked, from the census “General Tables” including data on occupations, literacy, religion and housing. Currently 3,383 Irish place references have been identified within the travel writing corpus, linking to 501 places. Overall, 16,331 placenames are held from the various places, an average of 4.48 names per place.

This gives some sense of the richness of the system, but its purpose is to provide a sense of place for particular places, which need to be sampled. For example, Tralee, County Kerry. The “place page” below contains the Bartholomew entry and a general location map, links to statistics for both the parish and the town, and also to mentions by the travellers Arthur Young and George Head: <https://visionofireland.org/place/28867>

Conclusion

Vision of Britain is often referenced as an exemplary rich gazetteer, but few if any later systems have adopted its architecture. The original British project had a complex evolution, but the recent extension to Ireland proved straightforward, and required no changes whatsoever to the underlying database table definitions, suggesting this is a highly generalisable model for “deep mapping”. It should also be emphasised that, while ArcGIS is very expensive, Postgres/PostGIS is open source and easily installed on PCs; and QGIS provides a familiar GIS front-end.

Keywords: Deep mapping; Ireland; Gazetteers; Travel Writing; Postgres.

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Acknowledgements

Thanks to Derek Rowlinson for his transcription of Lewis (1837).

SESSION 7

Shaping the Colonial Port cities: Trade Network and Spatial Structure in the Pre-colonial era

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Background

The period from the 16th to the 19th century, often termed the "pre-colonial era," commenced with the Age of Discovery. European-pioneered transoceanic routes first connected the world, gradually establishing a global colonial trade network with trade routes as links and port cities as nodes. The impact of this era was profound, significantly shaping Europe's subsequent rise and its civilizational trajectory. Port cities serve as an exemplary lens through which to examine how European civilization reshaped the world during this period, engaging in both conflict and fusion with indigenous societies. On the one hand, as vital trading nodes, port cities played a pivotal role in operating global trade networks that spanned regions and continents. On the other hand, they embody distinct spatial structures and material heritage resulting from European colonial transformation. Their characteristic spatial structure—manifested in grid street systems, central plazas, functional zoning, and infrastructures such as harbors and fortifications—was not merely a transplantation of morphological models, but also a spatial instrument employed by colonial powers to facilitate territorial control, resource extraction, and the integration of these cities into global trade networks.

Current Research

Studies of colonial port cities can be categorized into three principal strands. The first pertains to early modern maritime history, focusing on reconstructing how European empires established global trade networks [1–10]. This strand examines imperial expansion, colonial policies, and the organization, geography, and capital operations of key institutions such as the East India Company [3,10]. The second

lies within early modern global economic history, where scholars quantify global flows of commodities and capital using colonial archival data, with particular attention to the market roles of colonial port cities or urban agglomerations [3,9,10–19]. The third concerns case-study historiography of individual port cities, comprising extensive monographs and edited volumes that analyze diverse historical aspects—economic functions, spatial form, social structures—to reconstruct developmental trajectories [20–27].

Existing research, however, suffers from a bifurcation in perspective. Scholars in geography and economics often reduce urban interactions to abstract nodes within trade networks, whereas urban planning scholars tend to rely on qualitative, case-specific analyses, which limit broad comparative insights and the identification of generalizable patterns. This paper seeks to bridge these approaches by, on one hand, reconstructing the global trade network of the pre-colonial era to examine the external linkages of port cities as nodes, and on the other hand, analyzing the internal spatial structure of these cities and their inter-urban similarities, thereby probing their internal morphological linkages. Specifically, the study addresses three research questions:

- (1) What structural characteristics (e.g., hierarchy, clusters) can be identified in the global trade network of pre-colonial port cities?
- (2) How can the internal spatial structures of these port cities be systematically compared, and what patterns of similarity or typology emerge?
- (3) Is there a systematic correlation between a port city's position within the global trade network and its internal spatial structure? In particular, did colonial spatial structures propagate along trade routes, leading to convergence between the network of urban spatial similarity and the trade network itself?

Methods

Step 1: Compilation of Colonial Port Cities and Foundational Data.

This study establishes a geographic database encompassing nearly 300 port cities by integrating multi-source historical materials—including East India Company archives and colonial atlases—based on the Historical Geographic Information System (HGIS) methodology. Drawing on existing literature and open-source materials, the database systematically organises essential information on major colonial port cities during the early modern era.

Step 2: Depicting the Structural Characteristics of the Port Cities Trade Network and Nodal Roles.

Given that the core of the maritime colonial system lay

in commercial interaction, this research constructs a network primarily from the perspective of trade flows. Constrained by the completeness of historical sources, the study relies predominantly on publicly accessible archives of the East India Company to form a directed and weighted urban relational network, with shipping frequency between port cities serving as the measure of connectivity. Complex network analysis is then applied to quantitatively identify the centrality, influence, and structural roles of cities within the network.

Step 3: Decoding the Spatial Structure of Colonial Port Cities and Uncovering Inter-city Similarities.

This study conducts an in-depth analysis using historical maps from British and Dutch sources in the pre-colonial period. On one hand, a critical discourse analysis is carried out based on the formal features of the maps (e.g., cartographic conventions, decorative elements), their functions (e.g., navigation, administration, territorial claims), and perspectives (e.g., bird's-eye view, axonometric projection). This approach seeks to deconstruct the colonial ideologies, power relations, and the "othering" perceptions and spatial imaginaries of target cities embedded in these maps. On the other hand, graphical information from the maps—such as street layouts, building footprints, functional zoning, fortifications, and port facilities—is digitally extracted and systematically compared. Through the identification of relational patterns and quantitative morphological comparisons, the spatial structure of cities is quantified. By integrating the above two dimensions, an internal similarity matrix for the port cities is derived.

Step 4: The Interrelation between Network Position and Spatial Form: Examining the Transmission of Spatial Structure along Trade Networks

First, the Mantel test is employed to assess the global correlation between the trade network matrix and the spatial similarity matrix. This provides an initial assessment of the relationship between the trade intensity and the degree of spatial-structural resemblance among port cities. Subsequently, a correlation model is constructed to explain the transmission mechanism of colonial spatial structure. In this model, the dependent variable is defined as the shortest-path distance between cities within the trade network matrix, while the independent variable is their spatial-structural similarity.

Expected Outcomes and Contribution

This study is expected to reveal correlations between port cities' positions in global trade networks and their spatial structures, demonstrating how colonial spatial

structures propagated along trade routes. It will provide an integrated methodological framework bridging network analysis and urban morphology, advancing our understanding of pre-colonial's spatial logic.

Keywords: Colonial port city; Urban form; Urban network; Pre-colonial Era; Colonial culture heritage; Maritime trade

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PORTUSplus, 8 (Special Issue).

Spatial Narratives of Frontier Memory: A Digital Humanities Reconstruction of Xinjiang Reclamation Mobility (1949–1965)

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Background

The military reclamation efforts of the Xinjiang Production and Construction Corps (CPCC) represent a significant spatial practice in China's border governance during the 20th century (Glazunov et al., 2023). Under state organization, its members conducted cross-regional relocations, transforming deserts into oases and establishing a unique cultivation and settlement culture (Li et al., 2022). The oral histories of those who experienced these events not only carry collective memories of national construction and frontier development but also provide critical empirical evidence for understanding how institutionalized migration reshapes geographical and cultural spaces (Caquard & Cartwright, 2014). However, these oral materials are often characterized by colloquialism, fragmentation, and temporal-spatial discontinuities, making them difficult to directly apply to systematic spatial analysis (Seawright, 2025).

This study integrates digital humanities methods including GIS, text mining, large language models, knowledge graphs, and social network analysis, aiming to systematically interpret and visually reconstruct the flows of the Xinjiang military reclamation population during the state-led organized migrations between 1949 and 1965, and to explore how they established collective identities and cultural spaces? The study breaks down into the following research objectives: how to extract structured spatiotemporal knowledge from colloquial and fragmented oral texts; how to effectively present complex temporal, spatial, and social relationships in narratives through ontology modeling; and how to integrate multidimensional narratives to achieve dynamic, interactive spatial story reconstruction.

Methods

The study develops a digital humanities framework integrating qualitative coding, spatial mapping, and

social network analysis. First, tools such as PaddleNLP and Qwen3VLM are used to extract and standardize entities-including people, places, times, events, and objects-and their relationships from multimodal oral texts, transforming knowledge into a structured format. Next, GIS is applied to geocode location entities, mapping migration trajectories, event distributions, and reclamation hotspot patterns to visualize the spatial evolution of military reclamation activities from scattered land reclamation to clustered expansion. Simultaneously, a dual-layer network of “person-person” and “person-place” is constructed based on entity co-occurrence. Gephi is used for topological analysis and key node identification to reveal network structures of information flow, production collaboration, and cultural dissemination. Finally, an interactive story map integrates multimodal data, enabling linked narratives between maps and texts to dynamically present the transition from individual memory to collective spatial narrative.

Results

This study reveals that state-led organized migration profoundly reshaped the demographic distribution and cultural geography of Xinjiang. Individual migration trajectories show significant spatial clustering around key frontier settlements such as Shihezi (石河子) and Alar (阿拉尔), reflecting the shaping of spatial order by institutional forces. Spatiotemporal analysis uncovers the expansion of military reclamation activities from point-based pioneering to area-based colonization during 1949-1965. Social network analysis indicates that information flow and cultural diffusion exhibit a decentralized yet coordinated structure, with certain regimental farms and state farms acting as hubs in regional knowledge dissemination; it also identifies key individuals and communities central to production cooperation and organizational mobilization. Semantic mining via knowledge graphs further distills core cultural symbol clusters such as “hard struggle and pioneering spirit,” clarifying the mechanisms through which the military reclamation ethos was generated and sustained in concrete practice.

Conclusion

By integrating GIS, large language models, knowledge graphs, and social network analysis, this study builds a multimodal analytical framework for unstructured oral history, offering a reusable methodological pathway for spatial humanities research. The research not only achieves an organic connection between individual memory and macro-historical processes, forming a bottom-up institutional spatial narrative, but also provides empirical support for understanding how state power reshapes borderland geography through

organized migration and constructs collective identity and cultural space through mobility. The final outcomes not only advance the theoretical and methodological integration of spatial humanities but also offer a practical example for interactive storytelling and public communication of cultural heritage.

Keywords: Spatialized Narrative; Mobility; Oral History; Social Network Analysis; Multimodal storymapping

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Linking Narrative to Network: Spatializing Financial Trust and Capital Flows of the Chaoshan Chinese Diaspora via Qiaopi Documents

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Background

As a historical vehicle for cross-border capital flows between the Chinese diaspora and their kin, Qiaopi (remittance letters) embodies not only complex economic mechanisms but also profound sociological significance (Chen, 2007). Traditionally operating as an informal grassroots financial instrument, Qiaopi connected the diaspora in Southeast Asia with qiaoxiang (hometowns) in China, serving as a vital bridge for financial interaction (Hamashita, 2005). While these archives are rich in data, they have traditionally been treated as static historical texts (Jiao, 2011). In recent years, the rapid advancement of digital humanities has transformed Qiaopi archives into valuable resources of unstructured data, offering new dimensions for spatial and network analysis.

This study aims to link text to territory by systematizing these unstructured narratives into a spatiotemporal framework. By leveraging OCR and Large Language Models (LLMs), we transform raw archival images into machine-readable text. Through Named Entity Recognition (NER), we extract embedded spatial nodes, interpersonal ties, and financial flows. Furthermore, by integrating Social Network Analysis (SNA) with Geographic Information Systems (GIS), we construct a three-dimensional matrix of "Geography-Kinship-Finance." This computational approach allows us to visually reconstruct the trajectories of mobility for both capital and correspondence, revealing how trust networks rooted in kinship and geography facilitate cross-border capital circulation. Ultimately, by mapping textual narratives onto networked spaces, this research provides a novel methodological framework in spatial humanities for elucidating the dynamics of historical financial flows.

Methods

Integrating perspectives from digital humanities and quantitative financial history (Lu, 2019), this study aims to systematically reconstruct the trust networks and operational maps of the transnational finance of overseas Chinese in the modern Chaoshan region. We first convert unstructured Qiaopi archives into a multi-level standardized dataset covering "country, port, village, personal names, and amounts," resolving long-term data comparability through currency unification. On this basis, we use Social Network Analysis to construct a two-mode network between overseas nodes and domestic villages, revealing how kinship proximity under the "Differential Mode of Association" determines the trajectories and density of capital flows. Furthermore, we integrate the HP filter,

gravity model, and Cox proportional hazards model to quantitatively evaluate the impact of various factors on capital turnover efficiency, ultimately dynamically restoring the evolutionary mechanisms and resilience of the historical financial network within the "Geography-Kinship-Finance" three-dimensional matrix.

Results

The quantitative analysis reveals a dual heterogeneity in the spatial topology and temporal evolution of the Qiaopi financial network.

Regarding network structure, the visualization unveils a distinct morphological divergence among clans. Large clans, such as the Chen and Lin families (Figure 1), form high-density "multi-centric" spherical clusters, implying profound transnational social capital and resilience; in contrast, the Liu and Xu families exhibit loose, star-shaped structures characterized by single-node reliance.

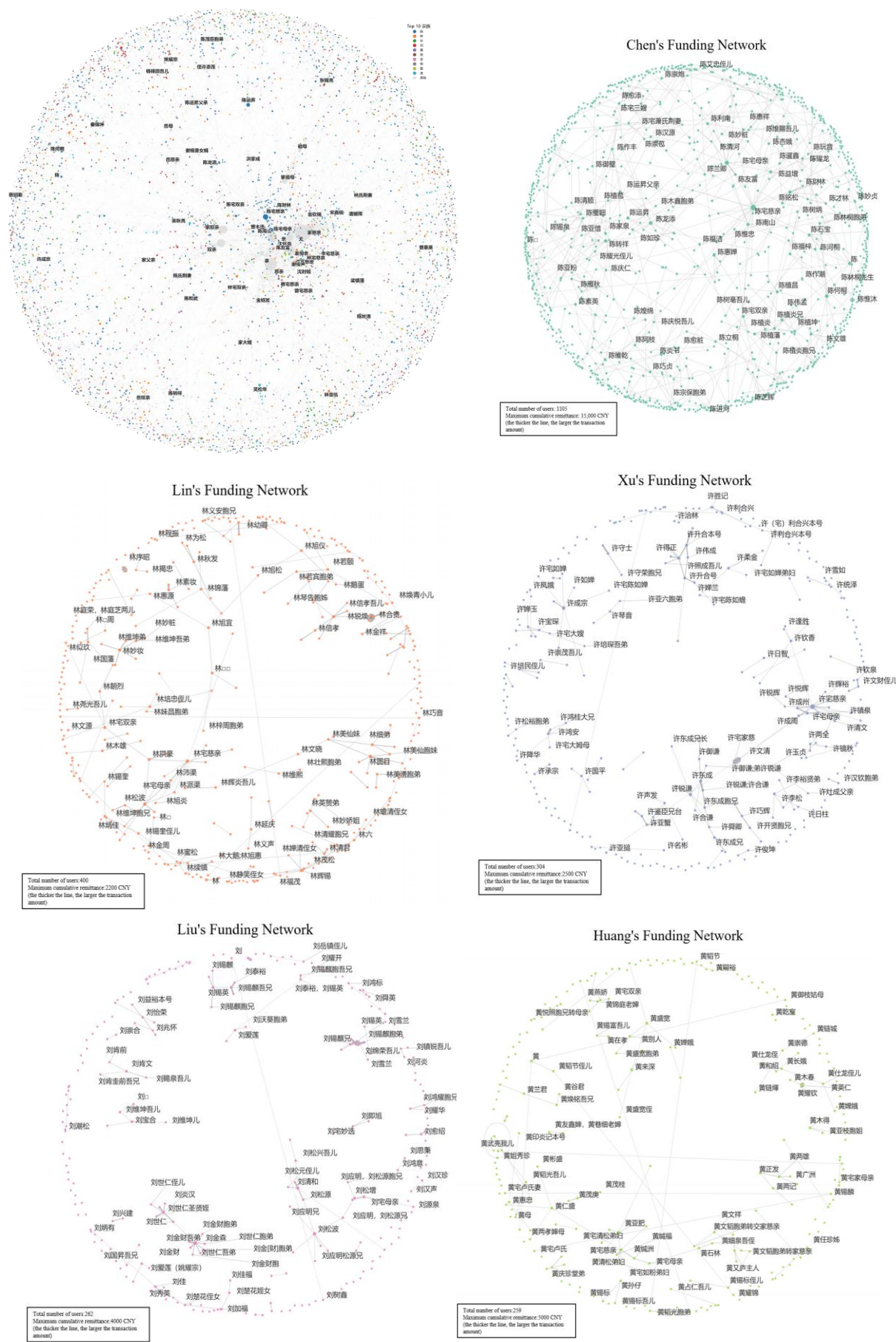
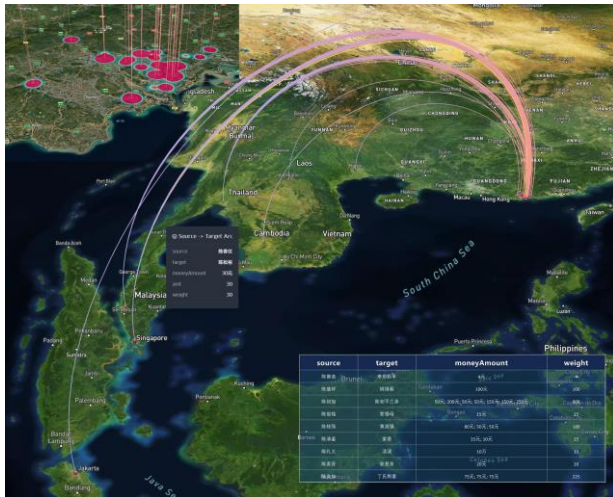


Figure 1. Comparative Network Topologies of Qiaopi Capital Flows Across Five Major Clans (Chen, Lin, Xu, Liu, and Huang).

This topological difference is further mapped onto the "kinship differential" of capital flows: "strong ties" among immediate kin bear the function of substantial capital accumulation and intergenerational transfer, while dense "weak ties" flowing to peripheral clan nodes construct an



inclusive network of welfare redistribution, confirming the deep embeddedness of financial behavior within kinship relations.

Figure 2. Spatiotemporal Visualization of the Chaoshan Qiaopi Network: Geospatial Flows and Temporal Evolution (1915 – 2002).

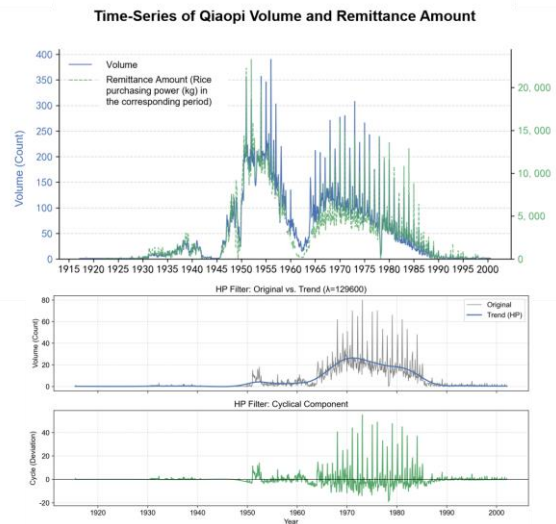
In terms of temporal evolution (Figure 2), the long-term trends decomposed via the HP filter indicate that fluctuations in Qiaopi volume are not random but highly coupled with international gold-silver price shocks, Southeast Asian currency devaluations, and domestic exchange policy shifts. This corroborates that this informal financial network operated not merely as a closed clan mutual-aid system but as an open system with acute adaptive responsiveness to global macroeconomic shocks.

Conclusions

By introducing Graph Large Model technologies, this study successfully transcends the qualitative limitations of traditional research, confirming the nature of Qiaopi as "empirical derivative finance." The findings demonstrate that the operational logic of this modern transnational financial network profoundly mirrors the projection of the traditional Chinese "Differential Mode of Association" onto the overseas landscape: kinship proximity directly dictates the trajectory and density of capital flows. Furthermore, clan leaders, acting in the dual roles of "geographical authority" and "financial intermediary," effectively reduced cross-border transaction costs. By constructing a three-dimensional "Geography-Kinship-Finance" matrix, we reconstructed the resilience mechanisms of this informal financial system in the face of war and institutional change. Overall, this research not only provides a data-driven perspective for understanding the pre-modern Asian trade-finance system but also demonstrates the deep value of

digital humanities methods in processing unstructured data for quantitative historical research.

Keywords: Textual Analytics; Social Network Analysis (SNA); Transnational Capital Flows; Spatial Humanities.



Large Language Models.

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SESSION 8

Interpreting Place through Deep Mapping: Spatio-Temporal Narratives of Aurel Stein's Central Asian Archaeological Expedition Texts

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Background

The archaeological age of the Western Regions constituted a complex historical period during which Western explorers entered Xinjiang and its surrounding areas under the pretext of investigating ancient sites and antiquities. Among them, Aurel Stein was one of the most active figures, whose

expeditions combined scientific investigation with the geopolitical agendas of the British Indian government. His travelogues and archaeological reports document practices of constructing an integrated spatio-temporal understanding of the regions he traversed, providing rich narrative materials for place interpretation. To interpret Stein's archaeological knowledge production, this study proposes a deep mapping framework grounded in textual narratives and movement trajectories. By integrating Historical Geographic Information Systems (HGIS) and knowledge graphs, it develops a spatio-temporal narrative approach that offers a place-oriented perspective on archaeological expedition texts.

Location, locale, and sense of place constitute the fundamental attributes through which place-based meaning is generated (Cresswell, 2004). In Stein's Central Asian expedition texts, places and trajectories function as the basic geographical units of spatio-temporal movement. Interwoven with extensive descriptive narratives, spatio-temporal indices, and place-based observations, these elements collectively form Stein's geographical cognition framework and carry the contextual and experiential dimensions through which he understood place. Mikhail Bakhtin's (1981) concept of the "chronotope" and the notion of the "deep map" proposed by Bodenhamer and colleagues (2015) provide essential theoretical foundations for interpreting narrative geographical texts. Building upon these theories, this study advances three spatio-temporal narrative threads: place characteristics—place relations, and place influences—which are developed across temporal and spatial dimensions to deconstruct Stein's understanding of place as expressed in his archaeological expedition texts.

The materials produced during Stein's early twentieth-century Central Asian archaeological expeditions include three formal archaeological reports—Ancient Khotan, Serindia, and Innermost Asia—as well as two more accessible expeditionary narratives, Sand-Buried Ruins of Khotan and Ruins of Desert Cathay. These two categories of materials are complementary and together constitute essential sources for understanding Stein's field investigations, major discoveries, and personal reflections. This study focuses on Stein's second expedition (1906-1908), taking Ruins of Desert Cathay as the primary textual source. As a pivotal expedition linking his earlier and later journeys, it covered a wide geographical range and is characterized by detailed textual records accompanied by survey maps, historical photographs, and archaeological reports. When combined with the Stein Gazetteer from the Digital Silk Road project, these materials enable fine-grained spatio-temporal narrative reconstruction and visualization.

Methods

Methodologically, this study proceeds through the following steps. (1) Based on Stein's survey maps and the Stein Gazetteer from the Digital Silk Road project, a historical geographic information database is constructed

encompassing landscape elements such as places, routes, and archaeological sites. Simultaneously, Ruins of Desert Cathay is subjected to semantic annotation at both the lexical and sentence levels, resulting in a deeply annotated corpus suitable for narrative analysis. (2) Knowledge ontology design is conducted within a place-interpretation framework. Drawing on the interpretive logic of place characteristics, place relations, and place influences, sentence-level semantics related to movement trajectories are structurally defined to provide a unified semantic foundation for subsequent knowledge extraction, relational modeling, and interpretive reasoning. (3) Under ontological constraints, knowledge extraction and graph database construction are carried out by systematically extracting relationships between places, routes, and contextual narratives from the annotated corpus. These relationships are stored in a graph database to form a knowledge graph capable of representing entity types and semantic relations, thereby supporting comprehensive analysis of place cognition structures within expeditionary narratives. (4) Narrative analysis is conducted along temporal and spatial dimensions by integrating sentence-level narrative sequences with historically reconstructed geographical space. Variations in sentence density, entity types, and descriptive emphasis along movement trajectories are analyzed to reveal narrative rhythms and evolving place cognition. (5) By synthesizing temporal and spatial analytical results, the study summarizes patterns of place perception and narrative structure formed during Stein's archaeological expeditions.

Results

The results show that Stein's expedition texts exhibit a coherent spatio-temporal narrative structure organized around movement trajectories rather than isolated archaeological sites. Integrating HGIS and knowledge graph analysis reveals that places function as relational nodes embedded within routes, pauses, and transitions, forming a dynamic network of spatial meaning. Temporal analysis identifies clear narrative rhythms along Stein's routes. Intensive archaeological phases are marked by dense place references and detailed descriptions, while long-distance travel sections foreground environmental conditions, logistical constraints, and experiential reflections. These shifts indicate an evolving sense of place moving from instrumental observation toward historically contextualized interpretation. Spatial analysis further reveals three dominant patterns: place characteristics constructed through recurring environmental associations; place relations shaped by route-based co-occurrence forming corridor-like structures; and place influences articulated through comparative narratives situating sites within broader historical and textual frameworks. Together, these findings confirm the effectiveness of deep mapping for interpreting expeditionary texts.

Conclusion

Grounded in theories of place and narrative, this study

reframes archaeological expedition texts as “chronotope” constructions in which place meaning emerges through movement, temporality, and relational narration. By operationalizing deep mapping as an interpretive rather than purely representational practice, it demonstrates how Stein’s Central Asian writings produce place through narrative rhythms and spatial comparison. This perspective advances spatial humanities by bridging narrative theory and historical geography in the interpretation of expeditionary knowledge.

Keywords: Deep Mapping; Archaeological Expedition Texts; Spatio-Temporal Narrative; Place Interpretation; Aurel Stein

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Acknowledgements

The research reported in this abstract was funded by the National Natural Science Foundation of China (Grant No. 52478049).

Participatory Mapping of Art Deco Architecture Through AI-Generated Podcast

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Background

Collaborations between academics and non-academic partners have been celebrated as a promising approach for achieving knowledge co-production. This has been particularly the case in cultural mapping literature, which has been calling for more genuine involvement from non-academic actors in generating knowledge and maps. Here, we present a cultural mapping process that intersects academic research with a non-academic group initiative. This project is part of developing a town observatory (TO) for Loughborough in the United Kingdom. The goal is to bring the bottom-up perspective about the town, that is, to foster and give voice to communities and their local heritage. The TO has as one of its digital platforms the Loughborough Stories, which is a collection of "ArcGIS StoryMaps" illustrating various themed narratives linked to the town’s history. This paper aims to present the process and progress

of The Art Deco StoryMap, a mapping initiative that originated from collaboration between academics of Loughborough University and the Loughborough Library Local Studies Volunteer Group (LLLSVG). The collaborative cultural mapping process incorporated the production of an AI-generated podcast to narrate the town's main Art Deco buildings as heritage assets. The town of Loughborough has 33 Art Deco buildings, and the StoryMap aims to map and highlight these buildings and encourage locals and visitors to look out for the unique architectural details.

Methods

The cultural mapping process happened throughout ten months of bi-weekly in-person meetings and monthly meetings with the whole team. The constant exchange and conversations generated significant insights and informed decision-making, resulting in a fluid and creative mapping process.

The use of AI in the co-design process has benefited from the support of colleagues from the Department of Computer Science and also the ethical clearance review of the University. These supports were key ensuring a critical and responsible use of the generative AI platforms. A series of workshops for the LLLSVG were staged, equipping them with new digital skills and giving the group digital confidence and autonomy for future projects. This co-design process has become essential for reflecting on how co-production can serve as inspiration or even be replicated for other communities, localities, and researchers. The use of AI to generate the podcasts incorporated the voices of volunteers, an approach that created a sense of ownership and encouraged more personality and engagement from the group.

Therefore, this paper aims to demonstrate how the Art Deco Trail StoryMap employed a distinctive methodological framework that employed ‘design thinking’ to generate a protocol that encapsulates the necessary steps for producing new StoryMaps through collaborative practice. This paper will also include discussions about the responsible use of AI as a tool to narrate and engage audiences through audio resources in the StoryMaps. This protocol can benefit other community groups seeking greater autonomy in sharing their stories.

Results

The paper presents the final outcomes of the Art Deco StoryMap project, which was facilitated by cultural mapping and design thinking, that is, through a collaboration between academics and non-academics. The ArcGIS StoryMap platform functions as a digital heritage map, combining narratives and storytelling about the town’s main Art Deco buildings with AI-generated podcasts. Additionally, the rich process of exchange brought discussions on co-creation, co-designing and the use of generative AI aimed at higher audience engagement and interaction. Accompanying the Art Deco StoryMap, the project

also created a printed leaflet used to promote the project and the Art Deco buildings, and a workshop series to build capacity and autonomy in the LLLSVG

Conclusion

The Art Deco StoryMap has demonstrated a significant impact across multiple domains. For the LLLSVG, the digital platform serves as both a record and extension of their broader research on the theme. For them, it was also significant to initiate and enhance their digital confidence and knowledge of generative AI to produce podcasts as another engaging feature in their activities and production of mapping narratives and storytelling. Within the Loughborough community, it offers an opportunity to learn about and engage more deeply with their urban heritage, potentially encouraging participation in the Art Deco walking tour in the town. For newcomers to the town, the heritage trail facilitates adjustment by fostering familiarity and knowledge about their new environment. Additionally, for academic researchers, the project contributes to the objectives of establishing the Loughborough TOWN Observatory, thereby enriching scholarly understanding of local heritage and urban development.

Keywords: Cultural Mapping; Heritage Mapping; AI-generated podcasts; Graphic Heritage

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Acknowledgements

The authors thank the LLLSVG team for their support, feedback, and participation during this project. The authors would also like to thank Dr Sara Saravi and Dr Firat Batmaz from the Department of Computer Science of Loughborough University for their support with the project. The authors are also grateful to all colleagues and stakeholders involved in the Healthy and Innovative Loughborough project as part of the Loughborough Town Deal for their support and engagement during this study.

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Background

Established in 1670, the city and region around Charleston, SC, is a place of profound significance to the social, economic, and political history of the United States, especially African American history that is too often absent from the record. That history is recorded in documents, structures, archaeological remains, and family histories of the region, curated by a range of private, public, and civic organizations, institutions, governments, and agencies. Existing partnerships between these entities are strong but lack a platform to explore the abundant, interwoven data sources to encourage further partnerships.

The Spatial History of Charleston (SHOC) is conceived as a deep history geospatial platform of the Charleston region. The broad goal is to create a historical spatial database infrastructure and deep map that encompasses the Charleston region from the colonial period to the mid-20th century (c. 1670 – 1950), with an explicit focus on African American descendant communities and their emergence and development from the late 19th to mid-20th century (1865 – 1950). This focus enabled the team to concentrate on the project's critical aspects such as establishing the means to integrate datasets developed separately by multiple partners and creating functionality for the platform via collaboration with community members and broader stakeholders, seeking to realign the historical narrative of Charleston.

Methods

SHOC first began with a community-based needs assessment, followed by the development of the historical spatial database infrastructure. This involved generating spatial and

Developing a Deep Map in a Historically Dense Landscape: The Spatial History of Charleston, South Carolina

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demographic data from resources such as maps, city directories, and census records, and incorporating work from partner organizations related to historic structures, cemeteries, and oral histories. Additional workflows for linking these datasets into a spatiotemporal framework have also been devised, along with a prototype interface that addresses community-derived interests. The scale of information is inconsistent due to historical racism and differences in racially correlated socio-economic conditions. To counteract this imbalance, community engagement is essential. By developing a community-focused deep map, SHOC increases accessibility to data that is both emic and etic, thus democratizing information and facilitating integration and synthesis.

Results

Beyond the academy and historical repositories, stakeholders in the community have expressed enthusiastic desire not only to contribute to the data being mapped, but to envision further applications of the deep mapping framework. The *Unapologetically Eastside Virtual Tour* is a community-centered digital oral history project designed to preserve, interpret, and activate the layered histories of Charleston's Eastside—one of the city's most culturally significant African American neighborhoods now facing accelerated redevelopment, cultural erasure, and displacement. Using a deep mapping framework, the project integrates archival materials, oral histories, geospatial data, and immersive media, including 360-degree photography and site-based documentation, to construct a multidimensional representation of place grounded in the lived experiences of residents.

Conclusion

The Carolina Lowcountry, and the greater Charleston area in particular, is a cultural and environmental landscape undergoing profound change, driven by the pressures of urban development and climate change. Over the 300 years of European and African settlement, its impacts on local and national history and culture have been profound. Despite this recognized significance, the most profound contributions to our understanding of the community lie in the spaces, places, people, and perspectives created and curated by its organizations and citizens. SHOC aims to provide a space where this information can be found, enabling the flourishing of stories to be told, unknown histories to be revealed, and the curation and management of our shared spaces to be conducted with an eye towards a sustainable model of community development.

Keywords: Deep Mapping; Charleston, SC; Digital Humanities

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Acknowledgements

SHOC relies on a diverse range of support. Informatics and base data development are supported by the Center for Historical Landscapes and by laboratory facilities in the Center for Social Science Research at the College of Charleston, which include a broad team of students supervised by Rivet and Newhard. Historical data are provided by our partners at the Charleston Library Society, the South Carolina Historical Society, the Preservation Society of Charleston, the Charleston County Public Library, Eastside Community Development Corporation, and the Archives Division of the City of Charleston. Financial support has been provided by the School of Languages, Cultures, and World Affairs and the School of Humanities and Social Sciences at the College of Charleston. Guidance on best practices has been provided by Don Lafreniere, Dan Trepal, Krysta Ryzewski, Sarah Scarlett, Robert Cowling, and our associate fellows of the NEH Community Deep Mapping Institute. Finally, members of community organizations throughout the Lowcountry, especially Anthony Coaxum, Phyllis Singleton, and Omar Muhamad of the Eastside Community Development Corporation, have been essential partners and collaborators as this initiative has moved from conceptualization to its current form.

SESSION 9

Mapping Multilevel Historical Borders in Central Europe: Ethnicity, Confession, and State Administration in Long-Term Perspective (1880–1930)

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Background

How can recent advances in the digital humanities enable the

detailed visualisation and credible public communication of multiple, yet mutually entangled, types of historical boundaries across a longer temporal span? The proposed paper presents selected results of the research project *Borders as a Cultural-Historical Phenomenon* (2023–2027), conducted by an interdisciplinary team of historical geographers, cartographers, and GIS specialists (Mužik, Münzberger, 2024). Focusing on the territory of present-day Czechia within a broader Central European context—historically characterised by pronounced multi-ethnic and multi-confessional configurations—the project seeks to visualise historically relevant and census-based ethnic and confessional boundaries during the period 1880–1930, and to examine how the ethnic layer correlated with administrative borders (especially district boundaries), whether and how it was deliberately used for altering such borders, as well as how it informed electoral geometries (election district boundaries) and subsequently influenced electoral outcomes. The central research aim is to assess how ethnicity-based boundaries aligned with, diverged from, or were utilised in the making of administrative and electoral borders, and how such configurations changed over time. This approach not only highlights the complex temporality and spatial stratification of boundary-making processes but also demonstrates the analytical value of combining historical cartography with computational and digital methodologies.

Methods

The project relies primarily on published and already digitised census outputs, in which ethnicity and confession were recorded as separate census categories and subsequently transformed into structured datasets. Census data were available for the years 1880, 1890, 1900, 1910, 1921, and 1930, enabling a decadal comparison across the late imperial and interwar periods, including the wartime transition. In the first phase, statistical data at the municipal level were extracted from historical census sources using optical character recognition (OCR), followed by systematic validation (Kodym, Hradiš, 2021). Based on the territorial structures defined in individual censuses, historical municipal boundaries are currently being reconstructed in a GIS environment, drawing on the CZ-RETRO vector database (Kuča, 2018). The same database is also used for the reconstruction of electoral districts, which are primarily based on judicial districts.

Results

The outcome will consist not only of individual spatial datasets representing selected types of boundaries, but, above all, of an interactive open-access web mapping application that will enable the correlation of ethnic, confessional, administrative, and electoral boundaries at a municipality-level resolution across time. The presentation of a multi-layered spatial dataset in the form of a web-based application will allow users to investigate how different types of boundaries interacted with one another, how they aligned or diverged, and how such spatial configurations evolved over time. Both the datasets and

the application are currently under development and scheduled for launch in September 2026.

Conclusion

Taken together, the ongoing research and the application outputs currently under development demonstrate how the emerging integration of census-based ethnicity and confession data with administrative and electoral boundary layers at a municipality-level resolution can expand the analytical scope of spatial historical research in Central Europe. By enabling the examination of these boundary layers across time, the project makes it possible to observe how spatial configurations changed over the decades in the context of demographic, cultural, identity, and political transformations. The resulting multi-layered spatial dataset provides a valuable resource for scholars working in historical and spatial research, who have so far lacked access to similarly detailed spatially visualised data and may use these layers for further analyses. In addition, the project can supply fine-grained empirical material for examining, for example, how ethnic composition shaped border-making processes and electoral geometries. The detailed historical dataset, enriched with population statistics from 1880–1930, will also significantly extend existing datasets, which currently exist at the municipal level only for selected regions of the former Austro-Hungarian Empire, such as Austrian Silesia (Ostafin, Kaim, Siwek, & Miklar, 2020), Croatia, or Hungary (GIStA Hungarorum, 2017), or for selected census years (Agárdi, 2020).

Moreover, due to its form and accessibility, the web mapping application can support popularisation and educational purposes by making such data intelligible to non-specialist audiences and by illustrating that boundaries are not fixed or immutable entities, but rather evolve and transform over time. Finally, the methodological workflow employed is transferable and can be applied to other regions or to additional types of boundaries once fully operationalised.

Overall, the project contributes to ongoing debates on how digital and spatial approaches can support the study of historical boundary-making in modern Central Europe.

Keywords: Multi-Level Borders; Central Europe; Historical GIS; Multi-Layer Spatial Analysis; Census Data.

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Acknowledgements

This research was supported by the Ministry of Culture of the Czech Republic under the NAKI III Programme for Applied Research in National and Cultural Identity (2023–2030), within the framework of the project *Borders as a Cultural-Historical Phenomenon: Specification, Analysis, Comparison and Interpretation* (Grant No. DH23P03OV030).

Deciphering cartographic representations of the destruction of Nuremberg (Nürnberg) during and after the Second World War (WWII)

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Background

During the bombing war in the 1930s and 1940s, cities were under attack and their administrations became part of the homefront. The notion *homefront* stands for an international phenomenon that includes various civilian activities for defence and for keeping the threatened societies functioning (Garon 2016). For many cities affected by WWII urban damage cartography was a crucial part of supporting these homefront efforts. After the war had turned against the German aggressor with its defeat in Stalingrad in 1943, the National Socialist (Nazi) regime wanted to secure enduring support of the war amongst the German population. To secure compensation for material losses and to learn from air raids for future assaults, the material war

damage to buildings was recorded. Only *Volksgeossen* (people who the Nazi system accepted as “Germans”), were entitled to compensation from the municipal War Damage Assessment Authority, which was part of the municipal war departments, regularly founded in German cities in 1939 (Süß 2014).

As a result of this Nazi bureaucratic procedure, many contemporary city archives in Germany store various damage maps created during the Second World War. These documents show the extensive structural effects of the bombing war to buildings, especially from 1943 to 1945. Taken together, the post-catastrophic help, organised by the offices which created the maps, also supported the regime and its war. Civil city administrations and local Nazi party offices maintained the homefront despite the obvious harm the war inflicted to the inhabitants. The damage maps from this period clearly show how administrations literally accepted their own destruction by unreservedly supporting the Nazi regime. By focusing on damage mapping for the historical centre of Nuremberg, this paper explores different Historical and Spatial Humanities approaches, including GIS analysis and visualisation (Ludwig & Alvanides 2023), to tackle various challenges associated with researching cartographic materials from historical archives.

Methods and Results

Different branches of the polycratic local and regional Nazi administration chose distinct cartographic means to assess destruction in terms of the spatial distribution and extend of damage within cities. In order to be able to decipher these maps today, scholars and researchers need to overcome several difficulties:

- In many cases, information (e.g. map date, legend etc.) is missing from the actual map.
- Only part of the complete stock of maps has been preserved in the various archives, due to the chaos of the war end or due to later decisions by the municipalities.
- The maps themselves were mostly prepared by untrained personnel, rather than by experts (such as surveyors or cartographers).
- Cartographic approaches to disaster mapping changed throughout the war period due to the sharp increase in destruction.
- Different offices/authorities were involved in preparing several maps showing the same disastrous situation, possibly relying on varied “eyewitness” information.

Our objectives are, first to interpret the different maps and organise them into temporal groups, thus deepening our understanding of how the Nazi authorities tried to make sense of the chaotic situation; and secondly to quantify the damage depicted on the maps and visualise it in a meaningful way using contemporary tools. The historical

maps analysed for this paper are published in Enss & Knauer (2023, pp. 196-232). Our methodology consists of two main approaches, discussed briefly here.

Historical contextualisation

Historical research reveals that some actors within the Nuremberg administration were involved in the national war ministry. As a result, a colour scheme for damage cartography first used in Hamburg was most likely transmitted to Nuremberg, where some damage cartographers continued to use the local own colour scheme in some maps in parallel. From historical studies related to other homefront activities, such as procurement of relief supplies, we know that the population needs soared and the administrative efforts adapted quickly to these developments. In parallel, the ascend from the war's front lines to the homefront with the resulting damage to buildings and homes evoked the quick and widespread adoption of damage cartography. In the summer of 1943, disastrous air raids in Hamburg made it clear that disaster preparedness needed to be channelled to the dense and flammable historic city centre with many timber-framed buildings. As a result, several plans at a scale of 1:2000 were drawn to monitor damage to the old city centre of Nuremberg.

Spatial analysis and visualisation of damage

We selected a range of damage maps from the same period of the war to digitise, analyse and compare, in order to resolve the hurdles mentioned earlier. The authorities used printed city cadastral maps as basemaps on top of which they depicted damage to single buildings with various colour schemes, either hand-drawn or in the form of overprints. The identical basemap showing every single building in a city area facilitated the digitisation of damage at a very fine scale, allowing for direct comparisons of the damage data using GIS spatial queries. The GIS comparison of different maps showing similar damage information reveals differences in the damage data and allows the exploration of different approaches adopted by the authorities for dividing the damage continuum in ranges of damage percentage. In addition, comparing undated maps to maps that have a date helps to arrange the studied damage maps in a chronological order; this is possible because damage increased continuously during the war.

However, the legends of historical damage maps are often divided into multiple sub-categories, attempting to capture the damage down to individual buildings or even to parts of buildings (e.g. facades). Due to this cartographic variety, using GIS for spatial comparisons of differences between maps in combination with non-spatial visualisations (such as Sankey diagrams) helps us understand the difference between the way damage is mapped to buildings. In this way, the damage ranges depicted in the map legends can be compared between two or more maps.

Conclusion

Our research demonstrates the process and methods that can be applied for deciphering a sample of the rich archival evidence depicting various cartographic representations of the destruction of Nuremberg. We take an interdisciplinary approach combining historical inquiry with modern spatial and visual analysis tools applied on an under-researched corpus of maps. In an age of digital cartography, we raise awareness of the value of map snapshots of historical events of destruction to allow future historians to study the destructive events in detail and explore the effectiveness of disaster response.

Keywords: Historical maps; Second World War; Homefront; Spatial analysis; Sankey diagrams.

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Acknowledgements

The project UrbanMetaMapping-Transfer was funded by the German Federal Ministry of Research, Technology and Space (Bundesministerium für Forschung, Technologie und Raumfahrt, BMFTR). We also acknowledge financial support from the Centre for Heritage Conservation Studies and Technologies (KDWT) at Bamberg University and from the Department of Spatial Planning at TU Dortmund University, Germany.

Medieval landscapes, GIS and settlement dynamics on the outskirts of Braga

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Abstract

Historical archaeology has the particularity of combining material evidences with other types of sources, such as documentary, iconographic, and environmental data, which have not always been used in an integrated way for the study of cities or rural areas. The use of spatial technologies has

proven to be essential for landscape studies, enabling a more comprehensive analysis of the territory, with recognized benefits in terms of systematization and quality of data within Landscape Archaeology research, which requires analysis at various scales. With a Geographic Information System (GIS), it can be carried out immediately, enabling the processing of information in an integrated way and associating archaeological data with a wide range of information.

Within this perspective, we studied the area under the direct influence of the city of Braga, framed by the integration of data of different natures into a GIS, using an analytical framework to answer several research questions related to the territorial dynamics identified, as the remain of local communities, their possible relation with the occupation of hillforts and the restructuring of the economic and social structures with the occupation of settlement units in the valley area as well as the functional connection with the roman structures, the possible relation with occupation continuity of those places, or the growing power of the archbishop after the restoration of the diocese and the impact in the settlement structures.

The use of technology increases the range of analytical possibilities and the level of detail to which terrain features can be accessed through the submission of data to various analytical protocols, allowing the identification of the general characteristics of archaeological sites that have the necessary conditions for their detection. The combination of different data sources, submitted to geospatial analyses, jointly interpreted with data from archaeological interventions, enables an integrated reading of the landscape evolution in a study area through an integrative and transdisciplinary analysis across different historical ages.

We guided the research by the connection of concepts such as walled spaces and defense, the direct relationship between topographical placement index (TPI) on hilltops, with difficulty of access and good visibility conditions, characteristics associated with a greater probability of being fortifications. It was also possible to relate locations with a mid-slope to foothill placement, a slight to negligible slope and a tendency for south, southeast or southwest solar exposure, together with the proximity to lands suitable for agricultural practice (average soil water retention conditions), to sites that had a big probability of association with places simultaneously related to Roman settlement, agricultural exploitation, and/or monastic communities, trying to understand and extrapolate a relation between a particular superposition of monastic structures to roman *villas* as a factor of bigger probability of correspond to a Mozarabic tradition monastery, with different characteristics of a monastery founded within the 11th century monastic reform.

The identification of several characteristics that can be associated with certain typologies, in an automated way, promotes the creation of non-intrusive surveys, enabling significant gains in archaeological research and environmental

impact studies, optimizing this type of research, reducing the resources needed and improving the quality of the work.

Keywords: landscape; territorial control; typology; road proximity.

SESSION 10

Property Expropriation and its Architectures: A Study in Spatial Humanities on the Land Regime in Palestine/Israel

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Background

Land and property expropriation are central instruments of colonial and postcolonial governance. They reshape territory through legal mechanisms that are often treated as administrative or geopolitical, while their architectural consequences remain comparatively under-described and under-theorised (Blomley, 2004). In Palestine Israel, expropriation has been a recurring practice since the Ottoman Land Code of 1858, it was reworked under the British Mandate, and it intensified after 1948, producing cumulative, uneven transformations of parcels, ownership, and development rights (Fischbach, 2003). Yet the relationship between expropriated property lines and the architectural forms that replaced them is still rarely reconstructed at the level where law becomes geometry, and geometry becomes building.

Spatial humanities offers an entry point into this blind spot by approaching property lines not as neutral cartographic marks, but as historical artifacts that condense decisions, conflicts, and forms of power. The challenge is that the primary evidence of land regime change is dispersed across heterogeneous sources: historical maps and plans, cadastral surveys, tabular land registers and *Tabu* documents, court and governmental files, planning records, and on the ground architectural traces. These materials are rich, but they were not produced as a coherent dataset. They contain discontinuities in scale, terminology, projection, and evidentiary status, and they often preserve competing claims rather than a single authoritative narrative. This project argues that the architectural history of expropriation can be advanced by treating such documents as a spatial archive of boundary making, then systematically translating their property lines into comparable geographies that can be read across time, and against built form.

Methods

The project develops a spatial humanities workflow for reconstructing the evolution of land parcelation and connecting it to architectural outcomes, using Jaffa and Tel

Aviv as a case study area. The method begins from a fixed corpus of approximately forty historical maps and plans of the area, spanning roughly the nineteenth century to the present, assembled as high-resolution scans and photographs from archives and collections. Each item is stabilised with an identifier and a provenance record, including archive source, date, scale when known, authorship when known, rights status, and scan details.

The first analytic step is georeferencing: each map is registered in GIS using documented ground control points, recorded transformation parameters, and map-specific uncertainty notes. This produces comparable georeferenced rasters that can be overlaid with contemporary basemaps and other historical layers. The second step is property line extraction: parcel boundaries, subdivision lines, and relevant annotations are traced into vector layers following a minimal, documented schema that prioritises provenance, map date, feature type, and confidence.

The third step is juridical linkage. Traced parcels are connected, where possible, to land registration materials, as well as to selected judicial and administrative documents that record ownership, transfer, seizure, and re-parcelation. Rather than assuming that a map alone represents a completed legal reality, the workflow treats cartographic and juridical materials as complementary registers of claim making. The fourth step is morphological reading: parcel evolution is analysed for anomalies that frequently signal expropriative action, including abrupt boundary straightening, discontinuous consolidations, dislocated access, infrastructural carve-outs, and the reallocation of development potential. The fifth step is architectural interpretation: for selected sites, property line change is read alongside planning approvals, building histories, and field evidence to interpret how expropriation is translated into urban form, typology, and material expression.

Results

As an early-stage study, the project reports results from the first one to two steps and from pilot linkages to juridical materials. The initial outcome is a geospatial corpus of georeferenced historical maps for the Tel Aviv-Yafo area, accompanied by vector layers of traced parcels and subdivision lines for a pilot subset. This produces a comparative “boundary atlas” that makes long-term property line change traceable and reviewable across multiple dates and regimes, while keeping uncertainties explicit.

Preliminary spatial analysis of the pilot subset demonstrates how property line evolution can serve as an index of governance. First, parcelation change is not evenly distributed: it clusters along sites of infrastructural ambition, administrative intervention, and contested land status. Second, different regimes leave different geometric signatures, visible in the ways boundaries are standardised, consolidated, or reoriented, and in how access and frontage

are recalibrated. Third, the pilot linkage to *Tabu* and related land registration documents shows that moments of legal transformation often precede or outlast visible physical change, producing time lags that are critical for architectural interpretation. These results set up the next phase of the project, in which a broader database of buildings built on expropriated land will be assembled and tested through deep historical analysis of selected architectural case studies.

Conclusion

This project proposes that the architecture of expropriation becomes legible when property lines are treated as historical evidence in their own right, then reconstructed as a spatial sequence across time. By aligning historical mapping, GIS analysis, and juridical documentation, it offers a replicable model for studying how land regime change operates through boundary making, and how these boundaries constrain, enable, and script architectural form.

The early outputs, a documented geospatial corpus and a pilot boundary atlas, are designed to function both as research infrastructure and as an interpretive platform. They support verification, extension, and comparative reuse, while enabling architectural historiography to move beyond single-building narratives toward systematic, map-based analysis of political-spatial transformation. Ultimately, the study reframes expropriation not only as a legal or geopolitical event, but as a spatial practice whose geometries continue to organise urban life and architectural possibility.

Keywords: Property expropriation; Historical GIS; Colonial governance; Urban morphology; Tel Aviv-Yafo

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Spatial Humanities of Construction: ML Derived Building Lifecycles from Municipal Records

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Background

Building construction files, permits, tax records, and related municipal paperwork record how cities are negotiated,

regulated, and materially transformed (Szekely, 2017). Spatial research, however, has often treated municipal engineering archives as a sea of bureaucratic materials to be sifted for a handful of “valuable” drawings, rather than as a heterogeneous institutional terrain that actively shapes, accommodates, and reflects architectural and urban transformations (Bruno & Corea, 2019). When working with these records at scale to produce high-resolution urban histories, reliance on administrative archives introduces a structural tension, as they are normally not designed to support diachronic analysis.

For example, such archives rarely provide a clear definition of when a building is “born” or undergoes a substantial transformation that effectively creates a new building. The ontological question of the temporal span of a building’s “life” becomes acute when attempting to reconstruct citywide construction chronologies, since peaks in documentation may reflect minor building modifications, tax-related paperwork, or shifts in bureaucratic routines rather than meaningful architectural change. The archive, in other words, can be loud at precisely the moments when the city is quiet, and quiet when the city changes decisively.

Methods

Building on our earlier work that treats building “birth” as an ontological problem for spatial humanities research (Horn et al., 2024, 2025), this study develops a machine learning approach that learns, from labelled archival evidence, to distinguish major construction events from minor interventions and to translate bureaucratic rhythms into spatially explicit chronologies. The study draws on the digitised building files of the Tel Aviv-Yafo Municipality Engineering Administration, focusing on 1974–1995, a period in which administrative practices were relatively consistent and central to the city’s restructuring.

The core methodological move is to shift from assumption-driven inference to supervised learning grounded in a historically defined typology of construction. Permits were manually classified into “major” and “minor” activities, where “major” included new construction, full demolition and reconstruction, large-scale additions (such as added floors or wings), and extensive facade transformations and restorations. “Minor” comprised routine additions, enclosures, interior changes, repurposing, and other limited interventions that often generate a significant documentary trail without inherently affecting the urban fabric.

Training began with 1,010 sampled permits, labelled to represent both the diversity of construction activities and the practical limits of manual review. A subset of building files was then reviewed to provide full temporal labels for significant construction years. The dataset was split into training, validation, and test sets to reduce overfitting. The model architecture was a Bidirectional Recurrent Neural Network

(BRNN), selected for its ability to learn sequential patterns across years within each building file, using the distribution of document types as inputs. Rather than evaluating each year in isolation, the model was trained to interpret a contextual temporal window around each candidate year, allowing it to capture preparatory filings, delayed approvals, and post-construction amendments as part of the same bureaucratic event. Model interpretability was addressed by estimating the relative contribution of document types to the model’s output through a local, derivative-based approximation, enabling a historical reading of which forms of paperwork most consistently signal major construction.

Results

Applied to 28,701 building files, the model identified 3,737 instances of major construction activity between 1974 and 1995, producing a revised annual chronology that reduced noise from minor interventions and isolated substantial transformations. Validation against a ground-truth sample yielded 91% precision and 63% recall, indicating that when the model flags an event, it is usually correct; however, it still misses a substantial portion of true events. Among correct predictions, 95% matched the exact permit year, demonstrating high temporal specificity. When the validation sample was split by period, performance was historically uneven: recall was substantially higher in 1980–1995 (72%), whereas the 1970s showed weaker results, consistent with the period’s less standardised metadata and the training set’s stronger representation of later bureaucratic structures.

Substantively, the resulting chronology revealed three phases that become legible when translated into spatial outputs. First, the late 1970s show a rise toward a peak, with geographically diverse activity across the northern, central, and eastern parts of the city. Secondly, the early 1980s show a steady decline reaching a low point, accompanied by a spatial contraction, especially in the southern city parts. Thirdly, from the late 1980s onward, the model indicated a renewed rise culminating in the early 1990s, with intense activity concentrated in already urbanised quarters and in neighbourhoods designated for densification and redevelopment. As such, the model not only predicted years but also reorganised the archive into a map of changing investment geographies.

Conclusion

This study demonstrates how AI can be used to formalise a historically grounded distinction between minor and major architectural change, and to expose construction trends that shape the city. By analysing document sequences, the model captures the city’s administrative logic and transforms it into a reproducible spatial chronology suitable for high-resolution mapping. The approach is modular and transferable to other cities and archives, provided that local typologies, bureaucratic rhythms, and validation practices are rebuilt rather than assumed. In that sense, the results underscore a

key methodological lesson for spatial humanities: model performance is context-specific, as are archives. Training, validation, and interpretation, therefore, need to be treated as historiographical labour rather than merely as a technical trait.

Keywords: Digitised archives; Building information databases; Construction chronology; BRNN; Urban history

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Historicising urban heat: Urban shade maps for excavating the climatic legacy of planning

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Background

Urban overheating is becoming a major global concern amid climate change; yet the consistent, ongoing integration of climate considerations into everyday urban planning and design remains rare (Mills, 2014). This discrepancy is nothing new in modern planning, indicating a persistent, fundamental failure that, unless thoroughly examined in retrospect, is bound to recur (Hebbert & Mackillop, 2013). Nevertheless, systematic historical analysis of the effects of climatic awareness or ignorance among the planning and design professions, and of their impact on urban climates, remains rare.

The main objective of this study was to provide an unprecedentedly broad and holistic historical account of the interplay between modern urban planning agendas and urban climates, with a focus on the climatic phenomenon of urban heat. It examines in what sense certain historical urban configurations of the last century were better adapted to heat than others, and the impact of planning ideologies and dogmas on the heat adaptability of these urban environments. Since urban heat is evaluated using quantitative climatic indicators, we cannot overlook them if we want to write histories that genuinely make sense of cities'

climates. Therefore, the study proposes an innovative approach to writing histories of urban climates by integrating quantitative and qualitative research methods.

Methods

In hot climates, shade is the most important climatic factor in mitigating heat stress, and its provision in public spaces indicates a higher degree of heat adaptability (Aleksandrowicz & Pearlmutter, 2023; Turner et al., 2023). Since outdoor shade depends exclusively on planning and design decisions, its spatial distribution in a city can reflect the successes and failures of planning in mitigating outdoor heat. Here, we demonstrate how the author-developed concept of urban shade maps (Aleksandrowicz, 2022) can be used to evaluate key aspects of urban heat adaptability, with a focus on 20th-century planning concepts.

Urban shade maps visually depict shading levels in streets, open spaces, and neighbourhoods, using a normalised metric to enable cross-comparison. In this way, urban shade maps help reconstruct a quantitative “shade hierarchy” of a city and, thus, evaluate the variance in heat adaptability across different streets and zones. Shade maps are produced based on several computational algorithms that take as input present-day, high-resolution Digital Surface Models (DSMs) of cities, along with extensive AI-based extraction of tree crown contours (Aleksandrowicz et al., 2023).

While urban shade maps were originally developed to inform future planning decisions, we can also see them as historical evidence of the trails left by cumulative planning and design intentions and actions, and as a means to trace the historical circumstances that shaped a city’s climatic weak and strong spots. In this study, we examined the effects of changing planning trends on the variance in heat adaptability capacity across three modern Israeli cities, all planned and built since the early 20th century (Tel Aviv-Yafo, Haifa, and Be’er Sheva). Each of these cities represents a variety of planning and design approaches prevalent during different periods of the last century, implemented in different geographic and climatic settings.

Results

By comparing the three cities’ shade maps, it is possible to trace stark differences in the outdoor shading conditions between the cities and within them. A general pattern emerges: neighbourhoods and urban developments since the 1950s have tended to result in poor street-shading conditions, although they provide relatively good shading in their open public spaces (mainly in local gardens). The “neighbourhood unit” concept of the mid-20th century, which became a dominant generative ideology in Israeli planning, surprisingly resulted in poor shading conditions in the neighbourhoods of Haifa and Be’er Sheva, whereas in Tel Aviv-Yafo, it was interpreted differently to secure street shading through trees. Unlike Haifa and Be’er Sheva, Tel Aviv-Yafo emerged as a city in which major central areas are well shaded in the hot season.

This is partly due to the manner in which Patrick Geddes's 1925 master plan for Tel Aviv was implemented and used to guide the subsequent development of other parts of the city. Geddes' Plan translated the principles of the "Garden City" concept to the specific geographic context of Tel Aviv as a coastal city, demonstrating how intelligent street layout, medium-density built fabric, and the careful integration of shade trees in public and private spaces can result in a successful heat-adapted urban environment.

Conclusion

The application of the high-resolution shade mapping methodology enables quantitative evaluation of the heat adaptability of cities, particularly in hot-climate countries, and links urban climatic conditions to specific historical circumstances and planning and design principles. Beyond narrating the specific climatic histories of each city, urban shade maps can serve as a tool that provides an objective common ground for comparisons of urban morphologies across different periods and locations, extending beyond man-made borders.

Keywords: Urban heat; Planning history; Modern planning; Heat adaptation; Geospatial analysis

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Israel's building-materials industry, 1923 - 1967

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Background

Since the late nineteenth century, modern construction has relied on cement, steel, and glass, materials whose manufacture demands constant, high-energy input. Today, their production accounts for over a third of global carbon emissions, yet sustainability debates often treat them as neutral technologies to be replaced or improved, without questioning the economic and institutional forces that sustain their dominance. This study examined the co-evolution of energy-intensive building materials and national energy systems, arguing that these materials not only depended on fossil fuels but also helped shape the regimes that sustained them. By tracing the influence of industrialization, energy policy, and regulatory choices on material use, the study shows how construction became locked into high-carbon trajectories, driven by deeper political and economic arrangements.

Israel provides an unusually instructive testing ground for exploring the intertwined evolution of energy supply, industrial organization, and building technology. During the British Mandate, the country's coastline and rail grid were re-engineered to serve Britain's new oil corridor from Kirkuk to the Mediterranean: the Iraq Petroleum Company (IPC) pipeline landfall at Haifa, its refinery complex, deep-water pier, and connecting railways embedded Palestine in an imperial fuel network (Bialer, 1998; Havrelock, 2017; Herbert & Sosnovsky, 1993). After 1948, the emergent Israeli state embarked on its own quest for energy autonomy, yet it still faced an almost permanent tension between urgent building demand, chiefly mass housing for successive waves of immigration, and erratic access to coal and oil. Austerity measures in the early 1950s, Germany's Reparations Agreement, massive investment in industrial development in the 1960s, and the inflation crisis of 1966 all turned the prices of cement, steel, and glass into a focal arena of economic and political contestation.

As national energy supply lagged construction demand, state policy increasingly relied on a dominant actor in the sector: Solel Boneh, Histadrut-owned and deeply embedded in national development, which, through its industrial arm Koor (1944), controlled material production, labour organization, and even energy exploration. This concentration of power allowed it to shape Israel's building economy in line with the political and economic priorities of the time, while formal

discourse continued to promote the appearance of open competition. However, the extent to which private competitors or alternative building materials were affected by the consolidation of economic power and industrial production remains unclear, as does the effect of these trends on the spatial distribution of quarrying, transportation, and manufacturing sites.

Methods

As no systematic dataset exists on Mandatory Palestine's and Israel's building-material industries, the study was set out to construct a historical survey of factories and manufacturers active between 1923 and 1967. This mapping was based on a wide variety of digitized publications, including newspapers, journals, yearbooks, professional reports, the official gazette, and archival files from the Israeli and British Archives. This mapping was intended to provide an empirical foundation for the types, scales, and ownership structures of construction firms active in Mandatory Palestine and Israel, as well as their spatial distribution.

The resulting dataset comprised a classified list of factories producing energy-intensive building materials, focusing on ownership, geographic location, and dependence on energy, extraction, and transport infrastructure. The dataset was complemented by historical research to reconstruct the timeline of policy interventions, energy transitions, and industrial shifts that shaped the sector's development. In this way, the geospatially mapped temporal transformations in manufacturing could be linked to broader economic and governmental shifts that may have influenced the emergence or demise of firms and production sites. The combined use of spatial and historical data offered new empirical insight into how energy access and institutional power influenced the evolution of the construction sector during a formative period in Israeli state-building.

Results

This research adopted a historical evaluation methodology grounded in the spatial humanities, integrating high-resolution, data-driven spatial analysis into historical inquiry by creating new datasets from existing digitized sources. By analyzing the dataset, it was possible to provide empirical evidence for a process of power and spatial concentration that effectively created multi-level monopolies controlling entire production processes of the country's main building materials.

Solel Boneh was founded in 1924 as the Histadrut's cooperative building firm and quickly expanded into a dominant force in construction and materials production, effectively becoming a quasi-state monopoly through guaranteed government contracts and control of quarries, cement kilns, and key transport infrastructure. By 1944, the creation of Koor Industries formalized its industrial reach, consolidating the production of cement (Nesher, Haifa, and Ramle), glass (Phoenicia, Haifa), and steel (Kiryat Haplada, Acre) under a single organizational structure.

The growing availability of coal and oil between 1923 and 1967 enabled Solel Boneh and its industrial arm Koor to secure control over Israel's building-materials sector. This dominance, shaped by state policies on fuel allocation, licensing, and public procurement, limited the rise of alternative producers and entrenched energy-intensive materials as the national norm. Structural advantages and institutional ties made this outcome appear both natural and unavoidable. These processes also meant that the spatial distribution of manufacturing became more limited, creating geographic industrial hubs that persisted for years.

Conclusion

In Israeli architectural and industrial historiography, the relationship between energy transitions and the production of building materials has not yet been analyzed with methodical or comparative depth. This study aimed to address this lacuna and to inform broader inquiries into the political economy of construction. Methodologically, it introduced an integrated approach that combines processed archival materials with digital mapping of firms, fuel quotas, and location, thereby linking technological and historical perspectives across disciplinary boundaries and spatial domains. The results demonstrated the added value of the methodology by moving beyond subjective and impressionistic reporting.

Keywords: Energy-intensive building materials; Infrastructure networks; Construction industry; State-led industrialization; Spatial historical analysis

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Acknowledgements

This research was supported by the Glass-Balaban Fund.

Mapping a Threshold City Critical GIS and Historical Mapping of al-Bassa's Urban Transformation

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Background

Pre-1948 Palestinian urban modernity has often been examined through major cities such as Haifa, Jaffa and Jerusalem, frequently relying on a rural/urban binary divide

that marginalizes urbanizing villages (Tamari, 2008; Yazbak, 2013; Zoubi, 2021). This paper intervenes in that framework by examining al-Bassa, a northern Palestinian village that was undergoing significant urban transformation prior to its destruction during the Nakba (the 1948 war).

Conceptualized here as a 'Threshold City', al-Bassa functioned during the British Mandate as a liminal urban entity between a village and a city, shaped by regional connectivity, infrastructural expansion, and architectural modernization (Abbasi, 2019; Haddad, 1987; Sayigh, 2009). Following the Nakba, al-Bassa was destroyed and spatially replaced by the Israeli town of Shlomi and its industrial area, producing a layered landscape marked by displacement, selective preservation and colonial reconfigurations. As a descendant of family members who experienced internal displacement during the Nakba and whose village was destroyed and replaced by new Jewish settlements, I find it essential to apply spatial humanities methodologies to research in general, and to analysis of depopulated Palestinian villages in particular. These methods allow for a more comprehensive understanding of historical realities, cultural significance and spatial transformations that settler-colonial practices have sought to marginalize.

Methods

As an architect and planner, I combine professional spatial analysis with archival documentations through an interdisciplinary spatial humanities methodology that integrates critical GIS, historical mapping, and 3D spatial documentation. Archival maps, aerial photographs, and planning documents from the British Mandate and Israeli periods were georeferenced and layered within a GIS environment to generate a multi-scalar spatial analysis of al-Bassa's urban transformation. Historical mapping layering techniques were used to digitally reconstruct al-Bassa's pre-1948 urban fabric, including its road network, public institutions, residential buildings and land-use patterns. In addition, 3D scanning and photogrammetric modelling of remaining architectural fragments enabled a spatial comparison of scale, orientation and land ownership in relation to the contemporary industrial area of Shlomi. This superpositional spatial analysis, bringing together past, present and planned future, enables a critical reading of erasure, spatial discontinuity, and settler-colonial planning practices as they manifest in the landscape.

Results

The geospatial analysis reveals that al-Bassa functioned as a dynamic and emerging urban center rather than a peripheral rural village. The superpositional reading of GIS layers demonstrates consistent patterns of densification, infrastructural integration, and architectural modernization prior to 1948. By contrast, post-1948 spatial interventions of Shlomi's industrial area exhibit a systematic disruption of the

historic fabric: historic road networks were erased, building orientations were disregarded, and large-scale industrial structures were imposed directly onto the historic residential core of the village. Although certain buildings are formally designated for preservation, their spatial isolation within the industrial landscape effectively severs them from their social and cultural context, reducing heritage to decontextualized material traces.

Conclusion

By integrating spatial humanities tool, this paper reframes al-Bassa as a critical case for understanding pre-1948 Palestinian urban modernity and its colonial disruption. The concept of the 'threshold city' offers both a methodological and theoretical intervention, demonstrating how GIS based reconstruction, historical spatial data, and 3D digital documentation can recover marginalized urban histories while exposing the spatial consequences of settler-colonial planning. The paper argues for the value of spatial humanities approaches in decolonizing urban narratives and in rethinking heritage, planning, and historical knowledge production in contested landscapes. More broadly, this approach offers a framework for a deeper understanding of spatial erasure of indigenous communities in global context.

Keywords: Critical GIS; Historical Mapping; Digital Reconstruction; Settler Colonial Urbanism.

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Acknowledgements

This research was conducted as part of doctoral studies in the Department of Architecture and Town Planning at the Technion, Israel Institute of Technology. The author thanks the advisor, Dr. Shira Wilkof, for her valuable feedback during the development of this research.

SESSION 11

Analysis of the Central Portuguese Way of St. James

using Geotechnologies from the Wikiloc tool

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Background

This study explores the potential of geotechnology as a tool for mapping and representing the Central Portuguese Way of St. James, highlighting the relevance of digital tools in undertaking the journey.

The increasing use of geotechnologies in the context of tourism and pedestrian mobility has changed the way territories are recorded and analyzed. Georeferenced data produced by the users themselves, such as GPS tracks and photographs with geotags, have demonstrated high potential for understanding spatial patterns of land use and visitor behavior, functioning as an effective complement to traditional methods of data collection (Barros et al., 2020; Barros et al., 2022; Calicis et al., 2024; Hamza-Mayora et al., 2025).

As part of recreational and hiking activities, collaborative platforms such as Wikiloc have been widely used to analyze the spatial distribution of routes, intensity of use, and location of points of interest (Costa et al., 2024; Motieyan & Esmaeili, 2026). Research on slow tourism demonstrates that georeferenced images tend to enhance landscapes, heritage, and immersive experiences within the territory, reinforcing the importance of the experiential dimension of the journey (Le Busque et al., 2022).

In this context, the Central Portuguese Way of St. James constitutes a particularly relevant case study for the application of geotechnologies, namely the Wikiloc tool, allowing the articulation of the pilgrim's lived experience with the spatial analysis of the route and with the production of thematic cartography that highlights the physical, landscape and cultural characteristics of the Way, contributing to its understanding, planning and territorial enhancement.

Methods

The study is based on the analysis of the Central Portuguese Way of St. James, an approximate route of 240 kilometers, starting at the Porto Cathedral (Portugal) and ending at the Cathedral of Santiago de Compostela (Spain), carried out by one of the authors of this paper in 2025. The methodology adopted is based on a mixed approach, combining the use of geotechnologies with direct and participant observation.

During the journey, the Wikiloc application was used for continuous monitoring and recording of the route, enabling the collection of georeferenced data relating to location, distance, travel time, and altimetry. At the same time, direct

and participant observation played a central role in collecting qualitative information, allowing the identification of relevant landscapes, points of cultural and historical interest, as well as sections that require greater attention from pilgrims (ground conditions, steep slopes, or proximity to roads).

The recorded data were exported in GPX format and analyzed in Geographic Information Systems (GIS) environment, using ArcGIS software, allowing the production of thematic cartography and a spatial analysis of the route.

Results

One of the main results was the production of a slope map, with the altimetric variations along the approximately 240 kilometers traveled. This allowed the identification of sections with greater physical demands, associated with steeper slopes, as well as segments with gentler progression.

Maps of landscape types were also created, showing the natural, rural and urban contexts and how they can influence the pilgrim's experience. The map of points of interest was considered, with elements of cultural, historical, and landscape value was identified and located. Cartographic analysis shows a greater concentration of these points in urban centers and historical centers, mainly associated with religious and architectural heritage.

Additionally, maps highlighted relevant complementary information, including the identification of sections that require greater attention from pilgrims, such as segments with uneven surfaces, exposure to weather conditions, or proximity to highways.

Conclusions

The use of the Wikiloc application allowed for continuous and precise recording of the itinerary, while direct and participant observation contributed to a deeper understanding of the Way's conditions, its landscapes, and points of cultural and historical interest.

The integration of digital records with GIS tools proved fundamental in transforming individual data into structured spatial information. The thematic maps produced allowed for the identification of the territorial diversity of the route, as well as the location of sections requiring greater attention from pilgrims, contributing to a more complete understanding of the Central Portuguese Way.

The combination of geotechnologies and participant observation constitutes a solid methodological approach, capable of enriching the analysis of long-distance trails. In addition to its academic contribution, this approach has practical utility for pilgrims, managing entities, and Jacobean associations, and can support the planning and safety of the Way.

Future research could deepen this methodology by comparing different Jacobean routes, collecting data at different times of the year, or integrating other digital data sources.

Keywords: Geotechnology; Central Portuguese Way of St. James; Wikiloc; Points of interest; Pilgrimage; Digital

cartography.

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The Pilgrimage in The Relic by José Maria de Eça de Queirós: A Story Map Analysis

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Background

Pilgrimage constitutes a structured form of religious mobility, involving travel to places regarded as sacred or spiritually significant. Across cultures and historical periods, pilgrimages have functioned as practices through which individuals and communities express devotion, seek spiritual merit, fulfill vows, or pursue personal transformation. Comparable journeys may, however, also be motivated by secular or non-religious purposes. Both types of movement, particularly when

they involve intermediate stops, can be productively analyzed through story maps, digital tools that integrate interactive maps, textual content, and multimedia materials (such as images, videos, and documents) to interlink space, time, and narrative. Story maps provide a powerful framework for the study of literary texts, especially novels centered on journeys, where geographic locations are not merely backdrops but active agents shaping characters' actions, perceptions, and plot development. By visualizing the spatial dimension of a narrative, these tools enable a more nuanced understanding of the interplay between geographic movement and thematic, symbolic, and structural elements of the story.

Methods

José Maria de Eça de Queiroz's *The Relic* (1887) offers a paradigmatic case study for this approach. In the novel, the protagonist Teodorico Raposo undertakes a pilgrimage to the Holy Land in the late nineteenth century, both to reinforce his public image as a pious man and to return a sacred relic to his aunt in Lisbon. The narrative interweaves geographic movement with satirical episodes and psychological dynamics, simultaneously exploring cultural, moral, and religious contrasts and exposing the hypocrisies of bourgeois devotion.

Results

By tracing Teodorico's pilgrimage, the maps reveal concrete correspondences between geographic movement and transformations in moral, psychological, and symbolic dimensions, making the novel's satirical critique of bourgeois devotion and its exploration of cultural contrasts more immediately perceptible. These results indicate that spatial visualization can uncover patterns and connections in the narrative that may remain less visible through traditional textual analysis alone.

Conclusion

From a pedagogical perspective, this approach encourages active, interdisciplinary learning by integrating literary interpretation with geographic literacy and digital competencies. More broadly, it contributes to the field of literary digital humanities by showing that tools such as story maps not only deepen interpretive insights but also enhance engagement in classroom settings. This method is therefore both analytically fruitful and replicable, offering a systematic way to investigate journey-based narratives and the complex interplay between space, narrative structure, and thematic meaning.

Keywords: Story Maps; Pilgrimage; Portuguese Literature

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Acknowledgements

I am grateful to my students of the First-Level Degree in Humanities, Geography course (Academic Year 2025-2026), for the valuable insights they provided on the potential of story maps in teaching and learning, which significantly informed the pedagogical perspective of this study.

Reconstructing Deportation Trajectories through Train Narratives in the *Israelkorporus*

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Background

The railway system was one of the central instruments of Nazi persecution, making the train the primary means of deportation. It therefore occupies a recurring place in survivors' testimonies, where the train routes often become the narrative axis through which the experience of deportation and transport is recounted. Against this background, the following questions arise: how do linguistic traces of train routes in survivor testimony enable the spatial and historical reconstruction of deportation trajectories, and what can this reveal about the experience of forced mobility?

Methods

To address these questions, this contribution centres on the testimony of Sara-Ruth Scheffelowitz (née Frankenthal), who was deported from The Hague to Westerbork on the 29th of September 1943 and subsequently involved in the final evacuation of Bergen-Belsen. Her story is drawn from an interview from the *Israelkorporus*, a corpus of narrative interviews collected between 1989 and 2019 in Israel by the German linguist Anne Betten. The interview was annotated using the qualitative analysis software MAXQDA, enabling systematic identification and classification of place references and dates. These data are then georeferenced and visualized through GIS-based digital mapping tools, which serve not merely as an illustration but as an analytical tool: the spatial reconstruction makes visible patterns of dislocation that are otherwise difficult to grasp.

Results

The linguistic analysis shows that the train forms the core of the narrative and the key element through which the trajectory of deportation can be reconstructed; the forms *Zug/Züge* and

their variant *Transport* are associated with verbs denoting confinement, lack of agency and forced mobility. The close reading focusing on the train routes reconstructs a non-linear trajectory characterized by deviations, returns, and forced stops reflecting the collapse of the German railway system in the final months of the war; at the same time, it highlights micro-locations such as the *Nebengleis* ('sidetrack').

Conclusion

This contribution suggests that the analysis of linguistic traces in survivor testimony can be combined with geospatial methods to support the reconstruction of deportation trajectories. By integrating qualitative annotation with GIS-based mapping, it relates narrative structures to their spatial dimension and engages with key concerns in the spatial humanities, including mobility, spatialized narratives, and digital cartography. The case study shows how testimony can be approached not only as a narrative source, but also as spatial data that can contribute to the reconstruction and interpretation of forced movement.

Keywords: Holocaust testimony; Linguistic analysis; Deportation trajectories; GIS mapping; Spatial humanities.

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Acknowledgements

The author would like to thank her supervisor for their guidance and support. She also gratefully acknowledges the *Leibniz-Institut für Deutsche Sprache* (IDS) for access to the *Israelkorpus*.

The third dimension of the 1830 Habsburg Cadastral Map of Trogir and the medieval origins of the private property distribution within a city block

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Background

Habsburg Cadastral Maps are the first accurate maps produced for Dalmatian cities, making them a valuable historical window for a medievalist at the beginning of their research. Furthermore, the Maps are the earliest records of the distribution of private property within city blocks, as Dalmatian cities throughout the long Middle Ages never had a property tax that would have produced an administrative act in the form of a cadastre, whether in textual form or in both textual and map form.

The 1830 Map of Trogir (Benyovsky, 2005), the city inscribed on the UNESCO World Heritage List for the preservation of its medieval urban fabric, offers a clear, easy-to-read distinction between preserved and lost ecclesiastical and public buildings, as well as insight into predominantly unchanged perimeters of medieval residential blocks. However, the book accompanying the Map (*Protocolo delle particelle*) has not been adequately researched for the study of residential architecture within the city blocks. Therefore, a series of GIS maps has been produced for a selected block in the city centre to enhance analysis of the distribution of properties at the ground-floor level by simply copying the existing Map and, for all subsequent floors, using the textual information from the accompanying book. For the first time, these GIS maps provide clear insight into differences between multiple store owners on the ground floor and less property fragmentation on the upper floors, raising questions about the distinctions among a plot, a house, and a home.

Methods

The answers to these questions are derived from thorough research into medieval residential architecture (Plosnić Škarić, 2017, 2018, 2020). The research comprises three stages. The first employs ambulation as the standard method in art and architectural history, enabling the identification of preserved medieval structures and their subsequent changes. The structure of the walls, the styles of the window frames (from Romanesque to Renaissance), and whether they remain

in situ or have been moved indicate the changes medieval dwellings underwent over the centuries. The second stage comprises systematic research of the archive of the Medieval Commune of Trogir and the compilation of all information on private real property, primarily from notarial deeds, as well as an understanding of the legal framework and the political, social, economic, and private reasons underlying decisions regarding property transfers. The third stage involves mapping the archival information and comparing it with the preserved urban form.

Of all the information collected from archival documents dating from 1264, the year in which the first deed is preserved, to 1500, less than a quarter can be mapped. In the period when streets had no names, the location of a private property was described by listing the owners of neighbouring properties. Therefore, the mapping methodology involves having an orienteer within a block (e.g., the church, the tower, the relief depicting a noble family coat of arms, or similar) to locate the first transaction, and adding additional information by identifying the same neighbours in other deeds. The amount of information that can be mapped for the selected block is extraordinary, providing comprehensive insight into the distribution of private property and its subsequent changes. Compared with the preserved built structures, it enables reconstruction of the fifteenth-century property distribution and, by going back further, identifies a large compound with a courtyard and a tower, typical of twelfth-century Communes. All of this information, along with the understood changes, is visualised and presented as GIS maps.

Results

The disintegration of the compound throughout the thirteenth, fourteenth and fifteenth centuries, due to social, political and economic changes, explains the ever-changing distribution of private property within a block: the ground-floor stores were rented out or sold separately, and the upper rooms were divided among heirs, only to be joined by buying another room or part of an adjacent house in the next generation. The stone walls, constructed predominantly in the twelfth and thirteenth centuries, were altered only by the addition of new openings or the closure of old ones to provide a suitable home for the owners. Therefore, the term *domus* in the notarial deeds does not refer to a house as a building with a defined perimeter, but rather to a home, a unit of rooms, or sometimes only one room for the poorest, as a property of a family where they lived or which they rented out. Such property could include rooms at different levels extending along a block, with part of an inner courtyard or its possession *pro indiviso*. The perimeter of a *domus* changed with each generation, adapting to the existing built structures. This means that from the thirteenth century onwards, a house (or, in more complex examples, a palace) was a recently established and often newly embellished part of a block held by a single proprietor. The stone-built structure, as stated by law since the beginning of the thirteenth century,

was presumed to own the land on which it stood. Therefore, the plot in such a block was never disputed and was therefore never even recorded.

Conclusion

The conclusion is that the 1830 Habsburg Cadastral Map recorded only the momentary outcome of a centuries-long practice arising from the constant use of masonry structures constructed predominantly during the twelfth and the thirteenth centuries. The Map equated a plot with separate ownership at the ground-floor level and provided only textual information about the upper floors in the accompanying book. At first glance, the Map appears to depict numerous small houses rising above each store, whereas a proper understanding requires recognising medieval practices that endured for centuries, resulting in a complex structure bearing traces of subsequent changes.

Keywords: residential architecture; principles of medieval housing; long Middle Ages; 19th-century Cadastral Map; GIS maps.

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Acknowledgements

This paper is the result of the research project *Art and Architecture of Urban Settings in Croatia*, conducted at the Institute of Art History and funded by the European Union—NextGenerationEU.

Background

This paper examines how waterfront architecture and nature in Istanbul have been reciprocally produced and reproduced through material flows and power relations from the nineteenth to the twenty-first century. It focuses on selected coastal spaces of Istanbul through the lens of urban metabolism. While architectural research has traditionally centered on buildings and materials, contemporary ecological crises and concerns surrounding spatial justice call for an expanded engagement with broader disciplines and alternative methodological approaches.

Maps have historically functioned as powerful instruments of knowledge production and communication (Wood et al., 2010; Wilson, 2017). Cartographic practices have also been deeply implicated in processes of capitalist accumulation, mechanisms of state control, colonial territorialization, extractive economies, and military operations (Kitchin & Dodge, 2011; Schranz, 2021). The critical discourse on cartography and GIS that emerged in the late 1980s fostered the development of subfields such as critical cartography, radical cartography, deep mapping, and counter-mapping, all of which are grounded in the theoretical traditions of critical geography (Crampton & Krygier, 2010; Harley, 2011; Wood et al., 2010; Wilson, 2017; Schranz, 2021; Souza et al., 2025). Building on Caquard's (2013) work, Roth (2021) conceptualizes visual storytelling as a mode that repositions cartography as a hybrid practice situated between research and design for human experience.

Methods

As a methodological framework, the study titled *"Interactive Mapping of Istanbul's Metabolism"* (Sert, 2025) adopts interactive critical mapping through map-based visual storytelling to trace the origins of materials, power relations, and uncover layered backstories of waterfront architectures in motion. Rather than examining these processes in isolation, the research situates them within interconnected networks of relations and circulations over time, encompassing both human and non-human actors.

The methodological approach is implemented through an interactive interface developed using open-source web technologies and geoweb storytelling tools, which enhance narrative depth by enabling multiple forms of engagement. Open-source geographic information systems, particularly QGIS, were employed for advanced spatial analysis and cartographic production, while platforms such as Mapbox Studio supported the design of dynamic, interactive maps. In addition, Mapbox's storytelling tools, including Mapbox Storytelling and Juxtapose, were integrated to ensure a coherent and comprehensive assembly of diverse GIS components within a unified interactive environment.

Results

Mapping Istanbul's Urban Metabolism: Interactive Visualizations of Metabolic Flows

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Within this intellectual trajectory, the present study employs critical mapping as a form of visual storytelling to explore alternative ways of interpreting and representing qualitative data on coastal architectures through an urban metabolism framework, while addressing spatial and social justice concerns in architectural discourse. The concepts of metabolic flow, entanglement, and urban metabolism used here are grounded in a rejection of the nature–culture divide. *Metabolic* refers to the socioecological relations through which space is produced and reproduced, shaped by both human and non-human labor. From this perspective, metabolic flows highlight the circulation and transformation of materials, power, and labor not only in industrial production but also in the ongoing making and remaking of urban space. Geological materials from quarries, construction and demolition waste, water, coal, oil, and concrete constitute the primary elements of these flows. By tracing how Istanbul's waterfronts, urban transformation, demolition debris, mega-projects, civic resistance, and imagined futures intersect and circulate unevenly, this paper demonstrates how natural and social forces co-constitutively shape the architectural histories of the city's environment.

Conclusion

The visualization of the metabolism project and its results, particularly the interpretation of space-making practices as flows and the effort to make research data more accessible to a wider public, highlights the specific strengths of interactive mapping. In this sense, given the project's objectives of examining the shifting ideology of nature through spatial agendas, moving beyond the separation of the social and the natural, and tracing how the unfinished projections of one historical period are realized in another, interactive mapping functions as a particularly effective methodological tool.

In other words, by mapping the spatial traces of human history and ecological change in Istanbul, the project aims to both reveal the - often implicit and complex - connections between human history and ecological change, and to provide an interactive visual experience of the research and transformation of the same urban space, material or location in different periods.

Keywords: Interactive mapping; Urban metabolism; Istanbul, Spatial justice; Visual Storytelling.

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Acknowledgements

The scientific research presented in this article is based on the project titled *Interactive Mapping of Istanbul's Metabolism*, which I led and which was supported by the Scientific Research Projects (BAP) Fund of MEF University during 2024–2025. I would like to sincerely thank all those who contributed to this research through their feedback and support. Nevertheless, full responsibility for the content, interpretations, and any remaining shortcomings of this work rests solely with the author.

SESSION 12

Active and independent school mobility: Children's use and experiences in the city of Braga, Portugal

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Background

The motor vehicle-oriented transportation approach in

contemporary cities is responsible for traffic congestion (Erturan e Aksel, 2025). Urban environments are predominantly structured for adults and automobiles, rather than for children (Carroll *et al.*, 2015). Effectively, the built environment and social dynamics of urban areas limit opportunities for play, autonomous mobility, and social connections among youngsters. It negatively impacts their emotional, cognitive, and physical development (Carroll *et al.*, 2015).

Active and independent school mobility refers to the ability of children to travel to and from school autonomously and using non-motorized modes of transportation, such as walking or cycling. Indeed, the topic of school mobility has garnered increasing attention from the scientific community, integrating perspectives from various disciplinary fields such as Geography, Sociology, Engineering, Architecture, Urban Planning, and Health (Ribeiro, 2009, 2012; Ribeiro, Vitor e Silva, Rafaela 2025; Ribeiro *et al.*, 2025). The interest is justified by the complexity of the phenomenon and its implications for the health and well-being of children, environmental sustainability, urban planning, among other dimensions (Ribeiro, Vitor e Silva, Rafaela, 2025).

Methods

The present investigation adopted a quantitative method and the use of primary sources. It is based on the questionnaire surveys administered to the children and their respective parents from the nine schools in Braga that participated in this research. The sample included 307 children between 7 and 10 years old and 307 parents, mostly between 30 and 50 years old.

Results

It is noted that most children usually go to school by car, which indicates a high/significant dependence on individual motorized transport. On the other hand, only 15.0% of the children walk, and none use a bicycle, which demonstrates a low adoption of active mobility. In terms of modal distribution by school, significant differences were observed. The use of school transportation varies significantly depending on the school's location, ranging from 54% at school in the periphery to 5% at school in the urban centre. Children attending public schools have a higher proportion of walking trips (16.6%) compared to those in private schools (11.1%). quando os pais mais jovens (até 40 anos), a mobilidade ativa é mais do dobro da verificada nos pais com mais de 40 (21,2% vs. 9,3%), enquanto a dependência do automóvel sobe de 68,2% para 80,9% com o aumento da idade parental. Younger parents with lower educational qualifications tend to promote more active mobility for school trips, while those who are older and have higher education levels tend to use the car more, and in the case of the latter, also school transport.

Conclusion

A significant strength of this study is the diversity of participating children. In the territorial comparison, the

findings suggest that kids attending schools located in urban centers have a higher walking rate (16.7%) compared to those in more rural areas (10.1%). Nonetheless, automobile use prevails in both settings, attaining 76.8% in urban regions and 70.9% in rural regions. Designing a child-friendly city is very important in 21st-century urban design, and it is critical for cultivating an awareness of urban experiences from children's viewpoints. The findings, based on children's accounts, contribute to this.

Keywords: Spatial Humanities; GIS; Children's Geographies, Active and independent school mobility, Walkability.

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Acknowledgements

This initiative was supported through the Multiannual Funding of the Landscape, Heritage and Territory Laboratory (Lab2PT), Ref. UID/04509: Laboratório de Paisagens, Património e Território (Lab2PT/UM), financed by national funds (PIDDAC) through the FCT/MCTES. The authors award ICNF by making

STOPvespa data available.

Spatial methods to analyse the challenges faced by individuals with physical disabilities in the urban area of Barcelos

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Background

With the expansion of urban areas, amassing an increasing concentration of population (UN-Habitat, 2022), policy makers have focused in adapting these areas so that key aspects, such as the comfort and inclusion of all the residents are satisfied, as well as attending to ODS sustainability goals. Undoubtedly, due to following these strategies, fundamental concepts, namely mobility and accessibility, have become central in urban planning (Straatemeier, 2008). Whereas these changes have become the norm, there also has been an increasing concern with the subject of inclusion of people with physical disabilities in urban spaces (Ramírez-Saiz et al., 2025). However, in the municipality of Barcelos (Northwest of Portugal), despite political and legal advancements, there exists a lack of implementation of inclusive public spaces, particularly considering people with physical disabilities, in equal conditions of equality and dignity.

Therefore, facing these challenges, the present study focuses on the evaluation of public space in the urban area of the municipality of Barcelos (116.752 inhabitants), analysing its components, to better understand the difficulties that are felt by residents with physical disabilities.

Methods

A unique approach was developed with the aim of achieving an efficient process of assessment, adopting a quantitative approach. A range of categories was defined, applying a systematic categorisation of the objects that were accounted for the analysis. Based on these typologies, an Evaluation Grid was developed, containing questions pertaining to parameters that, in turn, were modelled by what the Law recommends and obliges. Additionally, a Complementary Evaluation Grid was created to evaluate access points to public and community buildings.

The process of data collection, applied during near seven months, between 2024 and 2025, and its subsequent analysis was supported by Geographic Information Systems (GIS), using ArcGIS Pro, Survey123 and Field Maps. The study

area consisted of the urban perimeter of Barcelos. Within this area, 763 public space elements were identified, georeferenced and evaluated, which were distributed across the following typologies: sidewalks (502), crosswalks (96), stairways (55), ramped stairways (11), ramps (15), vegetation elements (35), and protruding objects (12). Furthermore, 37 access points were also assessed, including staircases (10), ramps (10) and sidewalks (17).

Results

The conducted analysis warranted the mapping and statistical processing of the data, providing an important insight into the reality that individuals with physical disabilities face daily. This study enabled an in-depth assessment of the public space elements, highlighting multiple accessibility issues, including missing handrails on stairways, holes and surface defects on sidewalks, overly steep ramp gradients, and vegetation elements that fail to meet established standards.

The results show that, attending to the established parameters regarding the typologies, although there are positive situations, a rather considerable number of objects possess severe faults. These failures show that, even though there are policies and norms that address these questions, as well as monitoring mechanisms to assure that these rules are followed, those instruments are unable to prevent the objects' faults.

The simulation of paths through the area that was analysed was a complementary method to better grasp the barriers faced by individuals with physical disabilities.

Conclusion

The research conducted identified objects within the study area that constitute barriers to the movement of individuals with physical disabilities, providing an accurate picture of the problems faced by this population. Georeferencing of this data and its subsequent cartographic representation are important tools for attending to these situations, as well as being of interest in the field of urban planning.

In this context, and in view of the emerging challenges relating to accessibility and mobility in urban contexts, this research represents a crucial step towards understanding the dynamics at play in the municipality of Barcelos. It is essential to base this analysis on raising awareness among policy makers, who are responsible for solving these shortcomings, but also given the interest in the strategic development opportunity that these changes entail.

As these issues are related to territorial development, it is important to note that, in addition to correcting the identified flaws, other potential interventions may also be implemented. In this regard, mention should be made of measures aimed at making public spaces more inclusive, insofar as they can be used by all individuals, namely the development of plans focused on mobility and accessibility, or even the definition of a strategy to reduce private vehicle traffic in the city centre.

On the other hand, research has shown that the integration of

individuals with physical disabilities into public spaces goes beyond mere issues directed at this population segment. It is necessary to view urban planning as a fundamental mechanism for achieving significant changes in socio-spatial dynamics, since these inclusion processes are nothing more than a reflection of the need to rethink the way space is used by individuals.

The methodology developed for this research may also be applied in other urban contexts.

Keywords: Physical disability; Accessibility; Mobility; Planning models; Geographic Information Systems (GIS).

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Utopic Versus Dystopic city: an analysis based on vertical mobility

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Background

The 15-minute city aims to ensure that all essential services and amenities are accessible within a 15-minute walk or bike ride from any residence. This includes a variety of services such as education, healthcare, shopping, leisure, and more. In this context, pharmacies are considered a critical component of healthcare services. Ensuring their accessibility is crucial for the well-being of residents, particularly those who require regular medication. Given their importance, they are typically prioritised in the planning of 15-minute cities to ensure they are within easy reach for all residents, including vulnerable populations such as the elderly and those with disabilities.

The 15-minute city concept generally focuses on one-way

travel time to services. However, in practical daily use, the round-trip time can be significant, especially for activities with a short time between going and returning. Including return trips in these models could enhance their accuracy and applicability, as ignoring return trips may underestimate the time residents actually spend travelling, potentially affecting the perceived convenience and efficiency of the 15-minute city model.

Moreover, common models usually ignore differences in walking capabilities among residents (e.g., the elderly), which can lead to inequitable access to services. These differences could be due to physical conditions and/or building characteristics, such as the number of floors. Also, in multi-floor buildings, the presence of elevators and escalators can significantly impact accessibility, especially for elderly individuals.

Methods

By leveraging detailed pedestrian network data for the city of Lisbon (Portugal), we calculate more realistic routes between residential buildings and nearby pharmacies. To do so, we create a refined modelling framework that integrates vertical mobility constraints—specifically the number of floors in residential buildings and the presence or absence of elevators—into a network-based spatial accessibility analysis. Buildings are assigned a vertical impedance value based on their floor count, with higher penalties applied to those lacking elevators. This impedance is conceptualised as a proxy for the physical effort or time delay required for an elderly resident to descend to ground level, forming a precondition for engaging with the street-level pedestrian network.

The approach employs a cost-distance network analysis implemented in ArcGIS Network Analyst, in which origin nodes (residential buildings) are linked to destination nodes (pharmacies) via the pedestrian street network. The routing algorithm incorporates not only standard edge weights (e.g., distance, slope, travel time) but also an origin-specific cost modifier representing vertical impedance. This results in a building-specific accessibility surface that reflects both micro-scale vertical constraints and macro-scale urban connectivity.

Results

By synthesising geospatial building data (e.g., LiDAR), elevator presence (where available), and population age distribution, this model supports the computation of adjusted isochrones and refined accessibility scores at the building or block level. Such outputs enable the spatial identification of accessibility deficits, particularly in clusters where elderly populations reside in high-floor, non-elevator buildings distant from pharmacies. The result is a more accurate measure of effective access, one that moves beyond simple proximity and captures the layered spatial inequities present in the urban fabric.

Such an approach offers practical benefits for urban health policy and planning. It enables the identification of areas

where elderly populations face disproportionately high access barriers and supports scenario modelling, such as evaluating the impact of installing elevators, optimising pharmacy locations, or targeting home delivery services. Finally, by merging building-level data with advanced network analysis, this methodology fosters a more inclusive and realistic understanding of healthcare accessibility regarding urban ageing.

Conclusion

In conclusion, to better model elderly accessibility to pharmacies, it is critical to integrate building-level characteristics—specifically, the number of floors and the presence or absence of elevators—into the spatial analysis. Residents living on upper floors in walk-up buildings encounter a compounded accessibility burden, particularly those with limited mobility. By assigning a vertical mobility cost or penalty based on floor height and elevator availability, we recalibrate accessibility measures to reflect the actual physical effort required to reach street level before even beginning the journey to a pharmacy.

Keywords: 15-minute city; Elderly people; Vertical mobility; Lisbon; Pharmacies

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Acknowledgements

The Portuguese Foundation for Science and Technology (FCT) supported this research through doctoral grant No. 2022.11665.BD, awarded to Iuria Betco. We thank GEOMODLAB — Remote Sensing, Geographical Analysis, and Modeling Laboratory — of the Center for Geographical Studies (CEG) and the Institute of Geography and Spatial Planning (IGOT) for providing the necessary equipment and software.

Mapping Antiquity: Local Perception of Ancient Legacies in the Relaciones Topográficas de Felipe II

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Background

This project is situated at the intersection of historical research and spatial humanities. Its foundation lies in a close reading of the Relaciones Topográficas de Felipe II, focusing on references to material evidence of antiquity recorded in response to the royal questionnaire. In particular, the study draws on the question that asked about «los edificios señalados que en el pueblo hubiese, y los rastros de edificios antiguos, epitafios y letreros, y antiguallas de que hubiese noticia» (cited in Campos y Fernández de Sevilla, 2003, p. 458).

The project approaches these reports as one of the earliest attempts to inventory ancient heritage in Spain. It considers them as a source that captures local knowledge and perceptions of antiquity in the sixteenth century. While the Relaciones Topográficas have occasionally been cited in epigraphic and archaeological scholarship, their potential as a systematic source for the spatial study of ancient heritage has not been fully explored.

Historiography has predominantly examined the Relaciones within the framework of economic history (Salomon 1964), local religion and religious mentalities (Christian 1981, Campos y Fernández de Sevilla 1986), geography (Arroyo Ilera 1998), and early modern humanism and historiography (Alvar Ezquerro 2000; Alvar Ezquerro 2010; Alvar Ezquerro 2014). Scholars have emphasized their connection to antiquarian interests and the intellectual context of Philip II's reign. As a result, research has focused largely on humanist knowledge production rather than on the material traces of antiquity recorded at the local level.

By concentrating on the sixteenth-century perception of antiquity, this project foregrounds the historical moment itself rather than later archaeological interpretations. The map constitutes the final interpretative outcome of the research, serving not merely as a visual aid but as a tool for spatial analysis and historical interpretation.

Methods

The project is based exclusively on the corpus of the Relaciones Topográficas de Felipe II. Research is conducted using printed editions of the source. All data concerning references to ancient remains are extracted manually through close reading and systematically recorded in a structured Excel table.

For each entry, the following information is documented: the name of the settlement, its geographical coordinates, the type of ancient monument, and a brief description based on the text of the Relaciones. The data are subsequently integrated into a GIS in order to produce a spatial visualization of the reported ancient evidence.

GIS are used to map and analyze the distribution of these references across different regions. The project also employs digital tools, including automated procedures, to support data

processing and spatial visualization. At the current stage, the presence of an interactive user interface remains undecided.

Results

The project is currently at the conceptual stage. Its primary outputs consist of a digital map and related visualizations illustrating the spatial distribution of ancient monuments mentioned in the *Relaciones Topográficas*.

Preliminary results indicate several notable patterns. The data reveal frequent references to the reuse of ancient material, often with changes in the function or meaning of the original objects. There is also a clear quantitative concentration of references to ancient monuments in the province of Madrid, alongside regional variation that will be explored through comparative analysis. The project allows for both qualitative and quantitative observations regarding the presence and visibility of antiquity in different areas.

Conclusion

The principal contribution of this project is methodological. By combining close historical reading with spatial analysis, it offers a new way of approaching the *Relaciones Topográficas* as a source for the study of ancient heritage.

The project contributes to a deeper understanding of how antiquity was perceived at the local level in sixteenth-century Spain: how ancient remains were interpreted, what associations they carried, and which periods of antiquity were more clearly remembered or valued by local communities. It demonstrates how material traces of the ancient past were embedded in everyday spatial experience and collective memory.

This research forms part of a larger, long-term scholarly engagement with the *Relaciones Topográficas*, which the author has been studying for over a decade.

Keywords: Ancient monuments, *Relaciones Topográficas*, Spatial analysis

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Acknowledgements

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 101034371.

The author also gratefully acknowledges the support of the Instituto de Oriente Próximo of the Consejo Superior de Investigaciones Científicas (CSIC).

Mapping a Threshold City

Critical GIS and Historical Mapping of al-Bassa's Urban Transformation

HGIS for examining evolution of marked hiking trails: Israel, 1950's – 1995

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Background

Trails have existed for millennia to meet essential human needs such as nourishment, security, pilgrimage, and commerce. From at least 1876 onward, trails in the United States were deliberately marked for recreational hiking, a practice that later spread globally.

Israel provides a compelling case study for the historical development of marked hiking trails. Relative to its size, it is among the most densely marked countries in the world. Beginning in 1947, hiking trails were systematically marked and mapped, a process that expanded significantly in subsequent decades. Despite growing scholarly interest over the past fifteen years, research remains limited. There is little analysis based on historical primary sources and minimal engagement with spatial humanities methodologies.

My research addresses these gaps by examining the considerations and decision-making processes of local trails committees in determining trail routes in Israel. The study draws on historical primary sources—including documents, reports, correspondence, maps, and photographs—from the Israel Trails Committee (ITC) archive, personal archives of former ITC chairs, the Israel State Archives, and other collections. The research period spans from the completion of the first marked trail in 1947 to the inauguration of the Israel National Trail (INT) in 1995.

Methods

This research combines two complementary methodological frameworks: a historical-based approach and a spatial humanities approach, specifically Historical Geographic Information Systems (HGIS). The combination allows for both qualitative interpretation and spatial–quantitative analysis.

1. Historical-based approach

The historical-based approach involves critical examination of textual and visual sources to reconstruct trail planning decisions:

- a) Locating and collecting relevant materials from archives and personal collections.
- b) Conducting close, critical readings to identify patterns, motivations, debates, and considerations in trail routing.

- c) Comparing findings across source types to detect convergences, discrepancies, and institutional shifts.
- d) Synthesizing results in coherent written form.
- e) Continuously contextualizing findings and drawing conclusions throughout the research period.

2. Spatial humanities approach: Historical GIS (HGIS)

HGIS methods were employed to reconstruct, analyze, and visualize the spatial development of the trail networks:

- a) Collecting historical maps showing marked hiking trails.
- b) Georeferencing maps within GIS using the Israel Transverse Mercator Grid.
- c) Digitizing trail routes as polyline features.
- d) Attributing polylines with temporal metadata, including marking dates.
- e) Extracting quantitative spatial metrics, such as segment length, number of segments, and sinuosity.
- f) Mapping the chronological formation of trail networks to visualize spatial development.
- g) Comparing polylines across periods to identify patterns of expansion, contraction, continuity, and reconfiguration.
- h) Interpreting spatial comparisons to understand connections, transformations, and institutional strategies underlying trail evolution.

By integrating historical and spatial methods, the study examines marked hiking trails as both historical artifacts and evolving spatial infrastructures, offering insights unattainable through either approach alone.

Results

HGIS analysis shows that both the total length and the number of marked hiking trails increased over the research period, though growth occurred unevenly across regions and decades. Once established, trails typically remained stable, reflecting strong path dependency and the lasting influence of early routing decisions.

Four factors consistently shaped marked trail locations. First, prior trail infrastructures often guided new route planning. Second, sites of interest, such as historical, cultural, or natural landmarks, influenced alignment, reflecting both recreational and symbolic priorities. Third, accessibility, particularly proximity to roads and public transportation, facilitated public use and integration into broader mobility networks. Fourth, environmental considerations for preserving natural ecosystems and protecting open areas from public encroachment.

Beyond trail-specific insights, the findings advance scholarship on historical walking infrastructures, GIScience applications, and the spatial understanding of national history,

positioning trails as significant yet underexplored subjects in spatial humanities research.

Conclusions

The study shows that human-made factors and natural features determined trail routes over time. Variations in human activity, institutional priorities, cultural contexts and nature attractions produced unique trail networks across regions. Nevertheless, a shared underlying logic suggests common planning principles governing the historical evolution of marked hiking trails.

The methodological framework—combining historical analysis, spatial humanities approaches, and mixed textual, visual, and digital sources—offers a transferable model for studying marked hiking trails in other contexts and for analysing other human-made spatial networks. This approach demonstrates that trails can be understood as historically contingent infrastructures shaped by social, political, and cultural processes.

More broadly, the research points toward establishing a dedicated field of trail history focused on the global evolution of marked hiking trails. Understanding the historical development of trails can inform future planning, management, and conservation, providing insights into both practical and scholarly applications.

Keywords: Trails; Marked trails; Hiking; Historical GIS (HGIS); Israel.

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Consistency and change: the shape and uses of Lisbon's city margins

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Background

The first comprehensive city plan of Lisbon drawn from a topographic survey, dates from 1859 and was based on field work made between 1856 and 1858. It shows the full area of the city with an amazing and beautiful degree of detail.

Although there were further city plans made during the second half of the 19th century, it was necessary to wait 50 years to get another equally detailed plan. In the meanwhile, the city more than quadrupled its administrative area. In the early 20th century, the lack of an updated city plan was intensely felt and a full survey was deemed necessary. The new topographic survey was made between 1904 and 1911, with the corresponding plan drawn afterwards. In a similar fashion to the one from 1856-1858, it also renders the city with an extraordinary degree of detail.

This half-century time interval, as well as the visual details of both city plans and additional documentation, allows us to learn something about the margins of the city and their uses. Since its origins, Lisbon had to contend with a real physical margin, turned toward the Tagus River. The presence of such a body of water has permanently influenced the city evolution, both in the way the city used and adapted itself to the river. As to the other city margins (let's call them 'administrative' for lack of a better term), turned towards land, their uses have changed in time, according to the city growth. However, some marginal areas became forever (in)famously known because of their initial uses. Although urban renewal occurred in some

of those areas, others were more or less stigmatized from early on, as if to say that some portions of territory would always be side-lined.

Physical and administrative margins aren't the only ones that can be found in Lisbon. The urban territory contains several valleys that can be found as part of the administrative limits in the mid-19th century. These geographic features, by then located just outside the city, were an obvious target for the placement of, for instance, polluting industries. When they became part of the city themselves, in the late 19th century, their usages didn't really change for quite some time. Valleys were/are both dips in the city terrain and convenient areas to hide some less attractive elements of the city, be them those polluting industries, social housing projects or sewage treatment plants.

When jumping in time to a period more than a half century later (early 1970s), the city margins keep showing consistency in their use. There were precariously and illegally built houses along the road that surrounded the city, together with some of the poorer neighbourhoods of Lisbon. During the better part of the 20th century, the river front presented both a monumental scenery towards the west, and a strong industrial footprint towards the north. It is almost unavoidable to look into these uses without thinking about the Foucauldian concept of «heterotopia». According to the different eras, prisons, graveyards, urban green parks, popular fairs and social housing projects were either built, planned or occurred regularly in these city margins. One way or the other, all of these urban elements are also «other spaces», simultaneously connected to and set apart from the surrounding urban reality.

Methods

Map observation and interpretation, both from printed and digital versions. Establishing comparisons between both city plans (1856-1858 and 1904-1911) as well as more recent ones up to the present days, using the GIS tools provided by the city hall. Plotting several points of interest in the area they cover, based on information extracted from archival data. Comparing the purported uses of the city margins during the mid-19th, early 20th century and the current day.

Results

The ability to establish a continuity nexus between the way several city areas were/are used.

Conclusion

A study of this nature helps to understand why certain urban areas are used in certain ways. The role of the city margins as exclusionary territories is real. Their use as buffers between the city centre and whatever lies outside the city is also real, becoming prime locations to place both people and utilities that don't quite fit within the desirable urban order.

Keywords: Lisbon, Urbanism, City margins, Heterotopias.

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SESSION 14

The Project "Minors on the Move: Mapping Forced Migration from Nazism and its Testimonies"

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Background

Our project draws on the experiences of children and

adolescents who during the Nazi period were forced to emigrate from Germany and the territories gradually annexed. Beginning in 1933, discrimination policies caused the dispersion of family networks: some were fortunate enough to emigrate, oft through initiatives such as the Youth Aliya or the Kindertransport, while parents and relatives often could not emigrate and were consequently deported and killed.

Methods

Our research focuses on interview collections in German preserved at the Leibniz-Institut für deutsche Sprache/Mannheim:

- Israelkorpus (IS, ISW, Israel, 1989–2019; Betten 1995, Betten/Flinz/Leonardi 2023): people who emigrated to Palestine/Israel;
- corpus FEGB (UK 2017; Thüne 2019, 2025): 'children' from the Kindertransport and young migrants from the same period.

Biographical paths and narratives are analysed to highlight and georeference topological and chronological references, linking them to databases such as GeoNames, Wikidata, Yad Vashem, and the Arolsen Archives. The aim is to reconstruct both the migration routes of the interviewees and the dispersion paths of their families.

For this workshop, the research questions focus on:

- the places of time (Flinz/Leonardi 2023) recurring in the testimonies and their connection with memorial sites;
- how the interviewees trace their own migration routes (Thüne 2023);
- how the interviewees trace the deportation routes of their family members;
- instances of remembrance mentioned in the interviews (e.g. Stolpersteine).

To support this research, we engage with three computational humanities techniques:

1. MAXQDA (Kuckartz/Rädiker 2019) for content analysis, enabling thematic and keyword-based exploration of sources.
2. chronotopoi – biographical sequences of events linked to places – for subjects, perpetrators, and related individuals, allowing us to project routes on a time-enabled geographical map for both research and dissemination.
3. ontological information following the FAITH knowledge model (Ferrara et al. 2023; Ruskov/Sullam 2026), relating historical events with sources, people, and circumstances while retaining indications of uncertainty.

Results

The analysis of the Israelkorpus and FEGB interview collections identifies recurring topological and chronological references within the biographical narratives, which are systematically extracted and linked to external databases. Through the use of

MAXQDA, relevant themes and keywords are traced across the corpus, while the modelling of chronotopoi enables the structuring of biographical sequences of events associated with specific places. This combined approach supports the reconstruction of migration routes described by the interviewees, as well as the routes of deportation attributed to their family members.

Conclusion

The study shows that the integration of qualitative content analysis with computational humanities methods provides a structured way to analyse and represent complex biographical narratives. The use of chronotopoi and ontological modelling enables the organisation of information about events, individuals, and sources while preserving indications of uncertainty. This approach contributes to a more systematic reconstruction of spatial and temporal dimensions in the testimonies and supports both research and dissemination by enabling the projection of biographical data onto time-enabled geographical maps.

Keywords: Forced migration; Oral history interviews; Chronotopoi; Georeferencing; Digital humanities.

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Spurring Spatial Knowledge: Visualizing, Enriching and Integrating Place-based knowledge in the VOC Archives

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Background

The Dutch East India Company (VOC) was a colonial actor in Kerala (India, 1663-1795). Its archives contain a wealth of textual descriptions that document political, economic, and environmental conditions in the region. Alongside these textual sources, the VOC was an avid cartographic producer, creating detailed maps that depict diverse topographic features (Zandvliet, 1998; 2007).

Taken together, these materials constitute a substantial yet uneven body of spatial heritage, in which place-based knowledge was recorded, translated, and circulated across media. However, historians have yet to fully explore the combined value of these cartographical and textual sources for writing spatial histories of early modern Kerala (Van Wissen et al., 2025). Maps and texts are often consulted separately, which limits the capacity to reconstruct historical topographies and to analyse how spatial knowledge was produced, stabilised, and circulated across different media. As a result, the potential of VOC archives to support integrated, place-based historical analysis remains underdeveloped.

Building on Van Wissen & Petram (2024), we demonstrate how AI-driven enrichment of historic maps and manual curation integrate these disparate sources to advance historical analysis of VOC archives.

Methods

The *Necessary Reunions* project reintegrates VOC textual data with 30 historical maps of Kerala through a digital pipeline that overlays layered interpretations on original images.² Rather than treating maps as static images, we approach them as "spatial texts" whose meaning is unlocked through annotation and linkage (Abdul Jabbar et al., 2021). Our workflow combines textspotting (Wood et al., 2024) and handwritten text recognition (Van Koert et al., 2024) to generate machine-readable transcriptions of archival records, alongside other computer vision techniques to detect map icons and symbols (Ravi et al., 2024). This is complemented by georeferencing that aligns historical maps with modern spatial reference systems (Allmaps, n.d.). These processes are coordinated and curated through the project's custom viewer and editor, *re:Charted*, which enables the systematic linking of map features to specific textual references.³

A central methodological outcome is a historical gazetteer that aggregates place information across maps and texts.⁴ This gazetteer and research tool provides an entrypoint to individual attestations of places, which may be represented differently across maps, enabling the reconstruction of place histories from the VOC perspective. It links these places to other datasets and collections, such as the Atlas of Mutual Heritage in the World Historical Gazetteer (Dutch National Archives et

al., 2021) and to textual attestations in GLOBALISE.

Results

The *Necessary Reunions* project has systematically enriched and annotated 30 Kerala maps, accessible via the project website.⁵ By integrating these annotated maps with textual sources, we have produced a dataset designed to explore place biographies, a form of "spatial storytelling". This approach also allows us to visualize discrepancies in naming practices, shifting boundaries, and the varying labels assigned to settlements by the VOC, reflecting both temporal changes and the specific purposes behind each map's creation.

Rather than aiming for a single, "corrected" version of the past, our results deliberately foreground uncertainty and variation. We treat machine-assisted detections and georeferencing outputs as starting points for historical inquiry rather than final answers. This approach makes the "interpretive labor" of the historian visible, framing archival ambiguities not as errors, but as vital analytical windows into how colonial geographical knowledge was actually constructed.

Conclusion

Linked map-text annotation offers a productive framework for working with heritage-oriented spatial history. By remarrying cartographic and textual sources, the *Necessary Reunions* project demonstrates how historic maps can be reactivated as dynamic components of spatial narratives rather than isolated visual artifacts. While grounded in early modern Kerala, the approach is transferable to other geographies characterized by similarly fragmented documentation. The project demonstrates how AI can support, rather than replace, the historian's craft, enabling us to ask new questions about colonial representation and the digital future of spatial heritage.

Keywords: Spatial Humanities; Historical Cartography; Place-Based History; Digital Heritage; Colonial Archives

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² We follow IIIF annotation and enrichment standards (<https://iiif.io/api/presentation/3.0/>) and have developed a best-practise for storing annotated textual and visual enrichments, such as textspotting and geotagging output.

³ <https://necessaryreunions.org/viewer>. The tool is open

source and available in a GitHub repository:

<https://github.com/globalise-huygens/necessary-reunions>

⁴ <https://necessaryreunions.org/gazetteer>

⁵ <https://necessaryreunions.org/>

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Acknowledgements

The Necessary Reunions project builds on data made available by the National Archives of the Netherlands and the GLOBALISE Project. It was funded by the Dutch Research Council (NWO) under the SSH XS scheme (File Number 406.XS.24.02.046). We are also grateful to the Cosmos Malabaricus research project⁶ for providing the opportunity to test and refine our methods.

Artificial Intelligence and Electoral Districting in Portugal: Spatial Approaches to Representation, Territorial Justice, and Democratic Reform

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Background

The ongoing Portuguese debate on electoral reform, promoted by the “Reformar o Sistema Eleitoral, Renovar a Democracia”

initiative, has renewed attention to the spatial foundations of democratic representation. Electoral districts are geographical constructs that shape how votes translate into political power. At the same time, artificial intelligence (AI) and geospatial reasoning are increasingly present in international discussions on electoral design, offering both opportunities for greater transparency and risks associated with algorithmic bias. This study examines how AI-informed spatial thinking could contribute to the Portuguese reform process, focusing on the potential of computational approaches to support more representative and territorially coherent electoral districts.

Methods

The research adopts a conceptual and analytical approach grounded in political geography, democratic theory and spatial humanities. Rather than developing and producing technical districting models, the study evaluates how AI-assisted geospatial reasoning can shape democratic decision-making and public understanding of electoral space. It includes: (1) a qualitative assessment and analysis of the Portuguese electoral system and the reform proposals currently under discussion; (2) a comparative review of international cases where AI or geospatial criteria have been incorporated into districting processes; (3) a critical assessment of the risks and opportunities associated with integrating AI into electoral cartography, with particular attention to transparency, accountability and safeguards against the malicious use of gerrymandering; and (4) a spatial-theoretical reflection on how geotechnologies reshape debates on representation and territorial justice.

Results

Findings indicate that AI-supported approaches can enhance transparency and public understanding of electoral reform by clarifying spatial criteria and enabling the visualisation of alternative districting scenarios. International examples show that algorithmic tools can reveal representational imbalances and expose patterns of territorial inequality. However, AI does not eliminate political discretion: algorithmic outputs depend on the criteria selected and poorly regulated processes may reproduce or even exacerbate gerrymandering effects. In contrast, successful cases combine technological tools with independent oversight and participatory mechanisms.

Conclusion

AI and geospatial reasoning can contribute constructively to the Portuguese electoral reform debate, not by replacing political judgement but by informing political decision-making. Their democratic value lies in promoting transparency, supporting evidence-based discussion, and clarifying the spatial implications of different reform options, while depending on governance frameworks that ensure accountability, methodological openness, and safeguards against misuse. Integrating AI-assisted spatial analysis into the

⁶ [https://www.universiteitleiden.nl/en/research/research-](https://www.universiteitleiden.nl/en/research/research-projects/humanities/cosmos-malabaricus)

[projects/humanities/cosmos-malabaricus](https://www.universiteitleiden.nl/en/research/research-projects/humanities/cosmos-malabaricus)

reform process can strengthen public trust and support a more representative electoral system. To avoid risks of algorithmic bias or misuse, however, technological tools must be embedded within robust democratic safeguards and open methodological frameworks.

Keywords: democracy; electoral geography; electoral reform; political representation; Portugal.

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SESSION 15

Mapping invisible networks: digital archaeology and spatial analysis of Brazilian women scientists' international circulation (1950-1970)

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Background

Women scientists' trajectories remain systematically invisibilized in traditional institutional archives. In Brazil, as documented by feminist historians of science (Azevedo et al., 2004; Lopes, 1998; Rossiter, 1995), personnel records frequently omit international publications, curricula were not systematically archived, and institutional memory privileged male leadership narratives. This documentary erasure is compounded by what Putnam (2016) termed "international provincialism" of digital databases: Anglophone-centered platforms systematically underrepresent publications in regional journals, creating shadows in our understanding of Global South scientists' international insertion. This study addresses a central question: How can we map women scientists' international mobility networks when primary sources are fragmented across multiple countries and institutional archives? We demonstrate how artificial intelligence tools, originally designed for bibliometric review, can be repurposed as heuristic instruments for spatial history research, enabling what we term "digital archaeology" — the recovery of dispersed scientific trajectories through algorithmic mining of global databases combined with geospatial analysis.

Methods

We employed a three-stage methodology combining digital archaeology, spatial analysis, and network visualization. First, we identified 28 Brazilian women scientists with international links from the 1957 CAPES National Survey of Research Institutions, which documented 280 women scientists in Rio de Janeiro. Second, we used Research Rabbit, an AI-powered bibliometric mining platform aggregating CrossRef, PubMed, and Web of Science, to locate publications for each scientist through onomastic search (Ginzburg & Poni, 1989). This "archaeological" approach inverted traditional archival logic: rather than searching for scientists in Brazilian institutional archives, we searched for their production directly in global scientific databases. Third, we georeferenced all institutional

affiliations mentioned in publications (origin institutions, host institutions, publication venues) and mapped international mobility flows. We cross-validated results with primary sources on funding mechanisms: CAPES bulletins (1957-1970), Rockefeller Foundation records, and institutional biographical pages. For network analysis, we mapped co-authorship patterns identifying collaborative clusters spanning multiple countries. Spatial visualization employed QGIS for flow maps and Gephi for network graphs, revealing mobility patterns invisible to traditional narrative approaches.

Results

Digital archaeology located international publications for 18 of 28 scientists, accumulating 3,200+ citations across five decades. Geospatial analysis revealed two distinct mobility strategies with contrasting spatial signatures. Strategy 1 — Serial Internationalization: multiple short-term fellowships (6 months to 1 year) at distinct centers with systematic return to Brazil. Aída Hassón-Voloch (Institute of Biophysics, UFRJ) exemplifies this pattern: five fellowships from different agencies (CNPq, British Council, Fulbright, French funds) between 1952-1969, circulating through Cambridge (Fred Sanger's lab, 2× Nobel Chemistry), Paris (Roger Acher, René Wurmser), and New York (Severo Ochoa, Nobel Medicine 1959). Spatial visualization shows “star pattern” centered on Rio de Janeiro with radial flows to European/US centers. Strategy 2 — Scientific Emigration: permanent establishment of foreign researchers in Brazil, exploiting local comparative advantages. Hertha Meyer (Germany→Italy→Brazil, 1939) established 52-year career at Institute of Biophysics, developing expertise on *Trypanosoma cruzi* (Chagas disease parasite) accessible exclusively in Brazil. Her 25 articles (617 citations) show “reverse flow pattern”: expertise accumulated in Europe mobilized from Brazilian institutional base. Spatial citation analysis reveals multidirectional knowledge circulation: works published in Rio were cited by parasitologists in India (Panjab University), Germany (Universität Bonn), France (Université de Montpellier), and USA (UCLA), challenging unidirectional center-periphery diffusion models. Network analysis identified unexpected collaborative clusters: Brazilian scientists connected Cambridge, Columbia, NIH, and Paris through transnational co-authorship networks, positioning Brazil as active node rather than passive periphery.

Conclusion

This study makes three contributions to spatial humanities. Methodologically, we demonstrate how AI bibliometric tools can be repurposed for historical spatial research, enabling “digital repatriation” of scientific trajectories circulating exclusively in foreign networks. However, we alert to systematic biases: Anglophone databases underrepresent publications in Brazilian journals (15 of Bertha Lutz's 19 articles invisible to Research Rabbit), reproducing “international provincialism” identified by Putnam (2016). Theoretically, geospatial visualization challenges linear center-

periphery models: Brazilian scientists negotiated international collaborations based on exclusive access to biological resources (tropical parasites, Neotropical biodiversity), demonstrating what Raj (2007, 2013) and Cueto and Palmer (2016) theorized as asymmetric but mutually constitutive knowledge co-production through circulation. Empirically, we reveal that women's international scientific insertion between 1950-1970 was not exceptional but structured, varying according to scientific area, funding agency plurality, and institutional ecology. Spatial analysis proves decisive for understanding how local institutional conditions (laboratory infrastructure, post-graduate programs post-1968, legitimizing leadership) conditioned international mobility possibilities. Future research should expand this methodology to other Latin American countries, enabling comparative spatial history of women's scientific circulation in the Global South.

Keywords: Digital Archaeology; Women Scientists; International Mobility; Spatial Networks; AI in Historical Research

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Cartographies of memory: appropriation of early modern urban space in a feminist perspective (Lisbon, 17th century)

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This analysis reveals two key elements:

First, the intra-urban mobility of women who did not belong to the elite in Lisbon during the 17th century, which reinforces the idea that women's spaces extended beyond the domestic sphere and household responsibilities. Secondly, spaces are not segmented by gender or class. This means that through mobility within the parish and the city, women created networks made up of people from different social groups and of different sexes. This shows a geography of survival, but also a way of thinking about space based on women's sociability and work, which differs from the main historiographical discourse.

Conclusion

This paper concludes that, contrary to the historiographical stereotype of female seclusion, non-elite women in early modern Lisbon actively appropriated and shaped the urban space through their daily spatial practices and social networks. By applying a gender perspective and the methodological framework of 'cartographies of memory' to inquisitorial and pastoral visit records, our GIS-aided analysis maps their circuits of mobility and relational spaces. The results reveal a complex geography of survival, sociability, and work, demonstrating that the parish and city streets were dynamic, co-gendered spaces where women forged essential economic and social ties. This exercise in restorative justice mapping not only makes visible a hidden layer of urban experience but also contributes a critical gendered dimension to the spatial memory of the city. Also social relationships based on power can be perceived as subverting official narratives of social impermeability and profoundly hierarchized notions of space of European early modern cities (Zenobi et al., 2021).

Keywords: Spatial Memory; Gendered Geographies; Early modern Lisbon; Cartographies of memory

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- Acknowledgements**
- This paper has been supported and funded by Portuguese national funds through the Foundation for Science and Technology, under the project UID/00057/2025 (CIDEHUS-UÉvora).

Low-Cost Digital Heritage: A Google My Maps Approach to Porto's Iron Foundry History 1880-1980

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Background

Porto's industrialisation between 1880 and 1980 represented a period of profound urban and economic transformation, yet systematic mapping of its productive structures remained a significant historiographical gap. Iron foundries, as a strategic industry supplying essential components for infrastructure, civil construction and urban furniture, constitute a privileged object for understanding industrial location dynamics and their relationship with the urban fabric.

This project, developed within the doctoral research "Uma janela para a vida em tempos idos: A Companhia Industrial de Fundação (Gondomar-Porto) e a produção de ferros artísticos e ornamentais (1895 a 2024)", filled this gap by creating a pioneering interactive map georeferencing 137 sites in Porto over a century. The chronology (1880-1980) encompasses the cycle of growth, consolidation and decline of this industry. Beyond its historiographical contribution, this work explores free digital tools, specifically Google MyMaps, for creating accessible, collaborative and educationally effective research resources in spatial humanities. In contexts where financial

resources are limited, demonstrating how free platforms can produce robust research tools is particularly relevant.

Methods

The primary source was Porto's Commercial Almanacs, annual publications that, although sometimes undervalued by traditional historiography, constitute systematic repositories of information on commercial and industrial establishments. An exhaustive survey of foundries listed between 1880 and 1980 extracted data on company names, addresses, owners and years of activity.

Georeferencing faced significant methodological challenges: irregular street number registration, time lags in information updates dependent on owner submissions, incomplete data since not all establishments submitted information, and profound urban transformations over this extended chronology. Streets disappeared, toponymy was reorganised, and numbering systems changed.

Given these limitations, a pragmatic approach was adopted: mapping on current cartography, prioritising industrial occupation zone identification over precise georeferencing of each unit. Where original streets had disappeared, locations were approximated to their original sites. This methodology was considered most viable for contemporary spatial reading and analysis.

Google MyMaps was chosen for its user-friendly nature, information card customisation capabilities, data exportation possibilities, and ease of sharing without requiring specialised software installation. Each entry includes: identification number (ID); business designations over time; addresses listed in almanacs and respective years; indication of the mapped address; owners when mentioned; years listed; complete bibliographical references; and additional bibliography when available.

The map was structured in decadal layers (1890-1979) plus a general layer aggregating the entire chronology, enabling comparative analyses between specific periods and overall evolution. Due to the platform's ten-layer limitation, 1880-1889 appears only in the general layer. To overcome weaknesses, particularly the impossibility of using historical cartography as base layer, complementary resources were created, including an animated GIF visualising the numerical growth of foundries with strong educational potential.

Results

The publicly accessible mapping (https://www.google.com/maps/d/u/0/viewer?hl=en-GB&mid=1phj_AndFcrMCMOPCyVx6oLEn7uvzW2o&ll=41.150479099999999%2C-8.644916399999998&z=11) serves as a reference tool for researchers, teachers and those interested in Porto's industrial history. Layered visualisation identifies spatial and temporal patterns clearly correlated with the city's urban and infrastructural transformations.

Quantitative data reveal consistent growth: 10 foundries between 1880-1889, rising to 16 in the 1890s, then doubling

to 32 in 1900-1909 and reaching 40 in 1910-1919. After slight retraction in the 1920s with 34 entries, sustained growth continued until the historical peak of 86 active foundries between 1960-1969. Decline manifested abruptly in the following decade (1970-1980), reducing to 74 entries.

Spatial analysis evidences three distinct phases of industrial location, directly correlated with transport infrastructure evolution. Initially, between 1880-1900, foundries concentrated along the Douro River, dependent on waterways for hydraulic energy, raw material access such as iron ore and coal, and product distribution. The construction of Campanhã (1875) and São Bento (1896, made permanent in 1916) railway stations and the inauguration of Boavista and Alfândega branches triggered spatial reconfiguration: between 1900-1940, foundries expanded toward railway line vicinities. Finally, the 1945 National Road Plan and road network improvements in the 1950s-1960s enabled wider territorial dispersion, liberating the industry from its dependence on rail and river infrastructure.

These patterns empirically demonstrate how urban and infrastructural conditions directly impacted industrial location strategies. The mapping also contextualised cast iron works scattered throughout the city, making it possible to attribute authorship to pieces whose foundry marks are incomplete, showing only initials for example, and consequently to define production chronologies.

Conclusion

This project demonstrates how free digital tools can produce sophisticated, scientifically robust research resources, democratising access to spatial humanities methodologies. Google MyMaps proved effective for creating interactive reference maps, excelling in accessibility, ease of use, customisation capabilities and collaborative potential.

Main strengths identified include: no requirement for advanced GIS technical knowledge; intuitive interface facilitating sharing and public consultation; data exportation possibilities for complementary analyses; and flexibility in customising information cards. Limitations, namely the ten-layer restriction and inability to integrate historical cartography as base layer, were mitigated through creative solutions: creating a general aggregating layer, using historical cartography in post-editing for location validation, and producing complementary resources such as an animated GIF that enhances the tool's educational dimension.

From a historiographical perspective, the mapping identified spatial and temporal patterns directly correlating industrial location with urban transport infrastructure evolution, offering empirical visualisation of Porto's industrialisation dynamics. The tool serves both research purposes, such as contextualising works, identifying authorships and analysing business networks, and scientific dissemination, constituting an accessible resource for teaching industrial and urban history.

This communication problematizes the use of free geospatial technologies in digital humanities contexts, exploring both their potential and the methodological challenges they pose, and demonstrating that quality research in digital humanities does not necessarily require investment in proprietary software or complex technological infrastructures.

Keywords: Digital Mapping; Industrial Heritage; Cast Iron Foundries; Porto, Portugal; Free Digital Tools

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SESSION 16

Too Big to Ignore: UAV, GIS, and Preventive Archaeology of Salento's Specchie

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Background

Stone-built tumuli known as specchie represent one of the most distinctive yet least understood features of the archaeological landscape of the Salento peninsula (southern Apulia, Italy). These large stone accumulations - sometimes exceeding 40 m in diameter—have been variously interpreted as Bronze Age funerary monuments, Hellenistic or medieval watchtowers, or multi-phase structures reused and transformed over long periods. Despite their prominence in the landscape, the chronology, function, and spatial organization of specchie remain debated, largely due to the limited number of systematic excavations and the incomplete documentation of many examples.

Today, these monuments are increasingly endangered. Agricultural intensification, land reorganization, and stone removal are leading to the partial or total destruction of numerous specchie, often without prior archaeological investigation. In this context, the rapid mapping and assessment of these features has become an urgent task, not only for research purposes but also for cultural heritage protection and spatial planning.

Methods

This paper presents an integrated geospatial methodology combining UAV-based photogrammetry, GIS spatial analysis, mobile mapping, and field survey to document specchie within a preventive archaeology framework (Valutazione Preventiva dell'Interesse Archeologico, VPIA). The study is based on a case study conducted in southern Salento, where preventive

archaeological investigations were required in advance of planned land-use transformations.

The research area includes a large, well-known specchia documented in the bibliography, as well as a surrounding landscape previously considered archaeologically marginal. Through the combined use of high-resolution UAV imagery and systematic field verification, the project identified a previously undocumented concentration of smaller specchie, associated with surface scatters of archaeological material. These features had largely escaped detection due to their low visibility at ground level and the absence of detailed spatial documentation.

Methodologically, the project adopted a multi-scalar approach. UAV photogrammetry was used to produce orthophotos and digital elevation models capable of capturing subtle topographic variations. These datasets were integrated within a GIS environment together with historical cartography, bibliographic data, and field observations. To enhance the detection of stone-built features, index-based analyses—including variations of Excess Green (ExG) and brightness indices—were applied to isolate lithic concentrations from vegetation and soil backgrounds. Remote sensing results were systematically validated through targeted field survey, supported by mobile GIS applications to ensure accurate georeferencing and rapid data collection.

Results

The results demonstrate the effectiveness of combining drone-based remote sensing with traditional archaeological survey and low-cost digital tools. The integrated workflow enabled the precise mapping of known specchie, the identification of previously unknown features, and the reconstruction of their spatial distribution, suggesting a more articulated and dense monumental landscape than previously recognized.

Conclusion

Beyond the specific case study, this research highlights the broader potential of geospatial technologies applied to the humanities. Within the VPIA framework, the results directly informed proposals for conservation and management, showing how integrated digital approaches can support archaeological interpretation while contributing to heritage protection and planning policies. The study proposes a replicable model for documenting fragile archaeological landscapes characterized by long-term stratification and interpretative ambiguity, at a moment when many of these monuments risk disappearing from both the landscape and collective memory.

Keywords: UAV photogrammetry, UAV photogrammetry, Cultural heritage protection

Counter-Cartographies of the Pauliceia: Deep and Community-Based Mapping of the History of São Paulo

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2.0 digital historical cartographic platform of São Paulo city. Pauliceia 2.0 covers the period of São Paulo's urban and industrial modernization (1870-1940). The back-end database is linked to an interface to allow interaction among interested researchers with the opportunity to feed the database with events that can be spatially represented. This interaction enables researchers to produce maps and visualizations of their own research while providing data to all users. This project can enrich approaches to analyze the past while using new digital humanities technologies and open science to foster collaborative work and free knowledge flow.

The first phase of the project, focusing on a pilot area corresponding to São Paulo's city center, was carried out from February 2017 to January 2019. After this, a second phase aimed to promote the technological maturation of the platform, which included resolving operational issues and updating several of its libraries. The third phase, which aligns with the text now being presented, foresees the engagement of communities and collectives that have their own documentary collections related to the city's history, so that they can produce spatial representations of the topics relevant to them and the corresponding creation of layers on the platform. The identification and coordination of this target audience will be carried out through an established partnership with the São Paulo Municipal Historical Archive. The theoretical-methodological basis of the project in this phase is governed by the so-called deep mapping, focused on the spatial reinterpretations of history through collaborative, cumulative, integrative, and open cartographies.

Methods

In the period that is now beginning, the project team's priority will be to engage groups and collectives that hold their own historical collections, from a perspective aimed at the production of deep mapping. At the same time, the activities and objectives of the second phase do not cease, since it is precisely the intensification of the platform's use by its target audience that will provide the project team with information about operational problems and possibilities for improving the tool. The decision to launch the third phase rests on two perceptions: first, that the platform has reached a level of technological maturity that allows this "exogenous movement"; and second, that new levels of improvement and significant technological gains will only be made possible through the intensification of the platform's use by segments of its target audience.

Based on the documentary collections of the collectives and of the Municipal Historical Archive itself, layers will be created on the Pauliceia 2.0 platform. In addition to the cartographies produced, the project also foresees the consolidation of a methodological manual for community-based historical mapping and the creation of a Permanent Forum of Memory Collectives, both initiatives designed to ensure continuity and institutional stability for the project's results. The intended

Background

The project focuses on the final development of the Pauliceia

goal is to enrich the history of the city with perspectives that are characteristically neglected or marginalized, and that are not adequately reflected in official cartographies and in more traditional academic production.

Results

Since 30 October 2018, when the site was launched on the internet, 147 layers have been created and 9,952 users have accessed the platform, according to Google Analytics data. In addition, the platform has been used in several undergraduate and graduate courses in Brazil and abroad, and has supported various scientific research projects and academic works.

With regard to the current phase of the project, focused on deep mapping and community engagement, the project team was selected in a highly competitive international call for training in deep mapping at the NEH Community Deep Mapping Institute. Ten members of the group received remote training and consultancy throughout 2025, and three participated in an in-person phase at Michigan Technological University. In addition, partnerships were established with two memory collectives in the city, Ururay and Bom Retiro é o Mundo, dedicated to the history of two important neighborhoods of São Paulo. In the second half of 2025, training workshops in geotechnologies, bibliographic discussion sessions, and walking tours were held in the respective neighborhoods. In December 2025, an important research grant was announced by a funding agency (FAPESP), which will enable the project to be carried out under conditions of excellence over the next 40 months.

Conclusion

The central originality of the research presented lies in its commitment to collaborative work and open science as strategies for democratizing the production and circulation of scientific knowledge. Moreover, the project assumes as a premise that research on the history of the city of São Paulo can be significantly stimulated through its spatialization, broad availability, and mutual comparison, all within a single computational environment. The project's ultimate goal is to create conditions for the affirmation of new perspectives in the study of São Paulo's history through the integration of different research efforts in a digital platform made available on the internet and organized around space as its guiding principle. The use of GIS in historical research has, in itself, been associated with the possibility of analytical gains and new approaches. The articulation of GIS with open science, digital humanities, and deep mapping represents a field still little explored by historians, and the project seeks to help overcome this gap.

Keywords: Historical GIS; Public History; Digital History; Open Science; Deep Mapping.

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Acknowledgements

Arquivo Histórico Municipal de São Paulo; Arquivo Público do Estado de São Paulo; Bom Retiro é o Mundo; Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq; Emory University; Fundação de Amparo à Pesquisa do Estado de São Paulo – FAPESP; Grupo de Pesquisas Hímaco; Instituto Nacional de Pesquisas Espaciais; Instituto Tecnológico da Aeronáutica; NEH Community Deep Mapping Institute directors, instructors, staff and fellows; Pontifícia Universidade Católica de Campinas; Texas University at Austin; Universidade de São Paulo; Universidade Federal de São Paulo; Ururay

Mapping the "Illegal City": Methodological Strategies for Overcoming Spatial Invisibility in Historical GIS (São Paulo, 1920-1940)

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Background

This research is developed within the framework of the Pauliceia 2.0 project, a collaborative Historical GIS (HGIS) platform designed to map the urban transformation of São Paulo between 1870 and 1940. While the platform has successfully integrated vast amounts of "official" historical data, primarily sourced from municipal administrative records such as the Street Numbering Record (house numbering update logs), it faces a significant challenge common to digital humanities: the reproduction of historical biases through data silence. The core problem addressed here is the spatial invisibility of the so-called "illegal city" within digital mapping environments.

Drawing on the theoretical framework of Raquel Rolnik (1997), this study argues that the urban modernization of São Paulo

was not a neutral process but one governed by a dualistic legislative structure. Urban laws, such as the Arthur Saboya Code (1929), functioned as mechanisms of exclusion. By establishing strict technical standards for street widths, sanitation, and infrastructure, the State effectively defined what constituted the "official city." Areas that did not meet these standards, predominantly working-class peripheries and irregular allotments, were deliberately left in a legal and administrative vacuum. As Rolnik posits, this "illegality" was a state-produced condition that allowed the government to withhold public improvements from peripheral zones, reserving investments for the "legal" urban core.

In terms of historical documentation, the *Livros de Emplacamento* served as the primary tool for the municipality to organize and recognize the urban fabric by assigning official house numbers. However, because the State refused to recognize irregular allotments, these territories were often omitted from these registers. In HGIS projects, this results in "blank spaces" on the digital map that do not correspond to a lack of occupation, but to a lack of official legibility. This research focuses on the district of Lapa (1920-1940), a strategic industrial and railway hub, to demonstrate how these "illegal" areas can be reconstructed and integrated into the digital urban memory of São Paulo.

Methods

1- Cartographic "Ground Truth" (SARA 1930): We utilize the SARA Brasil 1930 aerophotogrammetric survey. Unlike thematic maps produced for administrative recognition, the SARA 1930 provides a high-resolution snapshot of the physical reality of the city, capturing buildings, alleys, and streets that were labeled as "n.o." (non-official) by the City Hall. This allows us to vectorize the "illegal" urban fabric that the house numbering logs ignored.

2- Relative Geolocation and the Metric System: The research is based on the "American system" of metric numbering introduced in São Paulo in 1929, where house numbers correspond to the exact distance in meters from the start of the street. While geocoding for official streets is direct—following the standard already consolidated in the Pauliceia 2.0 geolocator—unofficial areas present a chronological and documentary challenge. As the administrative regulation of many of these streets and their respective Street Numbering Record date mostly from the 1960s, the new methodology proposes the triangulation of diverse sources to reconstruct the numbering history. This process allows for understanding the metrics expressed in late records and applying them retroactively, ensuring spatial accuracy for the 1920-1940 period.

3- Data Architecture in Pauliceia 2.0: The technological infrastructure is based on open-source tools (QGIS, PostGIS, and GeoServer) to structure a spatio-temporal database that systematizes the road network. The main technical innovation consists of developing a geolocator

capable of processing address strings absent from official historical databases. The system uses the "illegal city" routes, vectorized from high-precision cartography, as a spatial reference layer, enabling the integration and geocoding of data from peripheral areas.

Results

This research is currently in progress, supported by a Master's scholarship from the São Paulo Research Foundation (FAPESP). Preliminary results in the Lapa district reveal a stark contrast between two urban models. On one hand, the "City Beautiful" ideals are present in the *Alto da Lapa* neighborhood, an official development by the *City of São Paulo Improvements and Freehold Land Company* from the 1920s, where every street and house is recorded in the *Livros de Emplacamento*. On the other hand, areas such as *Vila Ipojuca* and *Vila Argentina* reveal "illegal" occupations from the same period that only received municipal recognition in the 1960s.

The vectorization of the Lapa district shows that more than 30% of the street network in peripheral blocks was classified as "non-official" during the 1930s. By cross-referencing these maps with official numbering records, we identified "invisible houses"—buildings that appear clearly in the 1930 aerial photograph base map (SARA Brasil) but have no corresponding entry in the municipal registers. The project is developing a "Protocol for Peripheral Inclusion," which will serve as a technical model for the Pauliceia 2.0 platform to map other peripheral districts of São Paulo, ensuring that the city's digital history is not limited only to state-sanctioned spaces.

Conclusion

Mapping the "illegal city" is more than a technical challenge; it is a commitment to Public History and social justice in the digital age. By integrating Rolnik's critique of urban law into HGIS practices, this project challenges the notion that historical GIS must be limited by the archival gaps left by the State's administrative biases.

The methodological advancements proposed here allow for a more democratic representation of São Paulo's history, revealing the agency of the working class and the territorial dynamics of groups historically marginalized from official urban planning. As the research continues under FAPESP funding, the next phase will involve finalizing the geolocator's capacity to handle "unofficial" address strings, ensuring that the Pauliceia 2.0 platform serves as a truly inclusive tool for understanding the complexities of the Latin American metropolis. This work contributes to the Spatial Humanities by showing how geotechnologies can be used not just to replicate the archive, but to subvert its omissions.

Keywords: Historical GIS; Illegal City; Lapa; Urban Legislation; Public History.

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Acknowledgements

The author acknowledges the support of the São Paulo Research Foundation (FAPESP) for the Master's scholarship No. 2025/04821-6 and the Himaco Research Group (History, Maps, and Computers) at the Federal University of São Paulo (UNIFESP).

SESSION 17

Enhancing spatial-temporal representation and knowledge in the Architecture curriculum

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This article presents the teaching experience of the course 'Seminar on Digital Models in Architecture and Cultural Heritage Research: GIS and Graphs', within the framework of the Training Activities of the Doctorate Programme in Architecture at the University of Seville, which has been taught for the last four years. The document details the structure of the content taught, the learning methodology used in the Geographic Information Systems (GIS) module, and the results achieved. Finally, the conclusions are presented, discussing the analysis of the results achieved and the feedback from the students over the four years. The main objective of the article is to disseminate the method, highlight the importance of the GIS tool both in the professional field and in research careers in the field of architecture, and set out future lines of teaching innovation.

Background

Workshops, courses, and summer/winter schools are commonly used course formats in GIS teaching. However,

the incorporation of subjects or regular courses offered and/or integrated within the Humanities branch is still limited (Oliveri, 2024). In the specific case of the Degree in Architecture, of the 18 public universities in Spain that offer it, few incorporate GIS learning as a formal subject (Castellano et al, 2018). At the ETSA of the University of Las Palmas de Gran Canaria, the subject of 'Topography and GIS' is offered in the first year, in this case with a more technical focus, without addressing issues from the field of humanities. At the ETSA of the University of Seville, two optional subjects address GIS: Modelling and Data Analysis with Geographic Information Systems in Architecture, which focuses on technical aspects, and Advanced BIM and GIS Modelling, which explores GIS applications in cultural heritage studies. In this sense, the course offered attempts to fill this training gap, opening up its training to both doctoral students and teachers affiliated with any university, training centre, or administration.

Methods

The course consists of two blocks across four sessions: two on Graphs and two on GIS. It follows a project-based approach, combining comparative activities and practical exercises with real-world cases. Both blocks follow a methodological approach based on teacher-student interaction, incorporating experiences and case studies shared by the students. Regarding the GIS, the starting point is the idea that it is already deeply integrated into everyday life. Therefore, the aim is to foster students' awareness of the potential of GIS, making its learning process and integration into the Humanities more accessible. Similarly, emphasis is placed on the easy access and use of open data, as well as its creation and dissemination. In terms of resources, teaching relies on open-source software such as Quantum GIS, as well as applications based on cloud services. Additionally, the use of peripheral devices is encouraged through free applications installed on mobile phones and tablets, expanding the possibilities for work in ubiquitous environments. Furthermore, access to Spatial Data Infrastructures from public administrations is proposed, enabling the download of geographic information, essential for spatial analysis and representation.

As for the content of the GIS module, it is organized into two thematic blocks. The first block begins by contextualizing the use of GIS in the field of Cultural Heritage, presenting case studies, and then defining the structure and components of GIS, explaining the types of cartographic files, and providing guidelines for obtaining open-access data. The second block starts by outlining the basics of using the software, such as interacting with the interface, loading and visualizing graphic bases, importing files, etc. This block also covers core GIS operations: spatial analysis, geoprocessing actions, georeferencing of old maps, etc.

The applied project-based methodology, the practical nature

of the course, and the student profile make it possible for each proposed exercise to be developed into individual case studies. These are later shared collectively by merging the generated files, fostering a comprehensive understanding of the course and collective debate through cartographic viewers.

Results

Firstly, it is worth highlighting the positive feedback of the course both among the doctoral student community and the faculty members. This is evidenced by the number of participants enrolled in the four editions, with a total of 118 people, of which 67.8% are doctoral students and 32.2% are faculty members. Furthermore, the teaching materials developed and provided by the instructors, which are openly accessible (Ferreira-Lopes, 2025) and (Moya, 2025), serve both as a support guide during the course and as reference material that facilitates the continuation of learning, allowing students to implement what they have learned either in their research or in the faculty's teaching programs. Finally, regarding complementarity with the Graphs block, both the working dynamics and the possibility of sharing case studies with the GIS block foster interaction between the different parts of the course and provide consistency to the learning process.

Conclusion

Teaching GIS through this course offers a significant learning opportunity for the university community, particularly by opening new horizons in both research and the development of innovative teaching strategies. The editions held so far demonstrate that students successfully assimilate theoretical concepts, despite the initial complexity arising from technical terminology, and acquire the expected competencies in handling GIS tools, as reflected in the correct execution of the exercises proposed in class.

However, for future editions, it is considered necessary to rethink the duration of the course, especially regarding the block dedicated to GIS. Extending the course would allow for more structured practical exercises and the incorporation of new methodological approaches, such as fieldwork outside the classroom or additional GIS-related activities not yet explored in previous editions. Likewise, since the course is organized as a seminar, the exercises carried out are supervised but not graded, which means that it is not possible to formally assess the competencies acquired by the students.

In conclusion, the experience of these four years has been highly positive. Learning GIS from a humanistic perspective is essential in the field of Architecture, providing students with multidisciplinary approaches that are later applied to their research projects.

Keywords: spatial humanities; teaching GIS; architecture; cultural heritage representation; graphic representation

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Acknowledgements

The authors would like to thank the Competitive Research Programme Ramón y Cajal (grant no RYC2022-036213-I), funded by MCIU/AEI/10.13039/501100011033 and FSE+, as well as the Project INTHE DATA (grant no 2024/00000551) funded by the Seventh University of Seville Research and Transfer Plan.

Using AI services to create short videos from historical sports photos

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Many organisations involved in sports—such as clubs, associations, federations, and media outlets—maintain extensive photo archives documenting key sporting moments. These repositories often serve as valuable historical records, capturing iconic events, athletes, teams and milestones. However, these organisations typically possess fewer historical videos, as video cameras were significantly less accessible than still cameras, especially during the first half of the 20th century. This disparity is particularly noticeable in smaller cities or less-developed countries, where videographic archives are much scarcer than photographic collections. As a result, the historical record of many sporting events remains limited to still images, with fewer motion-based representations.

To address this limitation, this manuscript details and assesses our approach to transforming historical black-and-white sports photos into short videos. This process aims to breathe new life into still images by reconstructing dynamic motion, offering a more immersive way to experience the past.

Methods

The process of creating short videos from black-and-white sports photos involves two major steps:

1. Colourisation: The first step is to colourise the historical photo, bringing additional context and realism to the image. This is achieved using advanced AI-driven web services, such as Grok and Nano Banana, which analyse the grayscale image and apply colour based on a prompt, learned patterns and contextual understanding. In some cases, the coloured photo was edited to retouch some details.
2. Video Creation: Once the photo has been colourised, the next step is to create a short video. This involves animating the still image by generating motion sequences or interpolating frames to simulate movement, resulting in a video that offers a dynamic representation of the original moment. Again, AI services, like Gemini, PixVerse, and Pippit, play a crucial role in this step, enabling the smooth generation of fluid motion from a single still image.

These two steps depend essentially on the provided photo and on a prompt (i.e., a short text) that indicates to the AI service the aim of the user in creating the video. By combining these techniques, new way to preserve/experience the past and to create new realistic contents is available.

Results

To evaluate our method, we created short videos from historical photographs of Sporting Clube de Braga, a sports club officially inaugurated in 1921 in Braga, Portugal [1, 2]. We selected photos of particular significance in the club history and applied the two-step process to generate around 50 short videos (around 6 to 8 seconds). This procedure was repeated for every photograph until a result was obtained that was both sufficiently realistic and aligned with the intended objectives. The best video segments (39 in total) were used to create a 7-minute video (<https://youtu.be/M7ovKEfAt3U>) with moments of

the history of SC Braga.

During this experiment, we encountered the following seven major challenges.

1. Prompt issues – Working with historical photographs requires precise control over visual details, making prompt accuracy essential. A frequent issue was the AI ignoring user prompts.
2. Ethical limits – Some photographs include minors, such as children of players or young spectators. AI services often block these images due to strict safety policies, preventing enhancement or video generation.
3. Cultural bias – The generated videos often reflect English-speaking contexts. Architectural styles, signage, and other details may look out of place for the intended audience.
4. Colour errors – Uniforms and other materials, like flags, are essential for authenticity. AI often miscolours them, e.g., rendering Liverpool FC's red kit as green or blue, which feels inaccurate or disrespectful.
5. Face distortion – Athletes' facial features are important for recognition. AI often alters them, producing depictions that no longer resemble the real individuals.
6. Speed errors – Video speed can be unrealistic. For instance, football players sometimes move too fast or too slow compared with real match play.
7. Physics flaws – AI videos may show impossible things, like a one-wheeled bicycle, distorted bodies, or a ball moving backward. The AI doesn't understand football rules or physics, causing "hallucinations," such as defenders hugging strikers who just scored.

Beyond the technical limitations and visual inaccuracies that still characterise AI-generated videos, the main issue with the use of artificially created content for, in this case, historical reconstruction, lies in the fact that it lacks a human perspective. Historical reconstruction, while it should strive to be generally unbiased and objective, should be done with understanding of the context of the period or event in question, which the AI is currently incapable of. The technical flaws and errors in the video can, in time, be fixed with more

advanced and powerful AI models, but the human input which characterises all artistic medium cannot be replicated artificially. While unsuited as a final product, AI-generated content can be a useful tool for human creators in conceptualisation and technical support. The AI can quickly generate drafts of segments or the final project or help with the repetitive aspects of media creation. This way it can help facilitate the creative process but leaving the meaningful decisions to the human artist.

Conclusion

Automated pipelines are currently insufficient for high-fidelity historical reconstruction. As observed during our experiences, generative AI models frequently introduce anachronistic details or failed to correct specific features solely through text prompts. For instance, the AI often struggled to accurately reproduce the correct acronyms on the SC Braga kits or misinterpreted architectural details of the stadium stands. To mitigate this, we were compelled to adopt a hybrid workflow. This involved exporting the AI-generated photos, performing manual corrections using external image editing software to fix logos, kit colours, and structural elements, and then feed these corrected images into the video generation model. This confirms that while AI can handle the heavy lifting of animation, human intervention remains mandatory to ensure semantic and historical accuracy.

Despite these limitations, the technology proves highly effective for “atmospheric” preservation. While it may not yet be reliable for reconstructing a specific goal scored in 1921 due to physics and semantic errors, it excels at revitalizing static portraits and crowd scenes. This capacity to “breathe life” into archival footage offers museums and clubs a powerful tool for engagement, provided that the content is curated to avoid misleading historical representations.

Keywords: Sports, Artificial Intelligence, Photos, Videos

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Innovation in education implies the adoption of new practices based on new methods and resources that improve learning, aiming at the integral development of the student. In teacher training, innovation gains added relevance due to its disseminating effect. The introduction of innovative methodologies and resources in the training path of future teachers of the 1st and 2nd cycles of Basic Education, enabling them, as higher education students, to learn and co-construct knowledge in an active and participatory way, allows them to create a space for experimentation. This learning by doing empowers future teachers to appropriate methodologies and resources that they may later use in their teaching activity with their students. The recognition of these assumptions justified the collaboration of three teachers from different scientific areas – Natural Sciences, Geography, and History – to articulate knowledge, methodologies, and resources to construct an interdisciplinary learning path in teacher training at the undergraduate level in Basic Education and in professional master's programs (Ribeiro, Monteiro, & Quinta e Costa, 2017; Ribeiro, Monteiro, & Quinta e Costa, 2021), using geospatial tools. Story Map proved to be one of the structuring pillars of this path, allowing students not only to use, handle, and understand the tools available in this type of software but also to develop research skills, information organization, and critical reflection on geographic data, contextualized within a broad field of analysis, crossing Natural Sciences, Geography, and History.

This reflective analysis of the introduction of Story Map into the training path of students, from the Bachelor's degree in Basic Education to professional master's degrees in teaching in the 1st and 2nd cycles of basic education, seeks to understand how these future teachers have appropriated this tool in the construction and organization of knowledge and the possibility of integrating it into their future teaching practice.

This study considered distinct moments in the students' training path – the 1st and 3rd years of the Bachelor's degree in Basic Education; the 1st and 2nd years of the three master's degrees they chose for their professionalization – Master's in Preschool Education and Teaching in the 1st Cycle of Basic Education, Master's in Teaching in the 1st Cycle of Basic Education and Teaching of Portuguese, History and Geography in the 2nd Cycle of Basic Education, and Master's in Teaching in the 1st Cycle of Basic Education and Teaching of Mathematics and Natural Sciences in the 2nd Cycle of Basic Education.

In the first year of the Bachelor's degree, in the Geography

The Story Map in the training path of teachers of the 1st and 2nd cycles of basic education

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course, students were introduced to Story Map for an initial exploration. In the third year, in the Didactics of Social and Natural Sciences course, students used Story Map to present the results of research conducted within the framework of the CienTE teaching and learning methodology, developed from the creation of a biography of a prominent figure in the national scientific community, contextualizing it historically, geographically, and scientifically (Monteiro, Quinta e Costa, & Ribeiro, 2019; Quinta e Costa, Monteiro, & Ribeiro, 2025). By combining interactive maps, multimedia content, and text in an interdisciplinary approach, students were able to explore the potential of Story Map in organizing information and in presenting and articulating different areas of knowledge. It is with this knowledge base of Geographic Information Systems (GIS), and especially Story Map, that students enter master's programs to pursue their professional development. In the first year of the Master's program, as part of a teaching methodology course for the first cycle of basic education, students use Story Map to present and plan a teaching sequence on a given topic, with the mandatory construction of three technological resources. Also, in the first year of the Master's program, in a teaching-related course, students identify the statuary and toponymy of a specific urban space using a Story Map with ArcGIS software, a technology that allows them to build a digital map and develop skills in geolocation. Finally, in their second year, during their Supervised Internship, these students use Story Map as a pedagogical resource in the classes they teach to students in the second cycle of basic education.

The project began with the introduction of Story Map in the first year of the undergraduate program. Initially, it was decided not to make the use of GIS mandatory in the third year, and only approximately 25% of the students used it. Subsequently, it was decided to make its application mandatory, with students choosing different levels of complexity in the use of the technology, from maps from other sources, as a more basic cartographic representation tool, to the implementation of a GIS using ArcGIS software, creating Story Maps with dynamic maps. The deepening of students' skills in constructing Story Maps within the scope of academic work became evident throughout their training. The Story Map tool, introduced in the initial teacher training, was experienced and understood by the students, allowing them to perceive its potential and recognize its relevance as a pedagogical resource for students in the first and second cycles of basic education.

Keywords: Teacher training; GIS; Story Map; Pedagogical innovation.

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SESSION 18

Artificial Intelligence Meets Historical Cartography: Modelling Urban Blue-Green Infrastructure for Climate Adaptation

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Background

Spatial and environmental inequalities in Spanish cities have gained prominence amid climate crisis, urban pressure, and territorial transformation. Blue-Green Infrastructure (BGI)—including rivers, parks, wetlands, and ecological corridors—emerges as a key element for public health, quality of life, and urban equity. Unlike traditional grey infrastructure, BGI provides nature-based solutions that mitigate urban heat islands, reduce flood risk, improve air quality, and foster biodiversity. These systems deliver multiple ecosystem services while promoting social cohesion and healthier lifestyles.

Historically, Spanish cities faced severe challenges in water management and sanitation, which shaped their urban development from the 19th century onward. Early interventions focused on hygienic reforms and flood control, but lacked integrated strategies for ecological resilience. The concept of BGI gained traction in the late 20th century, influenced by global environmental movements and European

directives promoting sustainable urban planning. Today, projects such as Madrid Río, Jardín del Turia in Valencia, and Bilbao's Green Belt exemplify efforts to reconnect cities with natural systems. However, the adoption of BGI in Spain remains uneven, and its long-term impact on resilience, equity, and climate adaptation is still poorly understood.

This research addresses that gap by combining historical cartography, spatial analysis, and explainable artificial intelligence (XAI) to examine how BGI transformations relate to public health, territorial equity, and climate adaptation. Through an interdisciplinary approach, we aim to reconstruct the evolution of BGI from the 19th century to the present, identify key milestones in urban planning, and model future scenarios using an urban digital twin. This tool integrates historical, geospatial, and sociodemographic data with predictive simulations, enabling participatory processes and evidence-based policy design for sustainable and inclusive cities.

Methods

We analyze BGI changes from the 19th century to the present using historical maps (urban plans, cadastral records, aerial photos) and modern GIS layers. Comparative mapping visualizes territorial and environmental transformations. Key milestones—sanitation works, park creation, river restoration, sustainability policies—are identified and linked to health and resilience indicators. An urban digital twin integrates historical, geospatial, and sociodemographic data with predictive simulations using XAI models. Case studies include Madrid (Madrid Río), Valencia (Jardín del Turia), and Bilbao (Anillo Verde).

Results

Preliminary findings underscore the critical role of Blue-Green Infrastructure (BGI) in mitigating climate change, promoting equitable access to green spaces, and fostering social cohesion. Comparative maps reveal patterns of expansion and contraction, historical trajectories, and socio-environmental implications across Spanish cities. Case studies illustrate contrasting dynamics: Madrid Río exemplifies nature integration within a metropolitan context, while Bilbao showcases post-industrial regeneration through the Nervión river and green belt consolidation. Valencia adds a distinctive example of river restoration for urban livability. Together, these insights highlight how BGI transformations shape resilience and environmental justice in urban planning.

Conclusion

This research delivers an interactive digital atlas documenting BGI evolution and projecting future scenarios. This transferable model supports sustainable urban policies, strengthens climate resilience, and ensures equitable ecosystem services across Spanish and European cities.

Keywords: Blue-Green Infrastructure; Urban Resilience; Explainable AI; Historical GIS; Climate Adaptation

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Acknowledgements

Funding project research by Ramón Areces

**From Historical Maps to 3D Models:
Leveraging Digital and Geospatial Tools with
Elevation Data**

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Background

Three-dimensional (3D) modeling of historical maps has emerged as a powerful method for understanding the spatial, cultural, and social transformations of past landscapes. By converting static two-dimensional (2D) historical maps into interactive 3D visualizations, researchers can explore historical urban morphologies, topographic changes, and patterns of land use with unprecedented clarity. Historical maps, however, often contain distortions, inconsistencies, or artistic representations rather than precise measurements, making their digital reconstruction a complex task. This work presents a comprehensive 3D modeling workflow that integrates heterogeneous historical cartographic sources with contemporary geographic data to produce accurate and immersive historical reconstructions, supporting both academic research and public engagement. The workflow is built entirely on open-source software and publicly available data, ensuring transparency, accessibility, and reproducibility.

Methods

The proposed workflow, inspired by Flynn (2019), combines tools and techniques from geoinformatics, digital cartography, and 3D modeling. The process begins with a step-by-step evaluation of historical maps to assess their usability and georeferencability. This includes examining coordinates, orientation points, and key landmarks to identify suitable material, while excluding maps with severe distortions, low-resolution scans, inaccurate historical features, or purely schematic representations. This is followed by the georeferencing of digitized historical maps in QGIS, using identifiable points matched with OpenStreetMap data via the QuickOSM plugin, aligning them with modern coordinate systems to ensure spatial consistency. Additional tools, such as the OSM Place Search plugin, assist in locating historical features whose positions may have shifted over time. Typically, 15–25 reference points are selected at map edges and in key areas to maximize accuracy.

The georeferenced maps are enriched with 30-meter SRTM elevation data from NASA Earthdata, providing an accurate digital elevation baseline. Elevation data are merged into a unified heightmap to ensure consistent terrain representation, while image-editing tools such as GIMP are used to refine and crop the maps, preserving legends and other critical features in preparation for 3D processing.

Subsequently, the height information is applied as a heightmap in Blender, generating a realistic terrain model that reflects the topographic characteristics of the historical landscape. The resulting 3D model is polygon-reduced and optimized to balance visual fidelity with computational performance, using Blender's Displacement and Decimate

modifiers to adjust geometry according to the heightmap, while normal shading smooths the surface. It is subsequently exported in OBJ, FBX, and GLTF formats to ensure interoperability across visualization platforms such as Europeana, and Sketchfab.

The visualization and testing of the resulting models were conducted using the DFG 3D Viewer through the 3D Repository of Hochschule Mainz. This platform allows users to explore and interact with 3D reconstructions directly in a browser environment, facilitating accessibility and collaborative analysis without the need for specialized software.

Results

The workflow produced historically coherent and technically optimized 3D models that successfully represent the topographic and morphological characteristics of the selected study area. The integration of SRTM elevation data with georeferenced historical maps significantly reduced distortion and enhanced the realism of terrain reconstruction. The use of open-source tools ensured methodological transparency and reproducibility, while the export flexibility facilitated deployment across research, educational, and exhibition contexts.

The evaluation of the proposed workflow was conducted in an exploratory manner, with a primary focus on verifying its technical functionality and the consistency of the results. The quality was assessed through visual inspection and comparison with known references, allowing for an examination of how well spatial and structural elements were preserved or plausibly reconstructed in the 3D model. In addition, preliminary impressions from users with experience in spatial humanities were taken into account, but only in the form of beta testing and not through a systematic evaluation process. While this approach provides useful initial insights into the performance of the method, it remains largely qualitative and indicative rather than definitive. It shows that the workflow can produce coherent outputs, but more structured testing is needed to confirm its reliability, accuracy, and wider applicability.

Testing through the DFG 3D Viewer further demonstrated the potential of the platform for presenting and evaluating digital reconstructions. The viewer enabled smooth navigation, interactive scaling, and rotation of the models, making it easier for researchers and stakeholders to assess the spatial characteristics of the reconstructed landscape. For example, a 3D reconstruction of the historical landscape covering the Dresden and Prague regions (1835), created following the workflow presented here, based on a 2D map by Wörl (1835) and enhanced with georeferencing and elevation data, is available online (Siqueira & Bottmeyer, 2025). The Dresden–Prague example highlights the successful application of the workflow to real historical maps, providing a high-fidelity, explorable reconstruction that supports both research and public engagement.

Moreover, the workflow's modular structure allows for adaptation to different historical contexts, datasets, and time periods, offering a scalable and flexible framework for future projects in digital heritage and spatial humanities.

Conclusion

This study demonstrates that the combination of historical cartography and modern 3D modeling techniques can yield scientifically robust and visually engaging reconstructions of historical landscapes. The proposed workflow bridges the gap between archival materials and contemporary geospatial technologies, enhancing the interpretative value of historical maps. By integrating open-source GIS tools, elevation datasets, 3D modeling software, and web-based visualization through the DFG 3D Viewer, it provides a reproducible and accessible framework for researchers, educators, and heritage institutions.

Beyond its technical contribution, the workflow promotes new ways of experiencing and communicating history, transforming static maps into dynamic, explorable 3D objects. Much of the process remains highly manual and involves significant artistic interpretation to achieve visual coherence and historical plausibility. Future developments will aim to automate portions of this workflow by leveraging emerging machine learning models such as Google Nano Banana, which have the potential to accelerate reconstruction while preserving the interpretative richness of human-guided modeling.

Keywords: 3D modeling; historical maps; digital heritage; GIS; web-based visualization

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Radical Counter-Policy: Roots of Participation in National Film Board Interactive Cinema

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Abstract

Karl Marx locates radicality in the work of grasping roots, a task that directs attention to the conditions that make action durable (Marx, 1843). This presentation applies that orientation to interactive and immersive cinema hosted by public institutions, where participation takes procedural form through protocols of choice, trace, and credit. The paper advances counter-policy as a film-philosophy concept that names root-level institutional design work enacted inside media experiences: interface rules, attribution structures, evidentiary cues, and accountability signals that organize how participants encounter responsibility. The presentation defines the Canadian aporetic condition as a durable field of governance tensions that structure political belonging in Canada and remain active across law, policy, and public culture (Bessai, 2025). This analytic lens clarifies how institutional legitimacy persists alongside unresolved pressures that touch sovereignty, colonial dispossession, multicultural recognition, racialized hierarchy, environmental responsibility, and extractive political economy. The paper draws on sociotechnical imaginaries to treat interface arrangements as publicly legible world-making that links aesthetic experience with civic expectation (Jasanoff & Kim, 2009).

Two case studies anchor the argument. Biidaaban: First Light (VR) situates viewers within an Indigenous futurist Toronto and centers Wendat, Mohawk, and Anishinaabe languages. The experience organizes attention through voice, soundscape, translation, and credited roles that present language work as an institutional obligation and a public-facing form of recognition (National Film Board of Canada, 2018). Bear 71, launched as a web documentary and later reimaged as WebVR, stages wildlife monitoring as civic sensing through designed dwell time, scalar navigation, and trace overlays that keep evidentiary practices visible to participants (National Film Board of Canada, 2016). The presentation contributes to debates on radical media by specifying how radicality appears within apparatus and infrastructure as counter-policy. Counter-policy clarifies how interactive cinema can carry obligations across time through

inspectable traces, attributed labour, and documented procedures. Survival enters the analysis as practice inside media systems: attentive witnessing, language continuity, and accountability that participants can recognize and test within the experience.

Keywords: Radicality; Counter-policy; Interactive documentary; Sociotechnical imaginaries; Canadian aporetic condition

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SESSION 13 - POSTERS

Students' perception about GIS and Augmented reality to teach physical Geography

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Background

Technological developments are continuously shaping society (Ribeiro, 2024). Recent advancements include immersive technologies, such as augmented reality and geographic information technologies (Ribeiro *et al.*, 2017; Ribeiro *et al.*, 2025; Ribeiro *et al.*, 2016). Schools have to adapt to this reality within the educational context (Azevedo *et al.*, 2016; Ribeiro e Sousa, 2017).

Geographic Information Technologies (GIT) have been recognized for their role in enhancing the spatial thinking and geographical/digital abilities of students. Higher education institutions that are responsible for teacher training play a critical role in the acquisition of digital skills that enable them to integrate GIS into their classroom

practices (Azevedo *et al.*, 2019; Kerski, 2015).

Methods

It was deemed necessary to examine the perceptions in the context of geographical asymmetries in the application of this study. Consequently, classes from schools located in urban areas, in a transitional territory, and in a region with more rural characteristics were employed to ascertain the extent to which the variances in these contexts affect students' perceptions of the technologies.

In May and June 2024, the classes engaged in a variety of digital activities, including the presentation of a "story map" that focused on landforms at the national and global levels. Additionally, students were introduced to an AR application called "LandscapAR," which converts the contour lines drawn by the students into a three-dimensional representation of the landform. Subsequently, the students of the three institutions were asked to complete a questionnaire using "Google Forms" to evaluate their perceptions regarding the study. The research sample comprises 49 participants.

Results

Finally, the results show that most students employ technology on a regular basis, typically at their own discretion, while the instructors' initiative is less frequent. Most students disclosed that they are predominantly acquainted with "Google Maps" and/or "Google Earth" in the context of Geographic Information Technologies, and they rarely employ satellite images. Additionally, the students disclosed that they have not conducted a comprehensive examination of the knowledge or application of Augmented Reality.

Nevertheless, most students acknowledge the value of GIS and AR as a motivating factor for the study of Physical Geography. In the same vein, they also demonstrated that these technologies enhance the dynamic and motivating nature of classes, particularly for students from urban areas. However, pupils in rural areas also disclosed this perception in a substantial manner, while those in the transition territory demonstrated a degree of indifference to the subject. Students generally acknowledge that these technologies are essential for the acquisition, consolidation, and comprehension of new content and skills, particularly in the context of Physical Geography.

Conclusion

Geographic Information Technologies play a very important role in teaching and learning process. It is very relevant to promote interdisciplinary learning, to motivate students to learn and to solve most of the issues in teaching physical geography.

Keywords: Spatial Humanities; Digital Humanities; GIS; Geotechnologies; Teaching Geography.

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Acknowledgements

This initiative was supported through the Multiannual Funding of the Landscape, Heritage and Territory Laboratory (Lab2PT), Ref. UID/04509: Laboratório de Paisagens, Património e Território (Lab2PT/UM), financed by national funds (PIDDAC) through the FCT/MCTES.

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Background

In the context of public policies and local government, the efficient management of Official Collection Centers (CROs) and animal welfare have become increasingly important in recent years (Koknaroglu e Akunal, 2013). The adoption of innovative technological solutions is driven by the necessity of ensuring transparent, sustainable, and fast processes in the collection, adoption, and monitoring of companion animals. In this context, the current study suggests the development of a mobile application that is designed to facilitate the real-time administration of CROs, with a particular emphasis on the Municipality of Felgueiras.

The digital transformation of public administration, in conjunction with the advancement of GIS, presents new opportunities to enhance communication between technicians, veterinarians, managers, and citizens, centralize data, and optimize workflows (Remoaldo *et al.*, 2017; Ribeiro e Alves, 2025; Ribeiro *et al.*, 2018; Ribeiro *et al.*, 2020). The integration of these tools enables the spatial analysis of data, which aids in the identification of patterns, the optimization of resources, and the reinforcement of animal welfare policies (Pasteur *et al.*, 2024; Roberts *et al.*, 2021). Additionally, it enables the monitoring of the daily activities of CROs.

Methods

The objective of this study was to understand CRO municipality workers perceptions about GIS technology to simplify the CRO management. Another objective was to analyse dashboard tools and spatial analysis in a GIS environment to examine animal management and welfare in the municipality of Felgueiras, Portugal. It was employed geographic data provided by the Institute for Nature Conservation and Forests (ICNF). The ability to analyze indicators such as collected, adopted, sterilized, euthanized, vaccinated, and electronically identified animals was facilitated by the construction of a synthesis panel (dashboard), which facilitated the engagement, the comprehension of pertinent patterns and the spatial relationships.

Results

The findings indicate that the municipality of Felgueiras has demonstrated a highly favourable performance, as evidenced

Moving GIS to animal welfare management

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by its high adoption and sterilization rates and low euthanasia rate, which are consistent with national animal protection policies. Furthermore, questionnaires were created and are presently in the response phase. The results of these questionnaires will be presented in subsequent research. This study illustrates the significance of utilizing official data and GIS tools to analyze and support decision-making in public policies regarding animal welfare.

Conclusion

Currently, animal welfare is on public agendas and is under enormous pressure from society. Online GIS tools can make a huge contribution to real-time management, public transparency, and engagement systems.

Keywords: Spatial Humanities; GIS; Dashboard; Animal welfare; Sustainability.

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Acknowledgements

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Online GIS tools to create a more efficient tool to lead with *Vespa Velutina*

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Background

Biological invasions are seen as one of the main threats to the conservation of biodiversity and ecosystem services, including the inherent socioeconomic benefits, due to the modifications they induce in the global balance of the biosphere (Vaz, 2018). The "Asian hornet" (*Vespa velutina*) is an example of an invasive species. Originating from China, it was identified in Europe for the first time in 2004, in the Bordeaux region of France França (Rortais *et al.*, 2010). Since then, it has shown continuous expansion, currently being established in various countries across Europe. She is often referred to as "an effective predator of the honeybee (*Apis mellifera*) and other pollinators," with studies assessing the potential risk to honey production and pollination services being very preliminary (Verdasca *et al.*, 2022). The first detection of the "Asian hornet" in Portugal occurred in 2011, in the district of Viana do Castelo (Carvalho *et al.*, 2020; Maia *et al.*, 2012). Since then, the species has rapidly dispersed along the northern coastal area and is currently established in much of the national territory (Nave *et al.*, 2022).

Methods

A quantitative study was implemented. We developed an online survey to obtain municipal technicians who deal with *Vespa velutina* problem daily about the relevance of having a GIS technological solution to manage the occurrences. It was

applied to Portugal municipalities technicians. Subsequently, we built a conceptual model to develop a platform, in a GIS environment, which includes tools for mobile technologies to make the process of identification, visualization, and communication more efficient.

Results

We obtained 181 valid responses. The results show that there is still a significant delay in how municipal chambers manage the control of the Asian wasp. Although 38.6% already use digital platforms (excluding the national STOPvespa platform from the Institute for Nature Conservation and Forests-ICNF), it is noted that most municipalities (58.3%) still adopt very traditional municipal management methodologies, hindering spatial analysis and the effectiveness in responding to occurrences. Regarding the functionalities present in their own digital platforms, municipalities prioritize georeferencing and operational control. The visualization of data and the georeferencing of occurrences is the most common feature, present in 73.8% of the solutions. Next, the importance of monitoring the status of nests (72.2%) and the ability to extract statistics (65.1%) stands out.

Conclusion

Despite the low use of GIS technologies to manage spatial data related to Vespa Velutina occurrence it remains as a spatial phenomenon where GIS can have great contributes. Results revealed a strong willingness to change the way these processes are managed, using GIS tools. The developed conceptual model and GIS solution evidence a way of how data flows can be efficiently managed.

Keywords: Spatial Humanities; GIS; Dashboard; *Vespa velutina*; Mobile technology; Sustainability.

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Acknowledgements

This initiative was supported through the Multiannual Funding of the Landscape, Heritage and Territory Laboratory (Lab2PT), Ref. UID/04509: Laboratório de Paisagens, Património e Território (Lab2PT/UM), financed by national funds (PIDDAC) through the FCT/MCTES. The authors award ICNF by making STOPvespa data available.

Deciphering the Urban Landscape of Early 15th-Century Prague

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Background

The development and transformation of medieval urban settlements form an important component of European cultural heritage. The ongoing project *Medieval Settlements – the Core of European Cities* examines the spatial organisation of medieval Prague through the analysis of historical sources combined with GIS technologies. A key source for reconstructing the early fifteenth-century situation is the unique reconstruction map by Tomek (1892), depicting Prague in 1419 on the eve of the Hussite Revolution. Building on this foundation, the project aims to expand and test additional possibilities for the digital representation and visualisation of the medieval city, including the incorporation of historical topographical works and external knowledge databases, as well as the development of a land-use component.

Methods

The project builds upon an already existing enriched vector data model of nearly 1,000 medieval localities identified on Tomek's reconstruction map. The current work, which is still in progress, extends the original data model and the content of the web map application presenting the project's outputs. Work began on linking the data model both to external knowledge databases (e.g., Wikidata, Wikipedia, and the Cultural Heritage Database) and to digitised historical topographical works (Tomek, 1855–1901; Teige, 1910–1915). The enrichment of the data model is being tested for integration; due to the time-intensive nature of the task, this is currently implemented as a targeted pilot with the potential to scale through automated extraction workflows. In parallel, work is also underway on the analysis and interpretation of historical land use, aiming to refine and supplement information on contemporary landscape features using the

latest insights from archaeological research.

Results

The ongoing extensions result in a progressively enriched spatial environment integrating object data, topographical information, and knowledge-base entries. Integration with knowledge databases will be presented in two complementary forms within the application: an exploratory interface displaying all extracted data without selection, and a curated integration into the main map interface, limited to entities explicitly relevant to the early fifteenth-century urban context. Historical land-use analysis will be presented as a story map, guiding users through the green spaces and agrarian areas of the medieval metropolis.

Web map application: <https://bit.ly/MedievalPragueWebMap>

Conclusion

The existing project infrastructure provides a multi-component digital environment that supports the exploration of the reconstructed urban landscape of early fifteenth-century Prague and its comparison with later cartographic representations. The emerging land-use component introduces new empirical material for examining the functional organisation of the medieval city and for tracing how selected spatial elements transformed across subsequent periods. By making these datasets available through an interactive mapping interface, the project supports both scholarly research on medieval Prague and broader public engagement with its cultural heritage.

The current phase of development also opens further avenues for methodological expansion. The integration of historical topographical works holds the potential for generating full-coverage spatial layers that could support future GIS-based analyses of urban development. At the same time, the ongoing testing phase enables consideration of workflows for automating data extraction from topographical texts and for applying deep-learning methods to the vectorisation of historical plans.

Keywords: Land Use; Medieval Prague; Topographical Works; Knowledge databases; Spatial history

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Acknowledgements

This poster presents results of the ongoing project *Medieval Settlements – the Core of European Cities. Based on the Example of the Interactive Cartographic Image of Prague*, conducted at the Institute of History of the Czech Academy of Sciences within the Strategy AV 21 Programme (*Anatomy of European Society; Cultural heritage as part of European and global discourse*, 2023–2026).

Social exclusion and GIS-T: the case of Guimarães municipality

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Background

The challenges of sustainability place the issue of geographical mobility at the top of urban agendas (Ribeiro, 2009). It transcends mere physical movement, particularly by car. In the European context, and specifically in Portuguese territory, a paradigm shift is taking place that seeks to move urban planning away from the historical dependence on private cars in favour of more sustainable, equitable, and efficient transportation systems. The municipality of Guimarães, with its polycentric urban structure, its historic center classified as a UNESCO World Heritage site, and its unique geographical characteristics, faces significant challenges in achieving this ideal of inclusive mobility to avoid social exclusion (Kenyon, 2011; Lucas, 2004, 2011; Remoaldo e Ribeiro, 2010).

Methods

The methodology adopted in this study is based on the use of Geographic Information Systems applied to Transport (GIS-T) as the main tool for analyzing the road public transport network of the municipality of Guimarães. The methodological focus is essentially diagnostic and analytical, aiming to understand the structure, coverage, and efficiency of the existing network, as well as to identify territorial inequalities in access to public transportation.

The choice of a GIS-T approach allows for the integration of

spatial, demographic, and operational information, enabling a detailed understanding of the relationship between the distribution of stops, the layout of routes, and the characteristics of the territory. Guimarães is a municipality heavily marked by the dispersion of its population, rugged topography, and strong contrasts between urban and rural areas, making it particularly important to assess the real, not just theoretical, accessibility of the population to the bus service.

Results

The spatial analysis, supported by network analysis, kernel density maps and through hot spots mapping, confirmed that the service offer is not distributed randomly, but strictly follows the population and economic density pattern. The quantitative results obtained are, at first glance, positive, as approximately 69.6% of the population residing in the municipality (around 100,000 inhabitants) is at a very high comfort distance, living less than 5 minutes on foot from a stop.

In low-density territories, in the North and East of the municipality, the risk of social exclusion related to transportation is more intensely, transforming mobility into a factor of inequality in access to essential goods and services. From an operational standpoint, the analysis of the routes highlighted the classic dilemma of transport planning between "coverage" and "frequency." The systematization of travel times and line lengths allowed for the identification that the routes designed to ensure universal territorial coverage, namely the night routes and the "sweeping" lines of the peripheral parishes, suffer from a severe penalty in their commercial speed and efficiency.

Conclusion

The use of geographic tools to measure and identify areas with lack of service were very useful. The current model of conventional busses on fixed routes shows signs of exhaustion in meeting the needs of low-density areas. To achieve true "Inclusive Urban Mobility," the future of planning in Guimarães should not only involve the densification of the existing network but also the exploration of complementary solutions, such as on-demand flexible transport, capable of serving the last 10% of the population without compromising the financial sustainability of the system.

Keywords: Spatial Humanities; GIS-T; Network analysis; Social exclusion; Bus stops.

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Acknowledgements

This initiative was supported through the Multiannual Funding of the Landscape, Heritage and Territory Laboratory (Lab2PT), Ref. UID/04509: Laboratório de Paisagens, Património e Território (Lab2PT/UM), financed by national funds (PIDDAC) through the FCT/MCTES.

Digital Humanities, Geography and Sustainability: A Systematic Review of Research Trends, Methods and Data

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Background

Spatial analysis has become a central component of Digital Humanities (DH), reshaping how human experiences, cultural processes and historical transformations are interpreted and represented through geographic thinking and geotechnologies. Despite the rapid diffusion of spatial approaches across DH, a comprehensive synthesis of research trends, particularly regarding application domains, methodological choices and data practices, remains fragmented. This study asks: how has DH research evolved in integrating spatial approaches and GIS-based methods, in terms of application domains, methodological frameworks, data types and geographic coverage, and to what extent do these studies connect with sustainability challenges?

Methods

A systematic literature review was conducted following the PRISMA protocol, covering 136 peer-reviewed research articles published between 2007 and 2023. Studies were analysed through a structured classification scheme organised into four dimensions: (i) application domain, (ii) nature and methodological approaches, (iii) data types, and (iv) geographic framing. In addition, a cross-cutting sustainability-oriented reading was undertaken to identify explicit sustainability frameworks and indirect alignment with the UN

Sustainable Development Goals (SDGs).

Results

Results reveal a rapidly expanding and increasingly diverse field of spatial DH. Spatial methods, particularly GIS, spatial analysis and digital mapping, enable new forms of inquiry and representation across interdisciplinary domains such as history, archaeology, literature, cultural heritage, economics and the arts. Methodological heterogeneity is high, with frequent hybrid approaches combining quantitative and qualitative data with text and archival analysis, network modelling, geovisualisation, and spatial storytelling (including interactive cartography and narrative mapping). However, limited methodological transparency persists: many studies provide insufficient detail on geospatial workflows, preprocessing steps, classification logic and validation procedures, restricting reproducibility and cross-study comparability. The review also identifies geographic and thematic concentration, with a predominance of European and North American case studies and a strong focus on history, literature and cultural heritage, reflecting infrastructural and funding asymmetries in global DH knowledge production. While relatively few studies explicitly adopt sustainability frameworks, many contribute indirectly to SDG-related challenges, particularly those related to innovation in digital methods (SDG 9) and education and capacity-building (SDG 4).

Conclusion

Spatial DH constitutes a promising interdisciplinary bridge to address sustainability-relevant issues such as spatial justice, territorial inequalities and resilience, while also raising critical questions about data ethics, methodological transparency and responsible geotechnology use. These findings reinforce the relevance of spatial humanities research in current debates on digital practices and socio-digital transformation, and support the need for more rigorous reporting standards and more geographically inclusive research agendas.

Keywords: Spatial Humanities; Digital Humanities; GIS; Geotechnologies

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Acknowledgements

We acknowledge the GEOMODLAB (Laboratory for Remote Sensing, Geographical Analysis and Modelling) of the Centre of Geographical Studies/Institute of Geography and Spatial Planning for providing computational infrastructure support for this research. The authors used OpenAI's ChatGPT (GPT-4) to assist with language editing, reference formatting, and consistency checking during the preparation of the manuscript. This research was funded by Foundation for Science and Technology (FCT) and CEG Research Unit, grant number UID/00295/2025 (<https://doi.org/10.54499/UID/00295/2025>)

Digital communication of creative experiences developed in a UNESCO Creative City

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Background

The creation of the UNESCO Creative Cities Network in 2004 established a global cooperation platform aimed at bringing together cities that consider creativity a strategic element of urban planning (UNESCO, 2024a). By 2025, the network encompassed 408 cities across seven categories (UNESCO, 2024b). Beyond its symbolic dimension, the network has contributed to promoting innovative practices, strengthening institutional alliances, and fostering community participation in addressing contemporary urban challenges, such as climate change, digitalization, and social inequalities (UNESCO, 2024c). Simultaneously, it provides cities with greater international visibility, stimulates tourism, and attracts investment, facilitating the exchange of knowledge and experiences (Pearson & Pearson, 2017; Gatten et al., 2021). The municipality of Barcelos is being part of the Network in the Crafts and Folk Arts category since 2017, recognizing the diversity of its artisanal productions, including pottery, woodwork, ironwork, basketry, and folk dances. This study examines how the offer of creative experiences is communicated digitally and how their spatial distribution

influences stakeholders' perceptions and the tourist experience in this municipality.

Methods

(i) Three institutional websites were analysed — the Municipality of Barcelos, Barcelos Creative City, and the Creative Tourism Network — to evaluate how creative experiences are digitally communicated. A total of 143 activities were identified, 108 of which correspond to creative tourism. For each activity, the following aspects were analysed: type of experience, location, costs, duration, participation requirements, languages available, content accessibility, usability, interactivity, navigation, and the level of trust conveyed by the website.

(ii) Three meetings with the Consultative Council were held, involving artisans, municipal representatives responsible for tourism, and entities linked to accommodation and restaurants. These meetings made possible to: critically interpret the digital analysis results; identify communication gaps; understand territorial and operational barriers; and discuss the real impact of the UNESCO designation on the tourist experience. Stakeholders' contributions also clarified the spatial distribution of the experiences, highlighting the strong centrality of activities carried out in the urban core and the lower participation in experiences located in peripheral areas, which require travel that many visitors tend to avoid.

Results

The website analysis revealed fragmented information and the absence of an integrated digital system that would allow visitors to clearly plan creative experiences. Although the range of activities is diverse, information regarding availability, booking, reservations, and access is often insufficient or missing, hindering visitor engagement.

The Consultative Council meetings emphasized that experiences are mostly concentrated in the urban centre, while several of the most distinctive activities — such as visits to artisans' workshops in the parishes of Galegos São Martinho, Galegos Santa Maria, Manhente, and São Miguel da Carreira — although promoted in tourist brochures, are less frequently carried out due to travel constraints. Organised groups are able to access these areas, but independent visitors often do not, due to additional transportation needs.

Stakeholders confirmed that many artisans are willing to receive visitors in their workshops and provide immersive experiences, but these practices depend largely on informal mediation by agencies, museums, or the tourist office. The absence of a unified digital portal, together with the lack of technological solutions to georeference and connect the available offer, reduces the visibility of peripheral experiences, limits visitor access, and weakens the territorial and community impact of the UNESCO designation.

Conclusions

The research demonstrates that Barcelos possesses a rich and diverse creative heritage but faces significant challenges in

translating it into a coherent digital environment and into an accessible territorial experience for visitors. Online communication remains fragmented, lacking essential information and coordination among stakeholders, which compromises understanding of the overall creative offer and hinders visit planning. Simultaneously, the spatial analysis shows that the most promoted and most frequently carried-out activities are concentrated in the urban centre, while highly valuable experiences located in peripheral areas remain less accessible and less visible, limiting the territorial impact of the UNESCO designation.

Contributions from the Consultative Council reinforce that artisans, and other local agents, are willing to welcome visitors into their workshops and creative spaces. However, these practices still rely on informal mediation and inefficient communication channels. This reality shows that moving from certification to everyday practice requires more than symbolic recognition. It demands the creation of digital and territorial infrastructures that support access, mobility, and the discovery of creative experiences.

Thus, fully realising the potential of Barcelos as a Creative City requires the implementation of integrated digital solutions, such as a single portal with consolidated information, georeferenced mapping of all creative experiences, and AI-based tools for recommendation, planning, and navigation. These approaches, aligned with Spatial and Digital Humanities, are essential to decentralize tourist flows, enhance the visibility of peripheral parishes, strengthen connections between visitors and the creative community, and maximize the sociocultural, economic, and territorial impacts of the UNESCO title.

Keywords: Barcelos; UNESCO Creative City; Creative Tourism; Geotechnologies; Spatial and Digital Humanities.

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Reconstructing Colonial Land Use in Sri Lanka

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Background

Colonialism profoundly shaped the political, economic, and environmental landscapes of colonised nations. Land played a pivotal role, serving as an economic engine fuelling the growth of colonial powers through its management. These colonial legacies have lasting impacts on ecosystems, as historical land-use patterns often influence present-day ecological dynamics with time-lagged responses (Yang et al., 2014). Reconstructing past land-use and land-cover changes is essential for understanding long-term human-environment interactions, particularly in post-colonial countries where the commodification of nature, especially mining and agricultural activities, reshaped landscapes and continues to affect economic and environmental systems (Olsson, 2009).

Sri Lanka underwent three eras of Western colonial rule: Portuguese (1505–1658), Dutch (1658–1796), and British (1796–1948). Each colonial power influenced the island's economy and land-use systems. Sri Lanka's fertile soil and favourable climate made it ideal for cultivating cash crops such as cinnamon, coffee, tea, and rubber, for global markets (Bandaranayake et al., 1990; De Silva, 1973; Gunatilleke et al., 2017; Mapa, 2020). Under Portuguese and Dutch control, cinnamon was a key export. This shifted during the British era with the emergence of coffee and tea plantations alongside widespread forest clearance.

However, these successive interventions are rarely studied as a connected spatial and temporal process. This research asks to what extent archives can be used to reconstruct colonial land-use practices across successive regimes. By focusing on the triangulated area between Colombo, Galle, and Kandy in south-western Sri Lanka, the study aims to reveal the magnitude and patterns of land-use change over four centuries.

Methods

This study adopts a historical GIS approach by georeferencing a corpus of trade records and cartographic collections from the colonial period. Each period presents unique challenges in terms of availability, geographic footprint, and data quality.

Historical records are often incomplete or fragmented (Agostinho, 2019; Graham et al., 2015; Romein et al., 2020) and may reflect biases or inconsistencies in their creation (Kulasuriya, 1995; Stoler, 2009). A hurdle is to harmonise heterogeneous datasets across space and time as this study integrates multiple source types: from the Portuguese (early port records and landscape sketches), Dutch (Dutch East India Company records, maps and land registers) and from the British (Survey Department maps, cadastral records, plantation registers, and transport infrastructure plans)

A first step involves digitising maps and georeferencing features found in archival records, associating them with commodities (cinnamon, coffee, tea, rubber, coconut) to trace how land use and trade networks evolved. The study focuses on the Colombo-Galle-Kandy triangle, a region that captures the transition from coastal trade hubs to inland plantation economies. This triangulation allows for the systematic comparison of land-use intensity and patterns across the three colonial periods.

Results

Preliminary analysis is expected to show a gradual "colonial creep" from the coast to the hinterland, driven by expanding control of power and advancing technology. Specific measures will include the quantification of plantation area expansion (in hectares) across periods and the evolution of port hierarchies and their hinterland connections. Overlay analysis will reveal spatial continuities in plantation zones, port hierarchies, and transport corridors between colonial and contemporary Sri Lanka. These findings will make visible the cumulative spatial logic of colonial transformation.

Conclusion

Reconstructing colonial land use as a layered process reveals how successive Portuguese, Dutch, and British interventions collectively shaped contemporary land-use patterns in Sri Lanka. Integrating historical cartography, trade data, and GIS provides an integrated understanding of the enduring impact of colonialism.

Reconstruction offers an evidence base for addressing pressing ecological challenges. Historical land-use legacies are linked to biodiversity loss (Davison et al., 2021; Dupouey et al., 2002) and the global carbon cycle (Pongratz et al., 2009). Making these colonial legacies visible and measurable is essential, as this colonial inheritance continues to influence post-colonial realities.

Keywords: Sri Lanka; Colonialism; Reconstruction; Historical land use

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