



# TOPORAZ / TRANSRAZ

A digital space-time model for networked research using  
the example of Nuremberg

Gefördert durch



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Universität  
zu Köln



 **FIZ Karlsruhe**  
Leibniz-Institut für Informationsinfrastruktur



TECHNISCHE  
UNIVERSITÄT  
DARMSTADT

**BSB** Bayerische  
StaatsBibliothek  
Information in erster Linie



# From TOPORAZ to TRANSRAZ



Quelle: Keystone/Second Roberts Commission / Wikimedia, Public Domain

**TOPORAZ** from  
2015-2018  
Concept and  
Prototype

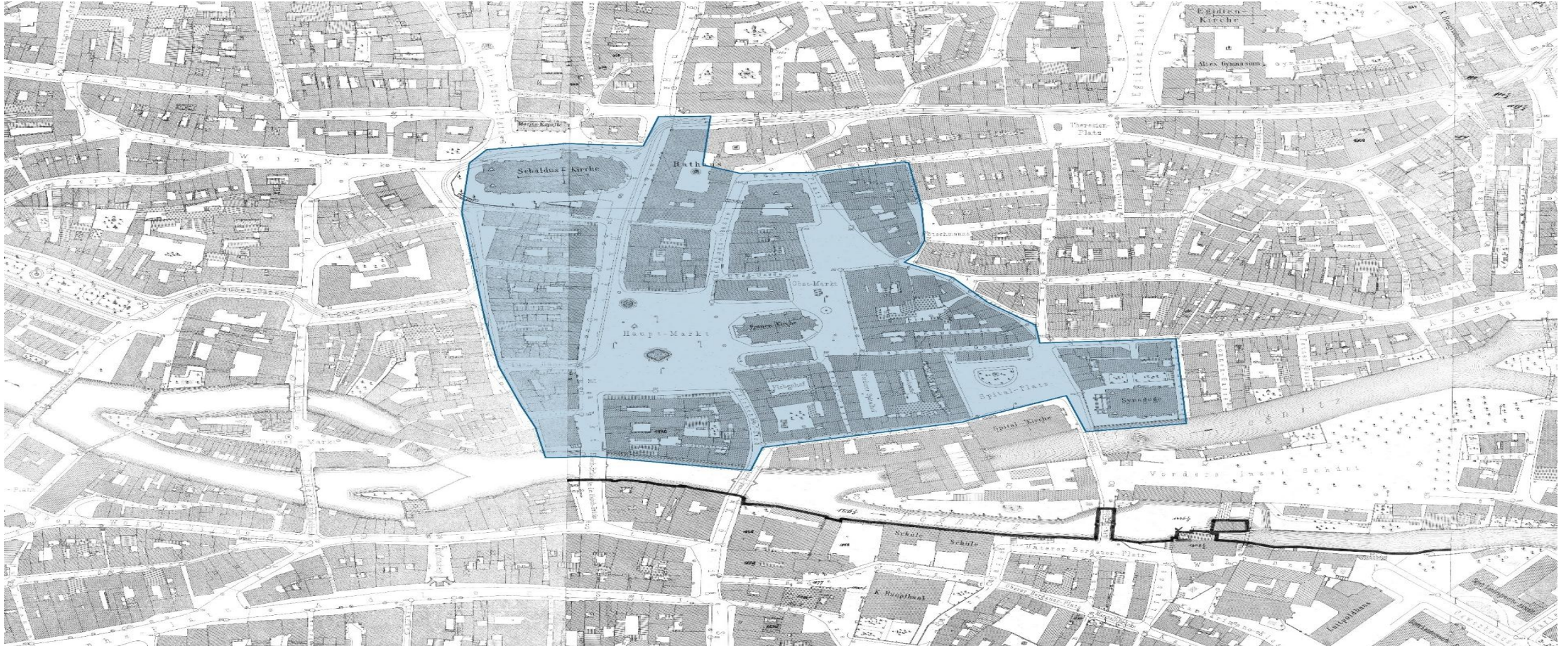
**TRANSRAZ** from  
2020-2023  
Generalization  
and Transfer







# TOPORAZ study area





# Partner TOPORAZ

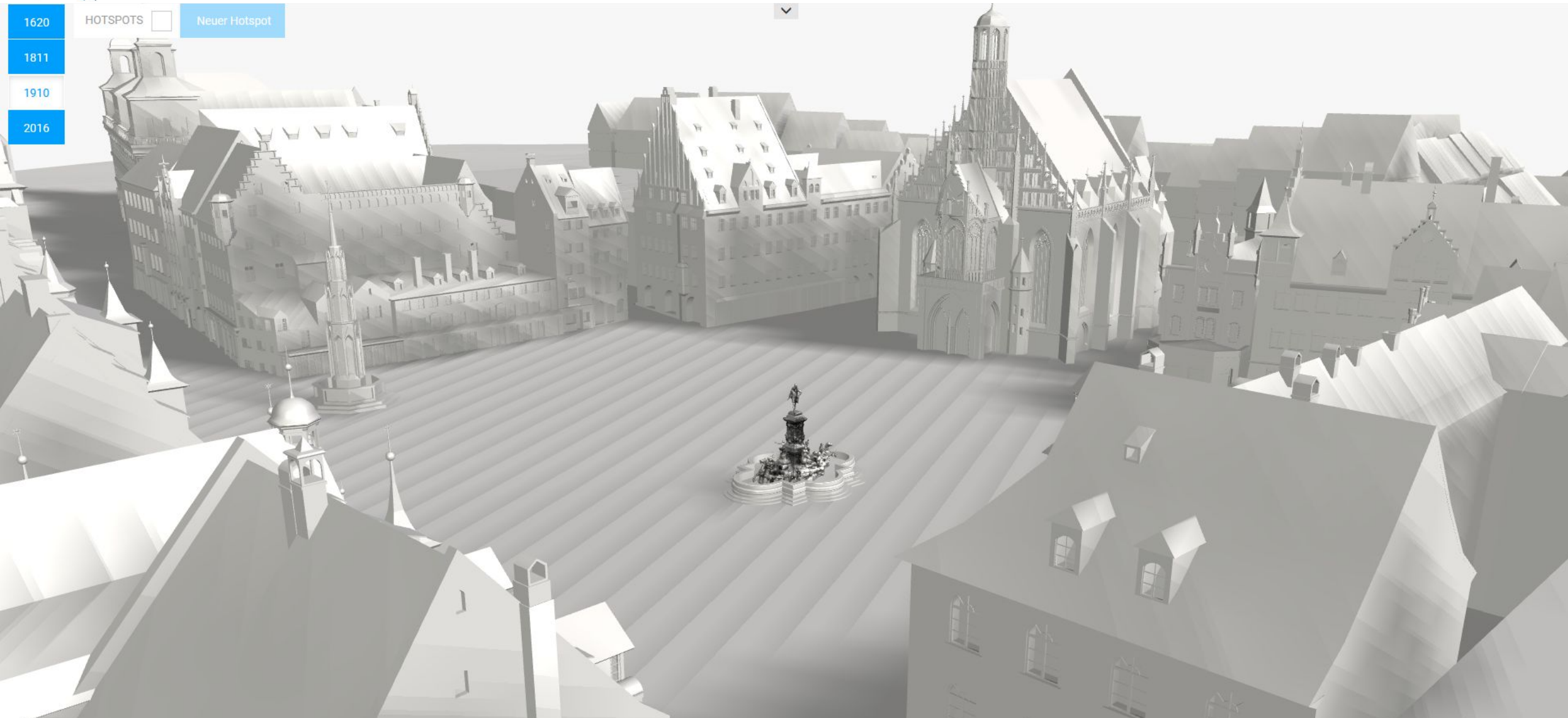
- University of Greifswald  
Caspar-David-Friedrich-Institut
- University of Cologne  
Institute of Art History, Department of Architectural History
- Technical University of Darmstadt  
Digital Design
- FIZ Karlsruhe – Leibniz Institute for Information Infrastructure  
e-Research division







# Result TOPORAZ





# TRANSRAZ study area

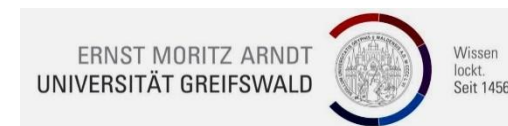






# Partner TRANSRAZ

- University of Greifswald  
Caspar-David-Friedrich-Institut
- FIZ Karlsruhe – Leibniz Institute for Information Infrastructure  
e-Research - Research Data department



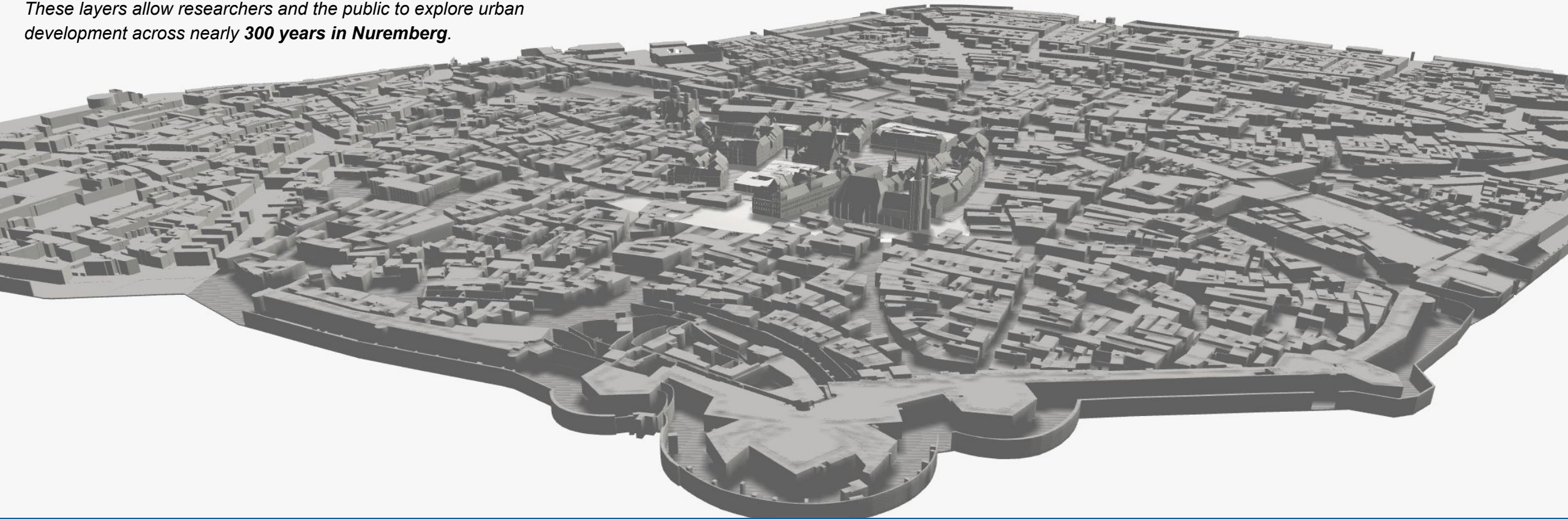


# TRANSRAZ result

## Time layers

- ① **1620** — representing the **early modern city structure** before major changes in the 17th century.
- ② **1811** — showing the situation after **early modern transformations**, based on surveys from that time.
- ③ **1910** — reflecting the city just **before the large-scale changes of the 20th century**, using detailed cadastral and architectural data.

*These layers allow researchers and the public to explore urban development across nearly **300 years in Nuremberg**.*







# Origin of the data

- Nuremberg City Archive
  - Scans of historical maps
- Cadastral Office Nuremberg
  - Scan of historical cadastral map (1910)
- State Office for Digitisation, Broadband and Surveying
  - Digital cadastral map (2015)
  - Digital terrain model (2015)
  - Original survey (1811)



LDBV 2015



# Goal: Interoperability between maps and models

Maps must be spatially calibrated

→ Georeferencing of map data

Linking of resources images, text and information to elements from the maps

→ Assignment of unique IDs (map vectorisation)

Map data should be viewed via browser

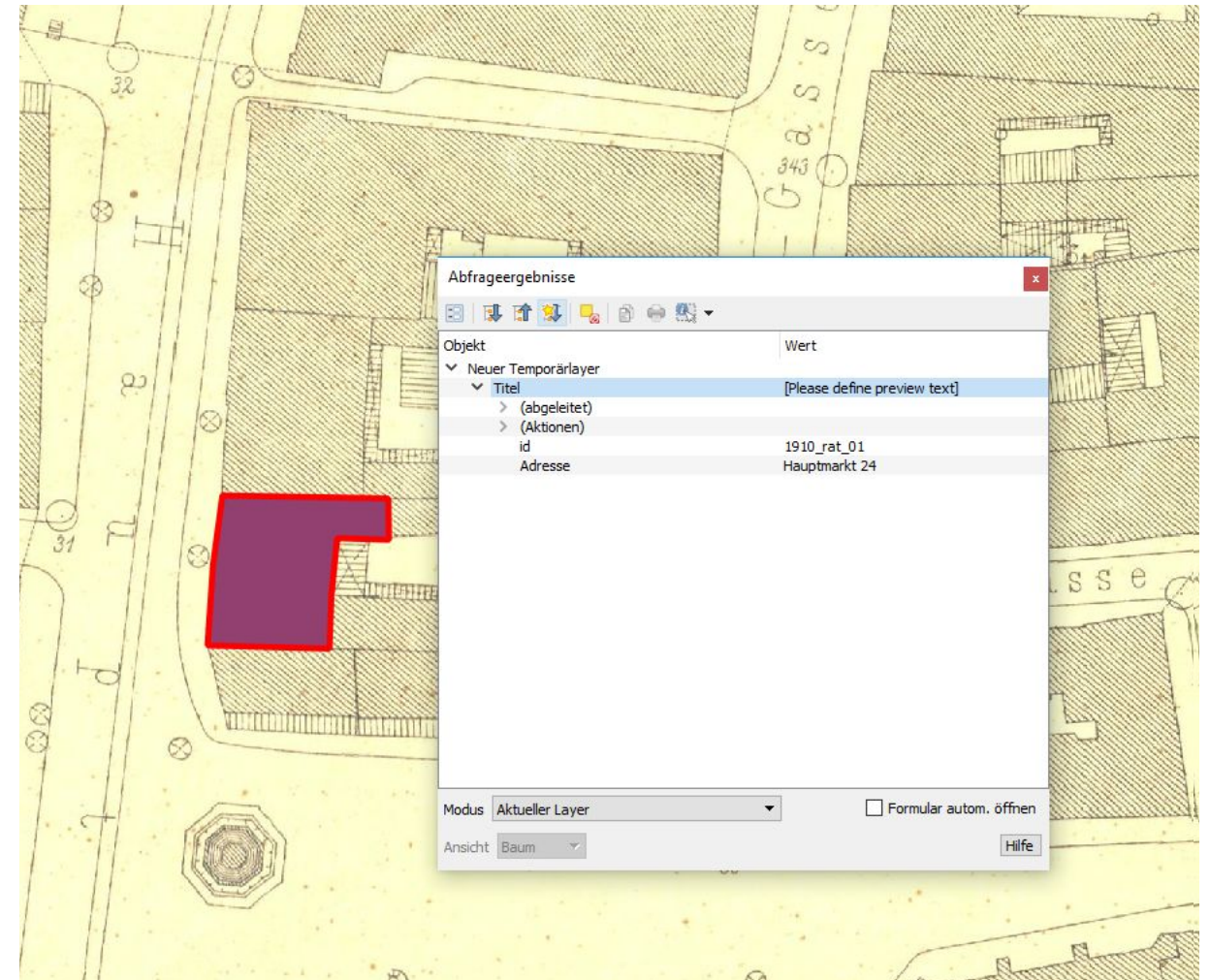
→ Tiling of raster data





# Vectorisation

- Tracing the geometry
- Enrichment with attributes (addresses, IDs, hatching)





# Holdings of written sources

## City archive:

- 18 running kilometres

## Nuremberg State Archives:

- 2.5 linear kilometres of archival records from the imperial city period, records of the Bavarian governments and state institutions of the 19th and 20th centuries.

## GNM:

- Private traditions of the patrician families

## Großgründlach:

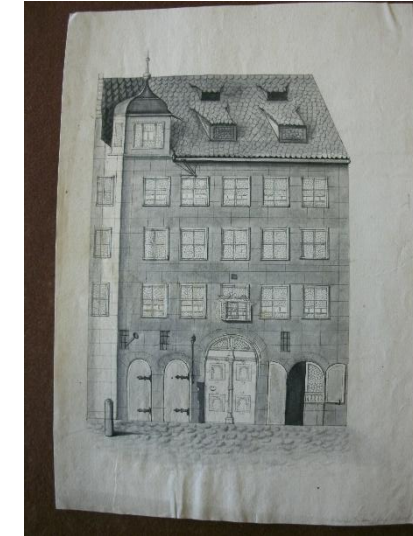
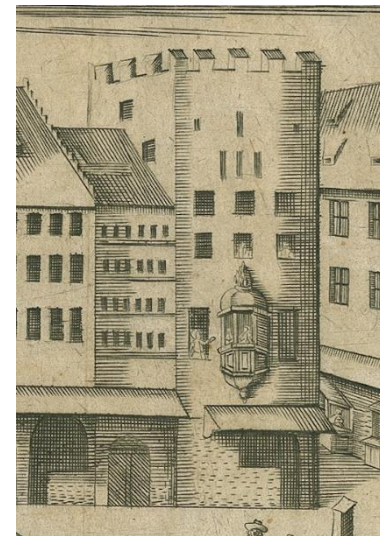
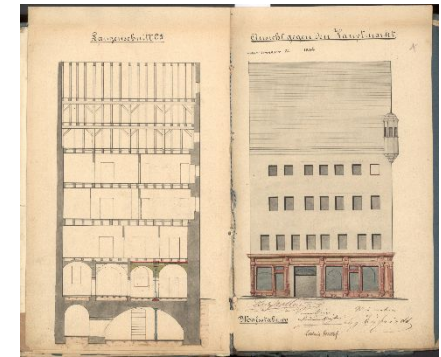
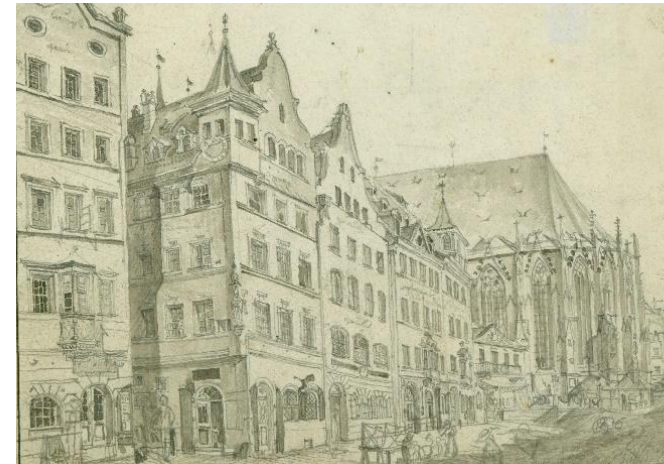
- Archive of the Barons Haller v. Hallerstein  
2500 documents, extensive file holdings







# Image sources







# Algorithmic assignment of image sources to buildings

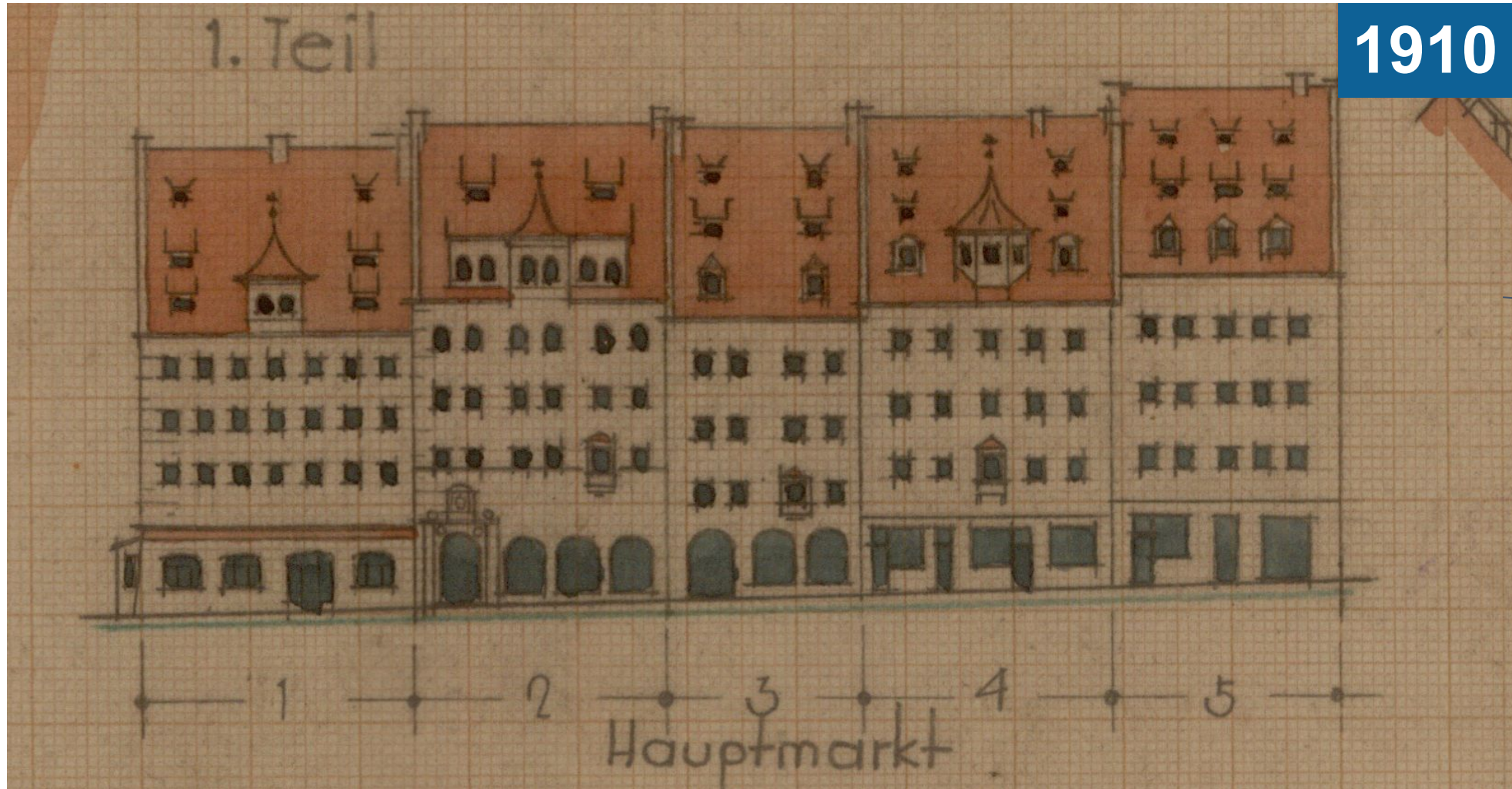
- Automatic assignment of image sources based on the address in indexing information
- Sources: Nuremberg city archives and own list of street names with variants
- Assignment approx. 70% successful, after optimisation 90%
- So far, images have only been entered for approx. 50% of the buildings







# Detail from student building survey (Bauaufnahme)

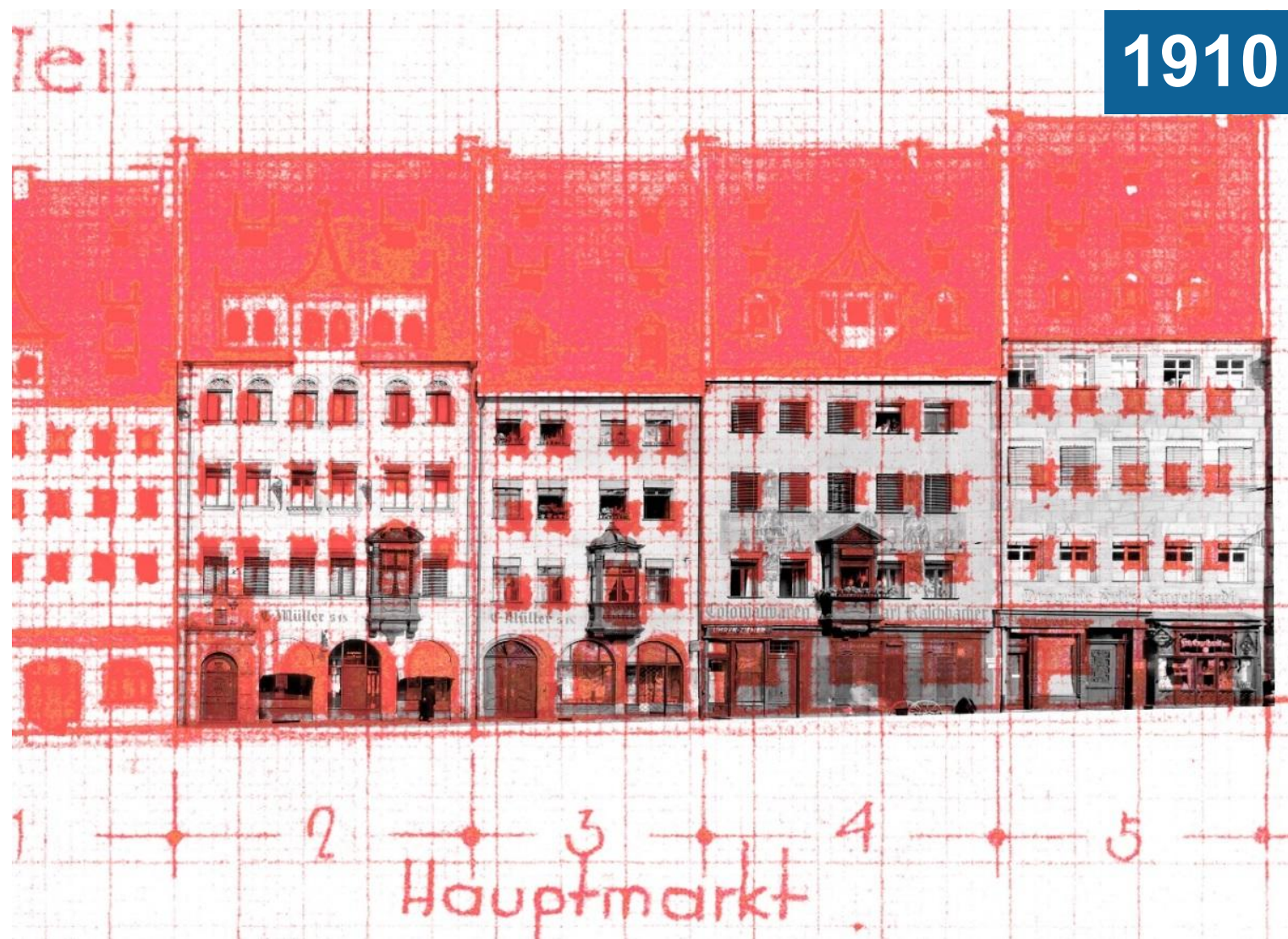


millimeter  
paper





# Comparison of graph paper and photo

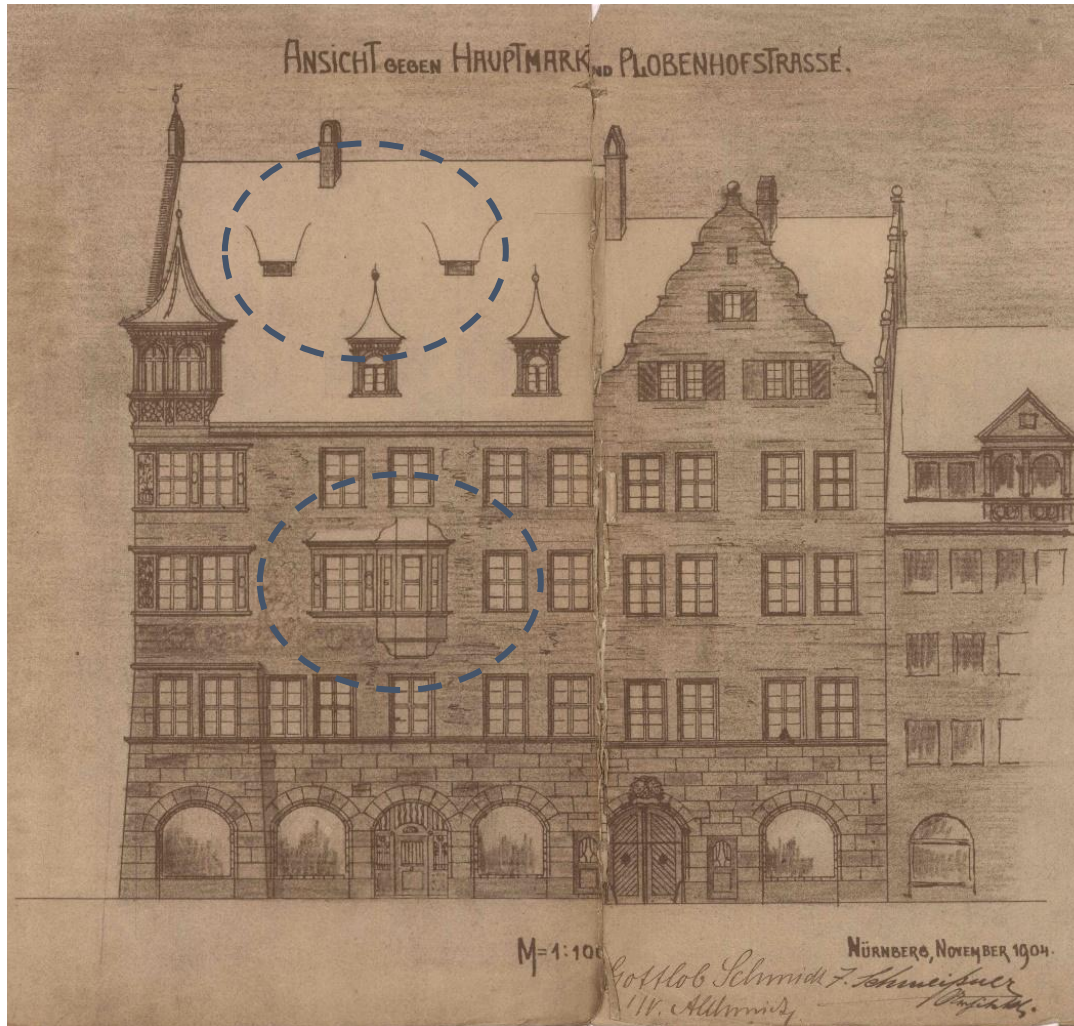


1910





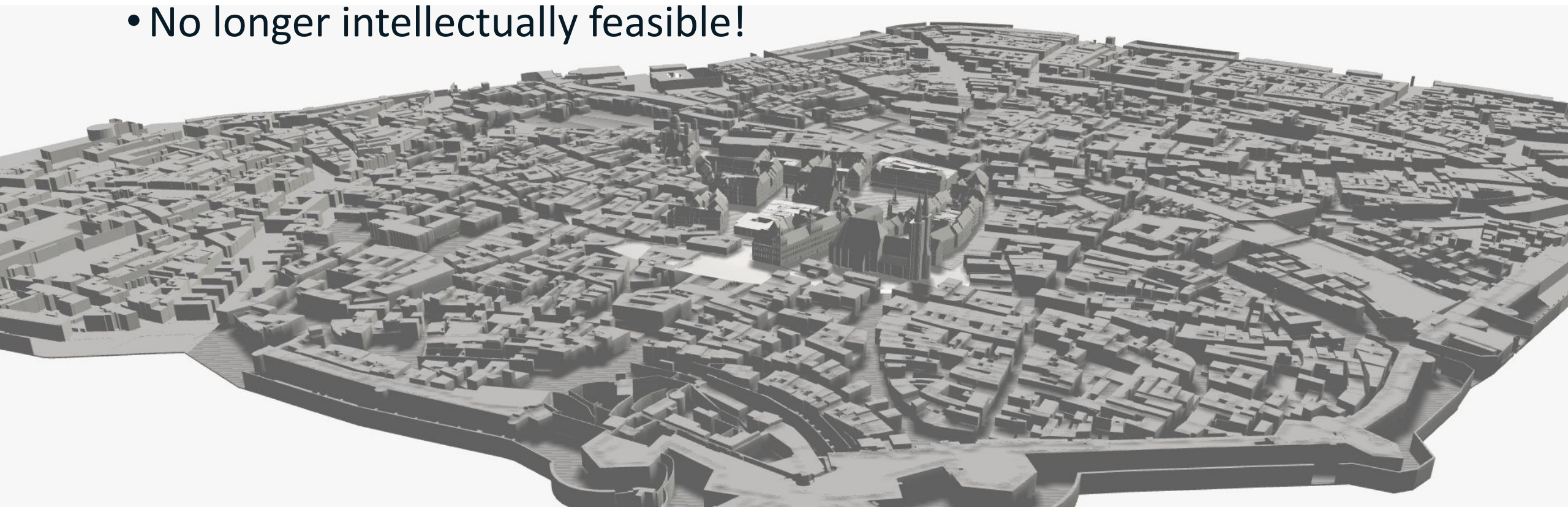
# Building files Plobenhof (1904) - Unrealised planning





# Automatically generated models in TRANSRAZ

- Extension of the study model to the second city wall
- Growth from approx. 200 to more than 3,700 buildings
- No longer intellectually feasible!







# Metadata capture

- Delimitation of substructures
- Input of basic information
  - Orientation of the building
  - Number of storeys and height
  - Roof shape and pitch
  - Bay windows ("Chörlein")
  - Dormer windows
- Basis for calculated models

Formular Gebäudemetadaten

Errichtet  
Vor 1620 x ☐ geprüft  
[Datumsauswahl](#)

Zerstört  
im Verlauf des 2. Weltkriegs x ☐ geprüft  
[Datumsauswahl](#)  
[Weitere Details ausblenden](#)

Ausrichtung  
-Bitte auswählen- ▾

**GESCHOSSE**

Anzahl Geschosse  
1 ▾

**1. Geschoss**  
Geschosscharakter  
Normhöhe ▾  
[Chörlein an weiterer Fassade hinzufügen](#)

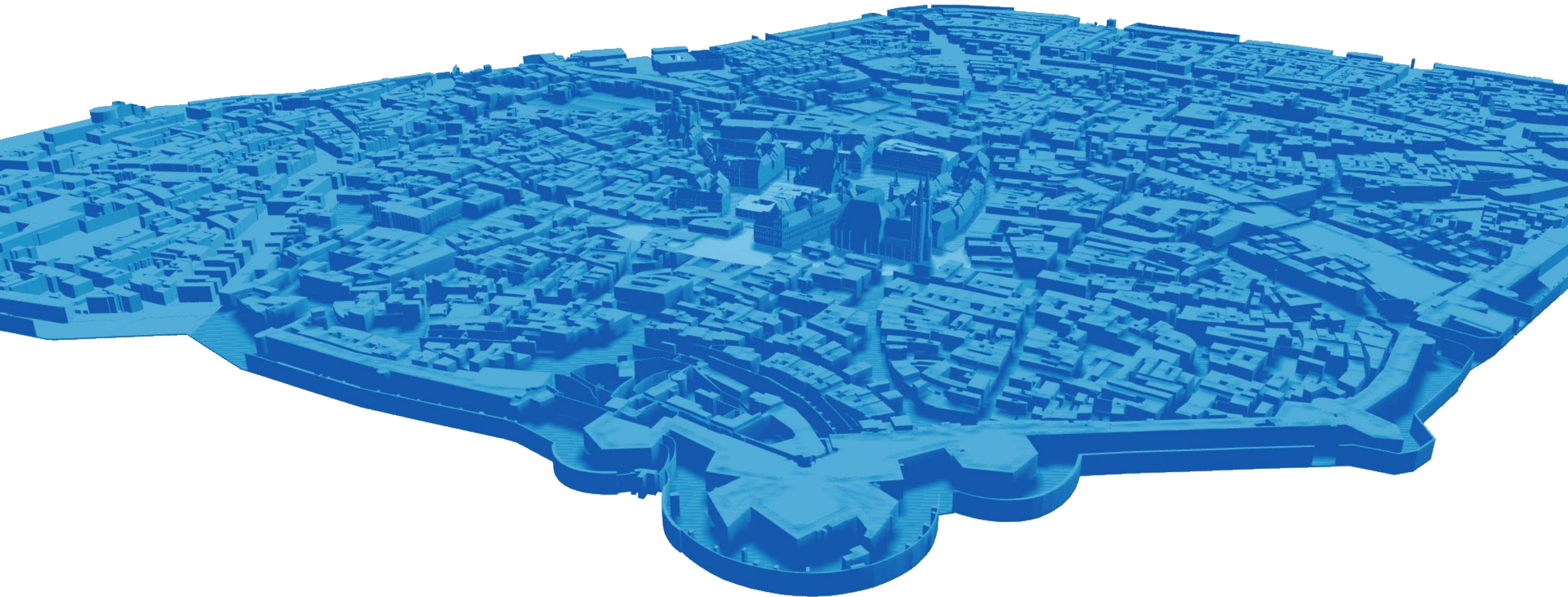
**DACH**

Dachform  
-Bitte auswählen- ▾

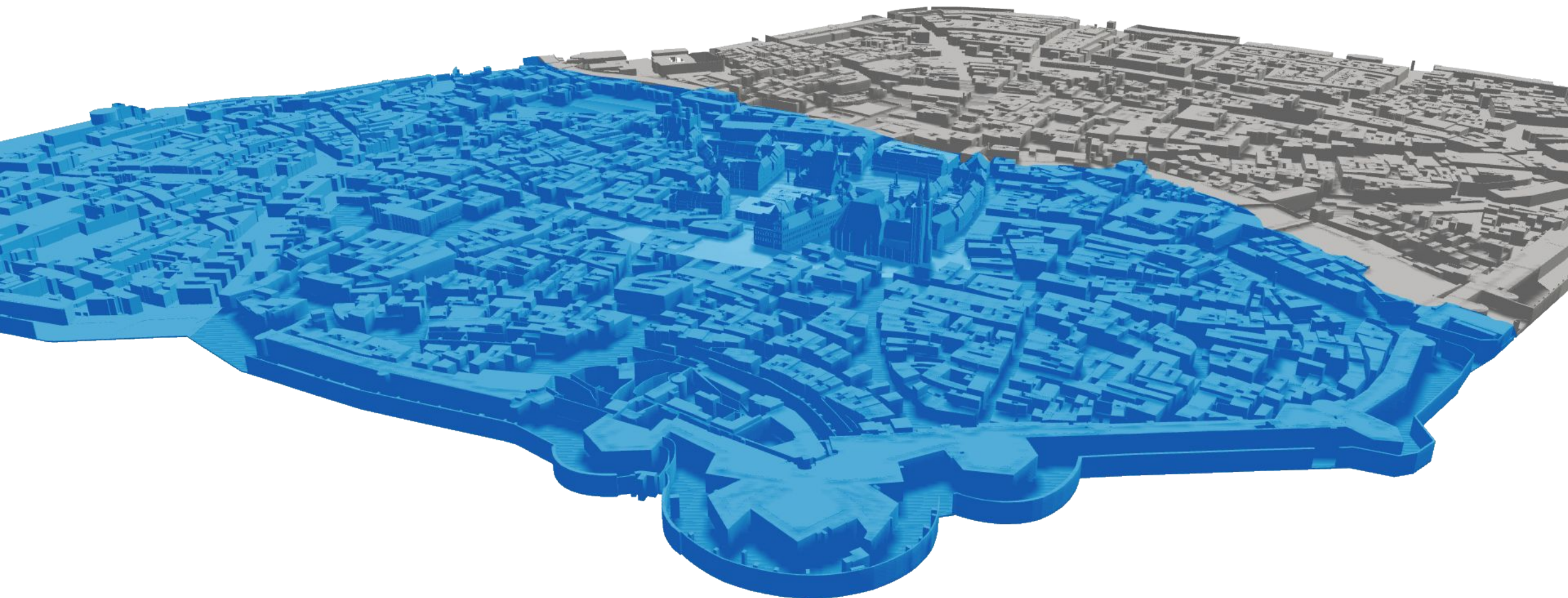
Dachsteilheit  
normal ▾

**Dacherker/Zwerchhäuser**  
[Erker an weiterer Dachseite hinzufügen](#)

[Eingabe abschließen und speichern](#)

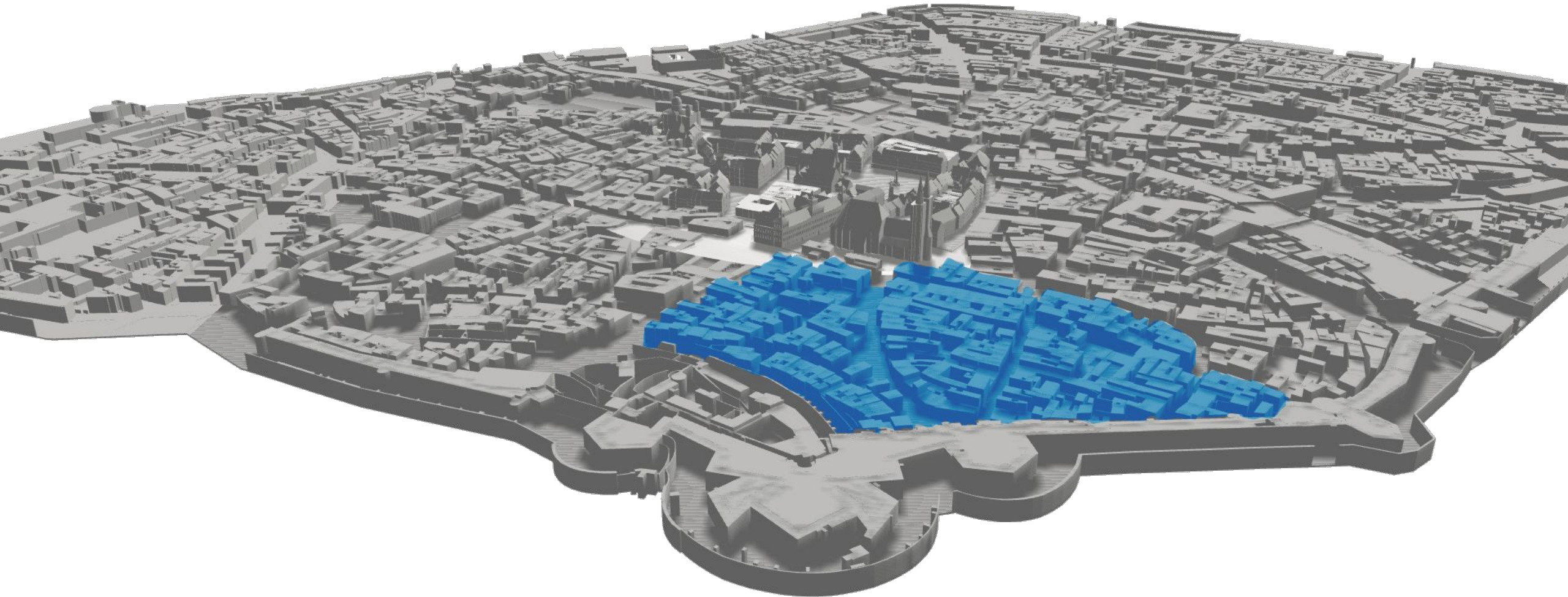








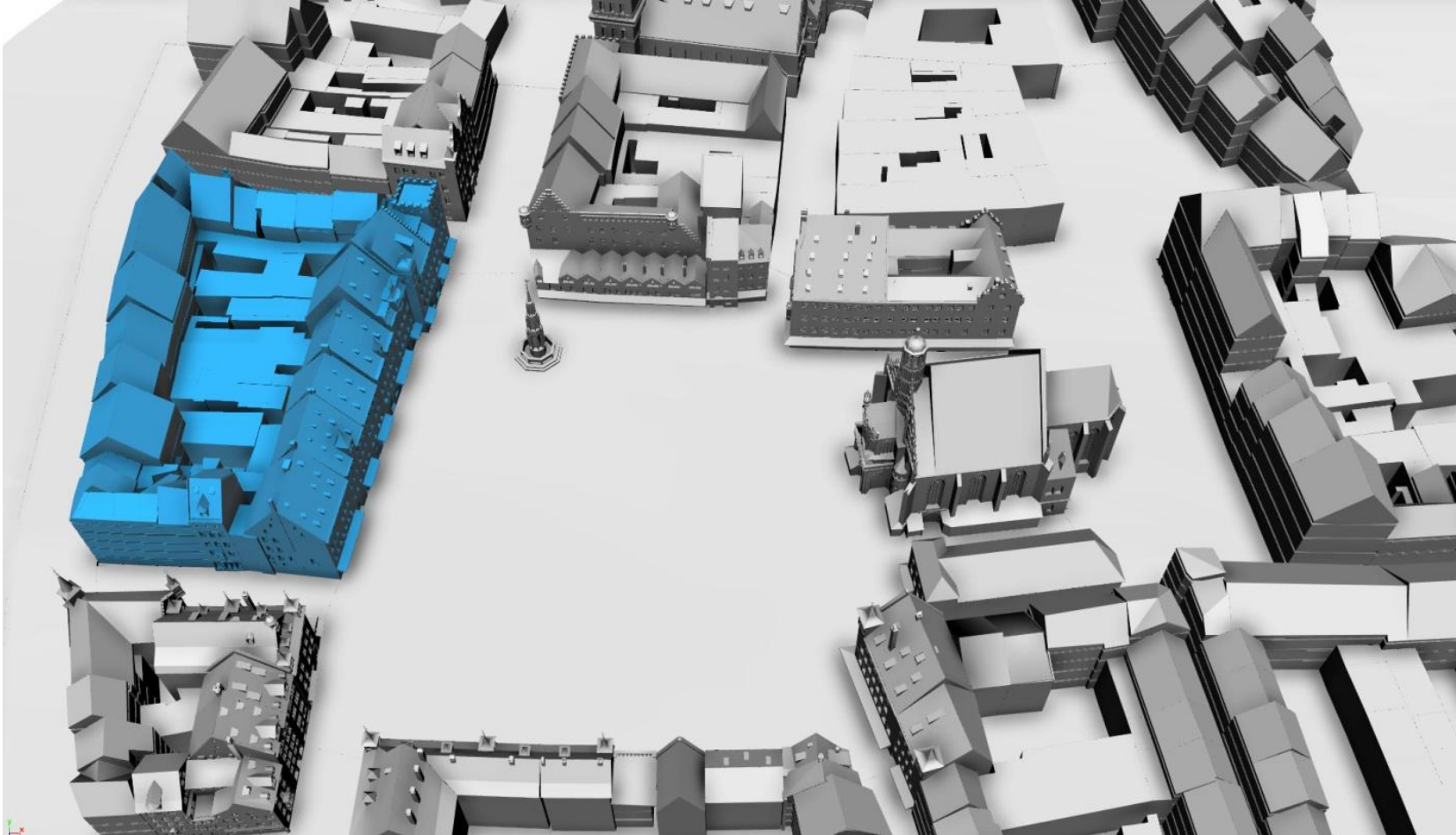
# Neighbourhood







# A block





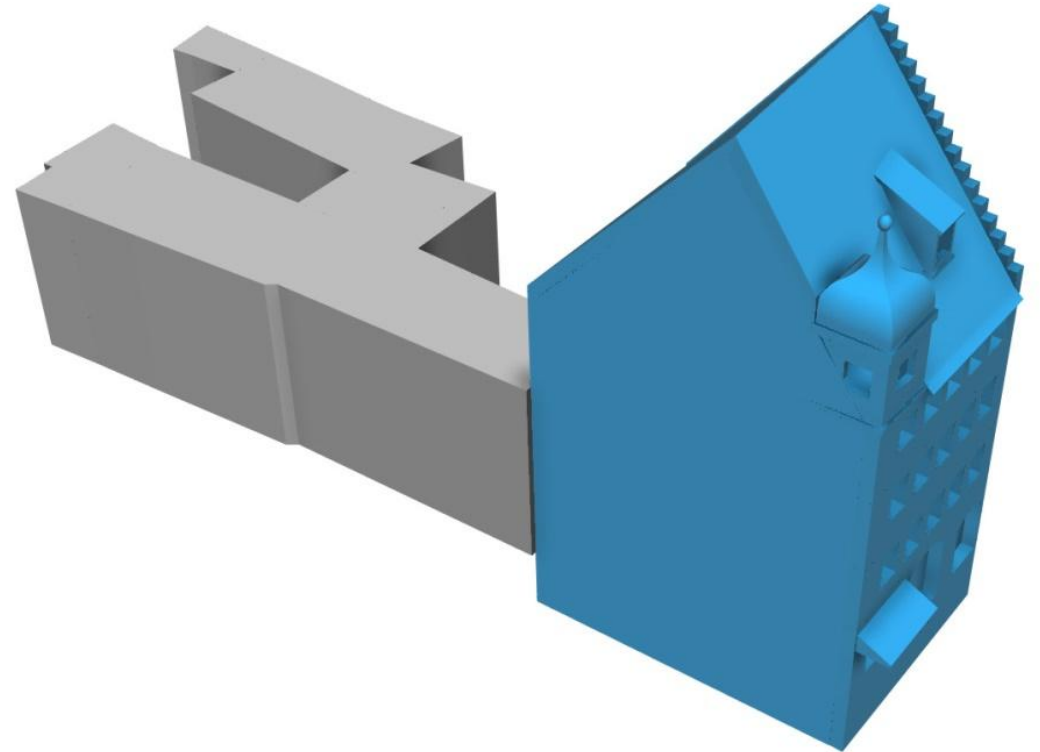
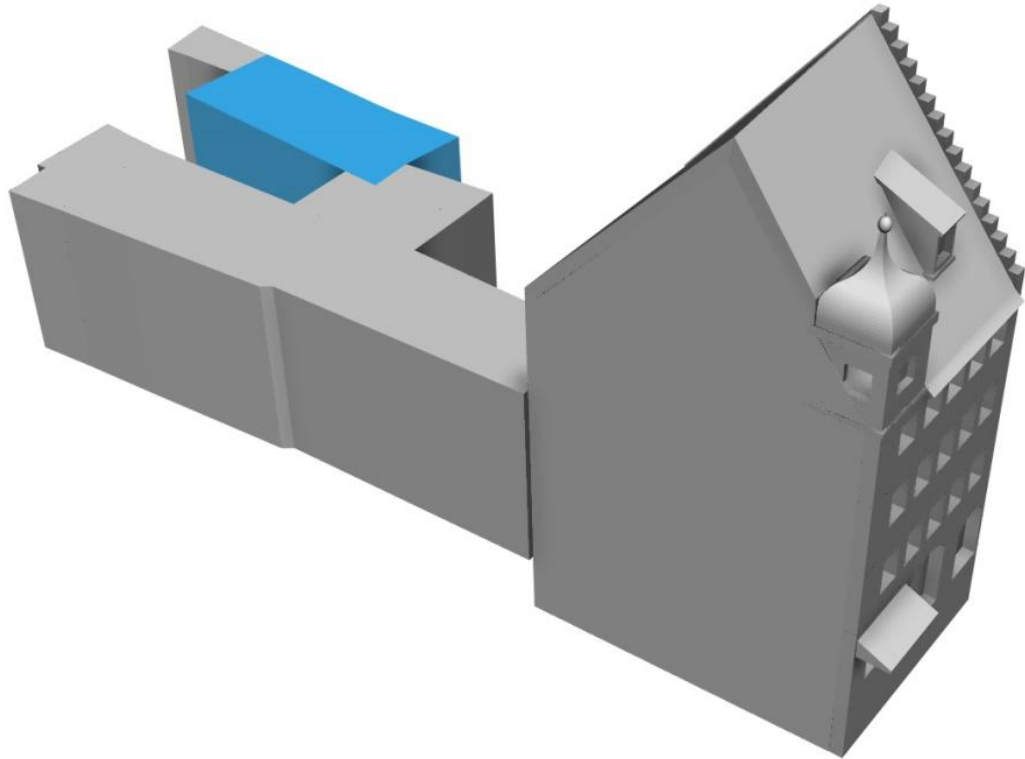
# Buildings





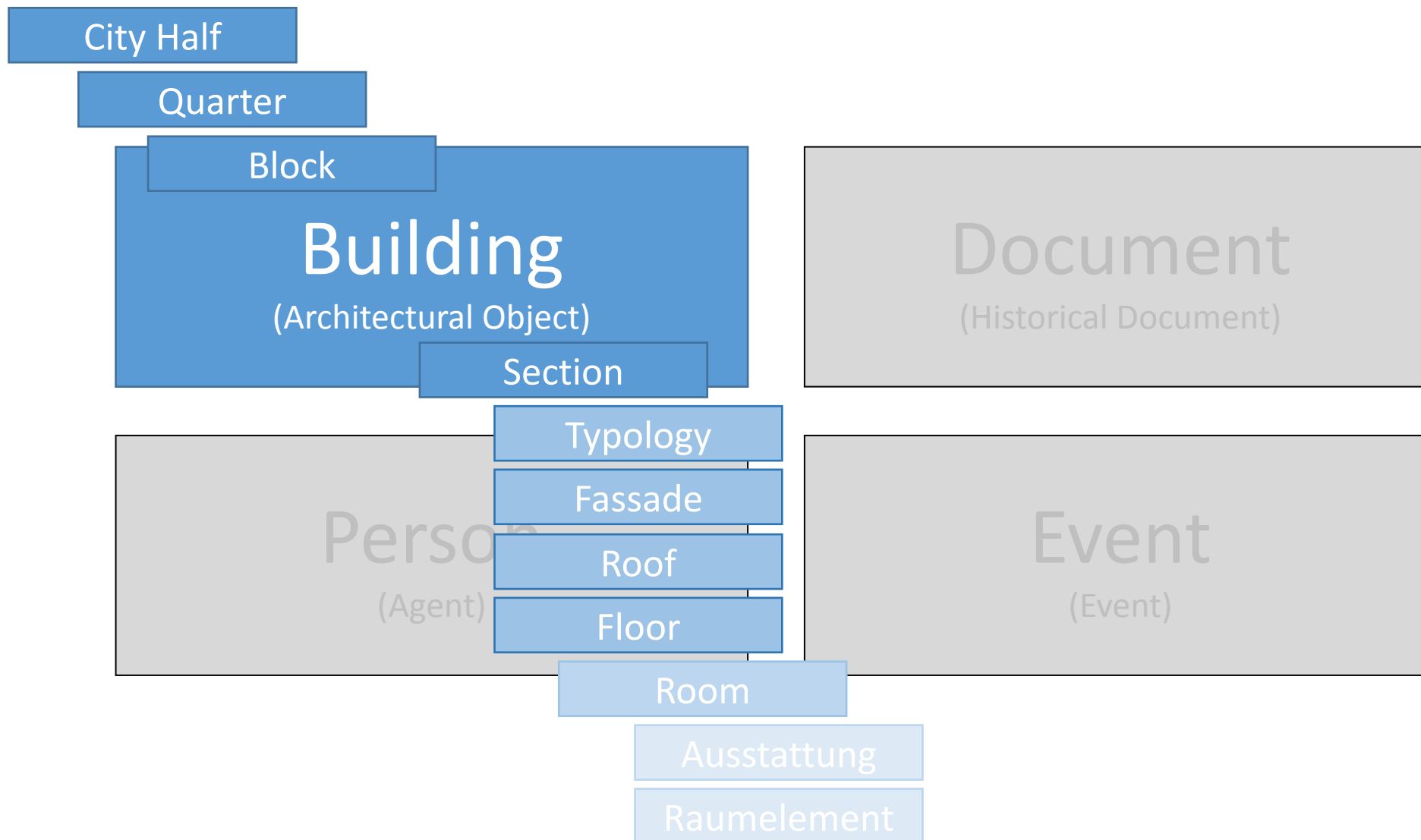


# Substructures





# Entities







# Primary entities

**Building**

(Architectural Object)

**Document**

(Historical Document)

**Person**

(Agent)

**Event**

(Event)



Building

(Architectural Object)

Document

(Historical Document)

Person

(Agent)

Event

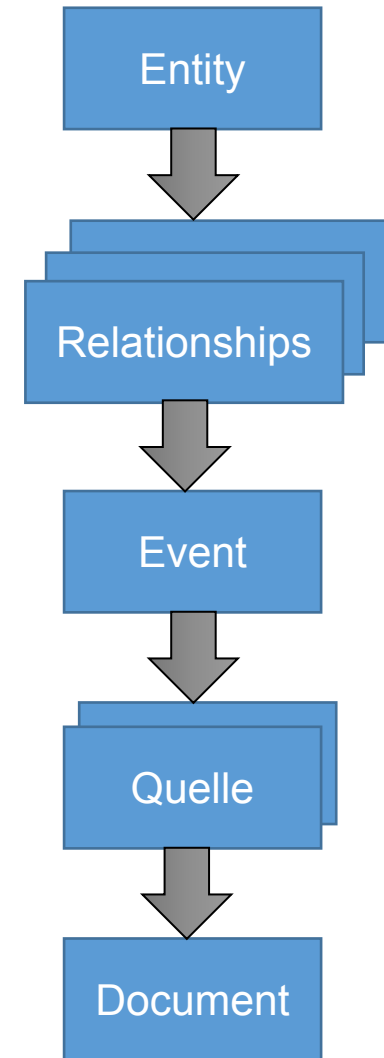
(Event)





# Event model

- Events determine a specific temporal process
- They can be documented by one or more **sources**
- **Sources** refer to a page/section/position in a **document**
- **Documents** are (digital) building files, address books, building drawings, maps, deeds, images, articles, etc.
- Events such as the sale of a house require several typified relationships (object of purchase, buyer, seller, notary, witness)
- Orientation towards CIDOC/CRM



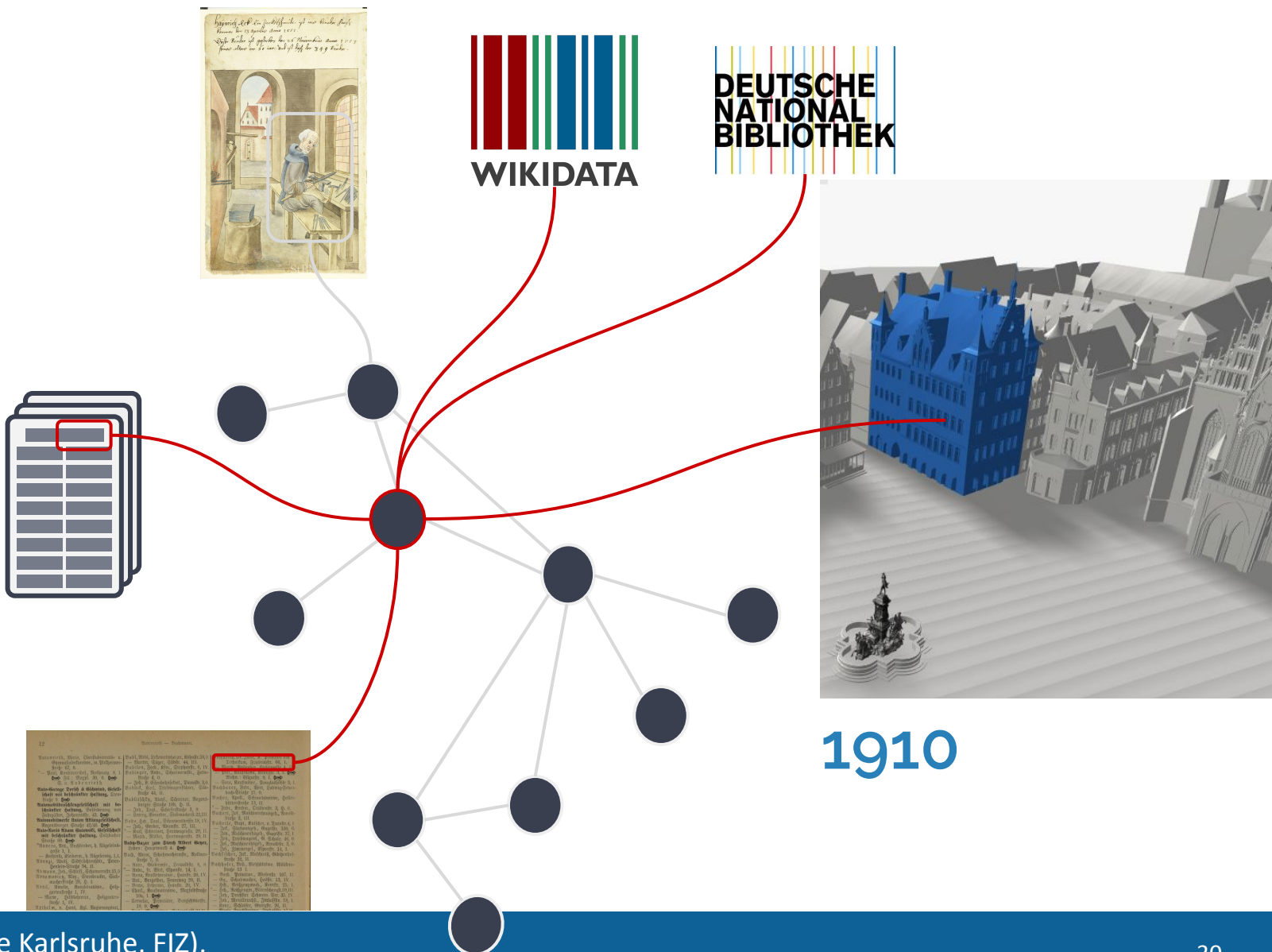


# Integration of historical sources

## TRANSRAZ Knowledge Graph

is used to link architectural objects **with people** and **companies** that lived or existed there at certain times.

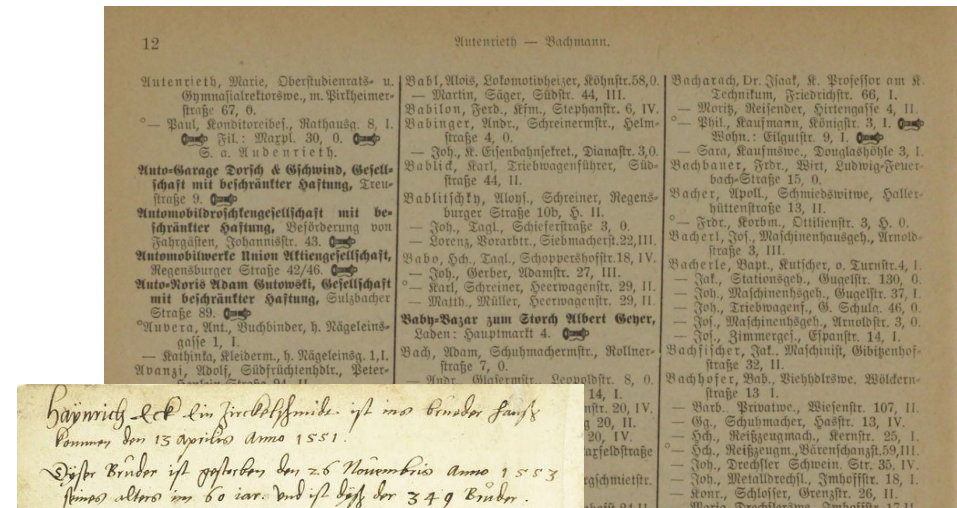
- Historical professions
- Family relationships
- Creative works
- Technological advances
- Historical events





# Historische Quellen

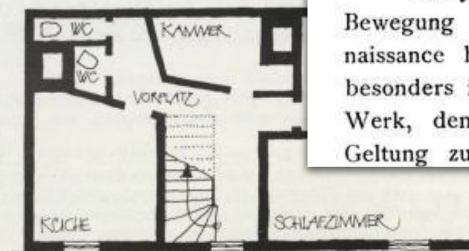
- Nuremberg address books (since 1792)
- Nuremberg lexicon of artists
- (12th century to mid 20th century)
- House registers of the Nuremberg Twelve Brothers' Foundations
- (14th century - 19th century)
- Notices of the Association for
- History of the City of Nuremberg
- (annually since 1879)
- Nuremberg Old Town Reports



Kleinheit der „Puppenzimmer“ sehr behindert.  
Eine — im ersten Augenblick utopisch aussehende  
lichkeit soll aber wenigstens zur Diskussion gestellt werden

Zeichnung 3 (rechts):  
Grundriß des  
2. Oberstockwerks.

Zeichnung 4 (unten):  
Möglicher Grundriß  
bei Vereinigung mit  
dem Nachbarhaus  
Obere Krämer-  
gasse 3.



Wappen der **Lemmel** und der Imhoff. Er war der letzte seines Geschlechts. Sein Erbe wurde Leonhard →Tucher. Seine Frau besaß 1514 das Haus Theresienstraße 2, das sie von ihrem Vater geerbt hatte. Sie starb im Brigittinnenkloster Maria Mai in Maihingen b. Nördlingen. Lit.: Biedermann, 1748 Taf. CCVI; Roth, 1802; L. Wilckens, in: Baier, St. Sebald 1979, S. 138; Schleif, in: Kammel, Christkind 2003, S. 109-112; CD-Rom „Das Große Tucherbuch“, 2004; Kohn, NHB

## Hans Sachs und die Reformation bis zum Tode Luthers.

Von

Dr. Jos. Beifus.

Die Jugendzeit des Hans Sachs fällt in Jahre der größten Bewegung auf jedem Gebiete. Die Errungenschaften der Renaissance hatten auch in Deutschland Boden gewonnen und besonders in des Dichters Vaterstadt Nürnberg waren viele am Werk, dem wiedererstehenden Altertum in weiteren Kreisen Geltung zu verschaffen. Auf dem Gebiete der Religion, das

Michael, Patrizier, Stifter,  
1484 Catharina († 1516),  
off, kinderlos. 1485-1513  
für den Apostelaltar der  
mit einer Darstellung des  
und Johannes dem Täu-  
Auferstehung der Toten,  
und Katharina sowie die



# Workflow and challenges

- OCR and hOCR of historical sources
- Correction of incorrect OCR results and normalisation of names
- Named Entity Recognition and Relation Extraction
- Linking and disambiguation of entities from different time periods and contexts
- Semantic representation of data extracted from historical resources and the relational database TOPORAZ.



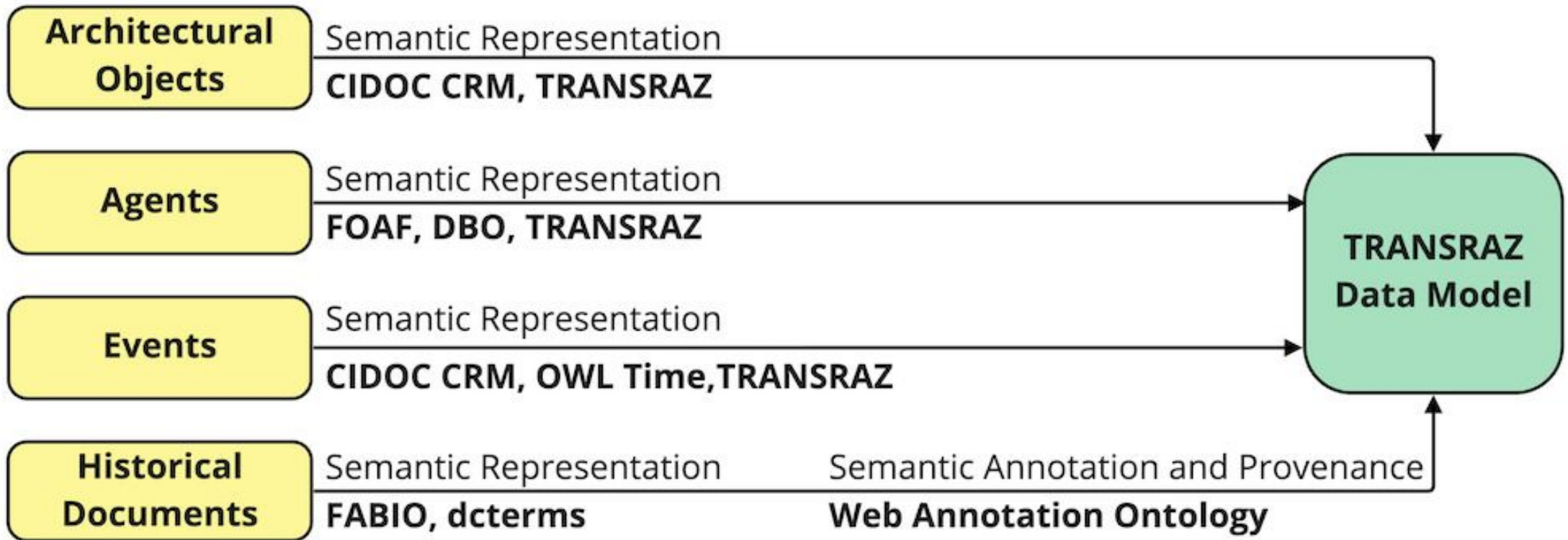




# TRANSRAZ Data Model: Modelling Approach

- **Bottom-up modelling**  
→ from concrete data to abstract model
- **Modular approach**  
→ four building blocks of the TRANSRAZ data model
- **Definition of modelling requirements for each block**  
→ based on research and competency questions from domain experts
- **Evaluation of existing ontologies based on these requirements**  
→ reuse and extension of existing ontologies

# TRANSRAZ data model: Ontologies



See documentation: <https://ise-fizkarlsruhe.github.io/Transraz/datamodel>





# Summary and lessons learned

- Machine processes for modelling and knowledge extraction are necessary above a certain scale
- OCR of historical sources is still unsatisfactory because it is error-prone
- Named Entity Recognition and Relation Extraction are therefore based on uncertain source data
- Comparison with multiple sources, citizen science and transparency (provenance) can provide a remedy



# Outlook

- Plan new project(s)
- other city / cities
- make infrastructure more generic and scalable
- interoperability

→ connect to other initiatives and infrastructures





# Hope you enjoyed it questions ???

contact: [felix.bach@fiz-karlsruhe.de](mailto:felix.bach@fiz-karlsruhe.de)



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