



Semantic Annotation for Medieval Cartography

The Example of the Behaim Globe of 1492

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Martin Behaim

6.10.1459

29.7.1507

- from 1474 in Flanders (Mecheln, Antwerp)
- from 1484 in Portugal
- 1485 Portugese knight
- marriage ~1485-89
- 1490 in Nuremberg
- 1493 back to Portugal



Behaim Globe

1492

- Ptolemaic map image
(=> *Martellus*)
- Details
 - medieval mappae mundi
 - Climate zones
 - Portolan elements
 - Degree marks on equator and meridian,
no coordinate grid
 - inscriptions and
overwritings;
encyclopedic texts



Behaim's "Erdapfel"

- More than
 - 100 miniatures, ca. 50 banners, 15 types of coats of arms
 - 50 long inscriptions (by at least 6 hands)
 - 2000 toponyms
- Diameter ~50 cm, laminated hollow sphere
- Paper, colorfully painted
 - Georg Glockendon; Gagenhart (writer)
- Production: cf. final account of 1494
 - collaborative product of Nuremberg's humanist circle
- *Latest Monograph: E.G. Ravenstein, 1908 ...*

Ptolemaic
map
image



Ptolemaic: Henricus Martellus Germanus (ca. 1490)

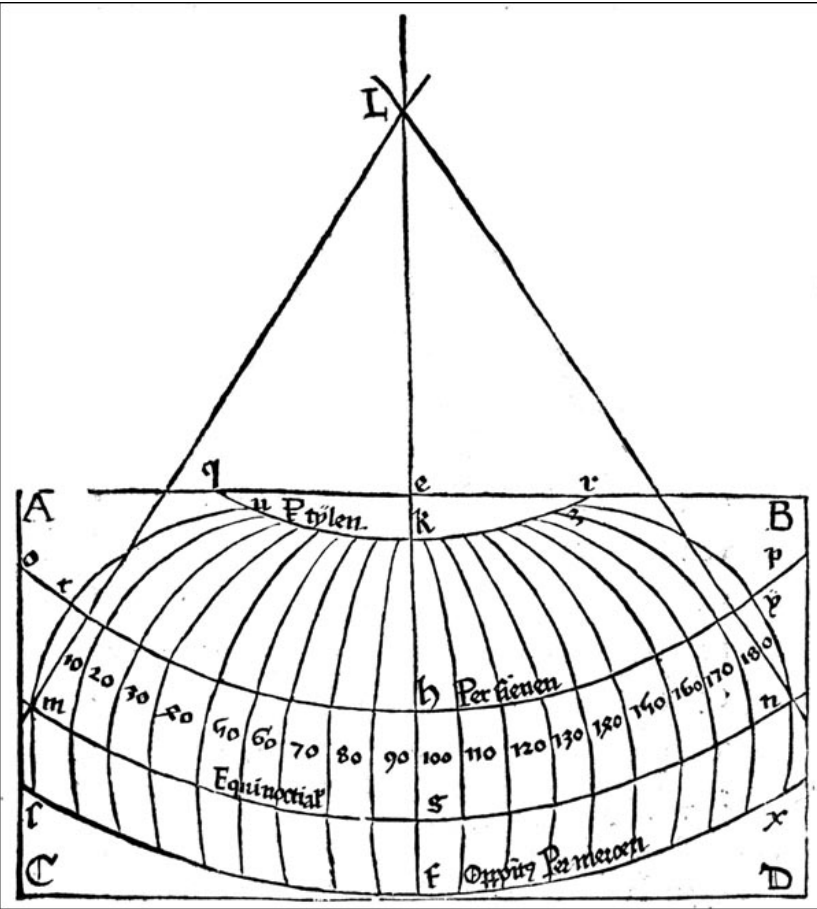
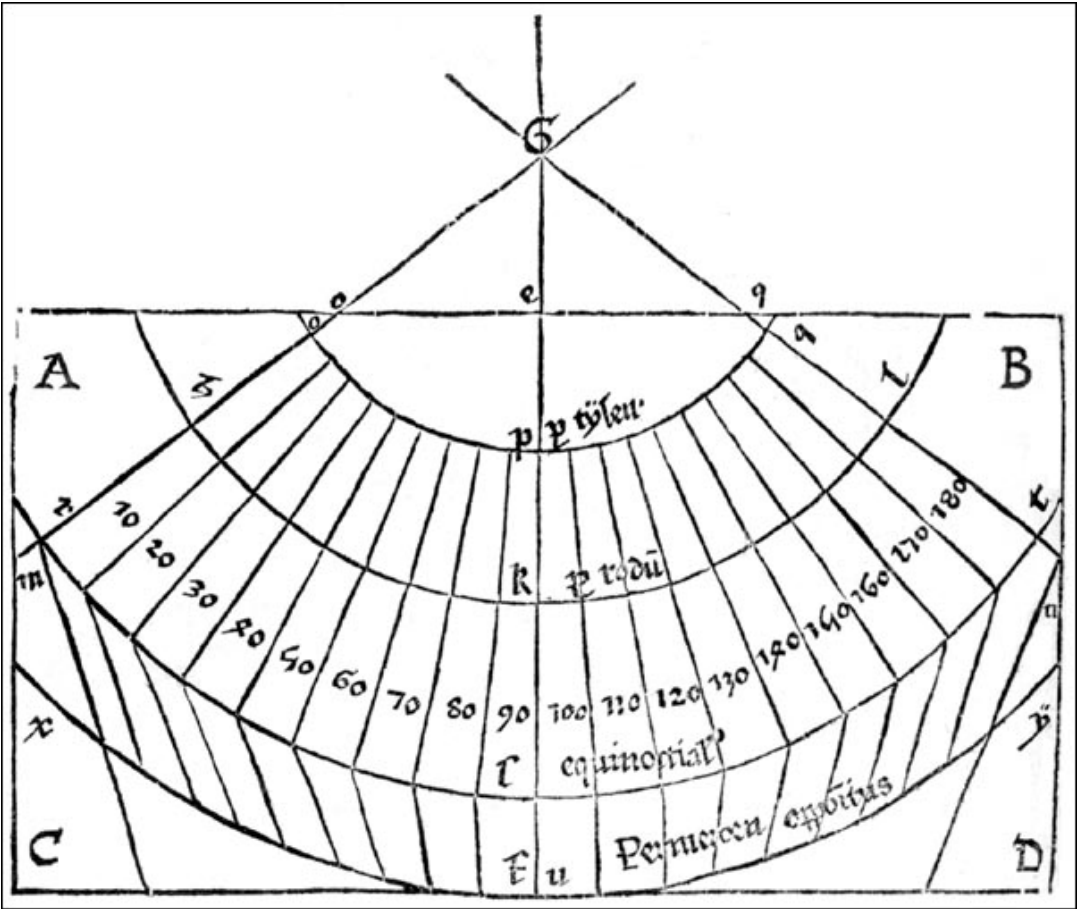


Claudius Ptolemy

- Klaudios Ptolemaios
ca. 100 – before 180,
Alexandria
- Most important works
 - “Almagest” (Megiste Syntaxis)
 - Geographike Hyphegesis
 - Book 1: Theory (Projections, ...)
 - Book 2 – 7.4: Catalogue
 - Book 7.5 – 8: Theory + maps (?)
- Humanist reception of Ptolemy: complex



Ptolemy: Projections



Behaim Globe / modern contours



G. Goerz, FAU, CS-DH

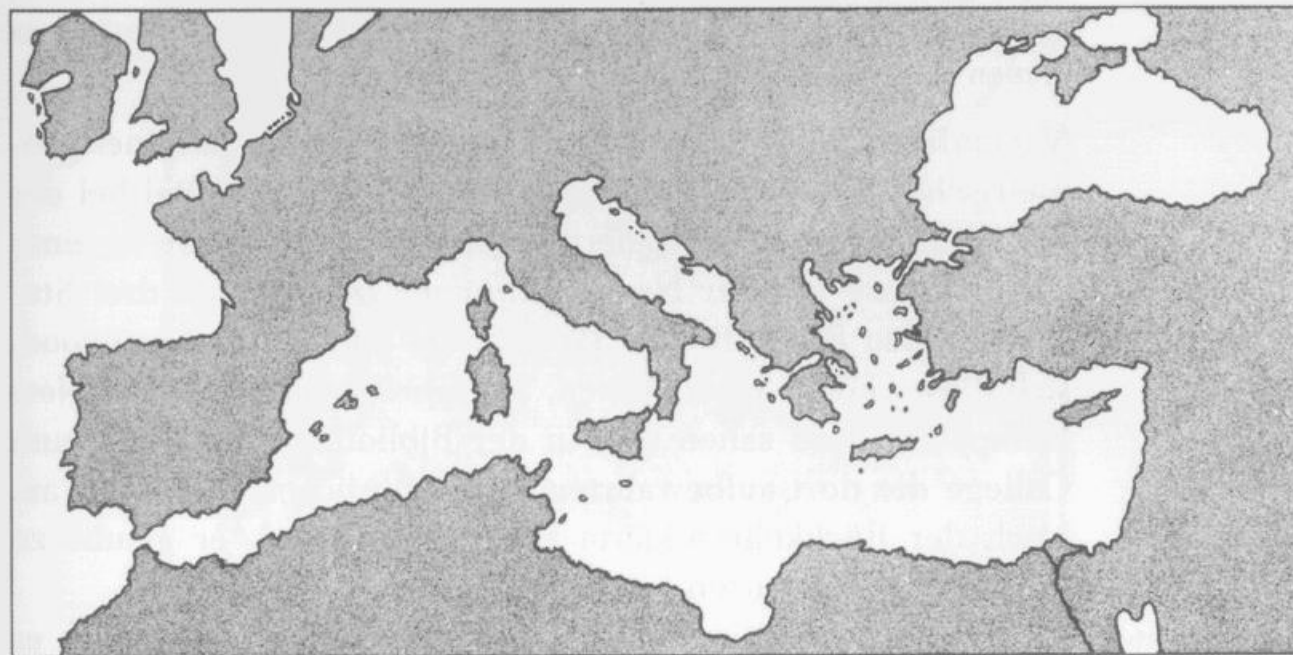
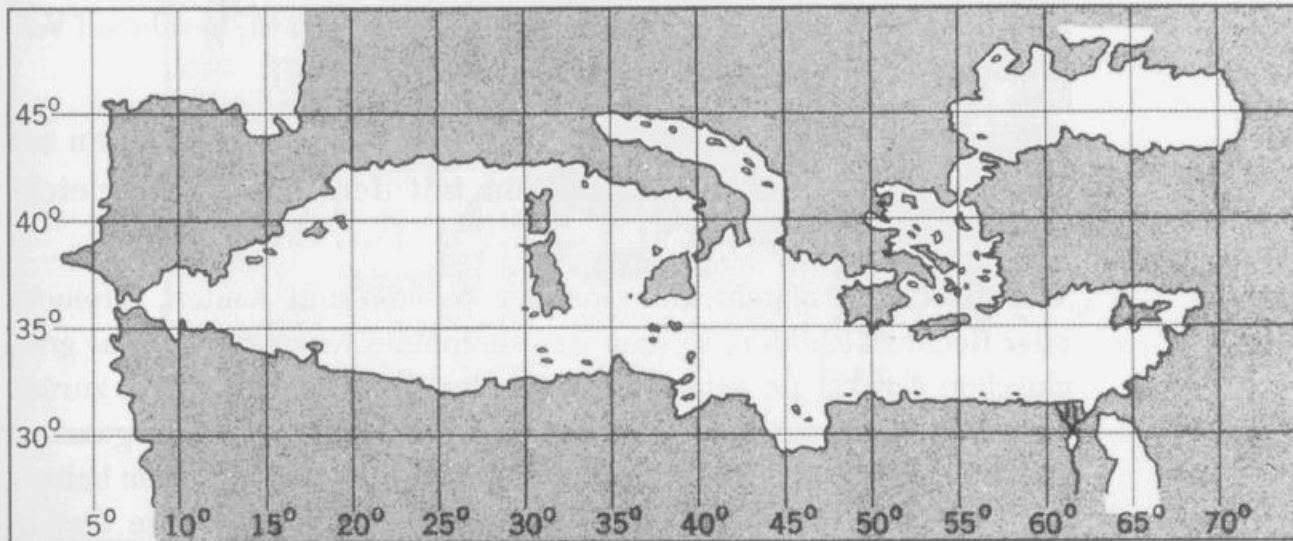


Abbildung 4. Nordenskjölds Vergleich der Mittelmeerkarte des Ptolemäus (oben) mit der Portolankarte von Dulcert



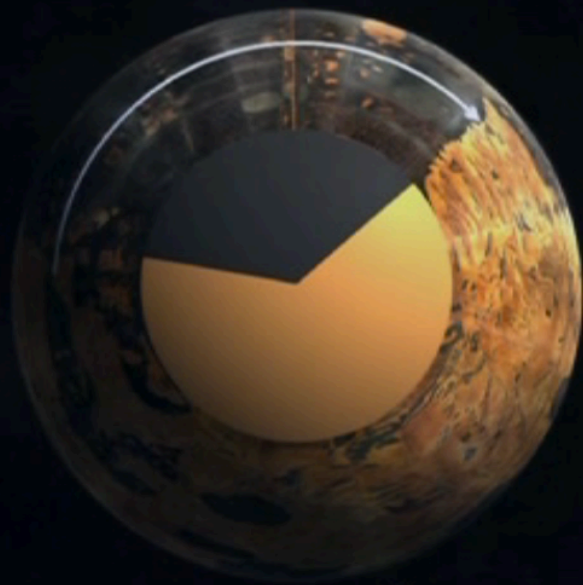


Third Ptolemaic Projection (~1465)

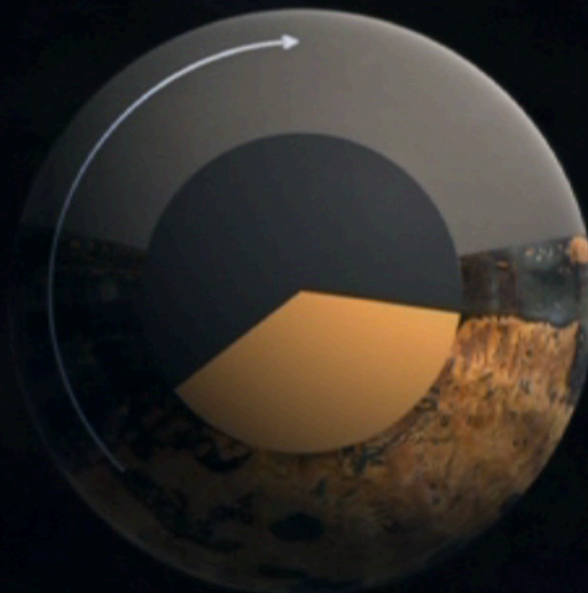
From Canaries
to
East Asia: 180°

from Northern
Europe/Asia (65°)
to
Central Africa (-15°)





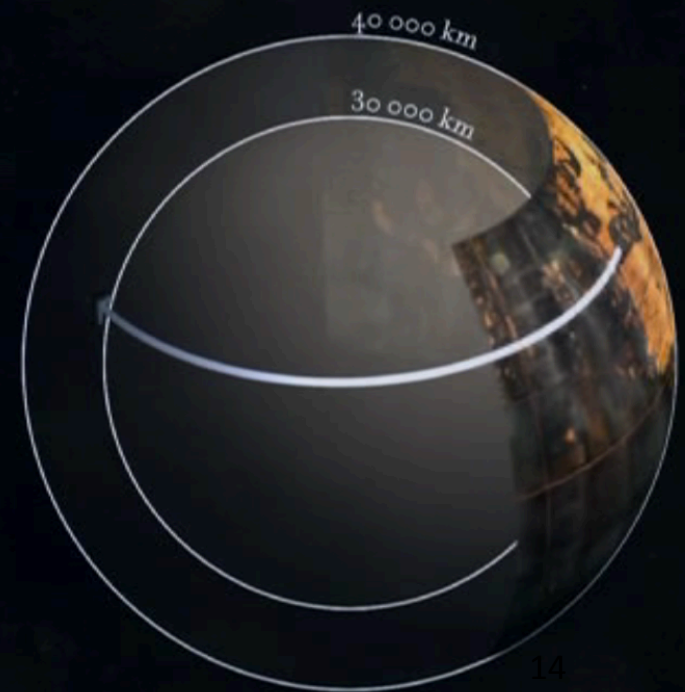
225°



130°

Problem 1:
Extension of the
inhabited world

Problem 2: Circumference of the earth
500 vs. 700 stadia per degree at equator
Marinos/Poseidonios: 180.000 stadia
Eratosthenes: 252.000 stadia

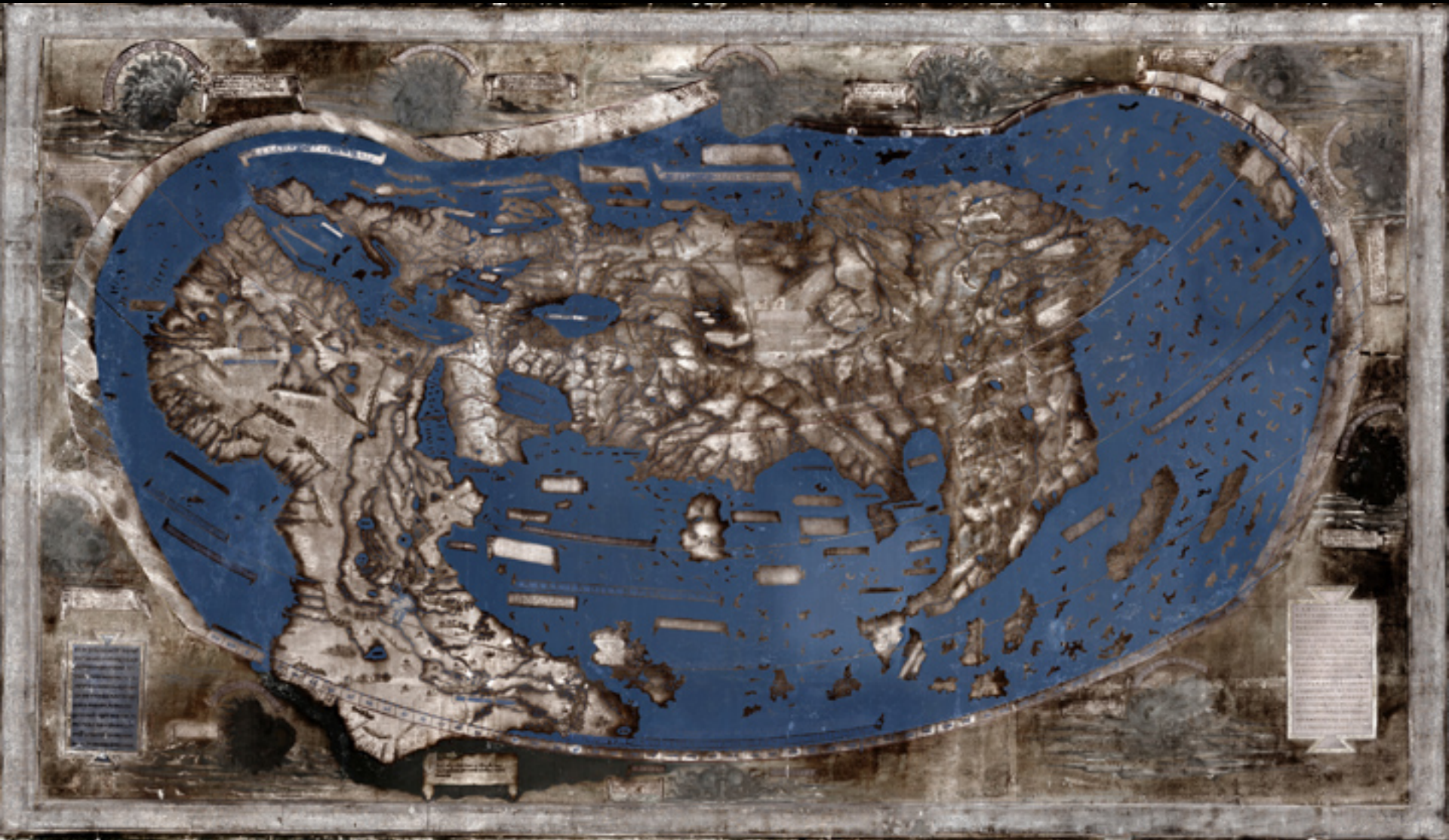


Henricus Martellus: World Map 1488/90 (Insularium, Florence)



Henricus Martellus: World Map 1489/91 (Yale)

Multispectral Record – *Coordinate Grid*



Behaim Globe

Mercator projection reconstructed



Attavante: St. Hieronymus (King Manuel Bible, 1497)
Chet van Duzer (2011)



F. Rosselli: World map – after Martellus (1492)



From the final account, 26.08.1494

Expensß - 1494 adi 26 Augst in Nürenberck - Expensß.

Hernach stett, was ich Jorg Holtzschucher ausgeben hab, den apffel oder mapa mundy in die runden einer kugel geleich, auch vmb die getruckten mapa in die kantzley zu machen, mallen vnd aller vncost, aus wefelch meiner hern der loßunger; die dan her Merten Beham meinen hern eim erbern ratt zu letze hinter im verlaßten hatt, die kunst vnd müe seinthalb daran gelegt etc. :

■ ■ ■

Item so zalt ich her Merten Beham vmb ein getruckte mapa mundy, da die gantz welt ina wegriffen ist, die da wol dint zu dem apffel ⁵⁾ vnd in die kantzley gehenckt wirt, kost 1 fl. 3 lb.; mer kost sie zu maln 1 fl.; mer zu fütern vnd leima 5 lb. 10 dn.; mer dem schreiner in ram vnd zwue taffel gemacht 1 fl.; mer dem Starch maller von disen hulzen tafeln zu maln, 4 lb. 6 dn.; facit. fl. 4. lb. 4. dn. 6.

Influences from portolans??

Jorge de Aguilar
1492: oldest
signed
& dated
Portugese
portolan



Pedro Reinel

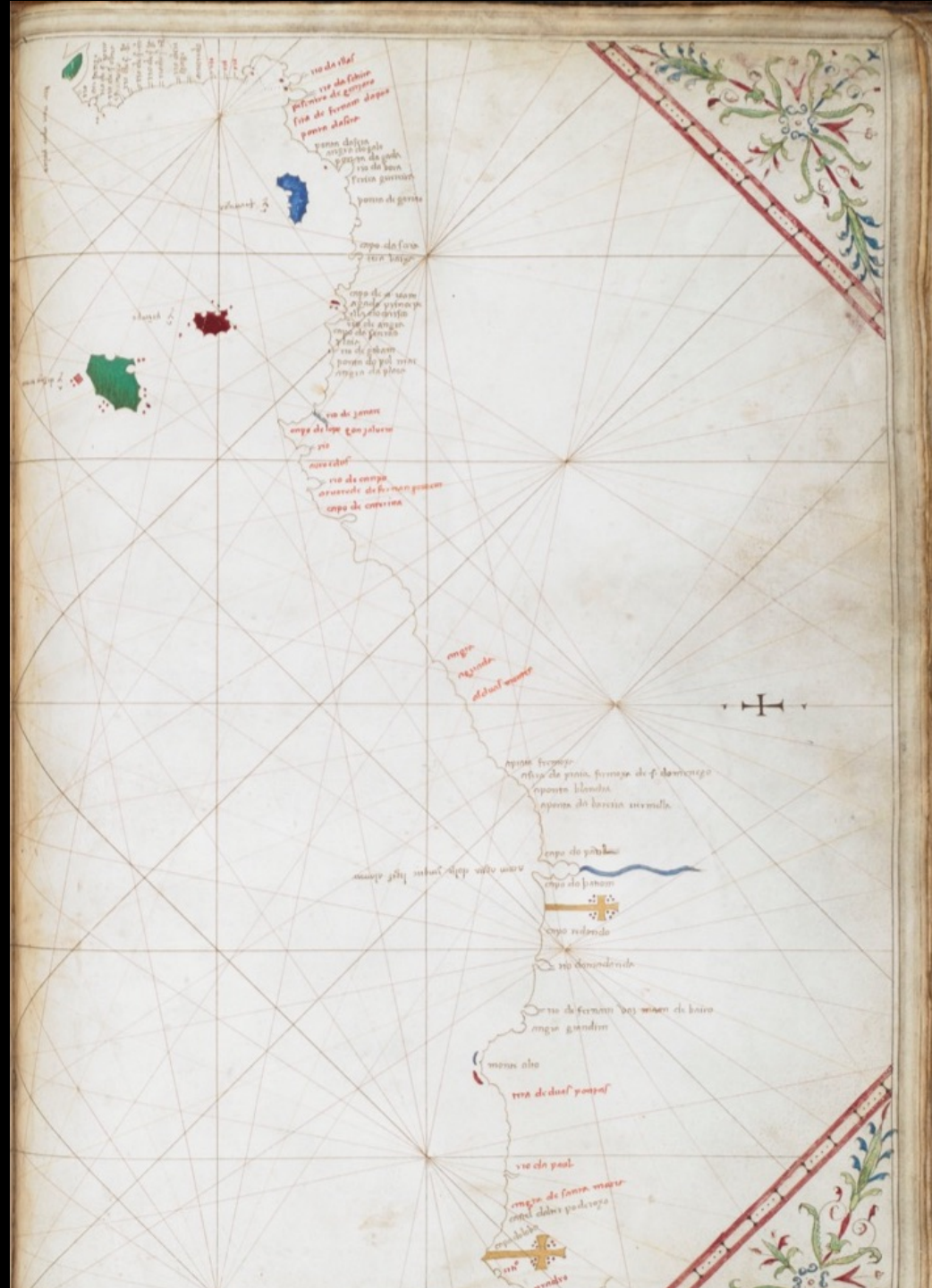
Oldest extant (?)
Portugese portolan
ca. 1484

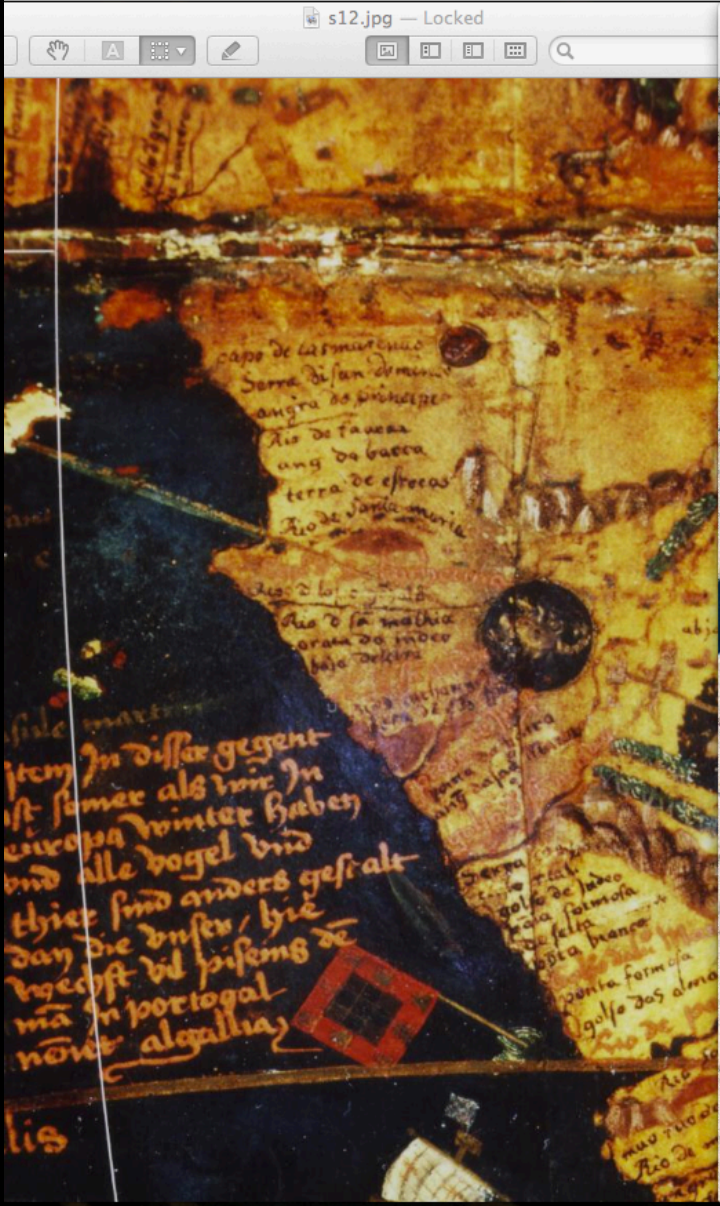


Ginea Portugalexe

Venetian copy of a
Portugese portolan
(after 1484)
ca. 1490

B.M. Egerton MS. 73, No. 33





Henricus Martellus Germanus, 1490



Madagascar and Sansibar

Caravel in the
Indian ocean
before
Vasco da Gama
(1498) !!



Fra Mauro, 1459



onei da queste isole foreane
e Papaver le tenebre le qual
to cauo no impacano in auesca

Lirca hi ani del signor 1420 una naue ouer concho de india discorse per una
trauersa per el mar de india ala uia de le isole de l'homenu e de le done de suo
ra dal cauo de diab e tra le isole uiede ele oscuritate ala uia de ponente e de
garbin per 40 giornate no trouando mai altro che aere eaqua e p' suo arbitrio
iscorse 2000 mia e declinata la fortuna. i fece suo
retorno in corni 70 fita al sopradito cauo de diab
e acostandose la naue a l'riuo p' suo bisogno in a
rinari ueteno uno ouo de uno oselo no innato
chrocho el qual ouo era de la grandega de una
bota danfora. e la grandega de loselo era tanta
che da uno pico de lala al altro se dice esser 60
passa. e co' gran facilità lieua uno elefante
e ogni altro grado aial efa grã dano ali habitati
del paexe et e uelocissimo nel suo uolar.

Ethiopia quasi
saluaça meridional

ETH
AV

Transcription translated (Falchetta)

- *Around 1420 a ship, or junk, from India crossed the Sea of India towards the Island of Men and the Island of Women, off Cape Diab, between the Green Islands and the shadows. It sailed for 40 days in a south-westerly direction without ever finding anything other than wind and water. According to these people themselves, the ship went some 2,000 miles ahead until - once favourable conditions came to an end - it turned round and sailed back to Cape Diab in 70 days. And when the ship came close to shore, the sailors saw the egg of a bird called a chrocho which was the size of a cargo amphora; and the bird itself was so big that from the tip of one wing to that of the other it measured 60 feet, and it could easily lift up an elephant or any other large animal, causing great harm to the inhabitants of the land; and it was very fast in flight*

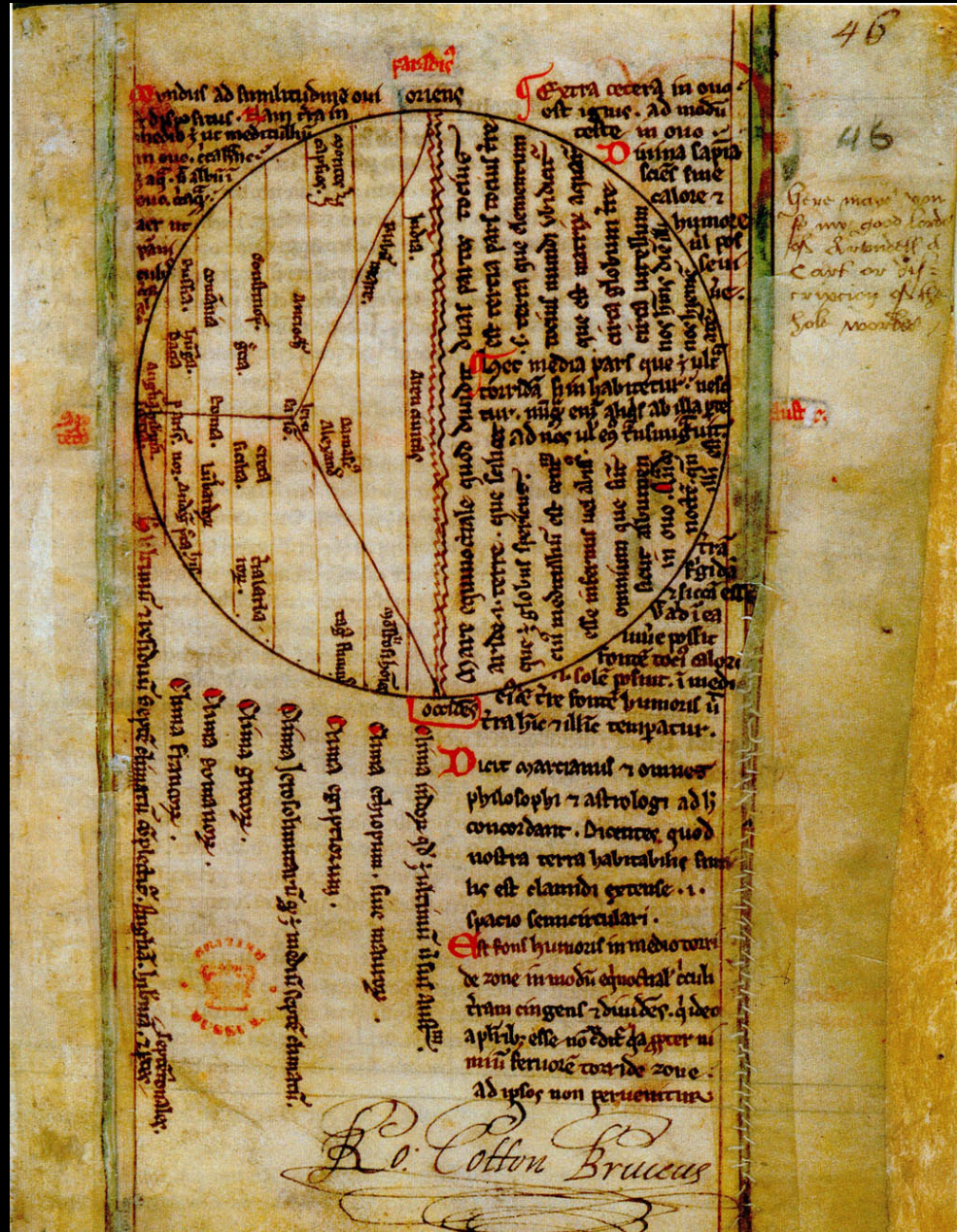




John of Wallingford (1250): Climate zones

Division of the earth into seven "climata" (latitude zones): same angle of incidence of solar beams

Time difference of longest day ½ hour, resp.



Encyclopedic elements in texts and images

Sources (some explicitly mentioned):

antique and medieval encyclopedias, travel reports

- Geography: islands, discoveries
- countries and peoples
 - habits, clothing, nutrition, religion, government
- flora and fauna
- monsters, curiosities, wonders
- merchandise
 - spices, pepper and herbs, exotic wood, ivory, gold, silver and precious stones

Secular turn: „*From the salvation road to the trading route*”

Prester King
John



Animals





G. Goerz, FAU, CS-DH

Monsters



Islands

mythical: Brazil

Canaries



Azores

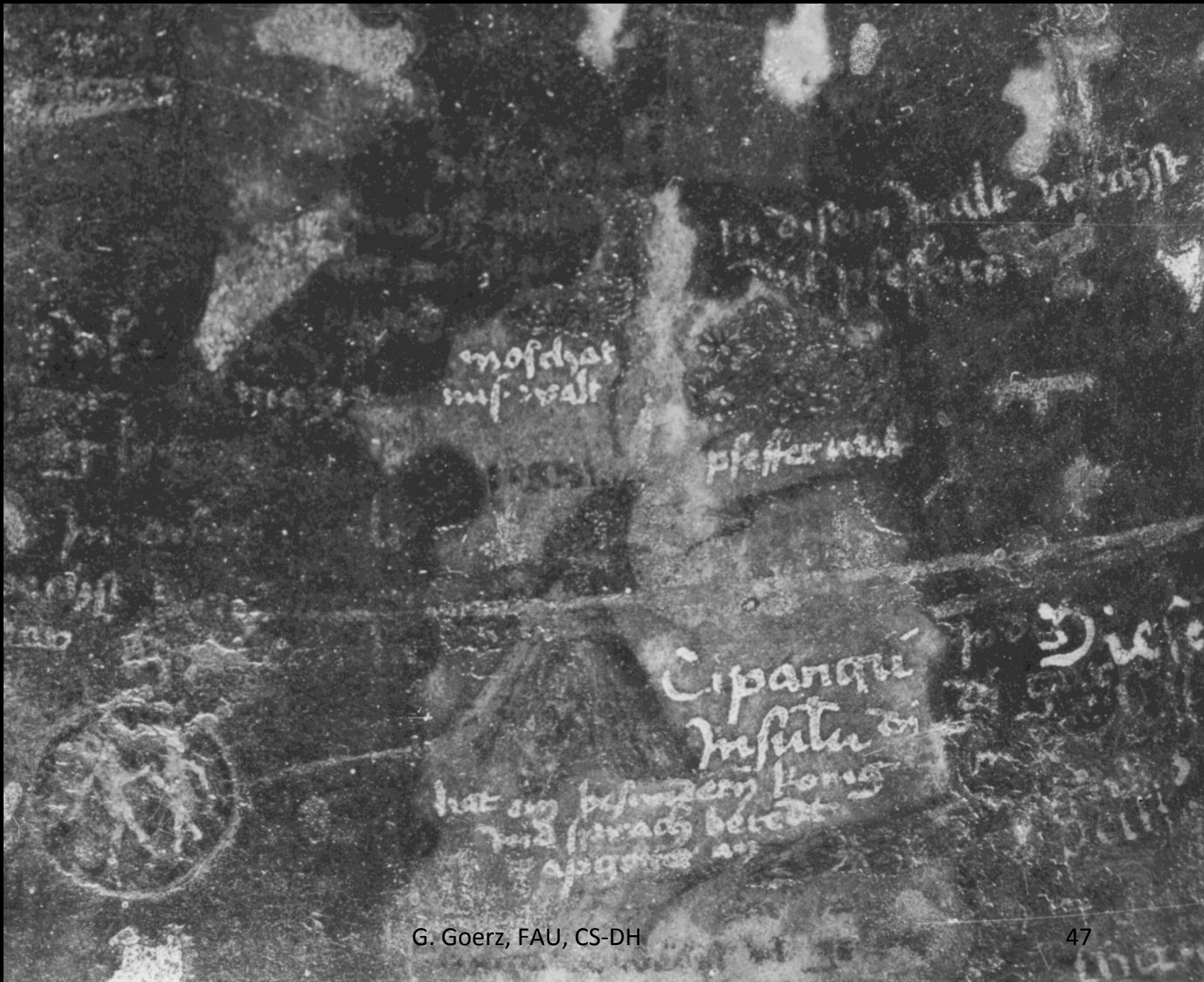


Cipangu (Japan)



Cipangu

B&W
Photos,
Published
in 1943



The globe:

Collaborative product
of the Nuremberg
humanist circle
(sources ...)

South pole calotte:
dedication text
(sponsors)



Dedication text

Aus furbitt [vnd be]ger der fürsichtigen erbarn vnd weisen als der obersten haubtleut der löblichen Reichstat Nurmberg die dann zu disen zeiten geRegiert haben Mit namen hern Gabriel Nutzelt heñ Paulus folckmen Vnd hrñ Niclaß Grola[nd] ist dise figur des appfels

gebracktizirt vnd gemacht worden aus kunft angebung vnd vbung durch den gestrengen vnd erbern hern Martin pehaim Ritter der sich dann jn dieser kunftt kosmo grafia vil erfarn hat Vnd bey einendrittel der welt vmb farn Solchs alles mit fleiß aufgezogen aus den

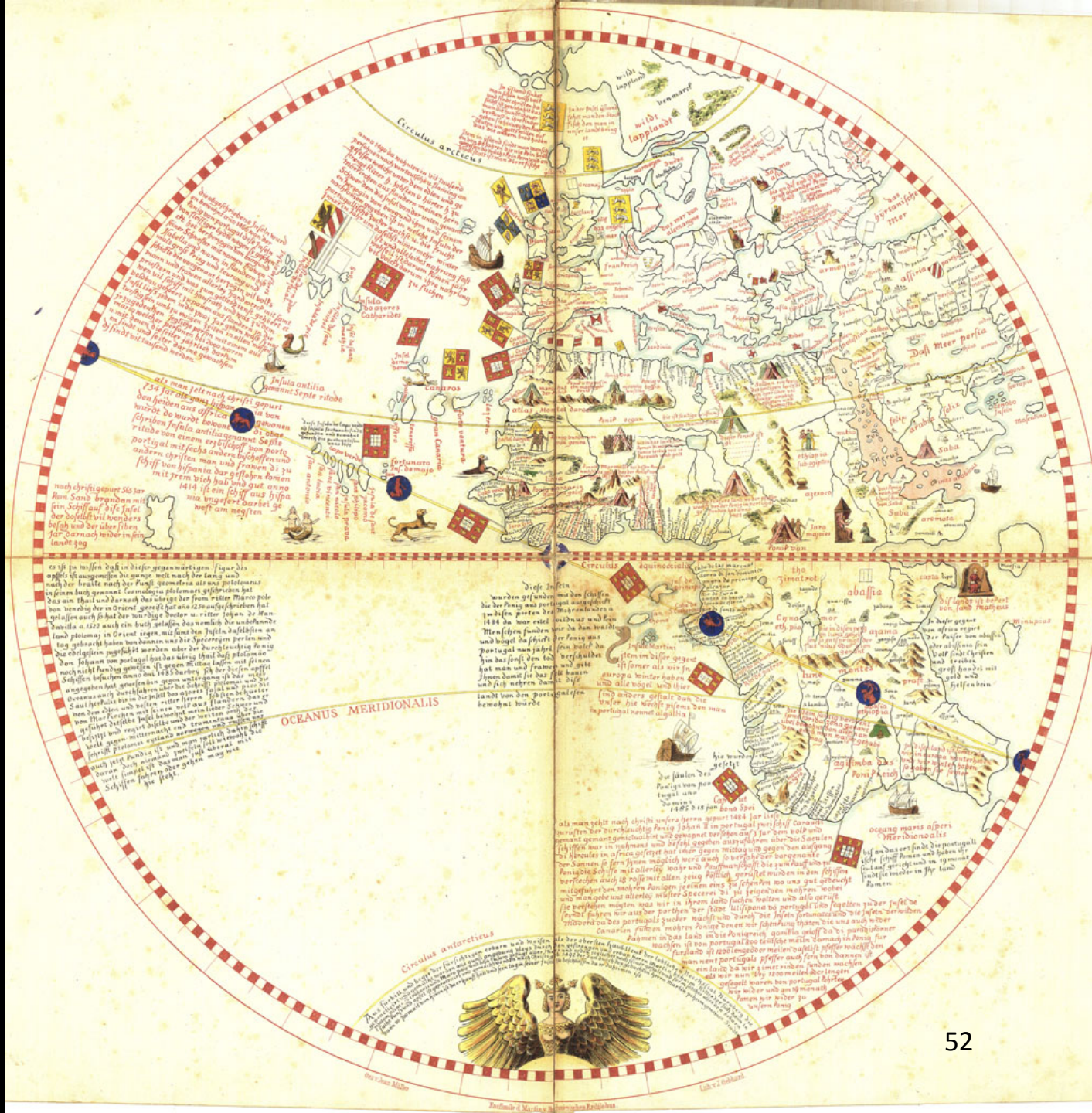
püchern tholomei plinÿ straboni vnd marcko polo vnd also zu famen gefücht alles Meer vnd ertrich yttlich[s] nach seiner gestalt vnd furm Solches alles dem erbern georgē holtzschuer von Rats wegen durch die gemelte[n haubtleu]te befolten worden ist

darzu er dan geraten vnd geholffen hat Mit möglichen fleys. Solche kunft vnd appfel ist gepracktizirt vnd gemacht worden. Nach cristi gepurt 1492 Jar der dan durch den gedachten her: Martin pehem gemein[er stat] Nürnberg zu ern Vnd

letz hinter jne gelassen hat Sein zu allen zeitē Jn gut zu bedenckē Nach dē er von hynA wider heim wendet zu [seinem ge]mahel das dan ob 700 Meil von hinn ist da er haus helt Vnd sein tag in seiner Insel zu [bef]chleiffen do er daheim ist

Reception

- Partial transcriptions (Nuremberg city archive) 16./17. c.
- Doppelmayr 1730
- Murr 1778
- Ghillany (1842), 1853
- Jomard 1854
- Ravenstein 1908
- Exhibition “Focus Behaim-Globus”, GNM 1992/3 [... database project (FAU, FORWISS)]



Ravenstein 1908

Martin Behaim's Erdapfel, 1492.



UB Freiburg, J 4554.d

Ravenstein, Ernst Georg

Martin Behaim: his life and his globe

London, 1908

Seite: III






















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145, xii)

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<http://dl.ub.uni-freiburg.de/diglit/ravenstein1908/0005>[Seitenansicht](#)[OCR-Volltext](#)[Vorschau](#)

a	b	I	II	III	IV	V
						
VI	VII	VIII	1	2	3	4
						
4a	5	6	6a	7	8	9
						

Project design for a new scholarly edition (online and print): FAU & GNM

- Behaim's globe as a material object
 - Material and techniques, *multispectral* 3D imaging
- Text and images (paleographic, linguistic/semiotic)
 - Based on Ravenstein's structure
 - including unpublished research by Ulrich Knefelkamp (Bamberg/Frankfurt.-O.)
 - Cultural history and history of science:
Language, contextualisation (information layers),
discourse: Nuremberg and Europe
- Knowledge representation
(technical: Visualisation, semantic disclosure, open archiving/LOD)

The Cognitive Maps Approach

- “In the last analysis all maps are cognitive maps” (Blakemore, Harley)
- Structuring knowledge according to cognitive criteria
 - strategies of perception, learning, memory, associative reasoning for different knowledge types
- Principle of ***georeferencing*** : organization and presentation of information

ORIENTIS

ORIENTIS

und verleit uns in
sich

und me
sich

und me
sich

und me
sich

Nach weis gepreß
dem hiesigen
das ist Oussere der Fall
wunder das was die
siben zur dinsten

Das was gelei
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Sonst
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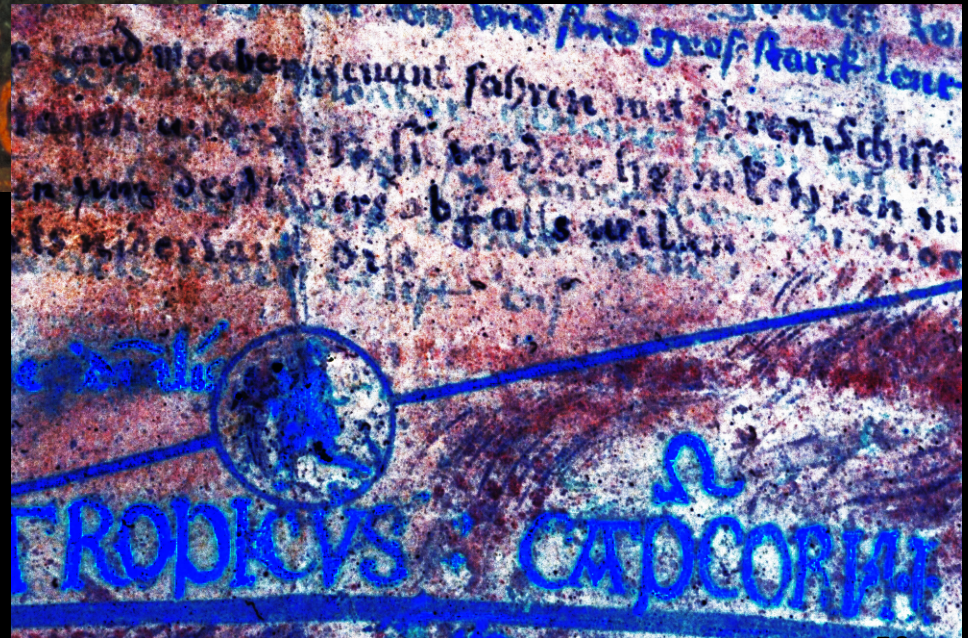
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17



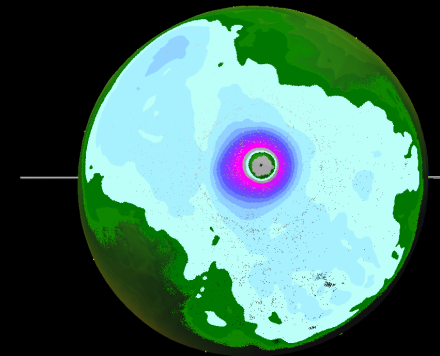
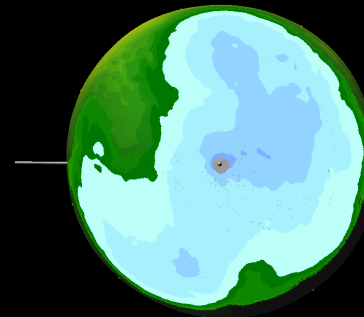
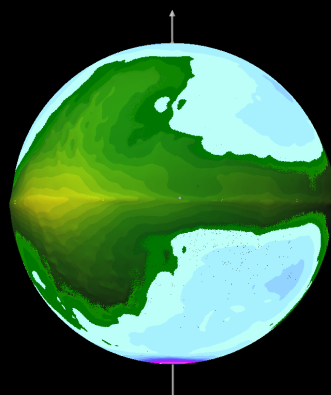
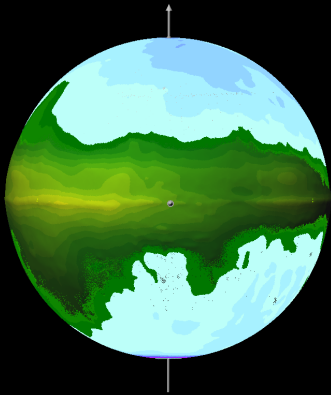
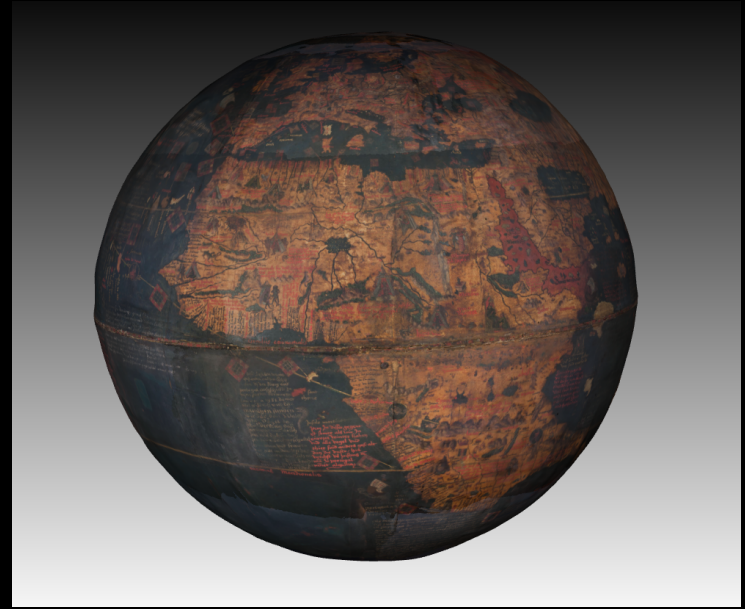
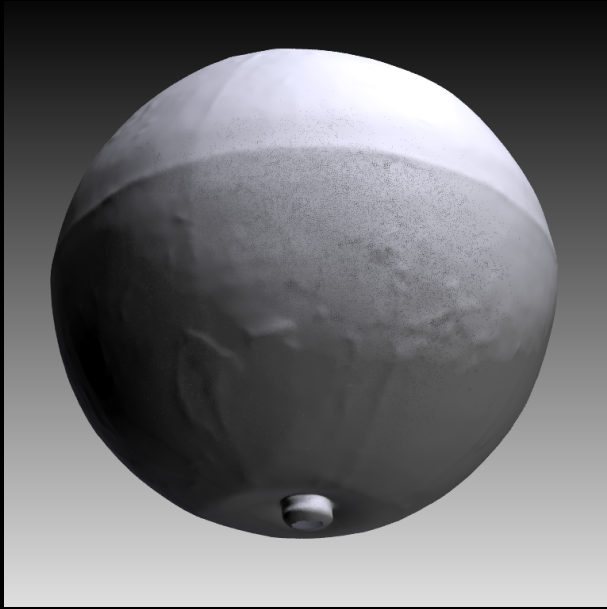
TROPICVS

Wann man
mandant
gleich hien
Meerstem
sich sehen die
sich nach dem
alles ditz Lo
Königen gegeben

Digital image processing



3D : Deformations




3D-Visualisation (here: Marble)

Marble – Virtual Globe

Navigation

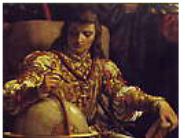
Legend

[Nationalmuseum](#) in Nuremberg. It was produced by [Behaim](#) in 1492..



Populated Places

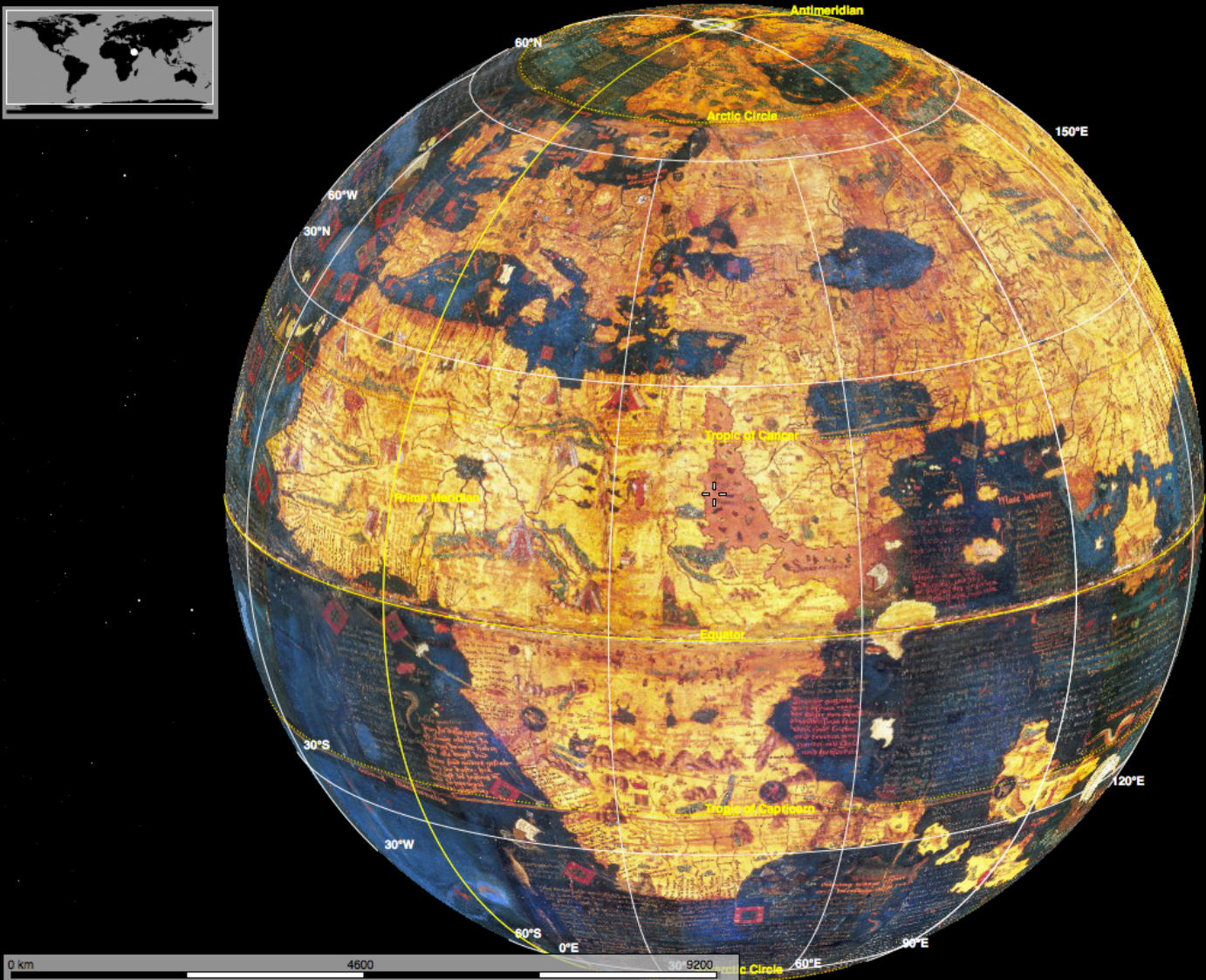
- Behaim Places
- Texte und Figuren
- Behaim 2011
- Ravenstein
- Ghillany Textur
- Coordinate Grid
- Accurate Coastline



Map View

Current Location

Routing



Antimeridian

60°N

Arctic Circle

150°E

60°W

30°N

Tropic of Cancer

Equator

30°S

30°W

Tropic of Capricorn


120°E

60°S

0°E

90°E

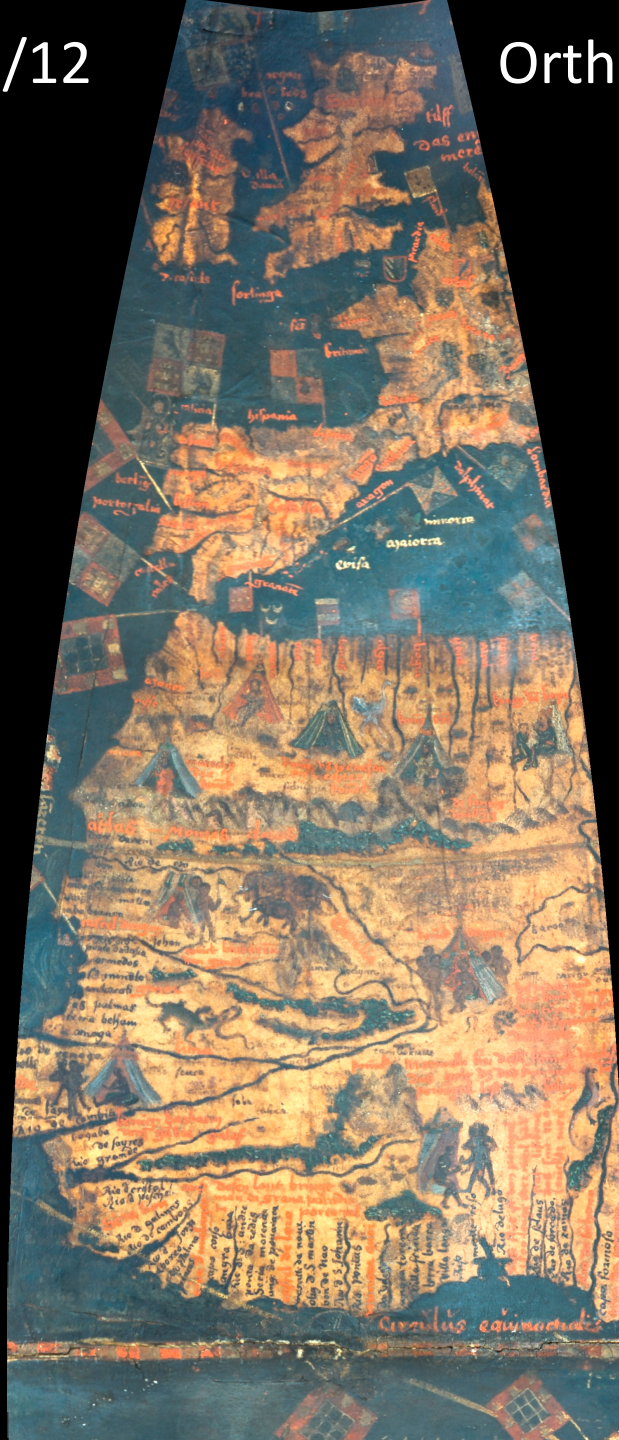
0 km 4800 9600



1990



2011/12

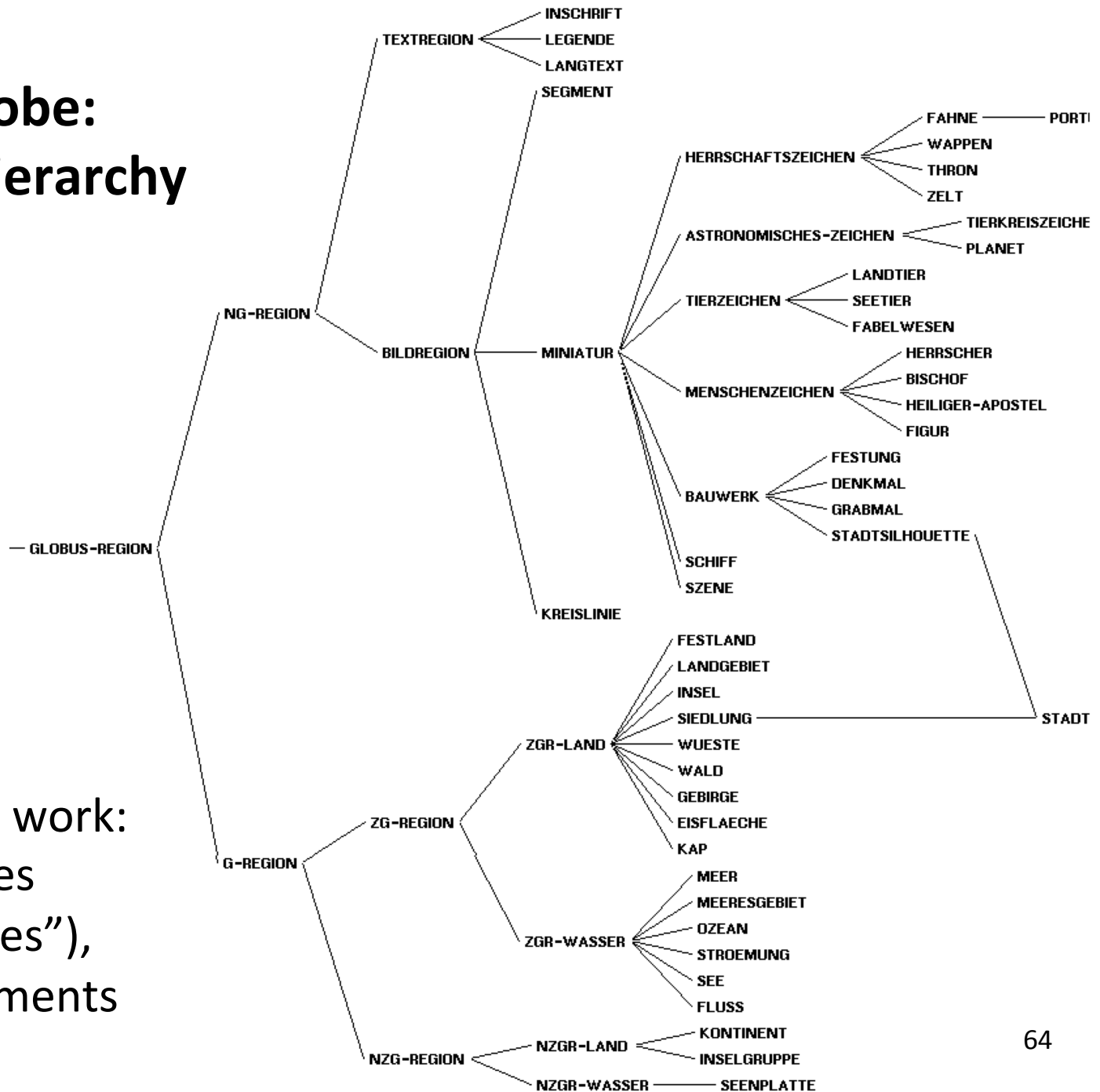


Orthophotos

Conceptual Model: Classification and (comparative) Catalogue of Places

- Semiotic–cultural *access* to georeferenced information
- Object classification: *visual*
 - map image (“geo”)
 - miniatures and inscriptions (“non-geo”)
- *Concepts* (classes) of objects with *properties*
=> class hierarchy
- Semantic annotation via conceptual model: *formal domain ontology*
- derived from a *reference ontology*: CIDOC CRM

Behaim Globe: Concept Hierarchy



From previous work:
~3000 instances
("catalog entries"),
including comments
and glossary

Behaim Concept Hierarchy in OWL Description Logics

The screenshot displays the Protégé OWL editor interface. The top navigation bar includes tabs for 'Active Ontology', 'Entities', 'Classes', 'Object Properties', 'Data Properties', 'Individuals', 'OWLviz', 'DL Query', 'OntoGraf', and 'Jambalaya'. The main workspace is divided into several panels:

- Class hierarchy: 'Verbundene geographische Region'**: A tree view showing the class hierarchy. The class **'Verbundene geographische Region'** is highlighted in blue. Its parent is **'Geographische Region'**, which is a subclass of **'Unverbundene geographische Region'**. Other classes in the hierarchy include **Thing**, **BC37_GLOBUS-ROOT**, **BC55_KOMMENTIERTES**, **BC70_MIT_QUELLENANGABE_VERSEHENES**, **Globusinfo**, **Globusobjekt**, **Glossar**, **Hypertext**, **BC38_GLOBUS_TYPES**, **E1_CRM_Entity**, **E2_Temporal_Entity**, **E52_Time-Span**, **E53_Place**, **Globusregion**, **BC6_BENAMTES**, **'Nichtgeographische Region'**, **E54_Dimension**, and **E77_Persistent_Item**.
- Annotations: 'Verbundene geographische Region'**: A list of annotations for the selected class. It includes:
 - label** [type: string]: Verbundene geographische Region
 - comment** [type: string]: Verbundene geographische Region
- Description: 'Verbundene geographische Region'**: A list of logical constraints for the class:
 - Equivalent To**: (None listed)
 - SubClass Of**: **'Geographische Region'**
 - SubClass Of (Anonymous Ancestor)**:
 - P48_has_preferred_identifier** **max** 1 Thing
 - P67i_is_referred_to_by** **some** E1_CRM_Entity
 - P148_has_component** **some** E89_Propositional_Object
 - P129i_is_subject_of** **some** E1_CRM_Entity
 - P94i_was_created_by** **some** E65_Creation
 - P106_is_composed_of** **some** E90_Symbolic_Object
 - P104_is_subject_to** **some** E30_Right
 - P105_right_held_by** **some** E39_Actor
 - P59i_is_located_on_or_within** **max** 1 Thing
- Object property hierarchy**: A list of object properties, including **'hat zeitliche Einordnung'**, **'ist Originalname von'**, **'ist Quelle von'**, **'ist Schreibvariante von'**, **'Koordinaten des ersten Wortes sind'**, **P101_had_as_general_use**, **P101i_was_use_of**, **P103_was_intended_for**, **P103i_was_intention_of**, and **P104_is_subject to**.

Reasoning with OWL-DL Ontologies

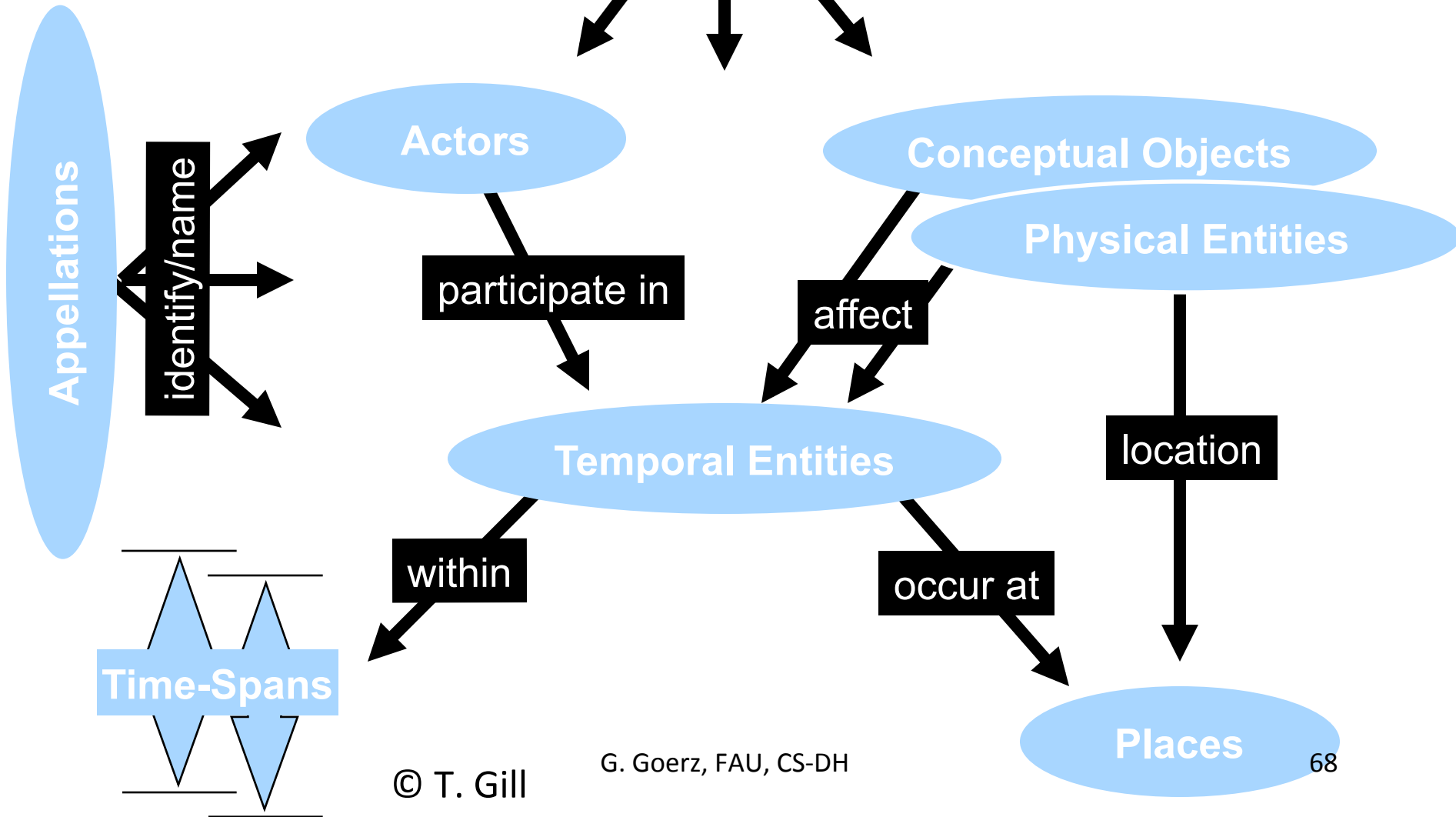
- Access to implicit information
(not resulting directly from the structure of the data base)
- Semantic Web technology: *Web Ontology Language*
- Semantic information in search: inclusion of the class structure
(“terminological reasoning” vs. “string matching”)
- DLs: Satisfiability (consistency), subsumption, instantiation (search), retrieval
- Processing semi-structured data: Instances of the same class may have different attributes
- User support: “Query Patterns” / Forms
(Constantopoulos et al., 2009)

Motivation for a Generic Approach: Reference Ontology *CIDOC CRM* (Cultural Heritage Documentation)

- Every domain ontology uses generic concepts: time and space, processes, actions and actors, ...
- *What ties sets of properties together as data sets?*
- **Event** as a key concept
 - To connect people, objects, places, time spans, etc.: make relations explicit, e.g. production events, meetings, travels (event sequences),...
- **CIDOC Conceptual Reference Model (ISO 21127)**
 - => <http://cidoc.ics.forth.gr>
 - Support of data exchange and interoperability

CIDOC CRM

Top Level Classes





Erlangen CRM / OWL

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About

The **Erlangen CRM / OWL** is an **OWL-DL 1.0** implementation of the **CIDOC Conceptual Reference Model (CIDOC CRM)**.

It has been originally created by Bernhard Schiemann, Martin Oischinger and Günther Görz at the **Friedrich-Alexander-University of Erlangen-Nuremberg, Department of Computer Science, Chair of Computer Science 8 (Artificial Intelligence)** in cooperation with the Department of Museum Informatics at the **Germanisches Nationalmuseum Nuremberg** and the Department of Biodiversity Informatics at the **Zoologisches Forschungsmuseum Alexander Koenig Bonn**. It is currently maintained by Martin Scholz, Georg Hohmann and Mark Fichtner.

The Erlangen CRM / OWL is an interpretation of the CIDOC CRM in a logical framework attempting to be as close as possible to the text of the specification. For information about the CIDOC CRM and related work please visit the corresponding **CIDOC CRM website**. The CRM is also available as **ISO 21127**.

Behaim Globe Portal (VRE WissKI)



Der Behaim-Globus | The Behaim Globe



Der Behaim-Globus ist der älteste erhaltene Erdglobus.

Er wurde in den Jahren 1492-1493 geschaffen und befindet sich heute in der Sammlung des Germanischen Nationalmuseums, Nürnberg (GNM).

*In diesem Portal werden Materialien aus einem gemeinsamen Forschungsprojekt zwischen der FAU Erlangen-Nürnberg und dem GNM präsentiert, die von den Forschungspartnern unter einer Creative Commons-Lizenz **by-sa** freigegeben wurden. Einige Daten sind urheberrechtlich geschützt und können nur mit einer besonderen Benutzungsberechtigung zugegriffen werden.*

The Behaim Globe is the oldest extant globe of the earth.

It has been created in 1492-1493 and is today exhibited in the collection of the Germanisches Nationalmuseum, Nuremberg, Germany (GNM).

*This portal presents data from a joint research project between the Friedrich-Alexander University Erlangen-Nürnberg, which have been released by the research partners with a creative commons license **by-sa**. Some data are copyright protected and can only be accessed with a special permit.*

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Abbildungen: Germanisches Nationalmuseum Nürnberg.

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User login

Username: *

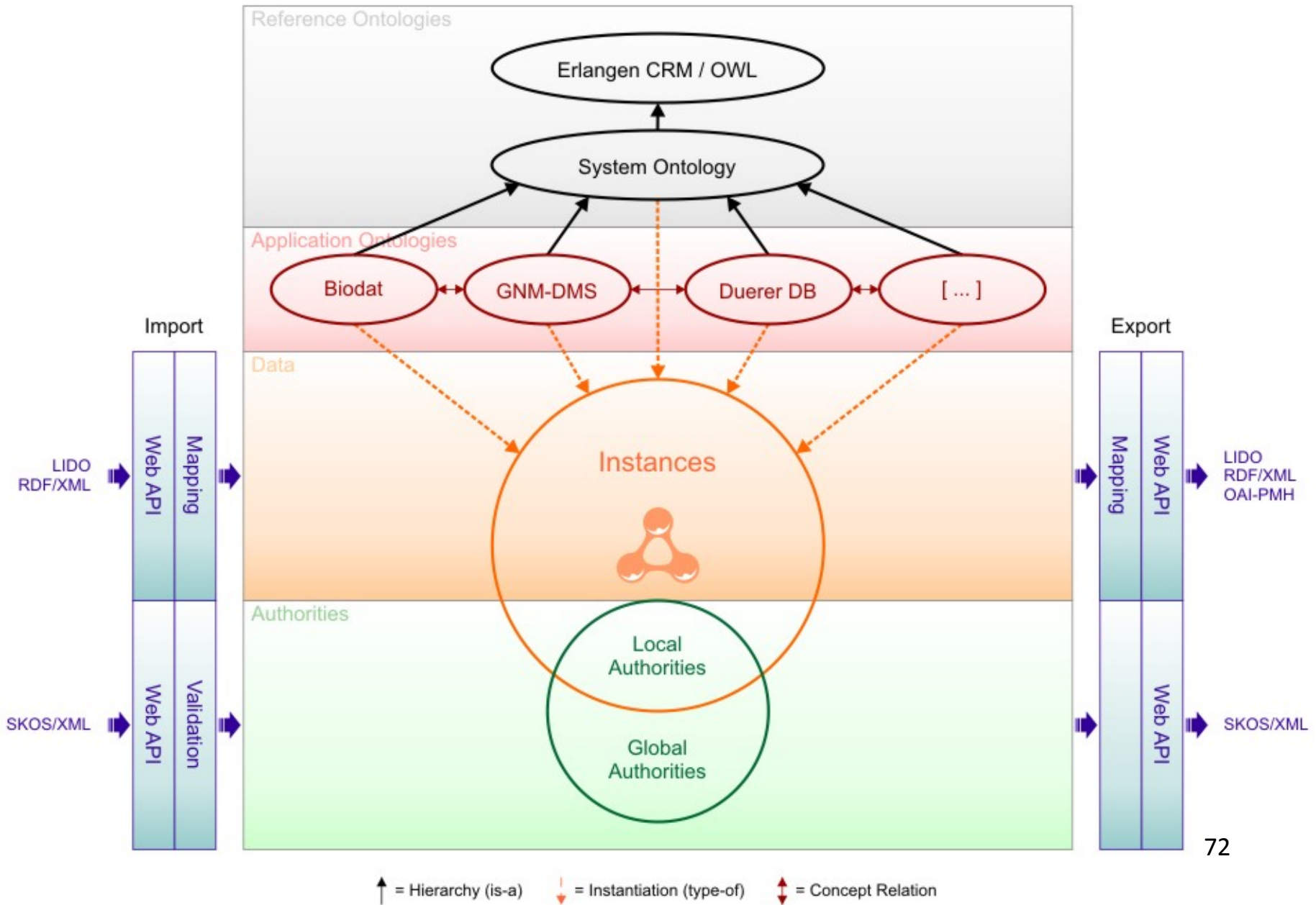
Password: *

[Request new password](#)

Who's online

There are currently 0 users and 1 guest online.

VRE WissKI: Layered Ontologies



Behaim WissKI : Catalogue of Places



Content management

Site building

Site configuration

User management

Reports

Help



WissKI

Martin Behaims Erdapfel (1492)

Der älteste erhaltene Globus der Erde


Find

Search in one of the categories below.

- **Miniatur**
Eine Miniatur auf dem Globus
- **Herrschaftszeichen (Miniatur)**
Eine Miniatur auf dem Globus, die ein Herrschaftszeichen darstellt; z. B. eine Fahne
- **Benennung (Textregion)**
Ein kurzer Schriftzug, der eine Miniatur oder Region auf dem Globus benennt; z. B. Toponym oder Personennamen
- **Beschreibung (Textregion)**
Alle Texte, die keine Benennungen sind. Ehemals die Klassen Langtext und Legende
- **Verbundene Geo-Region**
Eine zusammenhängende geographische Region auf dem Globus
- **Unverbundene Geo-Region**
Eine nicht zusammenhängende geographische Region auf dem Globus; z. B. eine Inselgruppe
- **Information**
Text mit Hintergrundinformation

(Form-based) Data Input – and Querying

Content management Site building Site configuration User management Reports Help 0 / 1 Log out Günther Görz

 **WissKI** Behaim-Globus Die Welt wie Martin Behaim sie sah. Wiki Home About us Logout

Create Navigate Find RelFinder SparQL

Miniatur

	Miniatur (all entries) ▾	<input type="text"/>	<input type="checkbox"/> exact match
OR ▾	Miniaturentyp ▾	<input type="text"/>	<input type="checkbox"/> exact match
OR ▾	Titel ▾	<input type="text"/>	<input type="checkbox"/> exact match
OR ▾	Identifikator ▾	<input type="text"/>	<input type="checkbox"/> exact match
OR ▾	Farbe ▾	<input type="text"/>	<input type="checkbox"/> exact match
OR ▾	Erhaltungszustand ▾	<input type="text"/>	<input type="checkbox"/> exact match
OR ▾	Kurzkommentar ▾	<input type="text"/>	<input type="checkbox"/> exact match
OR ▾	Urheber (all entries) ▾	<input type="text"/>	<input type="checkbox"/> exact match
<input type="button" value="Search"/>			

Development

- Devel settings
- Empty cache
- Execute PHP Code
- Function reference
- Hook_elements()
- Node_access summary
- PHPinfo()
- Rebuild menus
- Reinstall modules
- Run cron
- Session viewer
- Theme registry
- Variable editor

Search

Search this site:

- Second input modality: free text with partial parsing
- at input time: instantiation of modelled paths
class–property–class–...

Behaim WissKI (1)



Create

Navigate

Find

Capo De S Katherina (Kap)

View Create and Link Text Delete Edit Form Graph Network Paths Triples XML Outline Access control Devel

Kommentar:

Das im heutigen Gabun liegende Kap Santa Catarina wurde ca. 1474 75 von dem portugiesischen Seefahrer Ruy de Sequeira entdeckt. Die Ortsbezeichnung war zeitgenössisch sehr bekannt und taucht in diversen Quellen auf. Dieser Umstand erklärt wohl auch die im Vergleich zu anderen Kap-Bezeichnungen recht grosse Inschrift.

[\[Goto\]](#) [\[Edit\]](#)

▼ Verbundene Geo-Region

Geo-Region-Typ

Kap

Titel
Capo De S Katherina

Identifikator

Kap Capo De S Katherina

wird benannt durch

Capo De S Katherina

Farbe

Ocker

Erhaltungszustand

Erkennbar

ist benachbart mit

Rio De Santa Maria

Rio De Lopo Gonzale

ist Teil von

Westafrika

▼ Urheber

Person

Norbert Holst

Zeitstempel

17. April 1996

Search

Search this site:

Verbundene Geo-Region
http://wisski.cs.fau.de/behaim/content/inschrift_capo_de_s_katherina_12_1

Vocabulary:
Benennungen

Label:
Capo De S Katherina

Alternate Label:
Inschrift Capo De S Katherina 12 1

Development

- Devel settings
- Empty cache
- Execute PHP Code
- Function reference
- Hook_elements()
- Node_access

Behaim WissKI (2)



WissKI

Behaim-Globus

Die Welt wie Martin Behaim sie sah.

[Wiki](#) [Home](#) [About us](#) [Logout](#)

[Create](#)

[Navigate](#)

[Find](#)

[RelFinder](#)

[SparQL](#)

Papagei (Landtier)

[View](#) [Create and Link Text](#) [Delete](#) [Edit Form](#) [Graph](#) [Network](#) [Paths](#) [Triples](#) [XML](#) [Outline](#) [Devel](#)

▼ *Kommentar: Hytext Landtier Papagei*

Die buntgefiederten Vögel werden häufiger in den afrikanischen Reiseberichten der Zeit angesprochen, der venezianische Seefahrer Alvise da Ca'da Mosto widmete ihnen sogar ein eigenes Kapitel in seiner [Schilderung Westafrikas](#). Entsprechend solchen Berichten sind Papageien auch öfter auf dem Kartenmaterial der frühen Entdeckungszeit dargestellt, insofern ist diese Miniatur auf dem Behaim-Globus keine Besonderheit. Der exotische Reiz der Vögel war so gross, dass sie bereits ab der Mitte des 15. Jahrhunderts gefangen und nach Europa gebracht wurden, wo man sie auf Märkten verhökerte.

[\[Goto\]](#) [\[Edit\]](#)

▼ *Miniatur*

Miniaturentyp

Landtier

Titel

Papagei

Identifikator

Landtier Papagei

Farbe

Weiss

Rot

Blau

Erhaltungszustand

Erkennbar

Kurzkommentar

Die Zeichnung zeigt einen Vogel mit rot-weissem Rumpf, blau-grauem Flügelgefieder und langem Schwanz.

▼ *Urheber*

Person

Norbert Holst

Zeitstempel

13. November 1996

Images



Search

Search this site:

[Search](#)

Vocabulary information

Vocabulary:

Miniaturen

Submitted by [Martin Scholz](#) on [Tue, 04/16/2013 - 21:02](#).

[Add new comment](#)

Reasoning with Erlangen CRM / OWL-DL (in progress)

- Access to implicit knowledge based on domain ontology
- Usage of “query patterns” and “fundamental relations” similar to:

The screenshot shows the Researchspace: Rijksmuseum interface. The query is: Find All objects created by Paul, Sebastian [artist] and located in Portugal [place] or Paris [place] and created by The Lourve [institution]. A dropdown menu is open under 'created by The Lourve [institution]', showing options: 'currently kept by', 'references', and 'refers to'. A red box highlights the dropdown menu, and a red arrow points from the text 'Aggregated and Reasoned CRM relationships' to the 'currently kept by' option. The results section shows 1854 results, with a filter on the left and a grid of four images labeled 'Andromeda'.

Aggregated and Reasoned CRM relationships

Herrschaftszeichen
 Menschenzeichen
 Menschenzeichen
 Herrschaftszeichen
 Menschenzeichen

Tierzeichen
 landtier_strauss_9_6-084
 landtier_elefanten_9_5-090
 landtier_echse_und_schlange_9_7-092
 landtier_papagei_9_8-095

Bauwerk

Astronomisches-Zeichen

Image Annotation (in progress)

here (still):
UVic IMT
**<=> Recogito/
 Pelagios**



X landtier_elefanten_9_5-090
 Zu sehen ist eine Elefantenherde, drei Tiere sind deutlich erkennbar. Die Körper der Dickhäuter sind Grau und Braun gezeichnet, deutlich heben sich davon die weissen Stosszähne ab (NH).

Image Annotation (2)



Item In disser gegent
ist somer als wir In
europa winter haben
vnd alle vogel vnd
thier sind anders gestalt
dan die vnser, hie
wächst vil piseins de
man In portogal
nennet algallia

X
lesung_item_in_disser_knefelkamp_es

Item In disser gegent
ist somer als wir In
europa winter haben
und alle vogel und
thier sind anders gestalt
dan die unser, hie
wechst vil piseins den
man In portogal
nennet algallia

Annotations


Text
lesung_item_in_disser_knefelkamp_es
lesung_hie_wurden_gesetzt_knefelkamp_es
lesung_als_man_zehlt_1484_knefelkamp_es
lesung_hie_in_diesen_perigen_knefelkamp_es
lesung_hie_ist_ein_santig_knefelkamp_es

Integration of Incriptions

Research:

Comparison
of different
historic
readings

Markup of
place names,
person names,
time specifications,
events by means of
linguistic
text analysis
(semi-automatic)

**WissKI** Martin Behaims Erdapfel (1492)
Der älteste erhaltene Globus der Erde

[Create](#)

Item In Disser Gegent

[View](#) [Create and Link Text](#) [Delete](#) [Edit Form](#) [Graph](#) [Network](#) [Paths](#) [Triples](#) [XML](#) [Outline](#) [Access control](#) [Devel](#)

Moderne Lesung: Lesung Item In Disser 12 3

Item In disser gegent
ist somer als wir In
e^uropa winter haben
und alle vogel und
thier sind anders gestalt
dan die unser, hie
wechst vil pisems ^[1] d~e
mä In portogal
n~enet algallia ^[2]

[1] bisem, bisen [frnhd.]: Bisam, Moschus. Hier im zeitgenössichen Sinne für die - ebenfalls streng riechende - Zibetkatze stehend.

[2] algalia [span.]: Bisamratte, Zibetkatze
[\[Goto\]](#) [\[Edit\]](#)

Historische Lesung: Lesung Item In Disser Doppelmayr

It. In diefer Gegent
ift | Sommer als wir in |
Europa Winter hab_e |
und alle Vöogel und |
Thier find anders gefalt |
den die unfer , hie |
wächft vil Bifamb , den
man | in Portugall

Beschreibung (Textregion)
Identifikator
Legende Item In Disser Gegent 12 3
Titel
Item In Disser Gegent
Schlagwörter
Fauna
Klima
Handschrift
Bastarda
Überschrieben
Erhaltungszustand
Lesbar
Farbe
Rot

Images



Back to ... **Cognitive Maps**

- Problems in a spatial framework
 - **Where** : naming; states/processes, direction, distance
 - **What** : properties
 - **When**
- Elements of an epistemological organization of spatial knowledge :
Description of the construction of maps by (primarily) qualitative criteria

Augmentation: Spatial (qualitative) Reasoning

- Cognitive dimension of georeferencing
- “Cognitive maps”: lifting from the cognitive to the epistemic level
- Formal (qualitative) representation of
 - (abstract) regions and their relative positions
 - orientation and distance
- Basis: RCC-8

Spatial Queries

- Queries
 - Deictic: spatial properties of known objects
 - Iterative: identifying unknown objects by spatial properties
- Spatial Properties
 - neighbourhood, borders, interior and exterior of regions
 - Set-based: intersection, containment, identity
 - metric: direction, instance

Integration of Conceptual Model and Spatial Reasoning

- Modelling of maps: concept hierarchy
- Extension: hybrid reasoning
 - geometric model: topology and orientation
 - modified data representation (polygons)
 - spatial reasoning
- Technical implementation:
 - spatial concepts and properties as abstract data type (“concrete domain”)
 - algorithms for topology, orientation and distance: spatial inference

Integration with Description Logics

- Hybrid queries (first implementation w/ CLASSIC)
 - *Which geographic regions lie within Africa?*
 - *Which regions are south of the Azores and west of the Canaries?*
 - *What is east of the Black Sea?*
 - *Which cities in the continent of Asia are closer than 50 units east of the Caspian sea?*
- Next step: Reimplementation with OWL-DL
 - “Pellet Spatial” extension
 - Spatial query interface

A historical globe, likely a celestial globe, is displayed in a museum. The globe is made of wood and is mounted on a dark metal stand. It features a wooden frame with a circular ring around the equator. The globe's surface is painted with celestial patterns, including lines of latitude and longitude, and various symbols. The globe is positioned in the center of the frame, and the background shows a museum setting with glass display cases and informational panels.

<http://wisski.cs.fau.de/behaim>

<http://wisski.cs.fau.de/behaim>



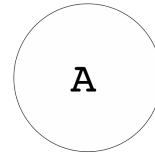
“Region Connection Calculus”

Topological regions:

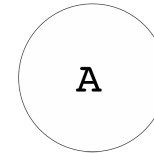
DC disconnected from
EC externally connected
to

PO partially overlaps
EQ is identical with
TPP tangential proper
part of

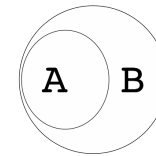
NTPP non tangential
proper part of



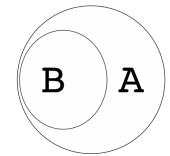
DC(A,B)



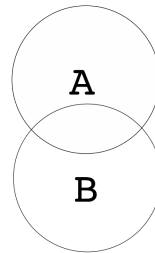
EC(A,B)



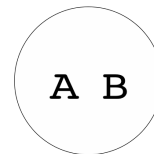
TPP(A,B)



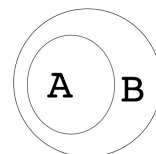
TPPI(A,B)



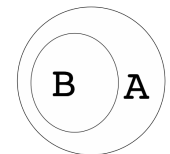
PO(A,B)



EQ(A,B)



NTPP(A,B)



NTPPI(A,B)

Spatial Reasoning

- Topological queries
 - identity (EQ), disjointness (DC, EC), overlap (PO), containment (N/TPP/I)
 - answering by lookup in relation table
- Orientation
 - primary object – reference object – reference system
- Distance: absolute or relative scale