

<https://sphaera.mpiwg-berlin.mpg.de>

THE SPHERE

Knowledge System Evolution and the Shared Scientific Identity of Europe

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# De sphaera



# Evolution of Knowledge Systems

- Homogenization of Knowledge
- Mathematization of Scientific Knowledge

# Definition of the Corpus: The Treatise on *The Sphere*



Mandatory Text at the  
Faculties of Liberal Arts

Reference text and  
connections with other texts

Introduction to geocentric  
cosmology

A folio of a 13th-century copy of Sacrobosco's *De sphaera*. Königliche Bibliothek Kopenhagen: MS NKS 275a

# Which Data? - Systematic Dataset

1472 – 1650

Only Printed Books

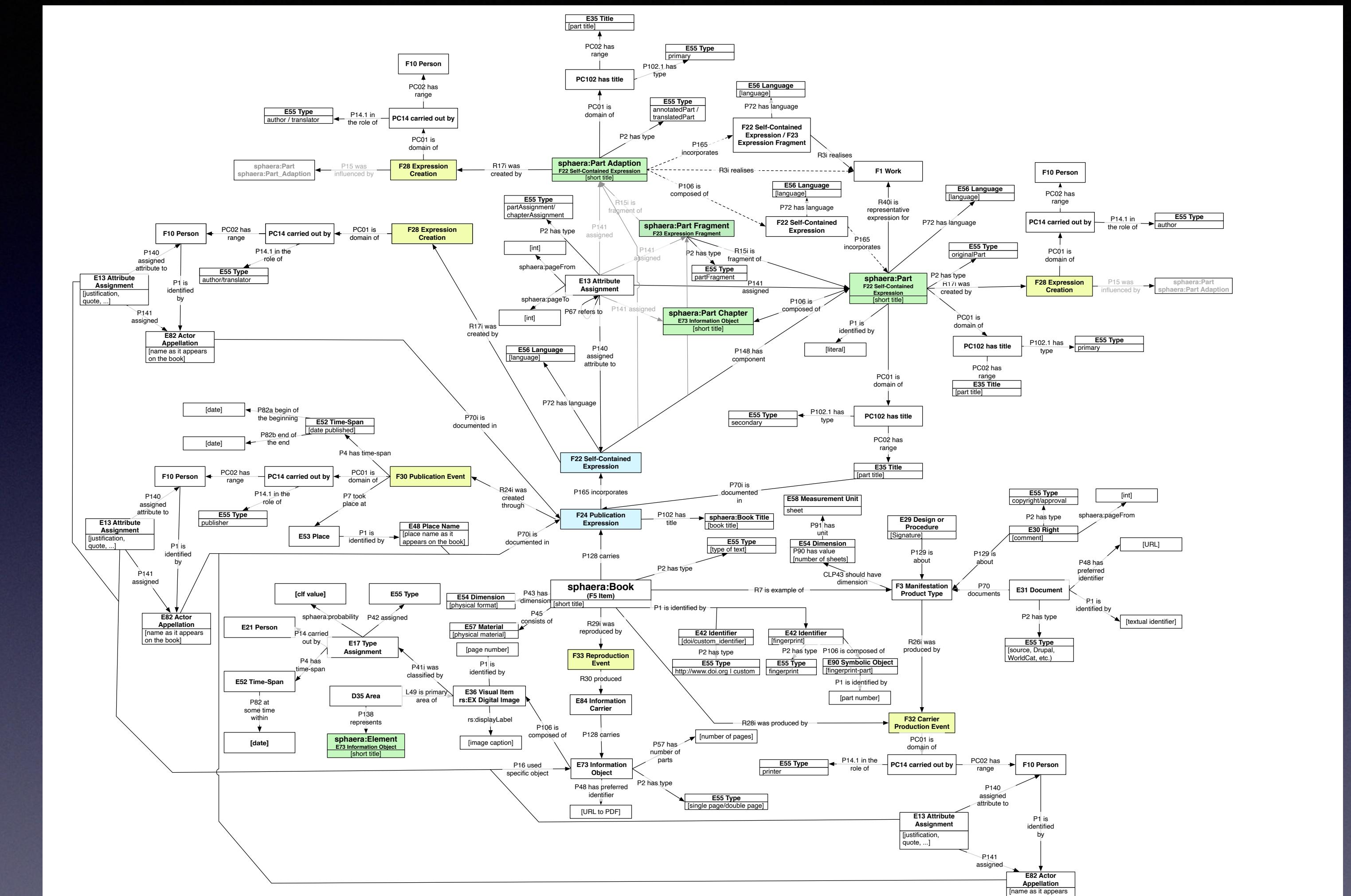
Corpus of 359 printed editions

# Corpus Tracer

The screenshot shows the Sphaera interface with five entries:

- Hartmann Beyer**: Date of publication 1550. Author: Johannes de Sacrobosco. Publisher: Juan de Junta. Title: *Sphera Ioannis de Sacro Busto cum commentariis Petri a Spinosa Artium Magistri, celeberrimique praceptoris Salmanticensis gymnasij, aeditis*.
- Quaestiones novae in libellum de sphera Ioannis de Sacro Busto, in gratiam studiosae iuventutis collectae ab Hartmanno Beyer, recognitae & plaeisque in locis auctae**: Author: Johannes de Sacrobosco. Publisher: Peter Braubach. Date of publication 1549.
- Prosdocio Beldomandi**: Date 1380 – 1428.
- Guglielmo da Trino**: Title: *Sphera materialis: eyn anfang vnd fundament der Astronomi / auss den elisten dieser kunst meystern / Euclide / Aristotele / Alphagano / Ptolomeo / Almeone / Vergilio / Ovidio / Lucano etc. durch den weitberübtten Johannem de Sacro busto ins Latin zusammen gesetzt / und nachmals durch M. Conrad Heynfogel von Nürnberg verteutscht / zuletz aber den alten exemplaren nach / durch M. Polychorium / allen der Astronomi liebhabern zu gut / fleissig wiederumb verlesen / und in vier teyl*.

RDF Knowledge graph.  
Data according to the formal ontology CIDOC-CRM and the FRBRoo extension for bibliographic records



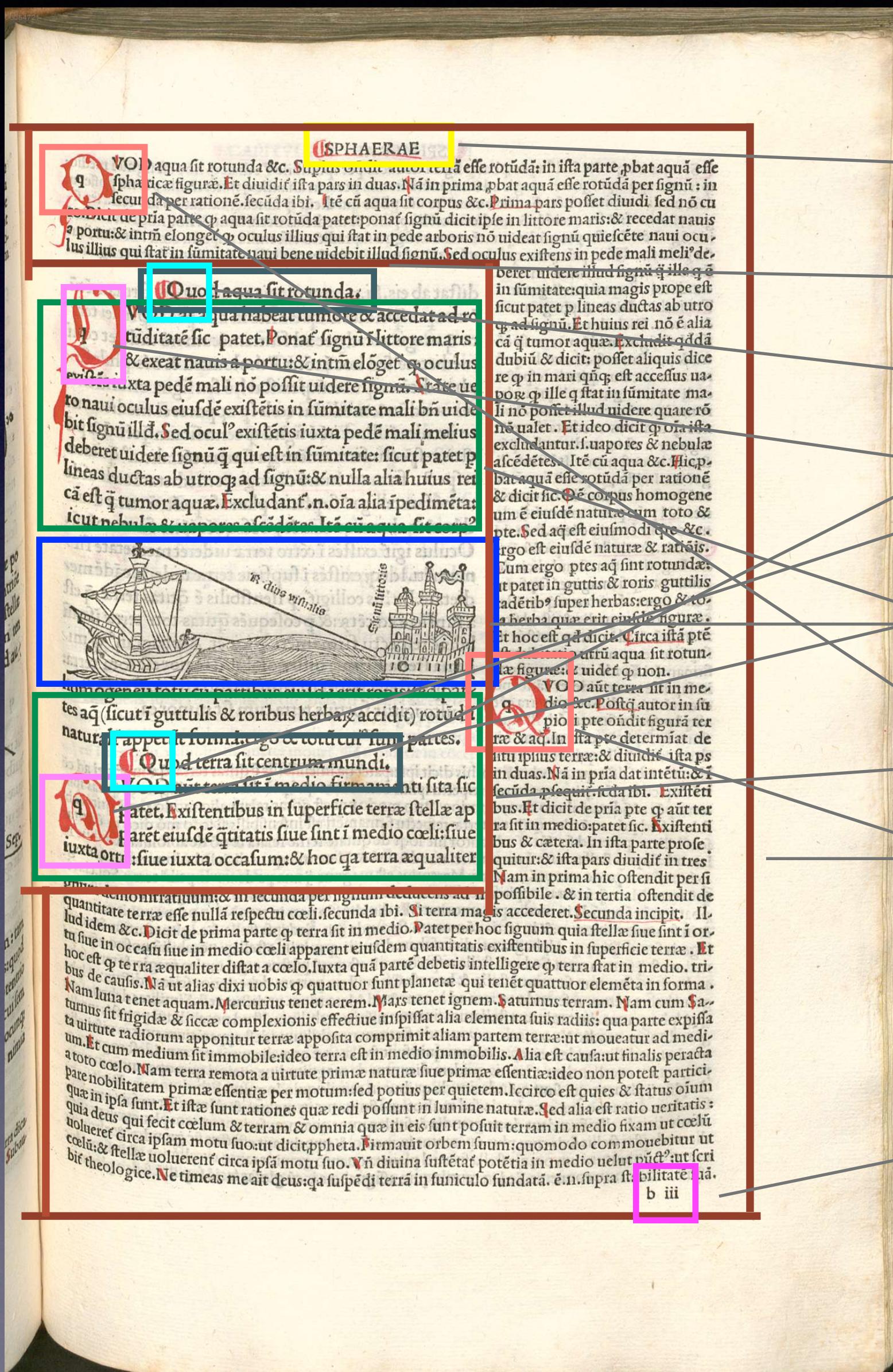
Florian Kräutli  
Matteo Valleriani  
[researchspace.org](http://researchspace.org)

# Metadata Geo-Temporal Distribution



Places of publication for the treatises published between 1472 and 1650 are visualized in Palladio. Screenshot of [hdlab.stanford.edu/palladio-app/](http://hdlab.stanford.edu/palladio-app/)

# CV-Based Approach



Running Heading

Headings Original Text

Initials Headings Original Text

Initials Original Text

Image

Original Text

Commentary Text

Initials Commentary Text

Signature

# Knowledge Atoms

Which data are representative for knowledge  
(Content of the treatises)?

- Texts (Parts) —————> Original text  
Commentary Text  
Translation
- Images
- Tables

# Data - Parts

- Original text parts: 444
- Commentaries and Translations: 119
- Evolution (Re-use)
- Occurrences of 239 (119 + 120 of 444) Parts:  
1653 (range: from 1 to 89 times)

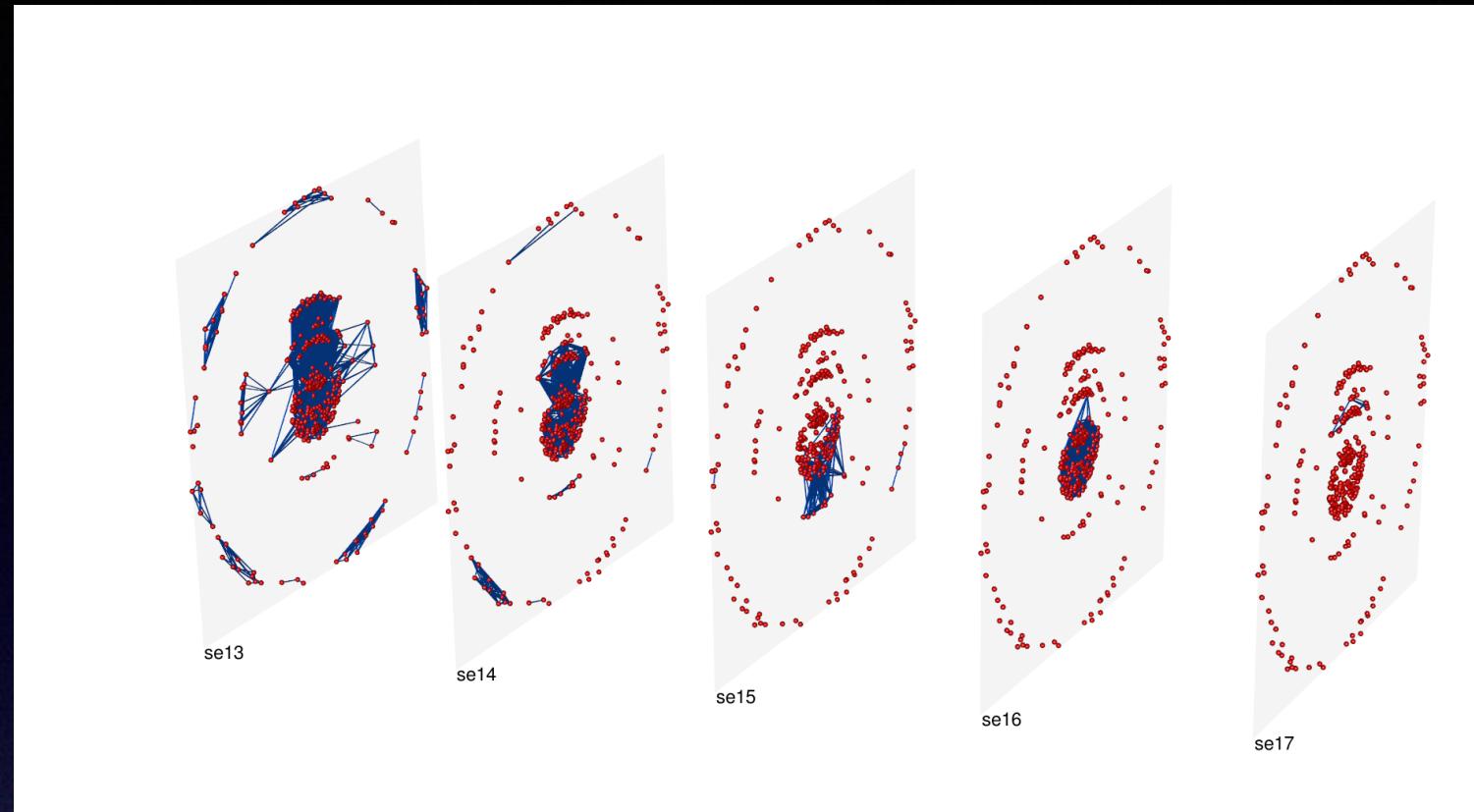
# Data - Images

<http://c108-011.cloud.gwdg.de>

ca. 20.000 illustrations



# Is homogenization the result of the emergence of a dominant community?

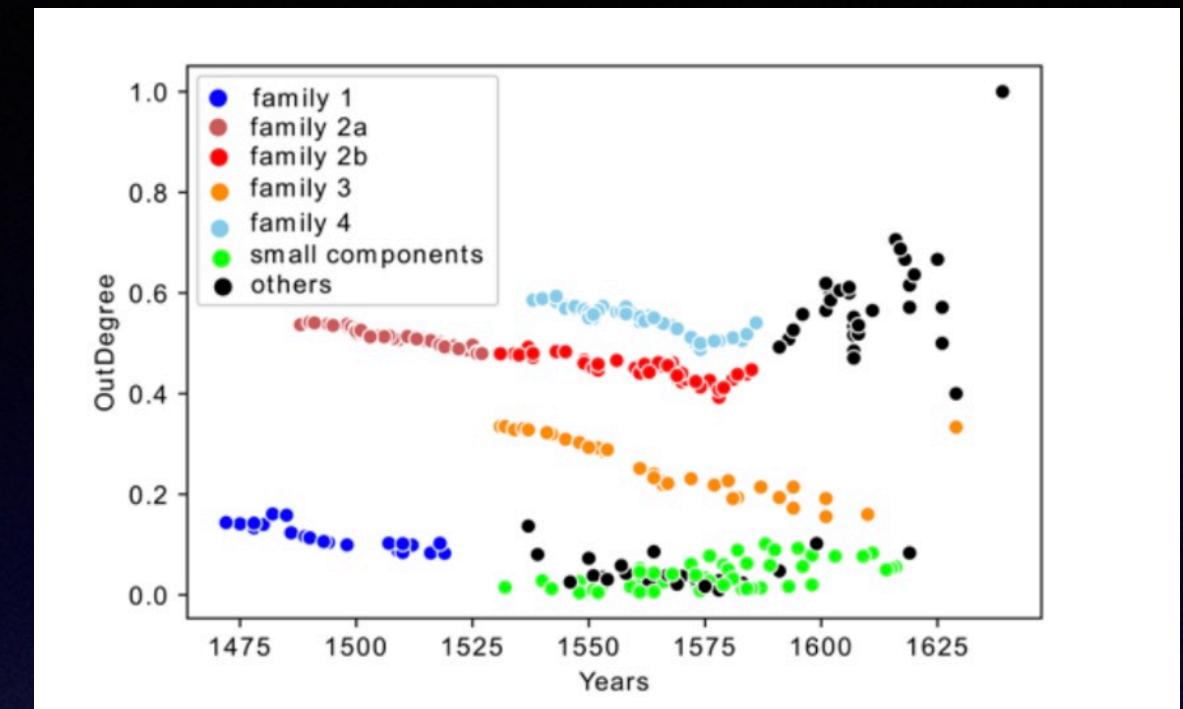


Nodes: Editions

Edges: two editions are connected when:

- se13: share same original text-part
- se14: share the same commentary on original text-part
- se15: share translations of the same original text-part
- se16: share different commentaries on the same original text-part (excluded se14)
- se17: share the same commentary on the same commentary or translation

Graphs are oriented: chronologically structured



Dominant communities:

Family 3: 1531: Wittenberg by Joseph Klug  
Family 4: 1538: Wittenberg by Joseph Klug

- Introduction of new original part
- Adoption in Venice and Paris (biggest production centers)
- More text parts (commentaries) in Paris
- Spread from Paris (and less from Venice) all over Europe

**JHNR**  
**Journal of Historical Network Research**

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**The Emergence of Epistemic Communities in the Sphaera Corpus**  
Mechanisms of Knowledge Evolution

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**Keywords:** Early modern cosmology, epistemic communities, multiplex network analysis, semantic network, knowledge evolution

**Abstract**

Published 2019-11-19

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<https://doi.org/10.25517/jhnr.v3i1.63>

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Issue  
[Vol 3 No 1 \(2019\): The third issue](#)

Section

# Introducing “Adaptions”



Nodes: Editions

Edges: two editions are connected when:

- se13: share same original text-part
- se14: share the same commentary on original text-part
- se15: share translations of the same original text-part
- se16: share different commentaries on the same original text-part (excluded se14)
- se17: share the same commentary on the same commentary or translation
- **se19: are "adaptions (book)" and contain a text-part which is strongly influenced by the same original text-part**

Graphs are oriented: chronologically structured

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Article | Open Access | Published: 13 November 2020

**Evolution and transformation of early modern cosmological knowledge: a network study**

Maryam Zamani, Alejandro Tejedor, Malte Vogl, Florian Kräutli, Matteo Valleriani & Holger Kantz

Scientific Reports 10, Article number: 19822 (2020) | Cite this article

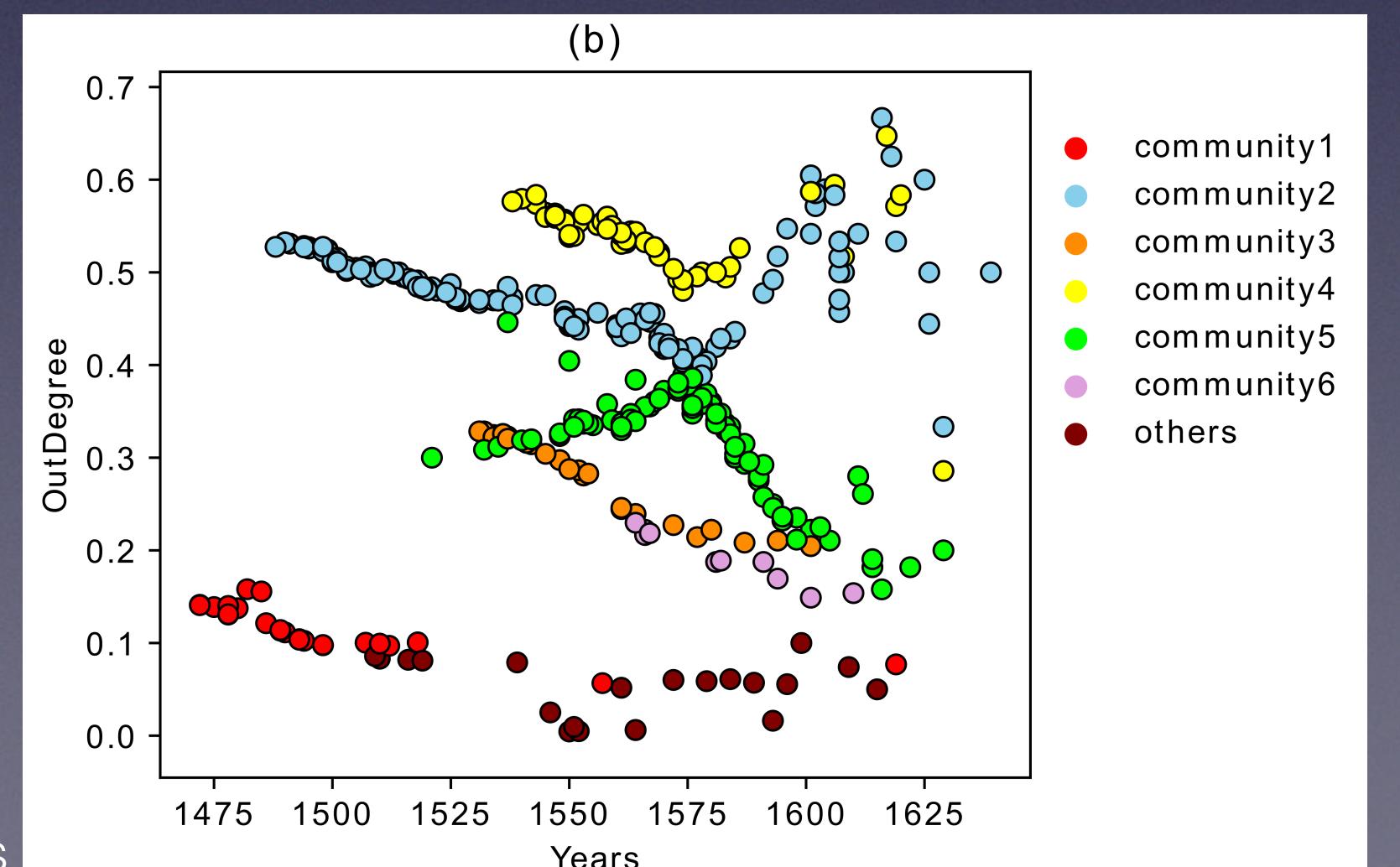
2054 Accesses | 1 Citations | 41 Altmetric | Metrics

**Abstract**

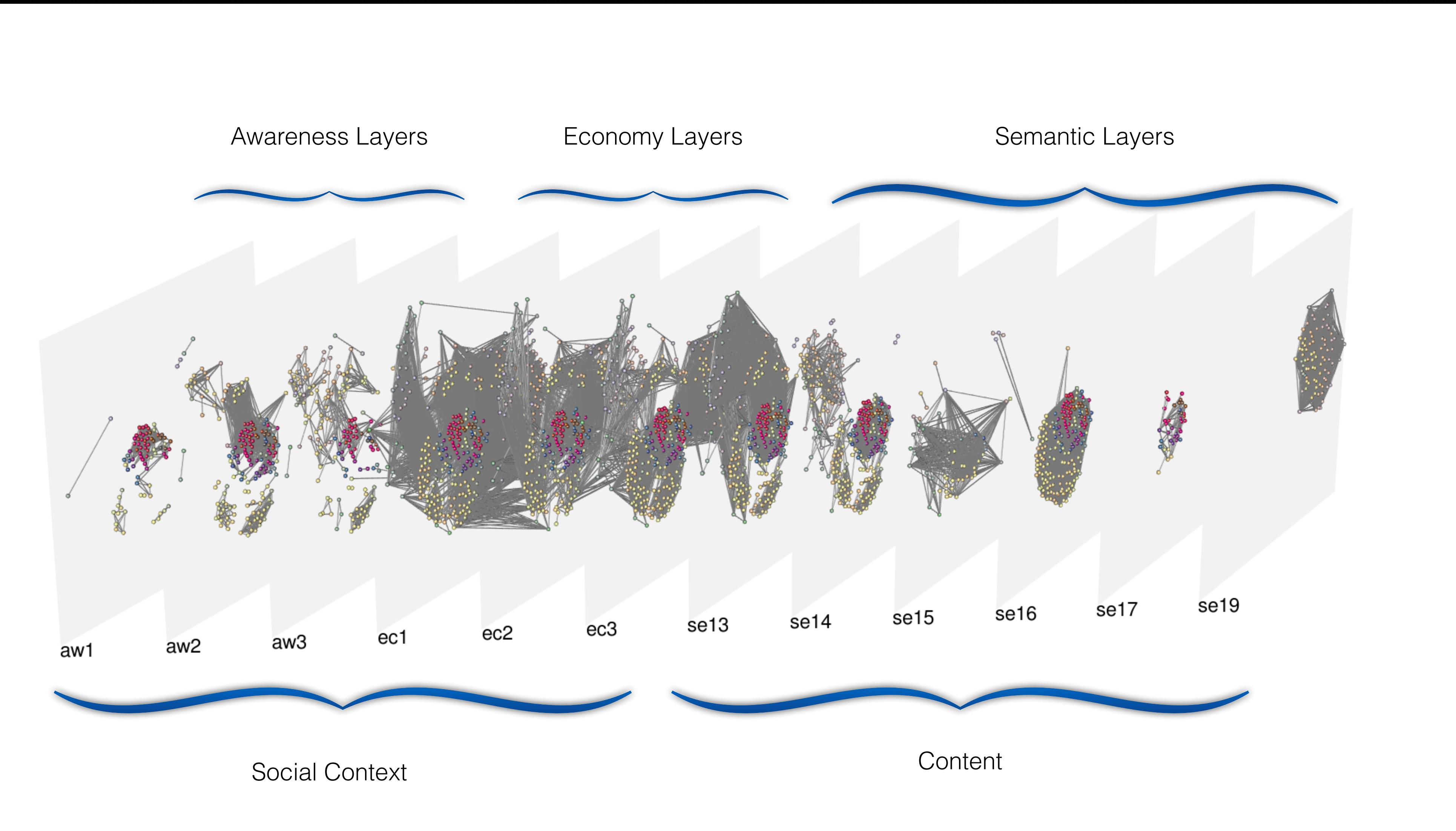
We investigated the evolution and transformation of scientific knowledge in the early modern period, analyzing more than 350 different editions of textbooks used for teaching astronomy in European universities from the late fifteenth century to mid-seventeenth century. These historical sources constitute the *Sphaera Corpus*. By examining different semantic relations among individual parts of each edition on record, we built a multiplex network consisting of six layers, as well as the aggregated network built from the superposition of all the layers. The network analysis reveals the emergence of five different communities. The contribution of each layer in shaping the communities and the properties of each community are studied. The most influential books in the corpus are found by calculating the average age of all the outgoing and in-coming links for each book. A small group of editions is identified as a transmitter of knowledge as they bridge past knowledge to the future through a long temporal interval. Our analysis, moreover, identifies the most impactful editions. These books introduce new knowledge that is then adopted by almost all the books published afterwards until the end of the whole period of study. The historical research on the content of the identified books, as an empirical test, finally corroborates the results of all our analyses.

**Introduction**

How does scientific knowledge evolve<sup>1,2,3,4,5</sup>? How did it evolve in the past, for instance, during a specific period of time? How does knowledge transform? Which epistemic mechanisms make knowledge homogenous and standardized and which causes it to differentiate and diverge<sup>6,7,8</sup>? And finally, how are these transformations intertwined with the process of transmission and preservation of knowledge over time<sup>9,10,11</sup>? These relevant and fascinating questions can be approached by means of network study as it provides efficient and appropriate investigative tools<sup>12,13,14</sup>. By means of this approach, scholars have, for



# Are semantic communities related to social communities?



- Data Matrix: M. Vogl, H. el-Hajj.
- Analysis: M. Zamani, H. Kantz
- Empirical corroboration and interpretative framework: M. Valleriani
- Layout: Fruchterman-Reingold / Isolated nodes are excluded / Centrality is colored

# Machine Learning Tasks in Sphaera and DH

- Data extraction
- Data analysis
  - Clustering on the basis of different forms of similarity
- Simulation of graphs' evolution

But also:

- Data cleaning
- Data provenance