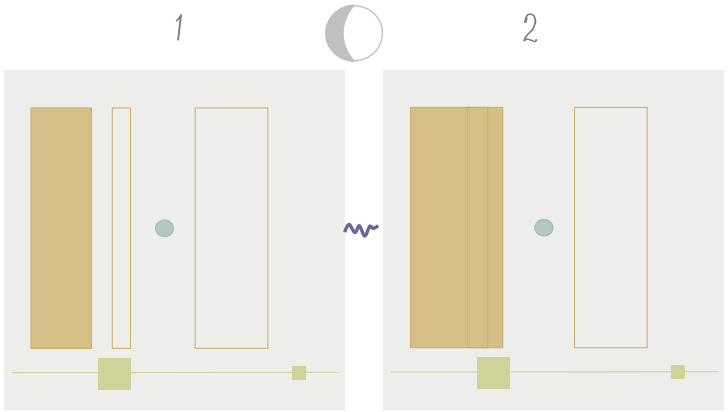
Knowledge modelling in heritage architecture

Szkolenie współfinansowane ze środków Unii Europejskiej
w ramach Europejskiego Funduszu Społecznego.



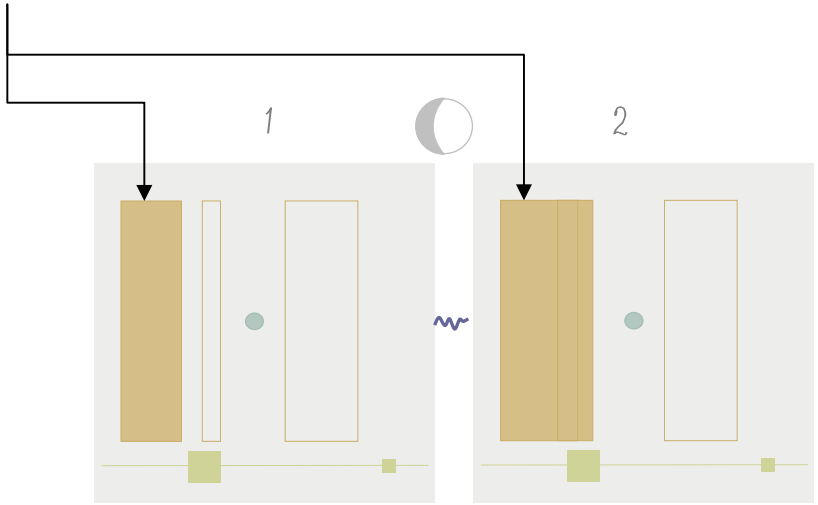
Knowledge modelling in heritage architecture

An illustrated introduction to issues, needs, open challenges in heritage architecture analysis.

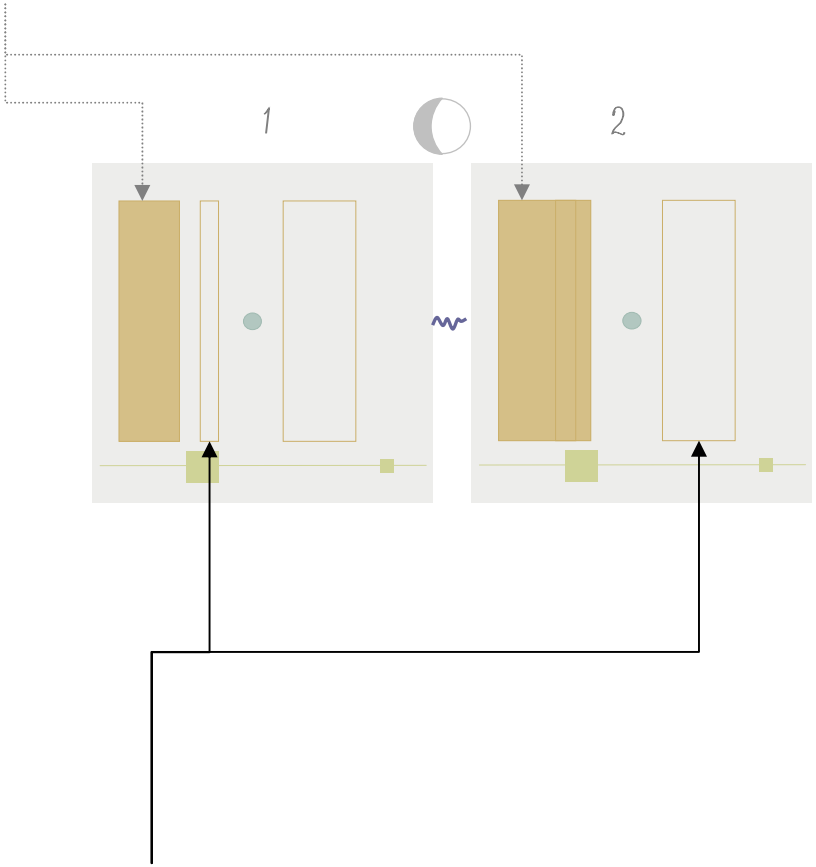
Informative modelling - from architectural modelling to Infovis

How reasoning visually on architectural transformations can benefit from Infovis concepts, methods, and legacy.

A number of experiments briefly commented, generally illustrated by some visual result – and not detailed in terms of process (time needed, tools and inputs used, quantities, context of the study)

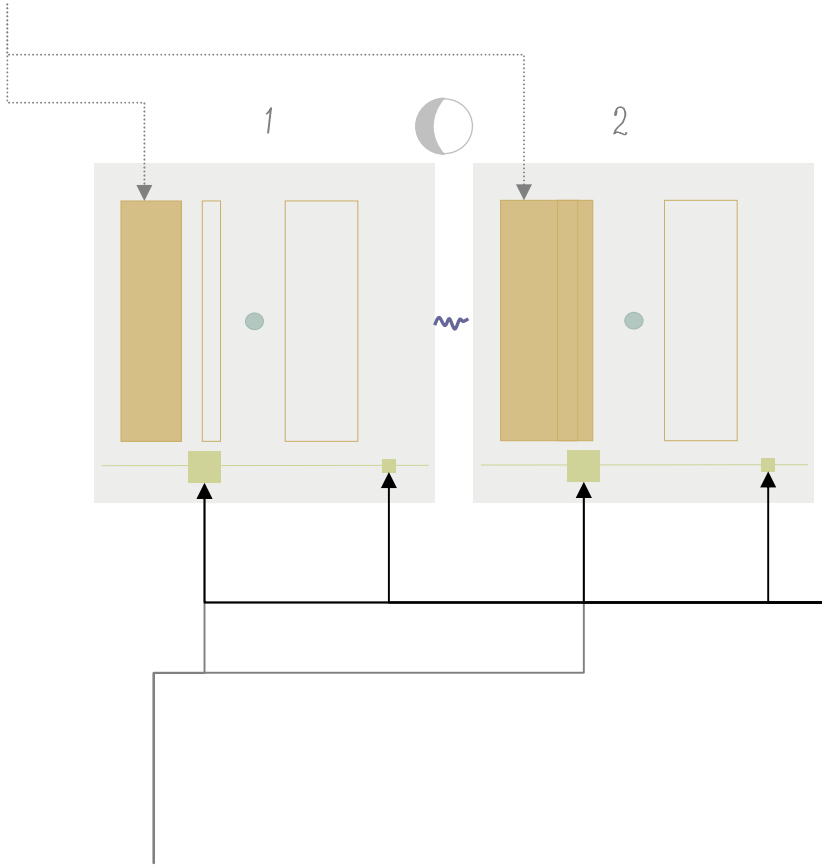


A number of experiments briefly commented, generally illustrated by some visual result – and not detailed in terms of process (time needed, tools and inputs used, quantities, context of the study)



Mini-workshops on real cases

A number of experiments briefly commented, generally illustrated by some visual result – and not detailed in terms of process (time needed, tools and inputs used, quantities, context of the study)



Open discussions on the processes and/or demos inside or outside of the modules.

Mini-workshops on real cases

Architecture ?

Science? Science is about depicting repeatable behaviours

Architecture deals with individual places, edifices, conditions, whereas science deals with trends, regularities, relations between items

A number of sciences are concerned by architecture, but does that make architecture itself a science?

Art? Not really – you don't need art, or if so you don't know why you need it.

Art does not protect from rain and cold.

source : Wikipedia

Architecture ?

Science?

Art?

Technology? A technology is primarily designed to serve a purpose.

There are things in architecture that are not designed to serve a purpose, to offer a service, but to convey meaning.

Architecture ?

Science, art, technology

Most often at least one of them

Z.Dmochowski "architecture, which of all the arts is the most socially conditioned"

Architecture ?

Architecture is about what people do

Architecture is about what people believe in

Architecture is about what people know

Z.Dmochowski "architecture, which of all the arts is the most socially conditioned"

source : Wikipedia

Architecture ?

Architecture is about what people do

Architecture is about what people believe in

Architecture is about what people know

A focus on knowledge modelling issues:

What should I see when I look at heritage architecture if I want to say what I understood to others, and if I want my computer to help me do it?

Knowledge modelling in heritage architecture

An illustrated introduction to issues, needs, open challenges in heritage architecture analysis.

the issue

the need

terminology

Open challenges

Analysis of a morpho-typology through visual means.

Knowledge modelling in heritage architecture

the issue [facts and bottlenecks in architectural modelling] : a classification effort - constraints, components, composition, stylistic affiliations, features extraction.

the need : Why do we create models? What difficulties when facing historic sciences information sets? On distributing information in time and space. From the item to the collection

terminology [data =! information ?]

Open challenges [in heritage architecture modelling] : orphan instances, concept/instance overlapping, reuse, templates, 3D survey, imperfect knowledge

Mini-workshop

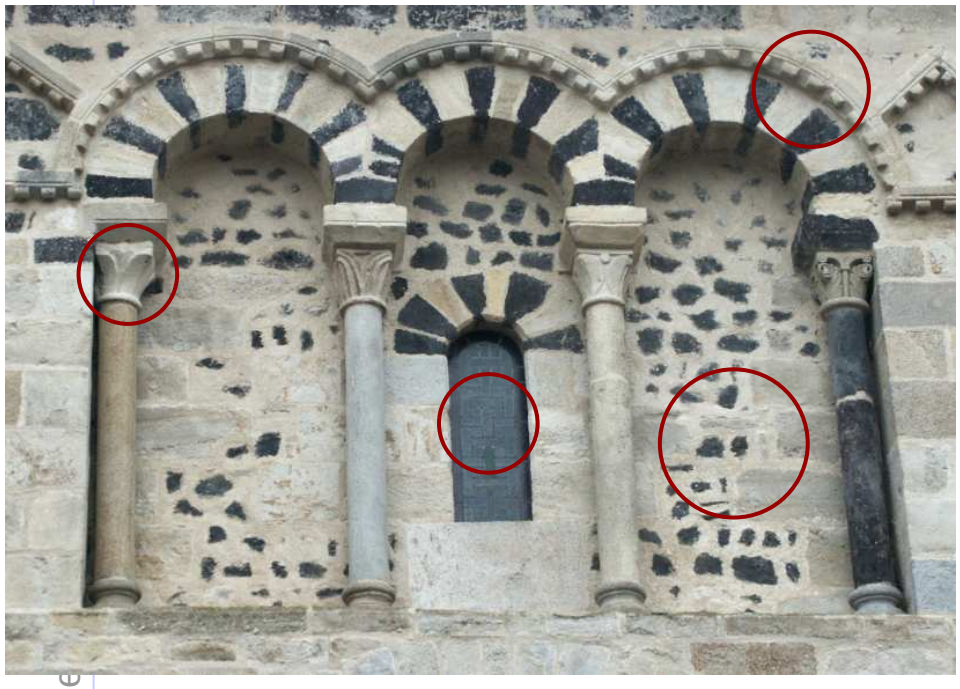
Analysis of a morpho-typology through visual means.
Evaluate similarities and differences between the Maniowy displaced wooden houses.

Knowledge modelling in heritage architecture :: **the issue**

Different, or similar?

Four differences

Four differences



Capitals

Opening : frame and sashes

Masonry

Archivolt

Two « types » of differences

Two « types » of differences

Components (proportion)

Composition (alignment)

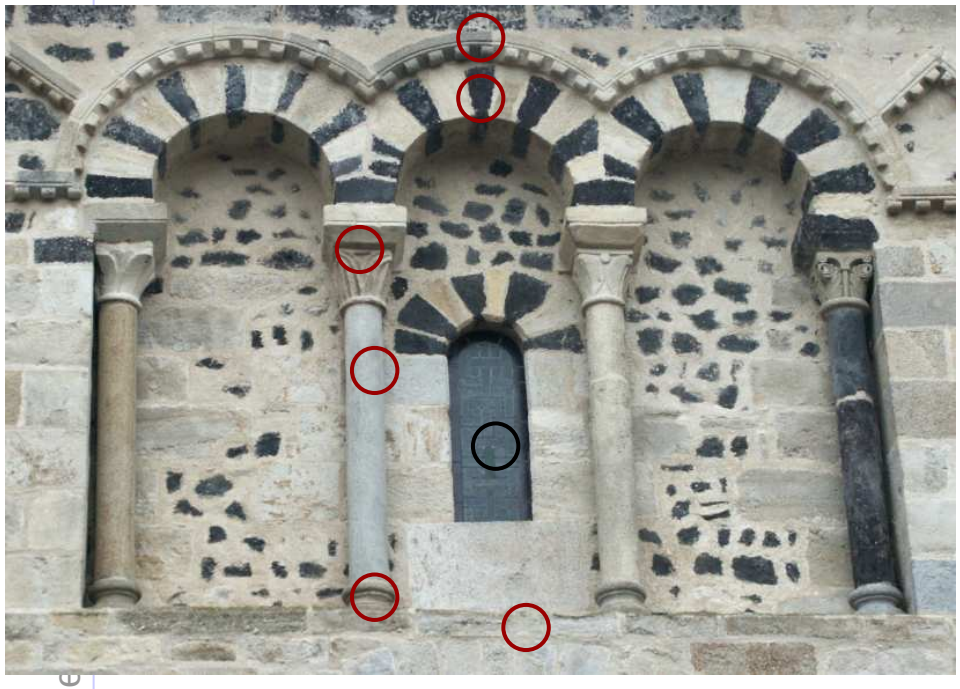
Three similarities

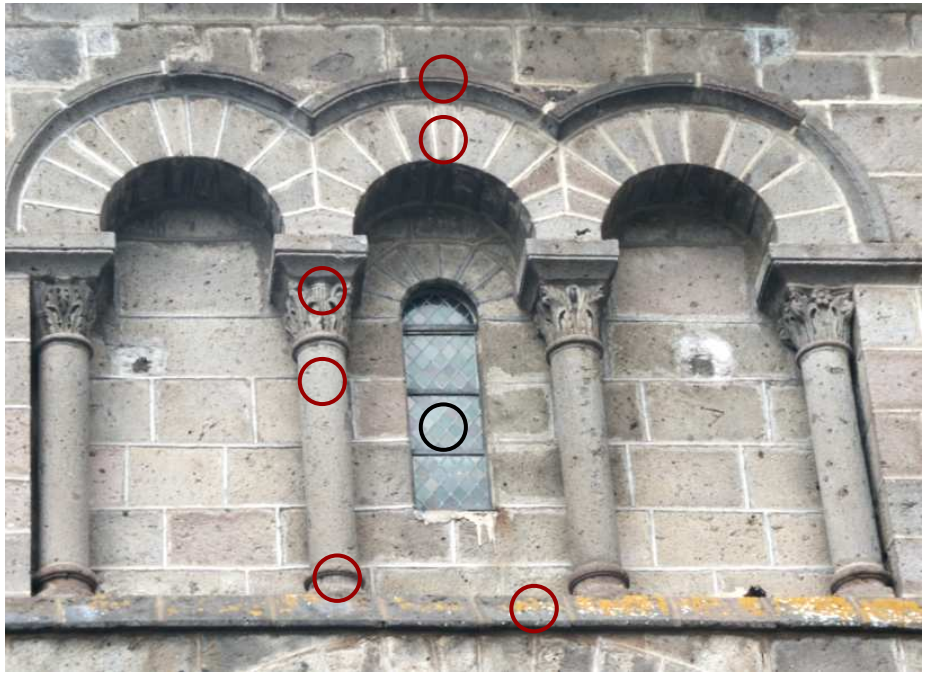
Three similarities

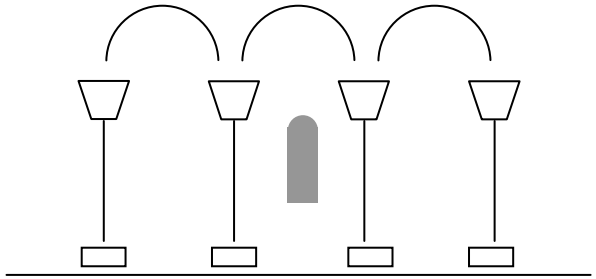
The composition: a 3-arches blind arcade

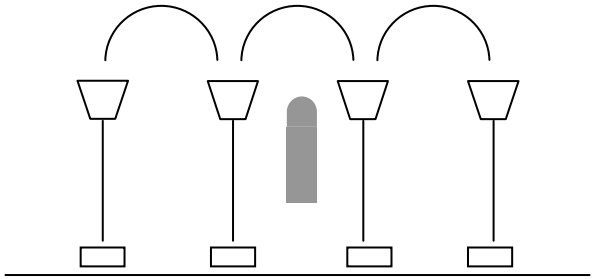
Type and number of components

Presence of an opening





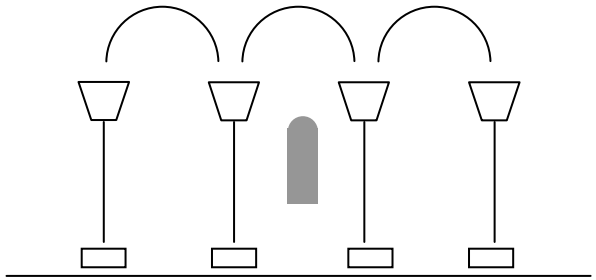


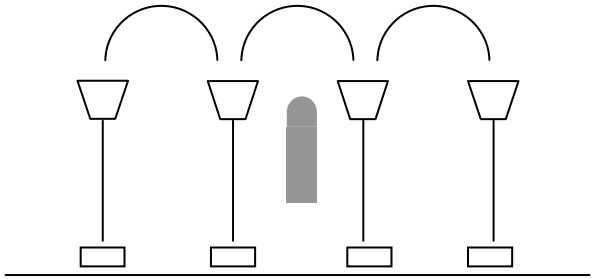


Knowledge modelling in heritage architecture, as we will discuss it **a classification effort**, i.e.

-*identifying facts, significant elements*
-*putting them in relation*
-*understanding relations as a system*

"Science is before anything else a classification, a way to put side by side facts that appear divergent […] In other words, science is a system of relations". (H.Poincaré, *The value of science*, 1902)

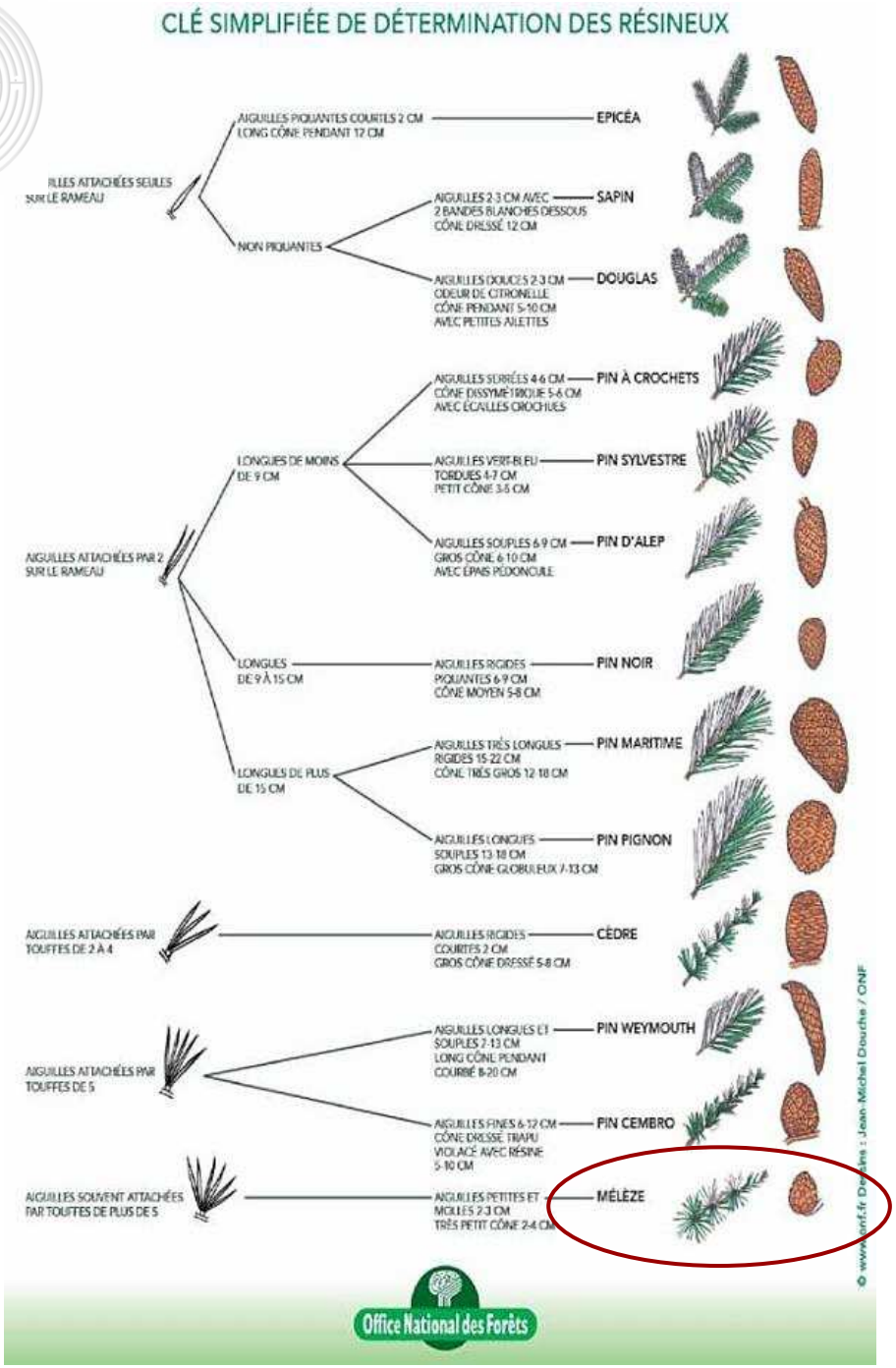




In that sense, architectural facts can be observed like other

Identifying facts, significant elements

domenicus.malleotus.free.fr

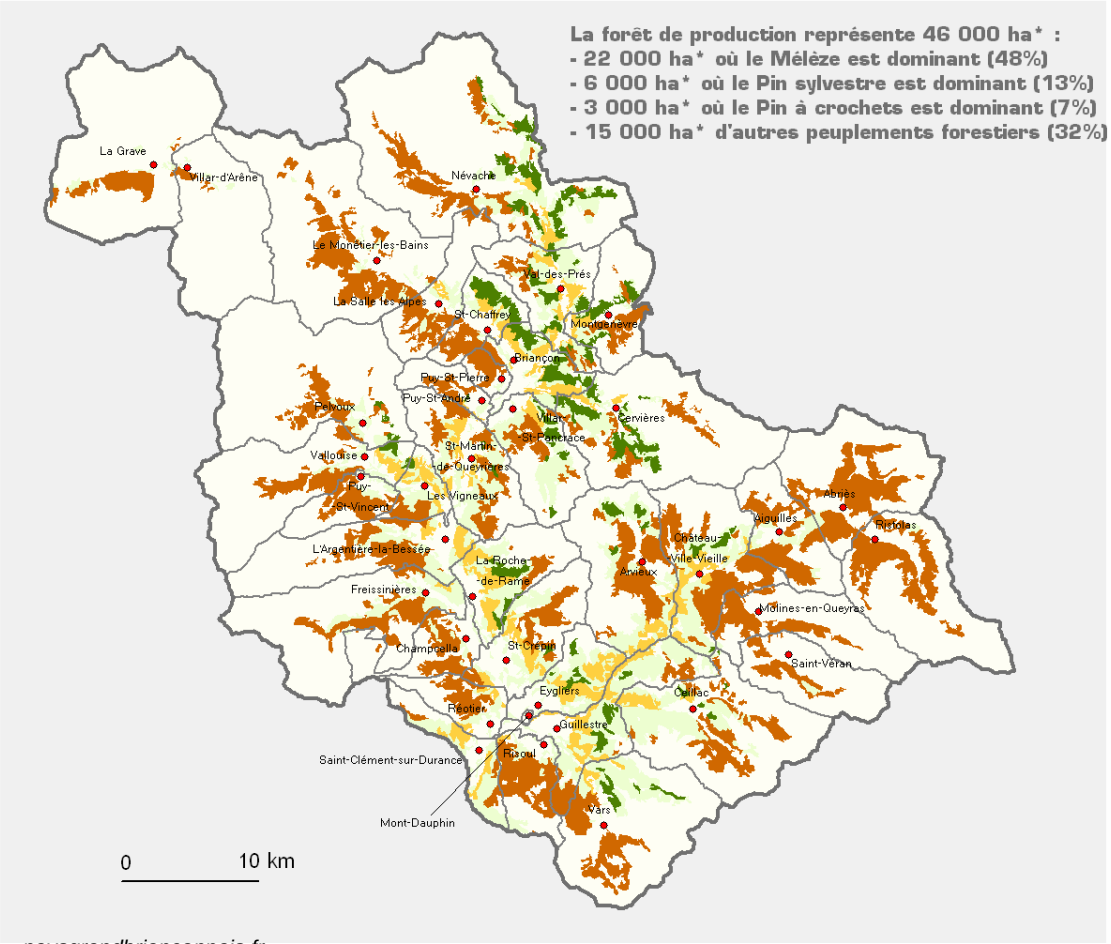


Identifying facts, significant elements putting them in relation

ONF classification
http://terredesherbes.over-blog.com/

Identifying facts, significant elements
putting them in relation
understanding relations as a system
[Only, architecture is man-made…]

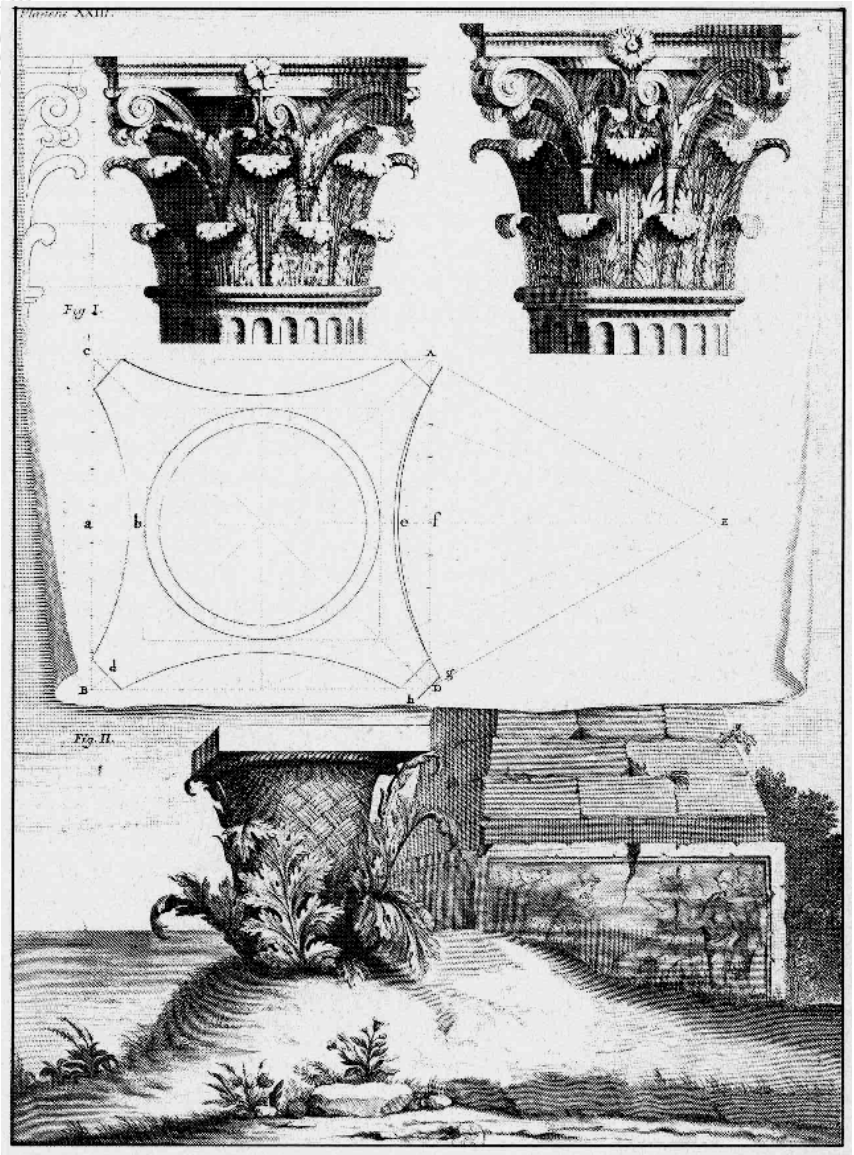
L'espace forestier du Pays du Grand Briançonnais
Type de peuplements forestiers



Peuplements forestiers
- Mélèze dominant
- Pin sylvestre dominant
- Pin à crochets dominant
- autres peuplements forestiers
- **Limites communales**
- **Limites du Pays**

paysgrandbrianconnais.fr

division lines ?



Françoise Fichet "La théorie architecturale à l 'âge classique"
Éditions Pierre Mardaga 1979

If we are to classify architectural facts, what division line?

The architectural theory is of support in identifying

division lines ?

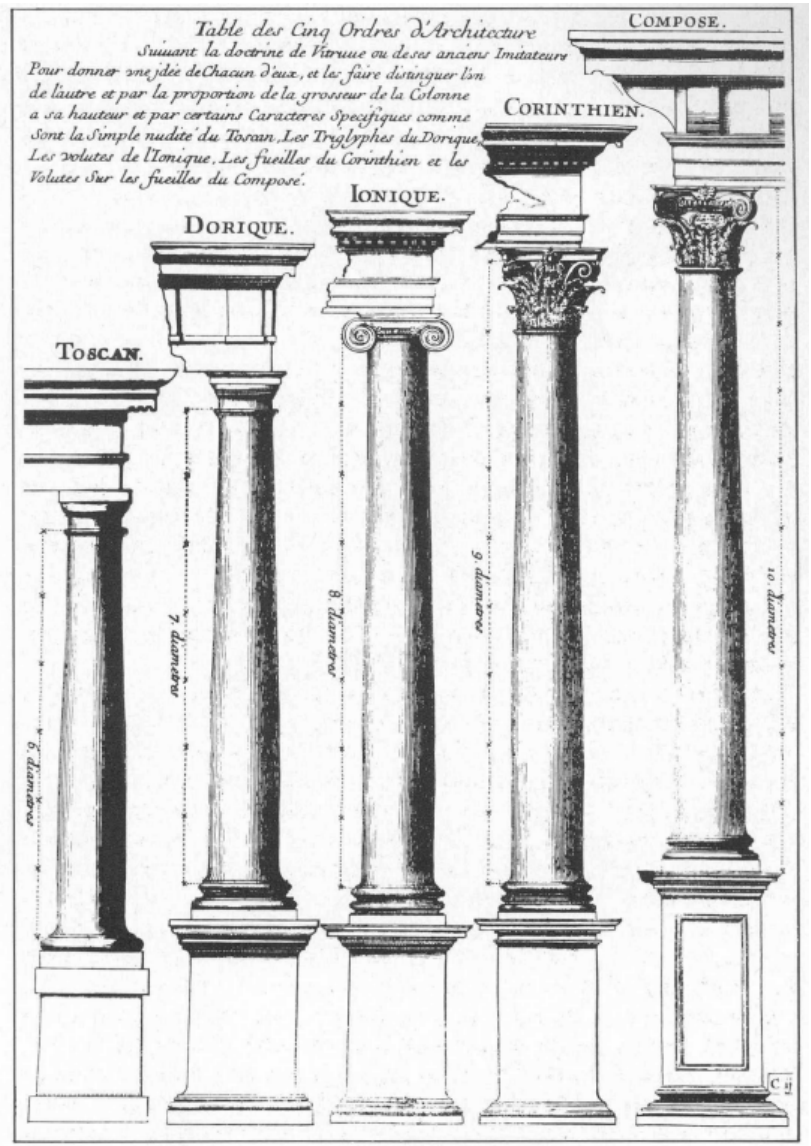


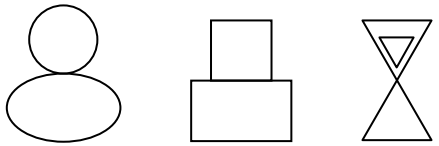
Table des cinq ordres d'architecture, François Blondel, *Cours d'architecture*, 1675-1683. Cliché B.N.

If we are to classify architectural facts, what division line?

The architectural theory is of support in identifying, but rather poor in classifying.

Françoise Fichet "La théorie architecturale à l 'âge classique"
Éditions Pierre Mardaga 1979

division lines ?



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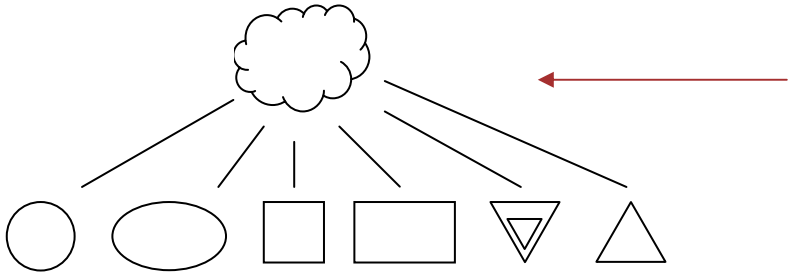

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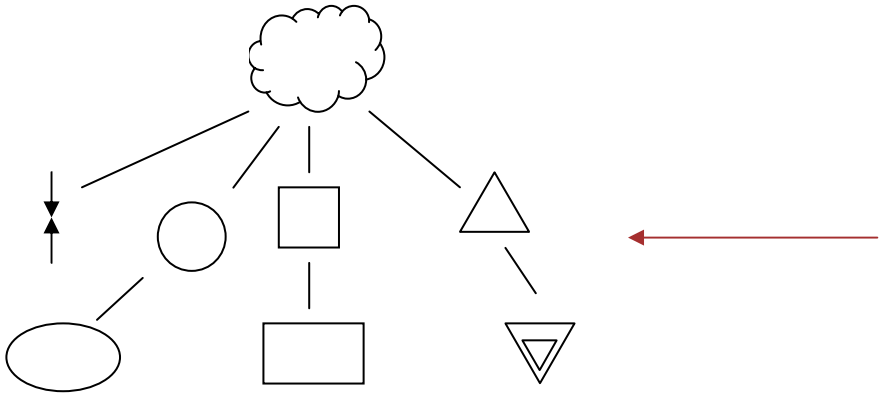


division lines ?

If we are to classify architectural facts, what division line?

Environmental constraints

Social uses

Components

Composition

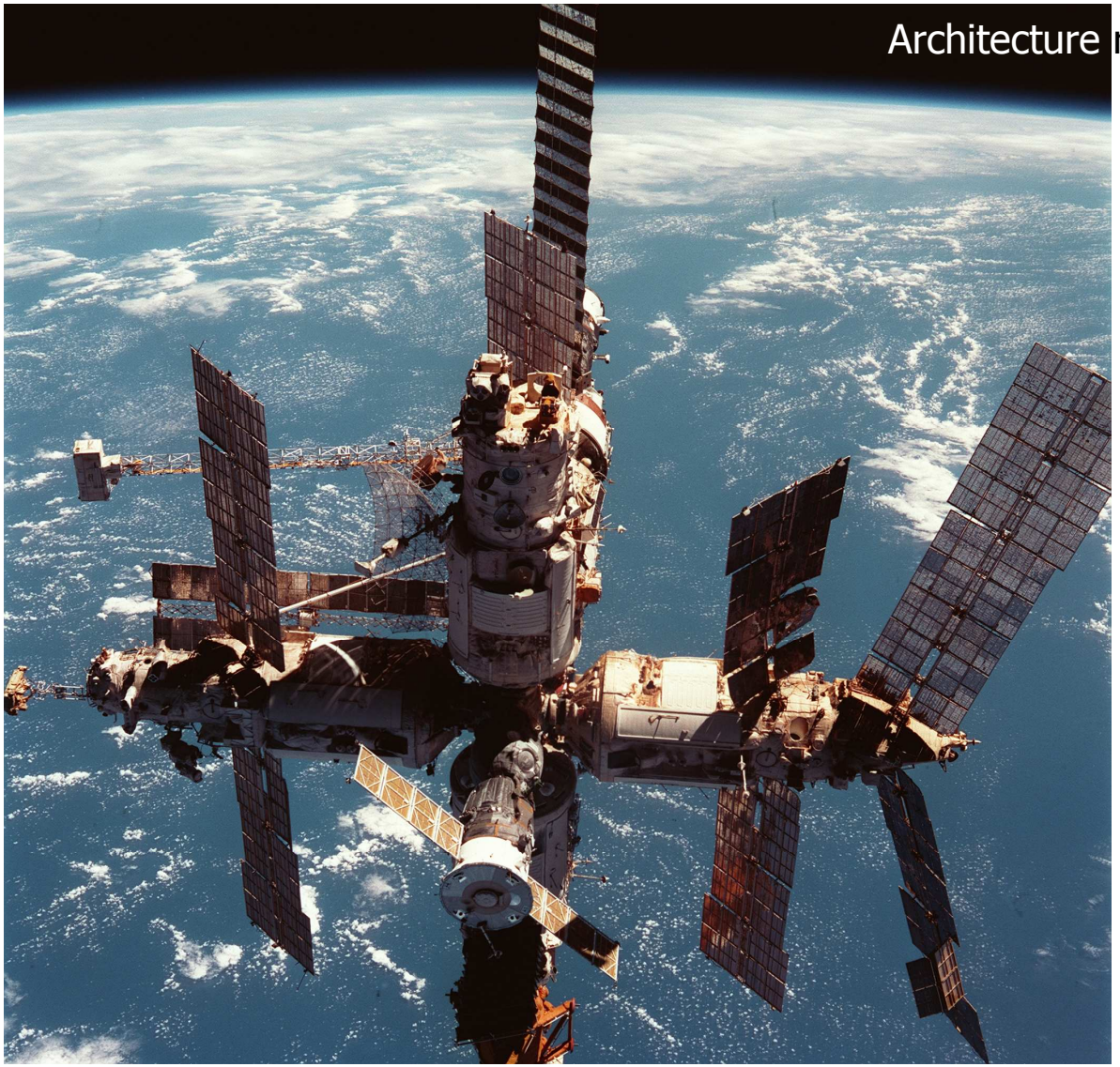
Design bias

Role as a symbol

Context

Stylistic affiliation

There are several biases you can choose to try and classify, what we will do now is illustrate some of these biases



Architecture results from constraints

What difference between this and architecture?

source : Wikipedia

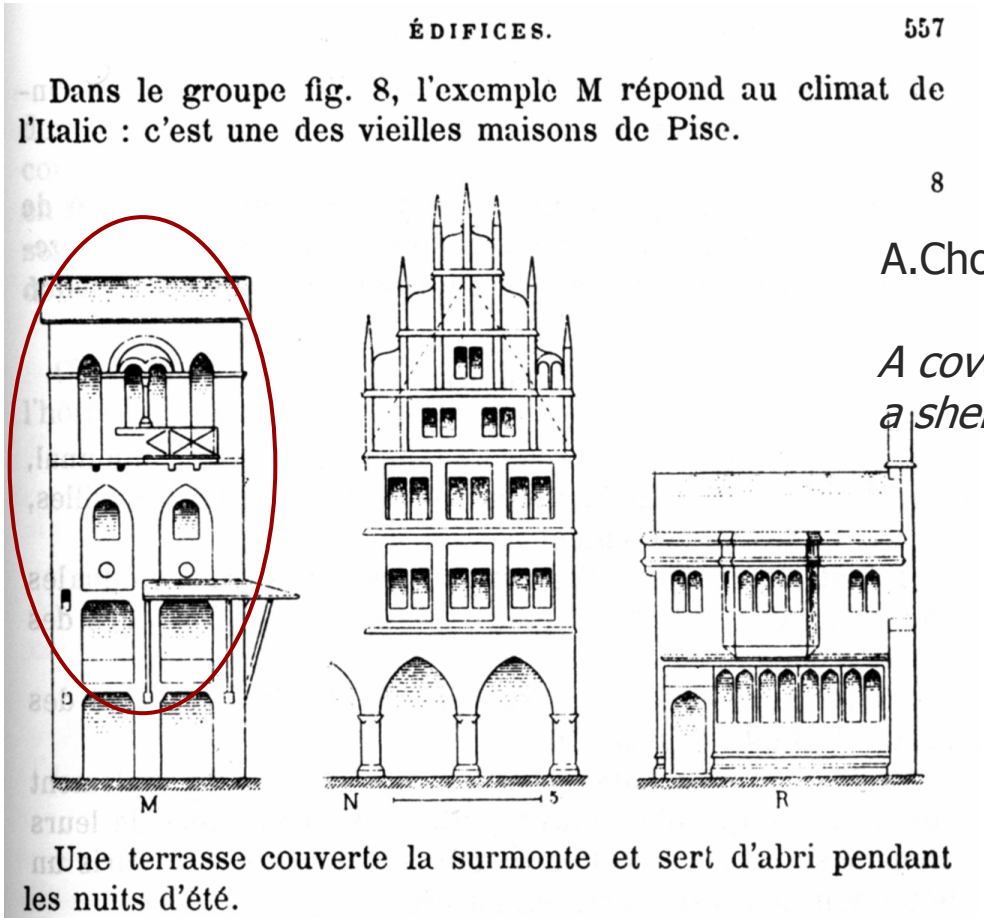
environmental constraints

Architecture results from constraints

the environment (natural)

Architecture results from constraints

the environment (natural)



A.Choisy, History of Architecture, 1899

A covered terrace topping it is used as a shelter during hot summer nights

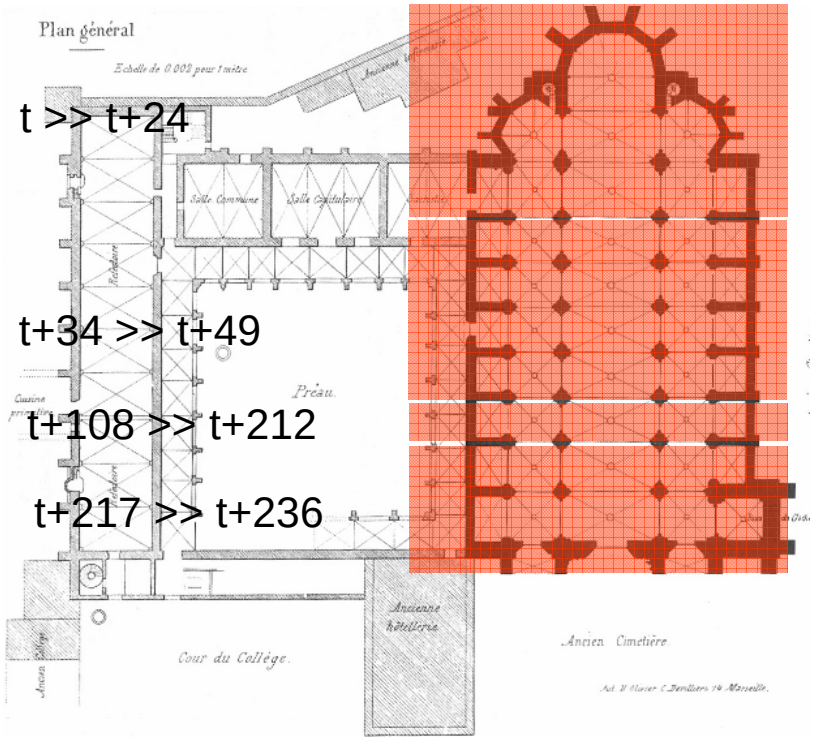
environmental constraints

Architecture results from constraints

the environment (resources)

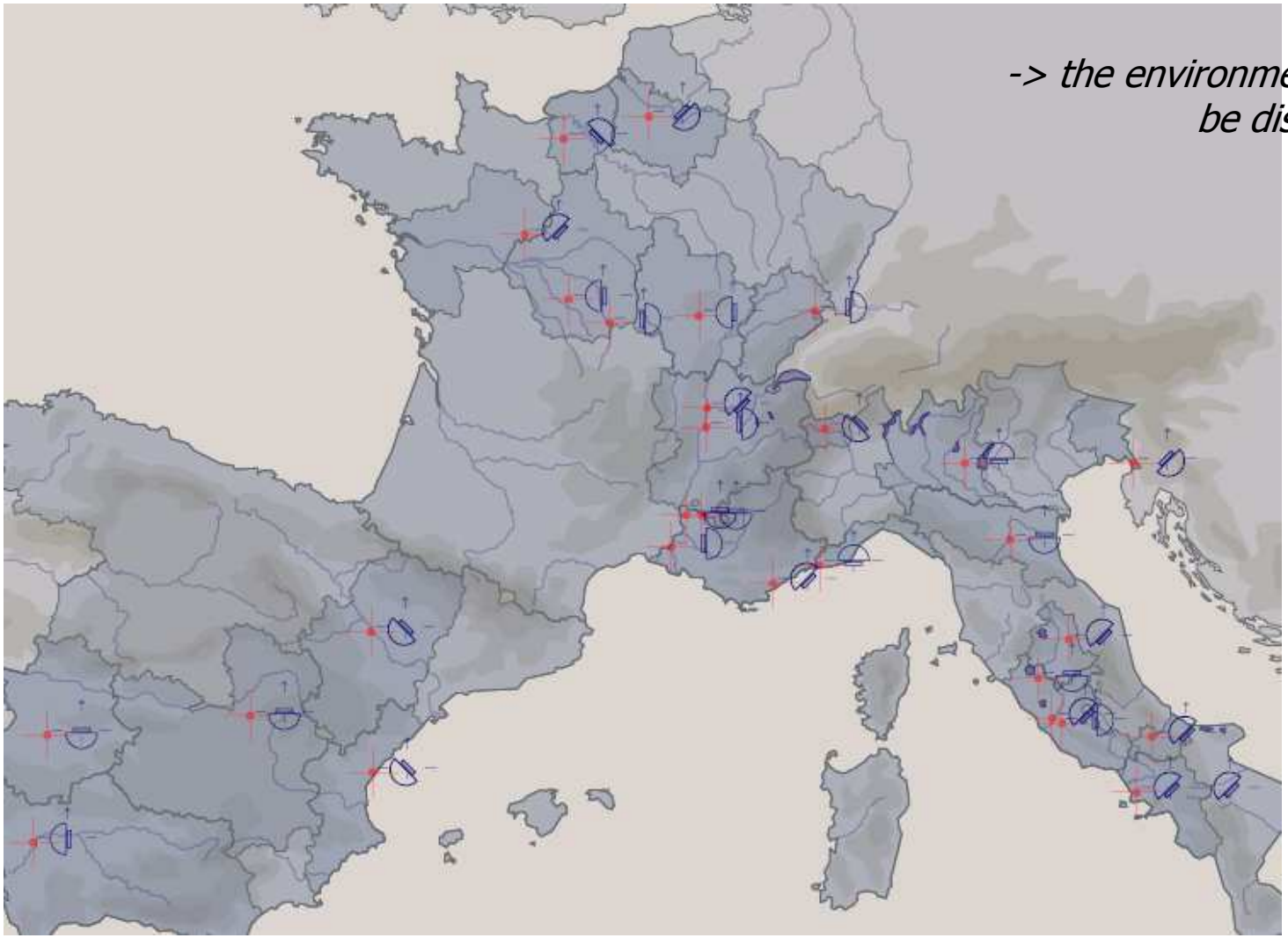
Architecture results from constraints

the environment (human resources)

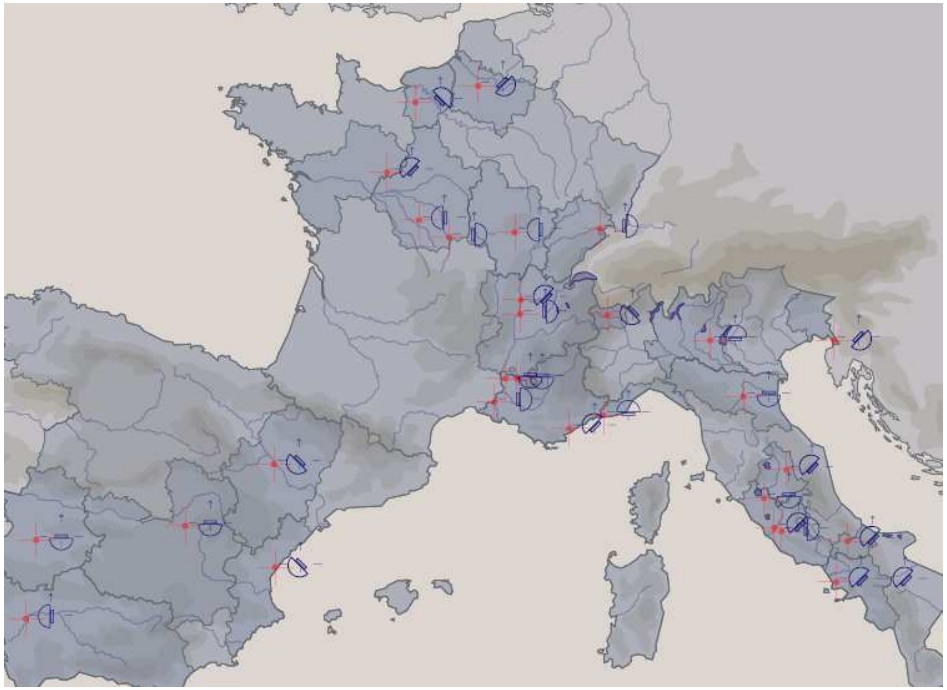


Classifying architecture by analysing environmental constraints

-> the environment may not be discriminating



Classifying architecture by analysing environmental constraints



literature : ethnology, but also in Vitruvius' "ten books of architecture".

Architecture is an answer to social needs

social uses

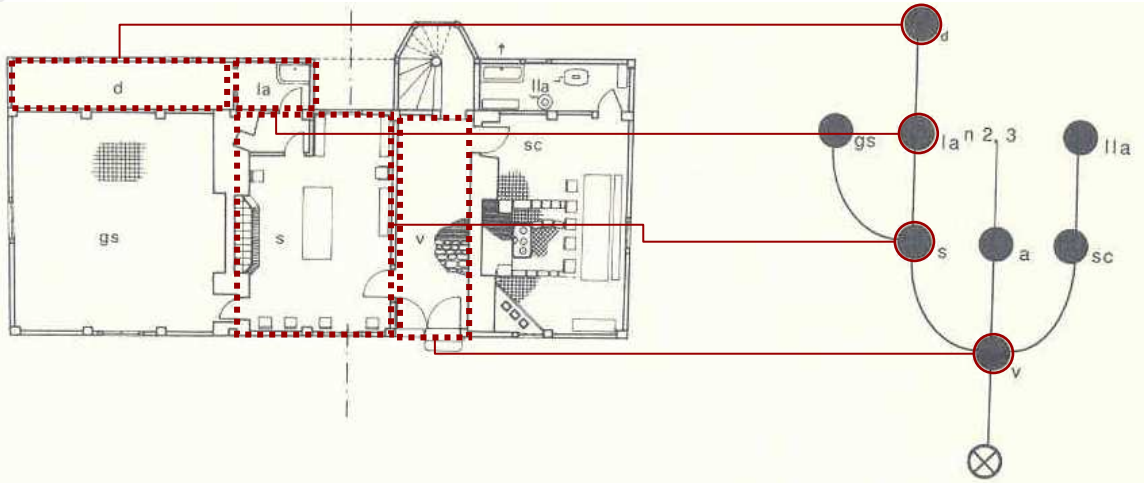


Fig. 64. — Plan et graphe de l'habitation « La Ferme de Pommereuil » à Sainte-Marthe, Pays d'Ouche.

Fig. 68. — Plan et graphe de l'habitation « Les Gossets, Dodainville » à Saint-Marcouf, Plain.
Corpus de l'architecture rurale française, NO 30 : le logis, niveau 1, rez-de-chaussée.

Architecture is an answer to social needs

we distribute spaces and activities in significant ways

- ⊗ Entrance
- ● Rooms
- ○ Rooms reachable from outside

J. Cuisenier
La maison rustique, logique sociale et composition architecturale, PUF 1991

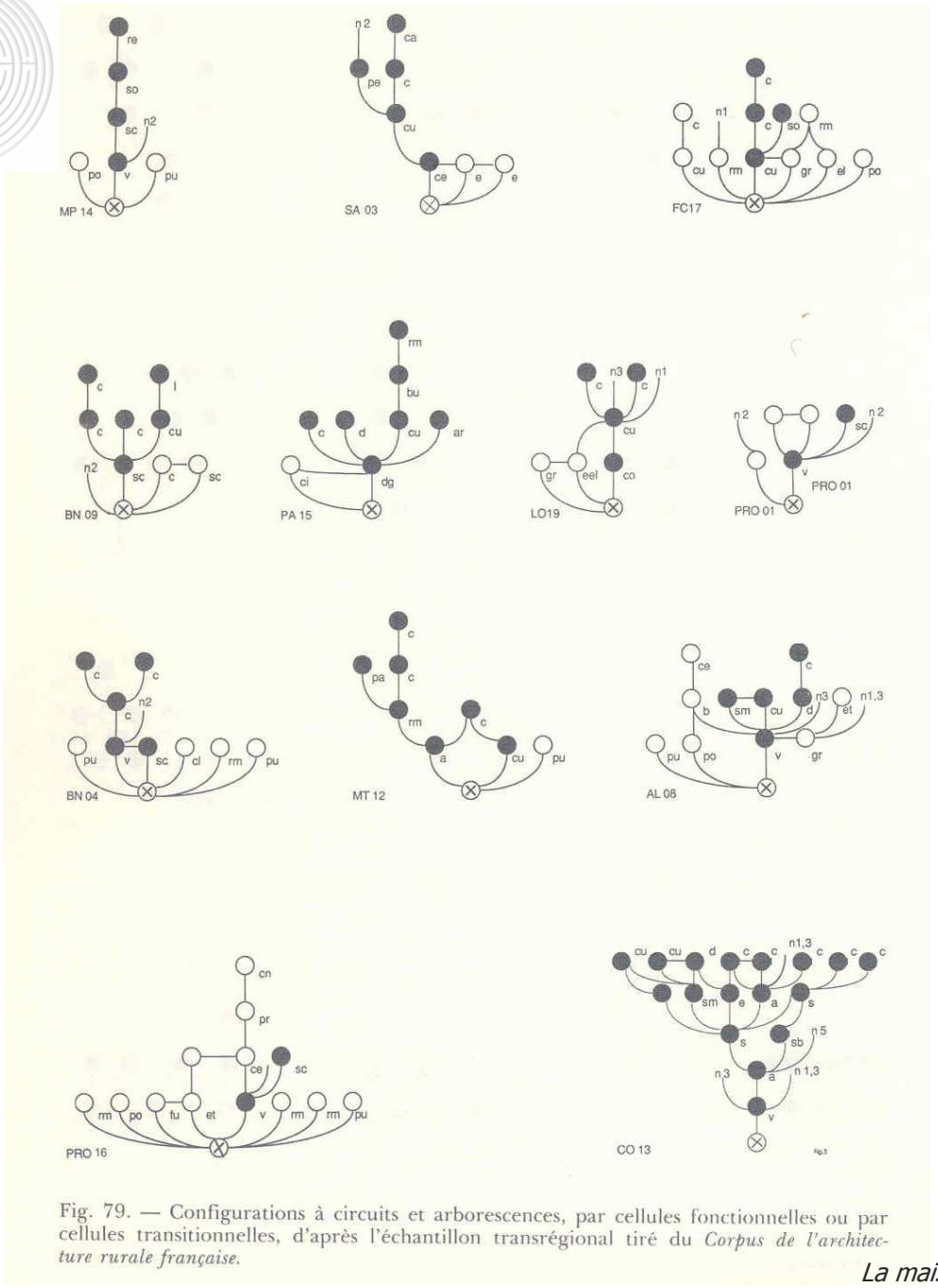


Fig. 79. — Configurations à circuits et arborescences, par cellules fonctionnelles ou par cellules transitionnelles, d'après l'échantillon transrégional tiré du *Corpus de l'architecture rurale française.*

Modelling biases

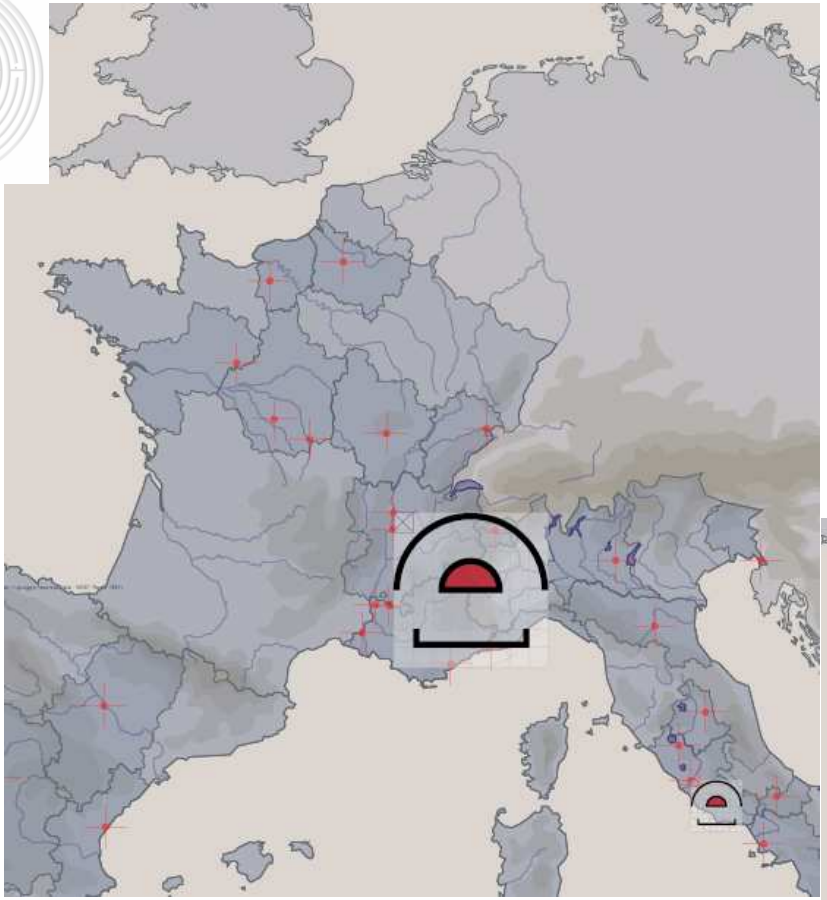
social uses

Architecture is an answer to social needs

we distribute spaces and activities in significant ways

We can try to analyse patterns of distribution across a region

J. Cuisenier
La maison rustique, logique sociale et composition architecturale, PUF 1991

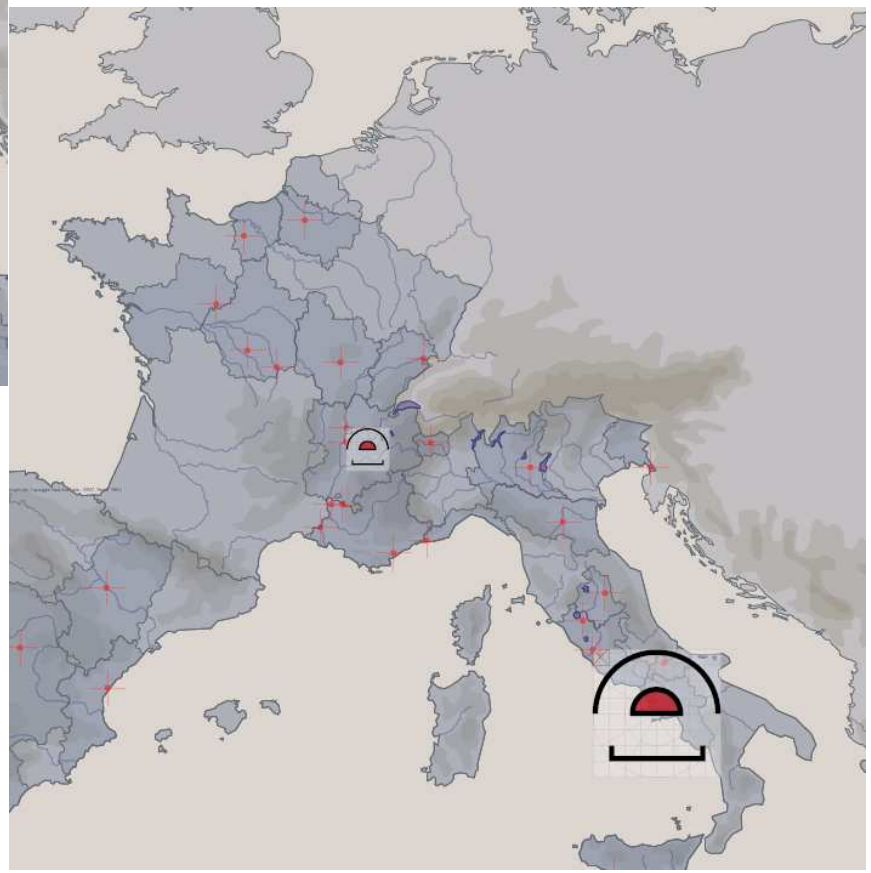


Modelling biases

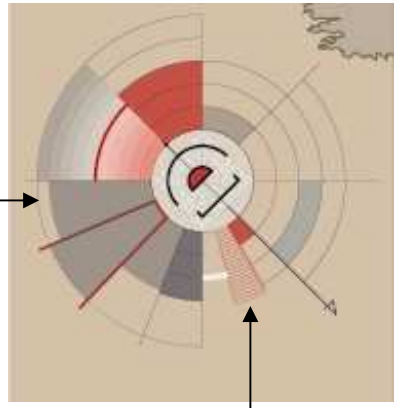
social uses

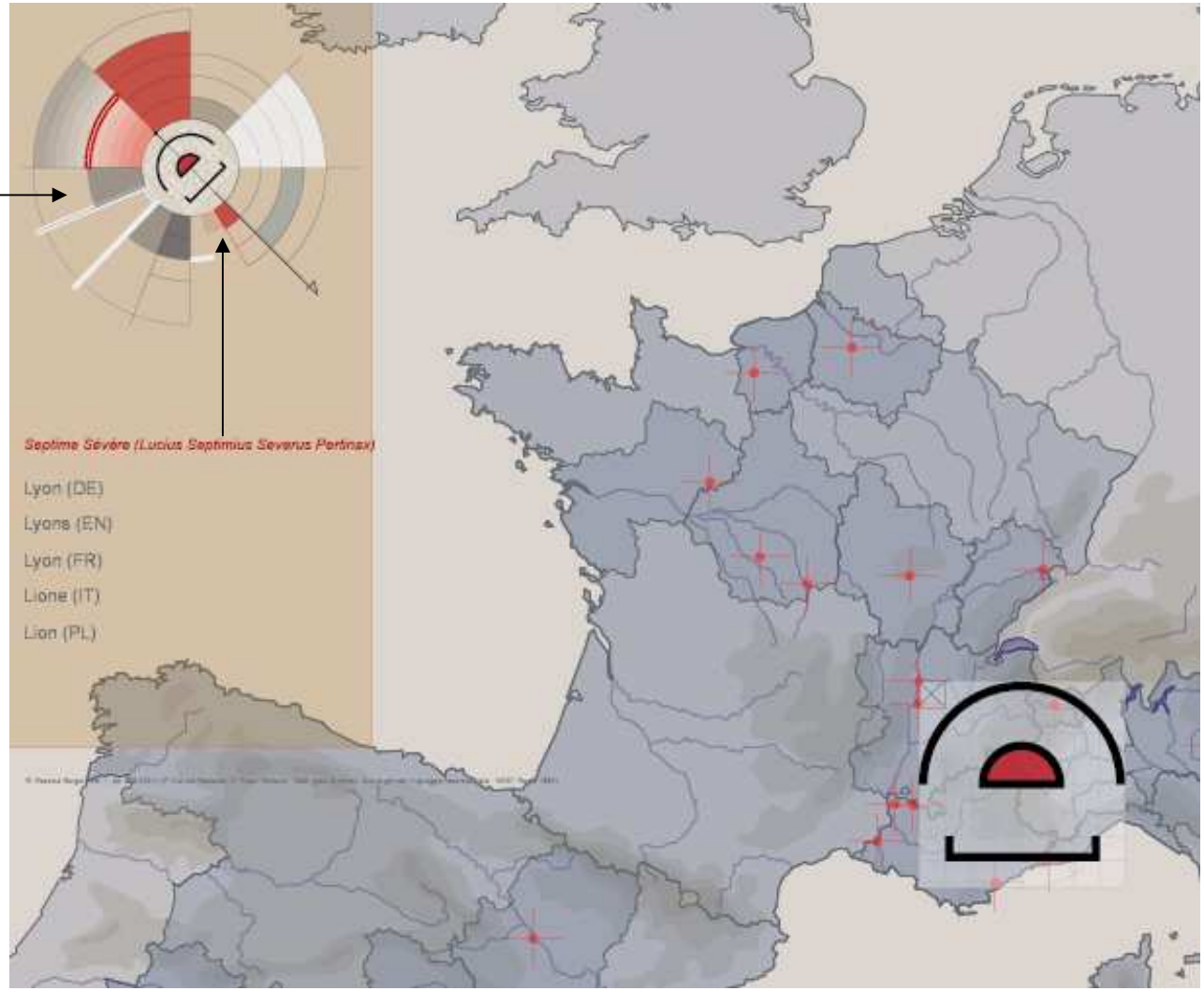
Architecture is an answer to social needs

we also align features of spaces with needs

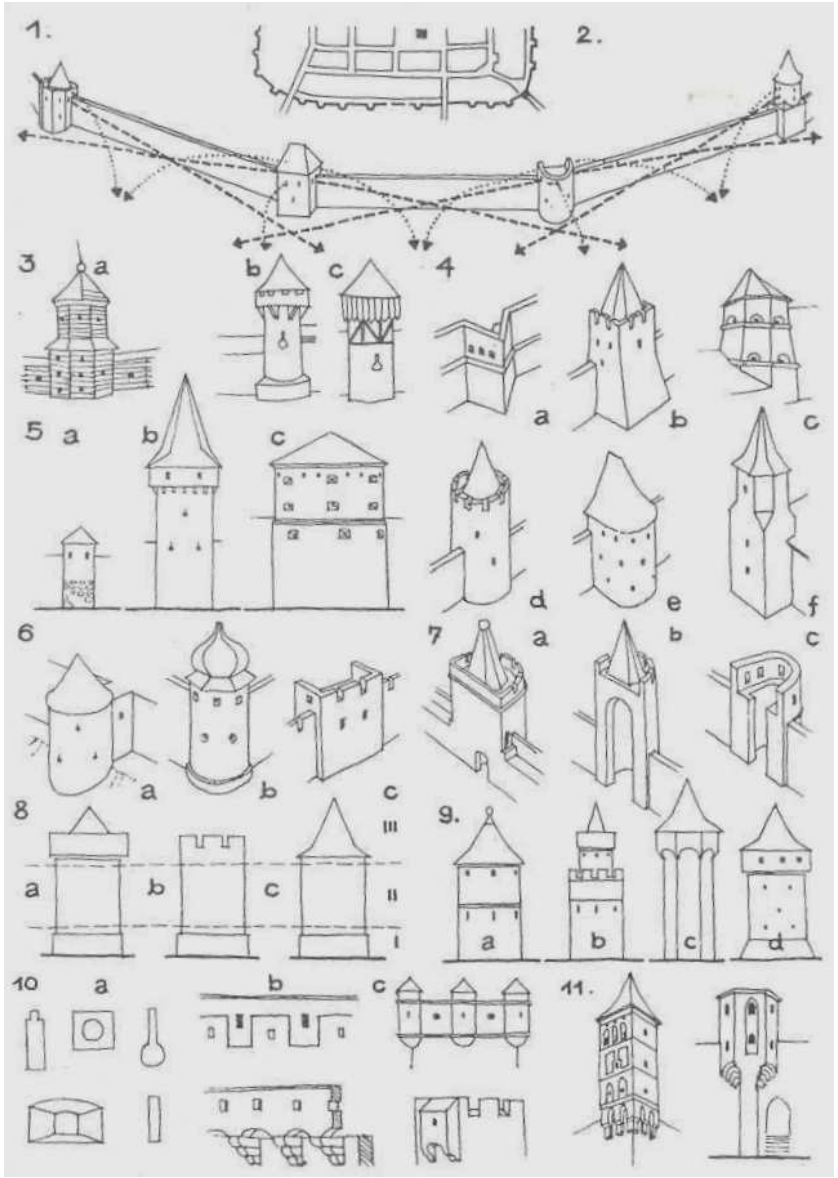


Architecture is an answer to social needs





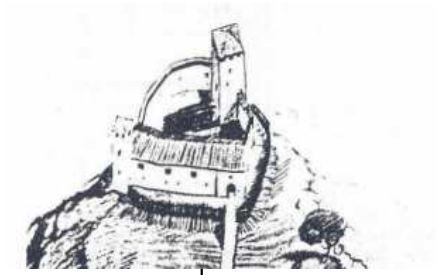
social uses

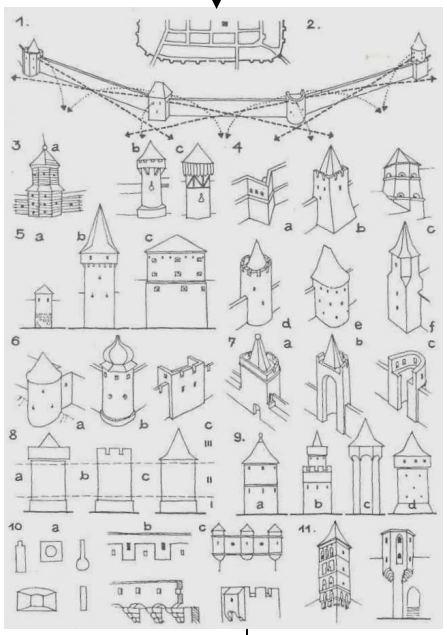


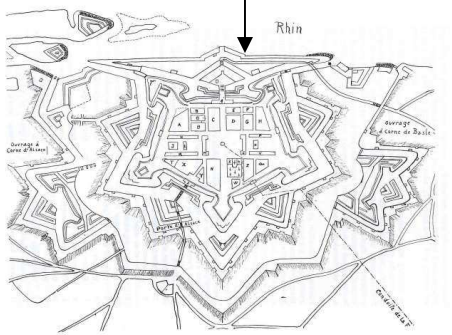
Architecture is an answer to social needs

needs of individuals, needs of groups

Janusz Bogdanowski
„Warownie i zieleń twierdzy Kraków", Wyd. Literackie, Kraków 1979







social uses

Architecture is an answer to social needs

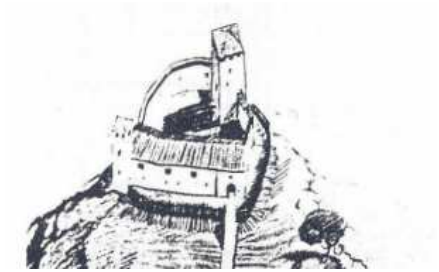
Needs and uses tend to change over time

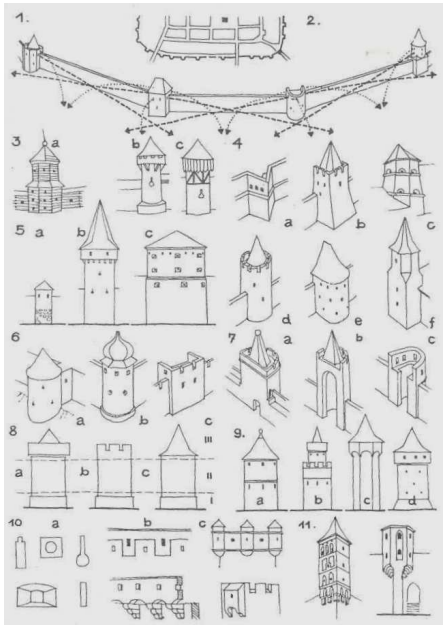
What is the key factor of this evolution?

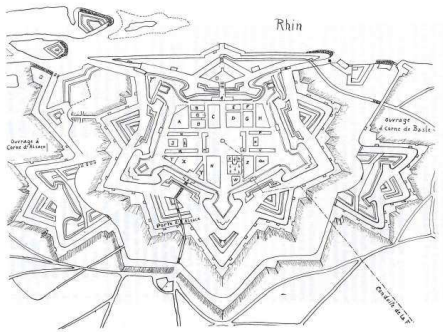
Zbigniew Dmochowski
„The architecture of Poland", London 1956

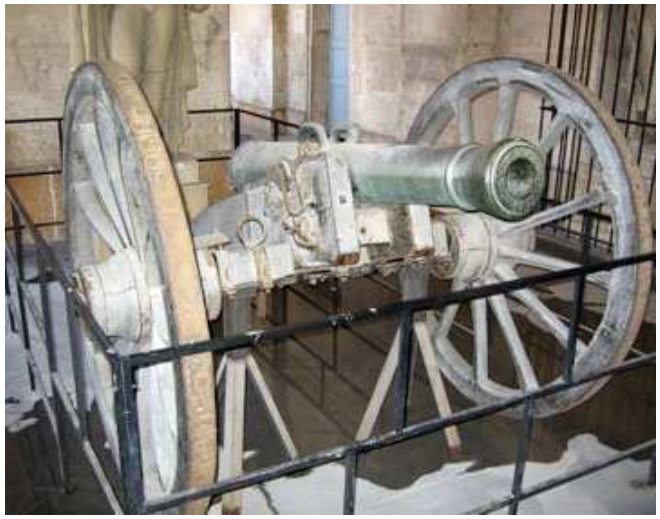
Janusz Bogdanowski
„Warownie i zieleń twierdzy Kraków", Kraków 1979

Ville du Huningue, [on-line] <*http://www.ville-huningue.fr/phototheque/theme-La-forteresse-page1/plan-de-la-forteresse-de-vauban-h160109-619.html*>

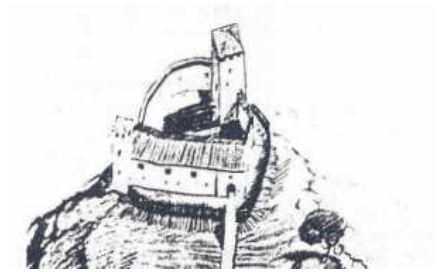


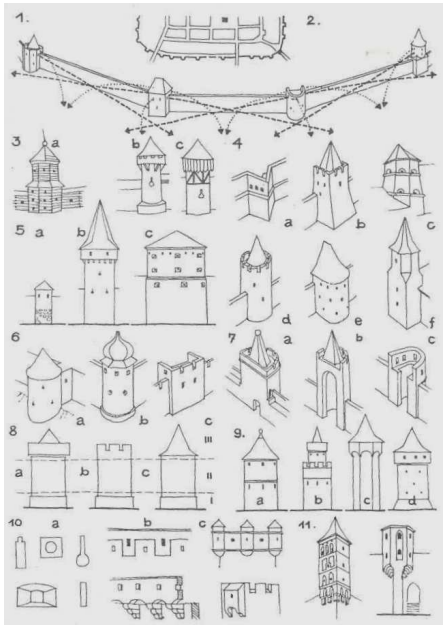


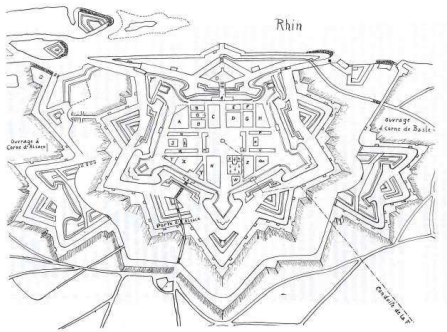




De la fortification, [on-line] <*http://sabreteam.free.fr/*>







Architecture is an answer to social needs

As the "architectural" answer becomes deprecated, new solutions become needed, and new uses have to be inserted inside the deprecated answer.

A classification based on social uses is not always convenient for long time spans

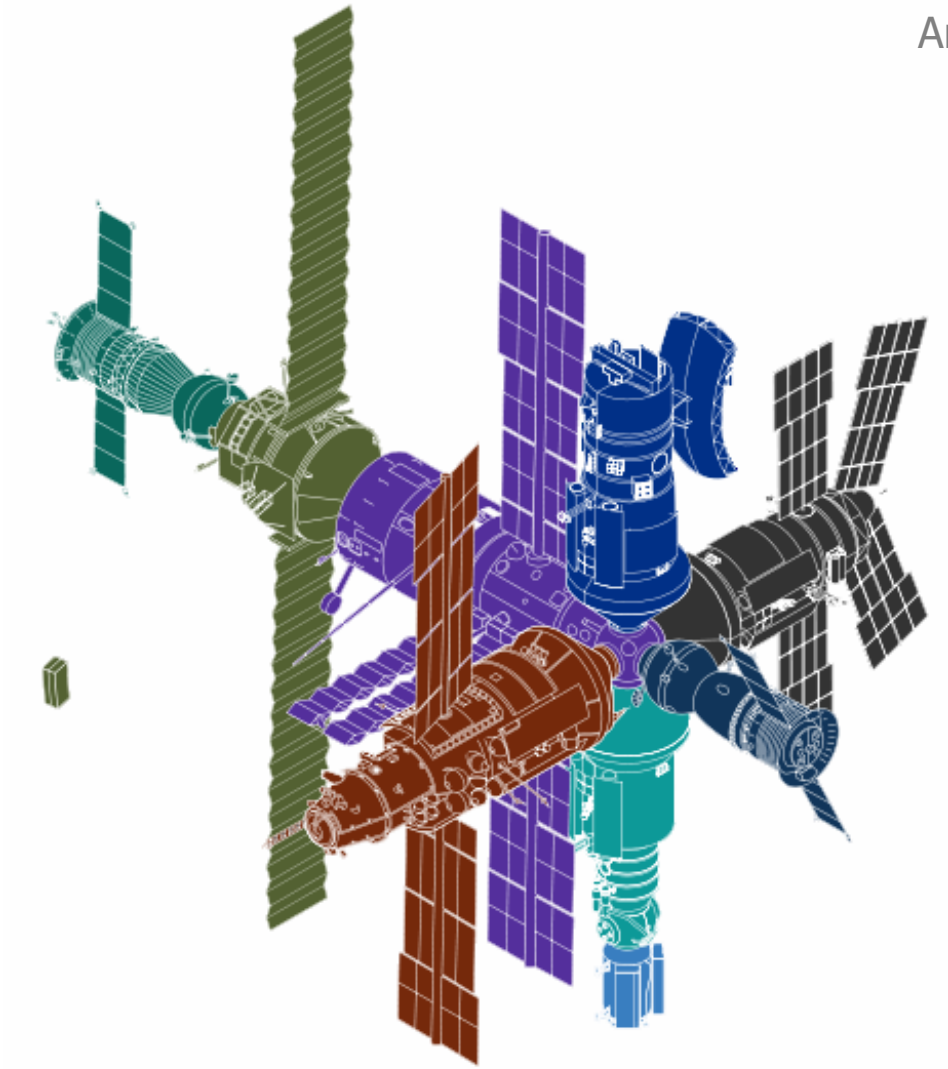
Janusz Bogdanowski
„Warownie i zieleń twierdzy Kraków", Kraków 1979

Mieczysław Tobiasz
Fortyfikacje dawnego Krakowa, Kraków 1973

Stanisław Tomkowicz
Ulice i place Krakowa w ciągu dziejów. Ich nazwy i zmiany postaci, BK nr 63-64, Kraków 1926

J. Cuisenier
La maison rustique, logique sociale et composition architecturale, PUF 1991
http://en.wikipedia.org/wiki/Space_syntax

literature : History of housing, urban studies, space syntax



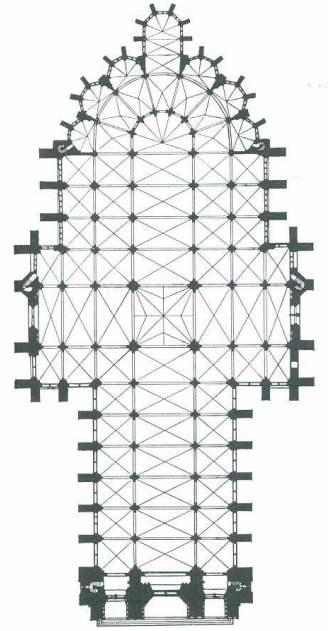
Architecture is made from components

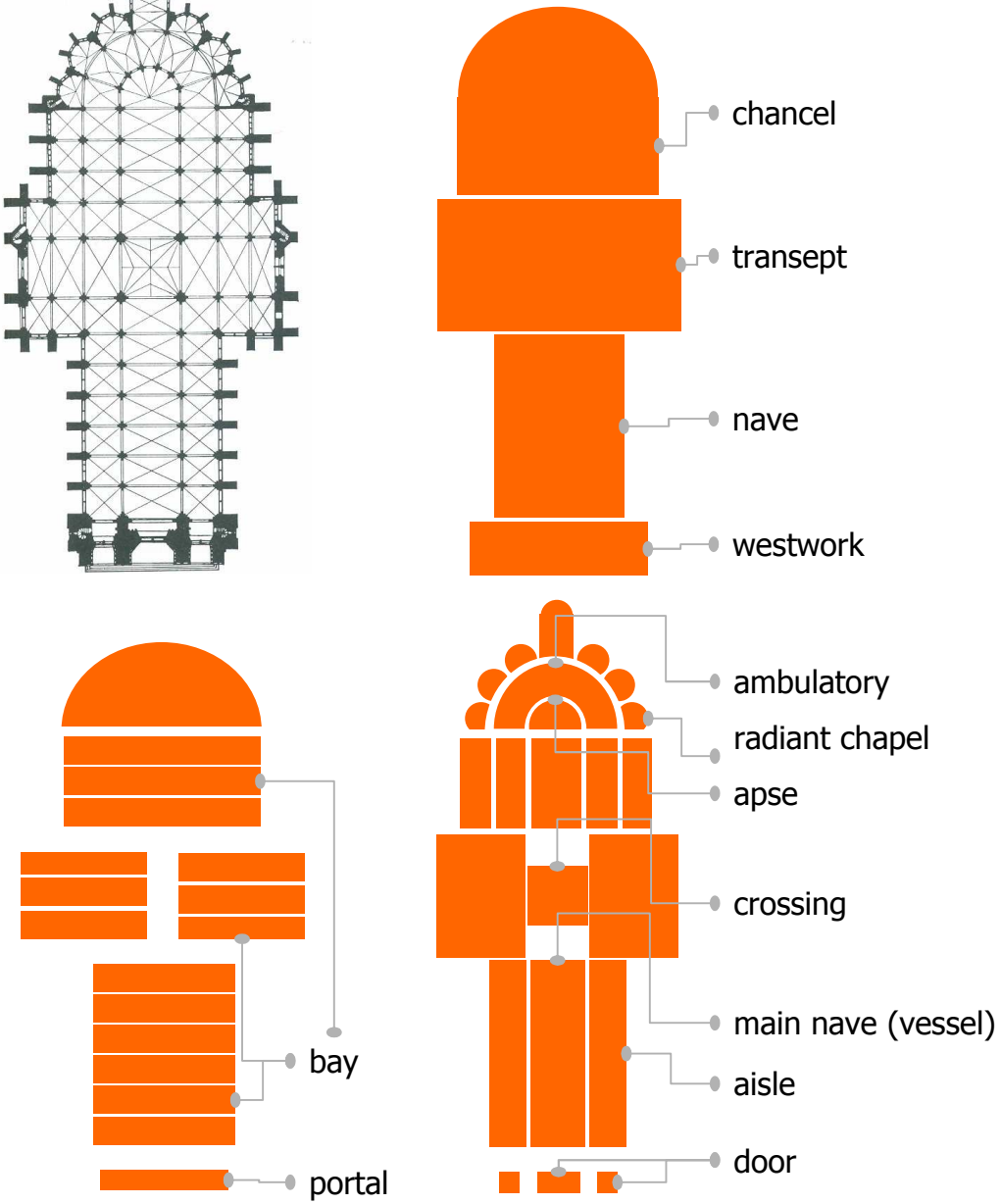
(lots of other things too..)

source : Wikipedia

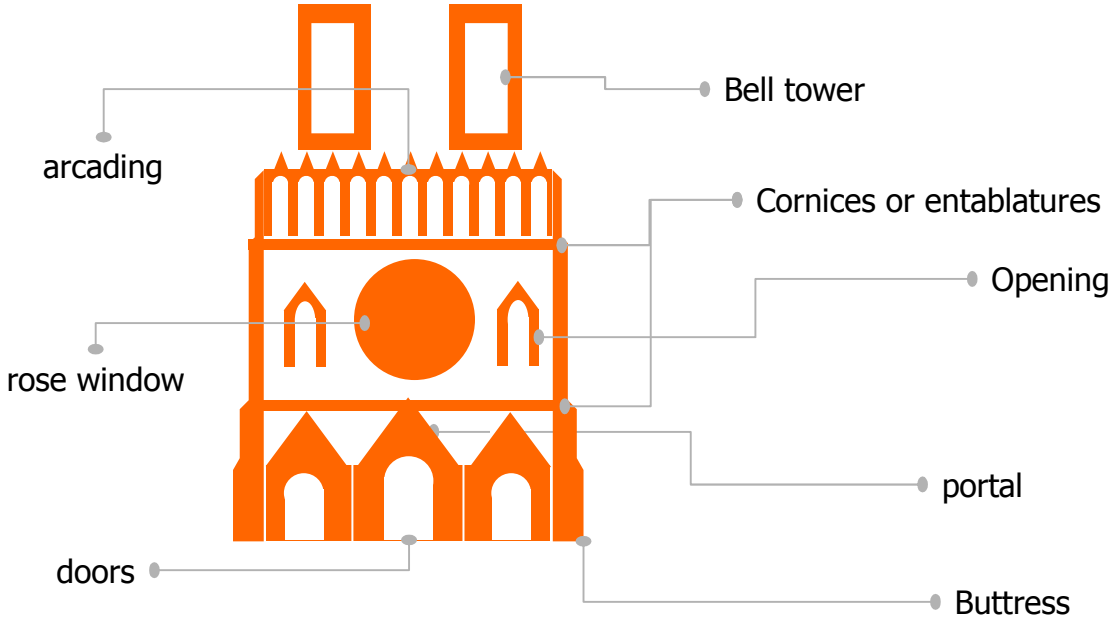
components

identification step





identification step



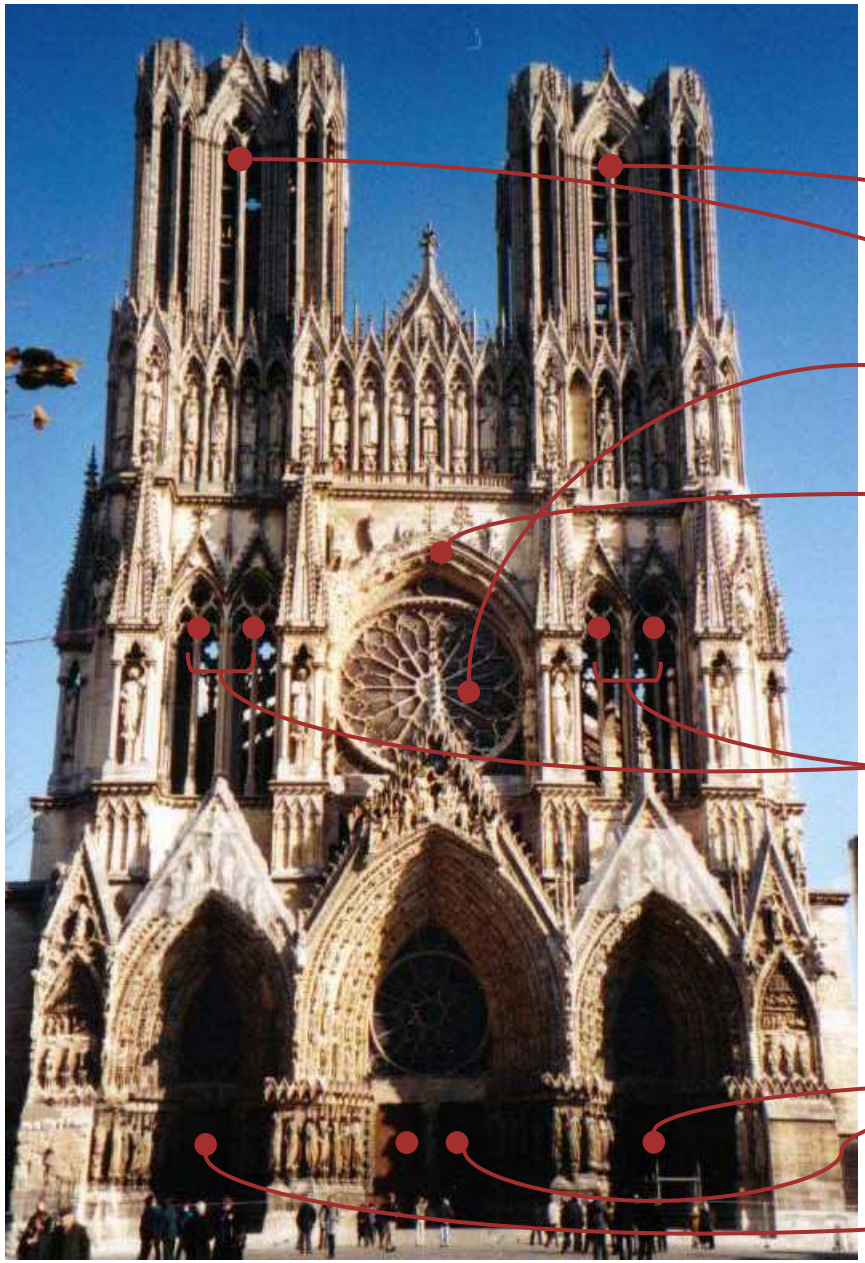
components

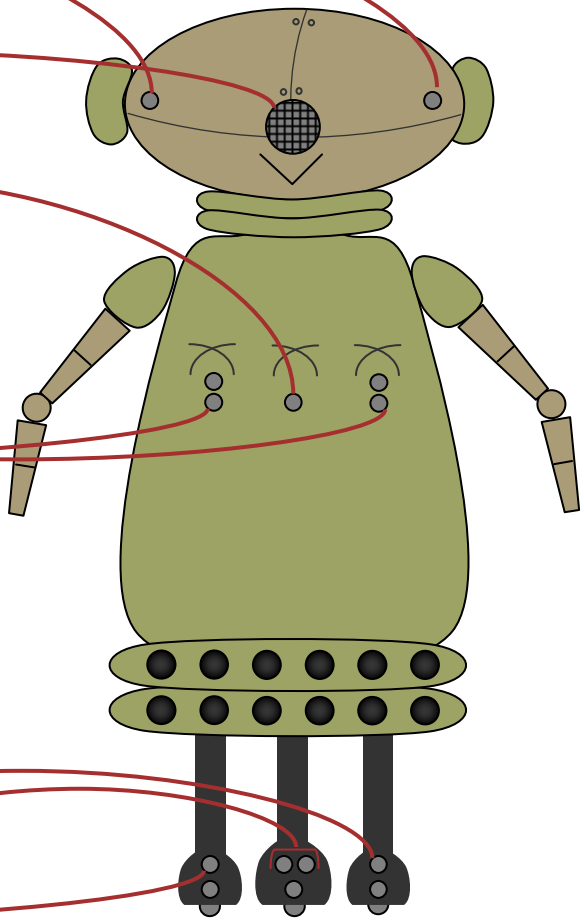
identification step

how many openings, and what kind of openings ?

components

identification step

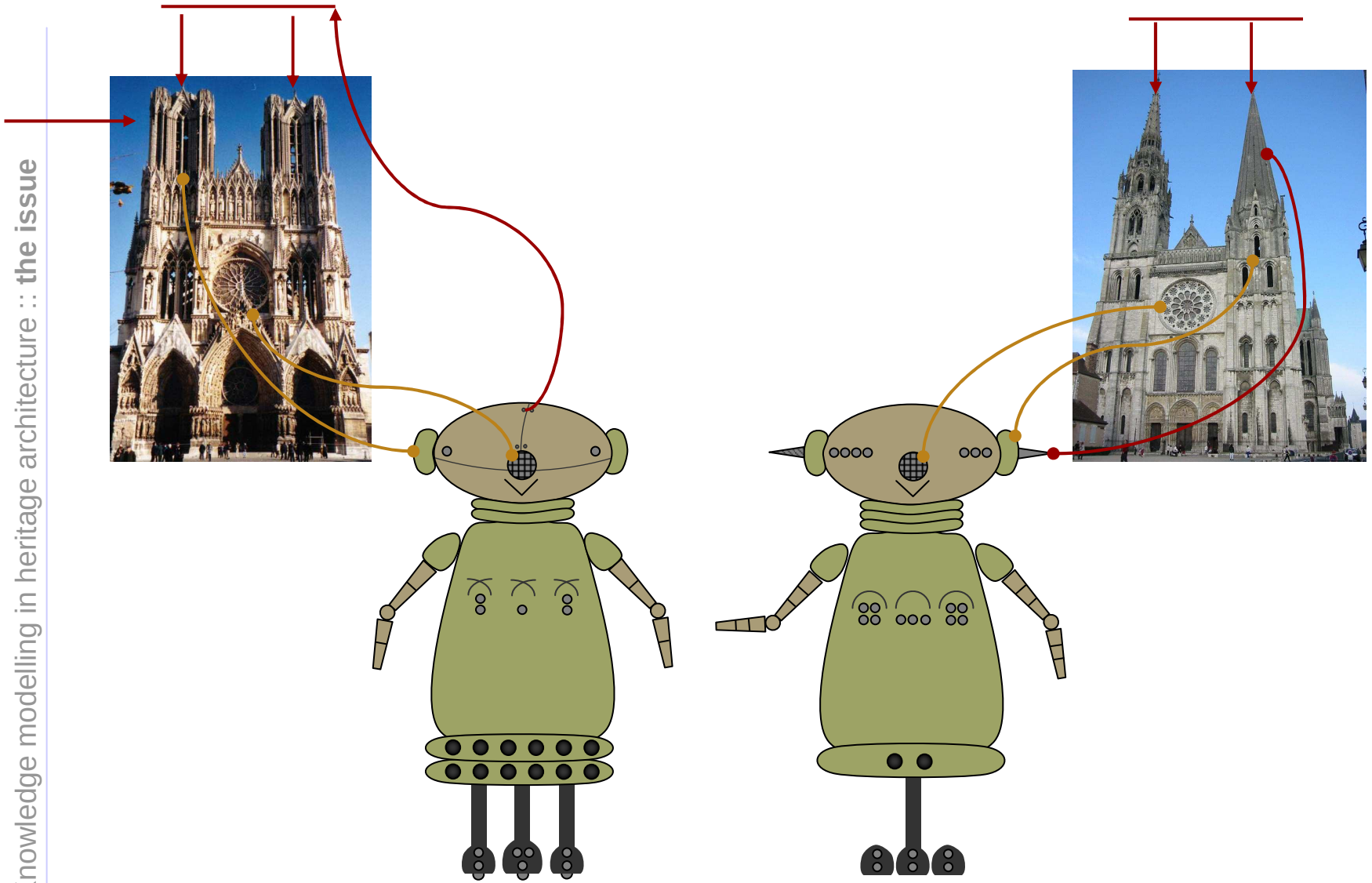




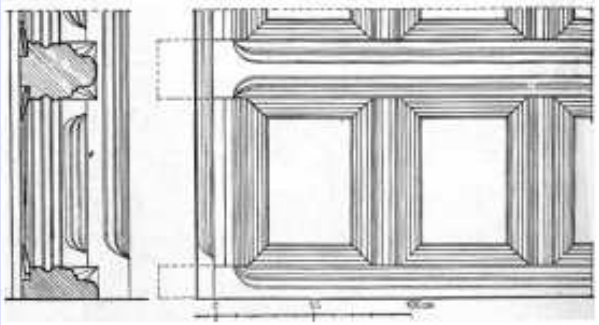
comparing components

How many common components?

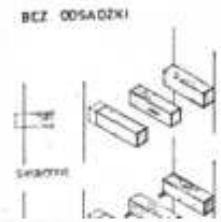
components

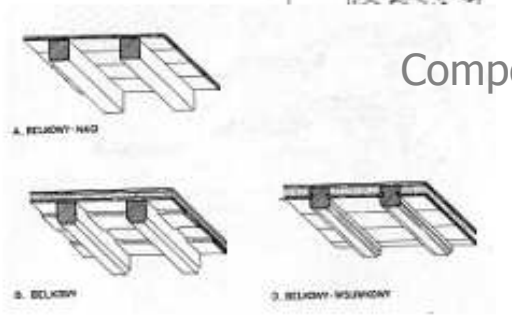


Inventory of components
Girders, Beams, Boarding, …



Typology of assembling





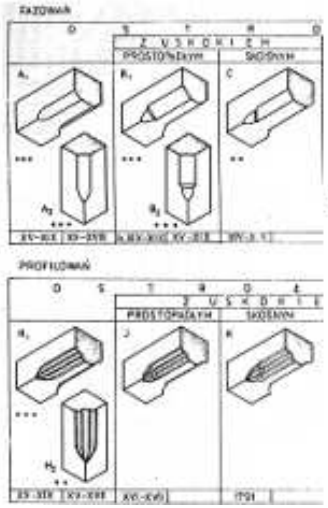
With rules to identify components, we may at least compare. But classify?

Components may be described by complex features

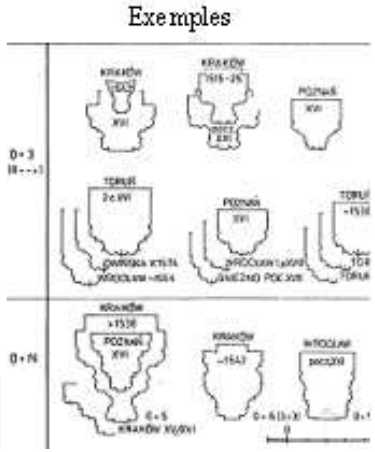
Jan Tajchman's analysis of wooden ceilings

Classification des terminaisons de profils:

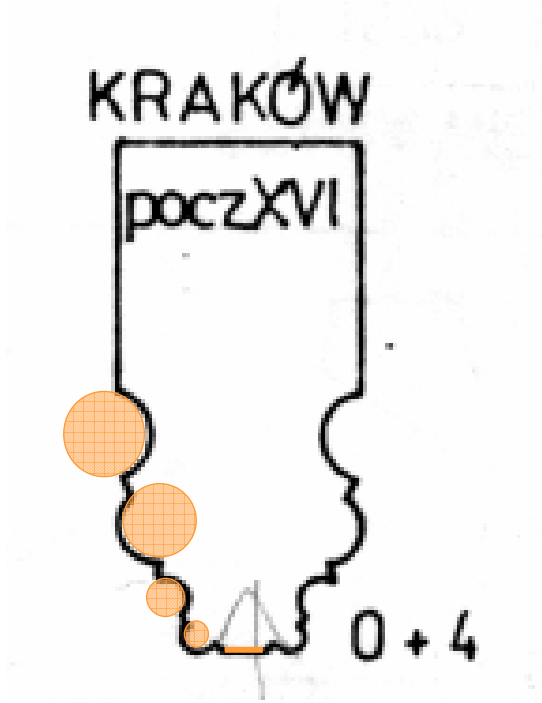
Type de mouluration
Géométries des terminaisons
Epoque d'utilisation



Classification of Profiles
groups, curve inversions, period of use



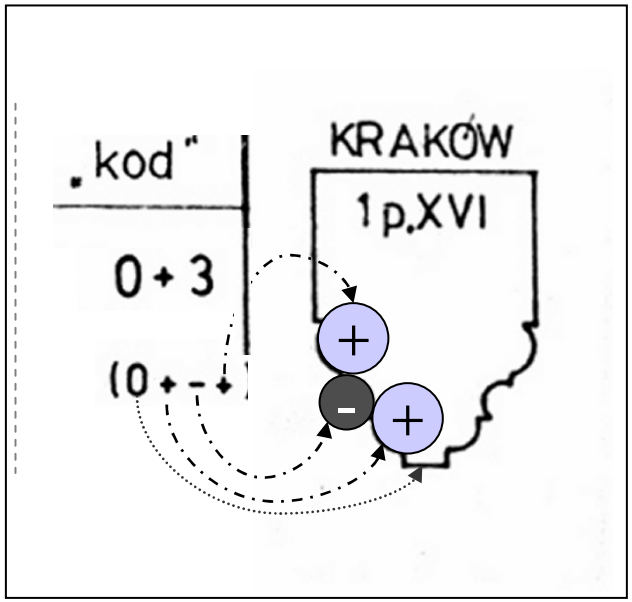
Jan Tajchman
Stropy drewniane w Polsce. Propozycja systematyki
ODZ, Warszawa 1989



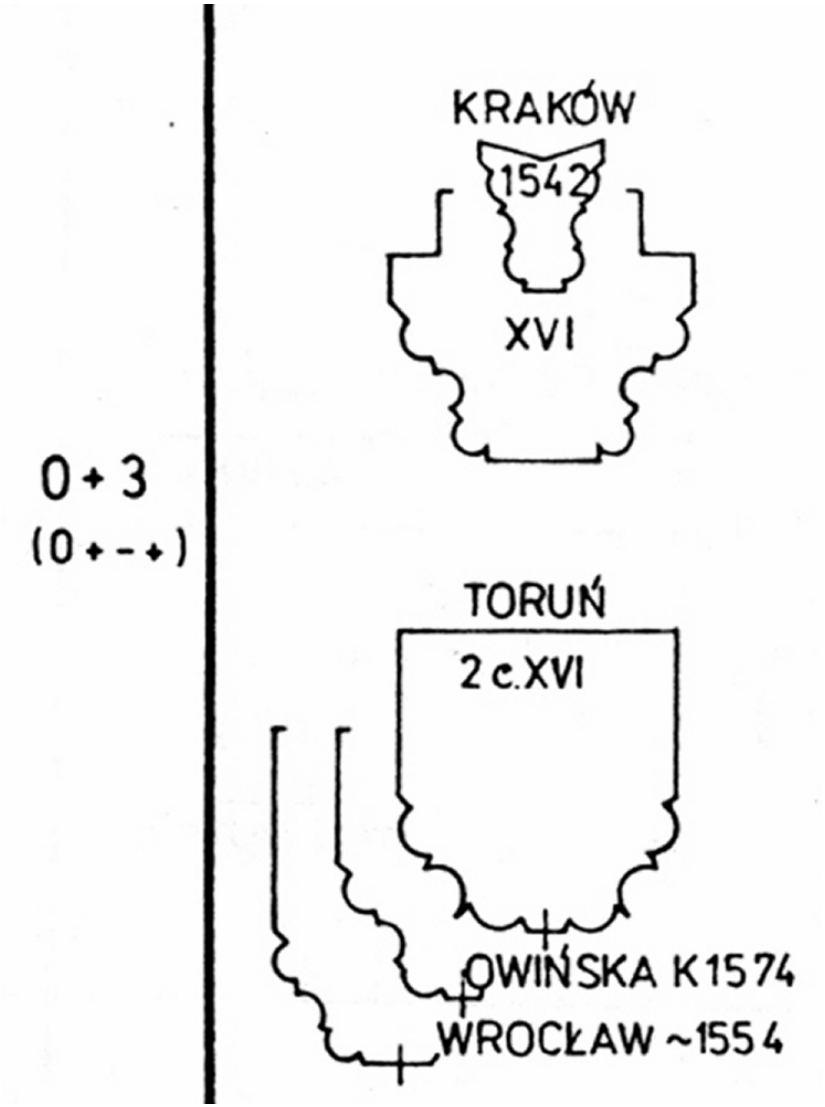
Jan Tajchman's analysis of wooden ceilings

Identification of features (counting curves)

A classification in groups / sub groups



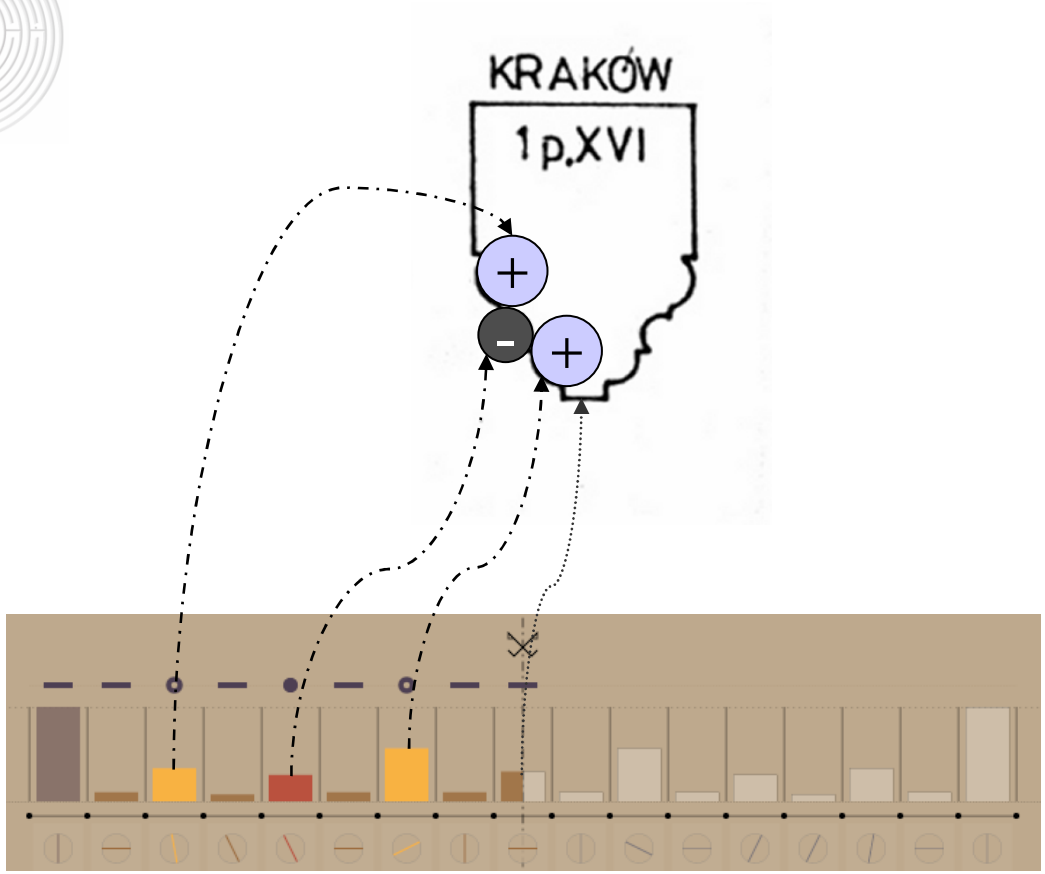
Jan Tajchman
Stropy drewniane w Polsce. Propozycja systematyki
ODZ, Warszawa 1989



Jan Tajchman's analysis of wooden ceilings

Classifying and dating wooden ceilings by identifying and counting their components and the way they alternate

Jan Tajchman
Stropy drewniane w Polsce. Propozycja systematyki
ODZ, Warszawa 1989



Jan Tajchman's analysis of wooden ceilings

The technology changes, the classification remains

literature : IJCISIM, F.D.K Ching, C.M Harris, (and most of the architectural theory).

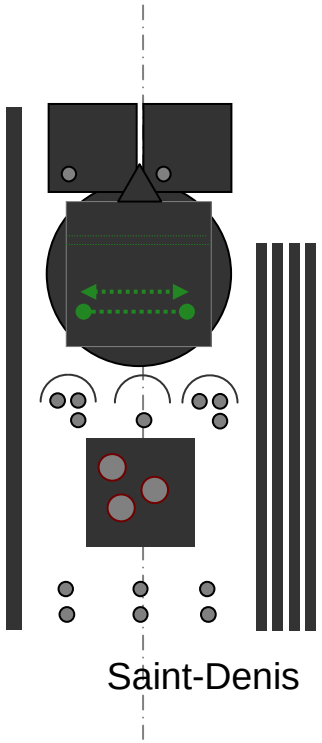
J.M. Pérouse de Montclos
Architecture – principes d'analyse scientifique, Imprimerie Nationale, 1988

W. Koch,
Style w Architekturze, Bertelsmann Publishing 1996

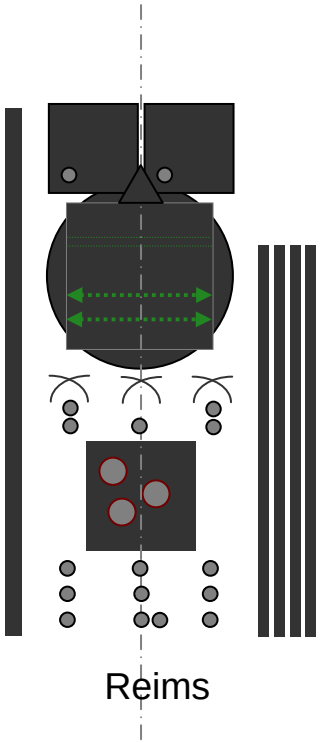
Jan Tajchman
Stropy drewniane w Polsce. Propozycja systematyki
ODZ, Warszawa 1989

D. Rattner.
Parallel of the classical orders of architecture. Acanthus Press 1998

composition



Saint-Denis

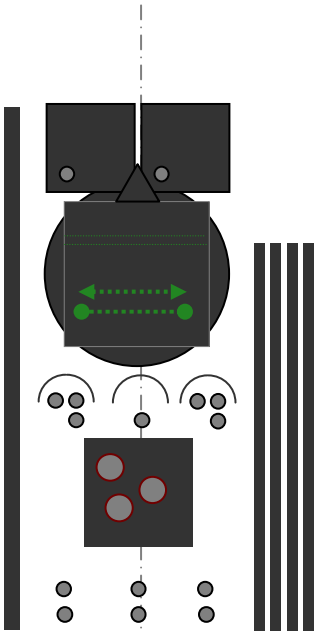


Reims

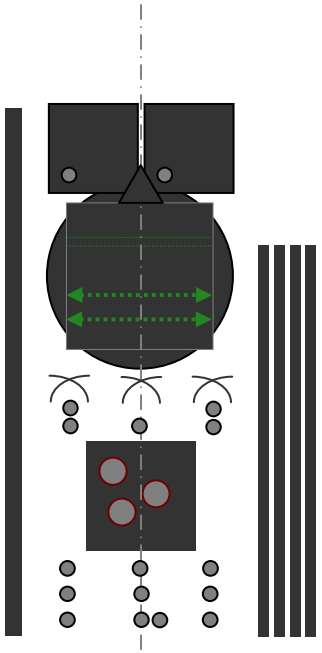
Artefacts contain components that are organised, composed, in a specific manner, according to composition rules.

Are these two almost similar?

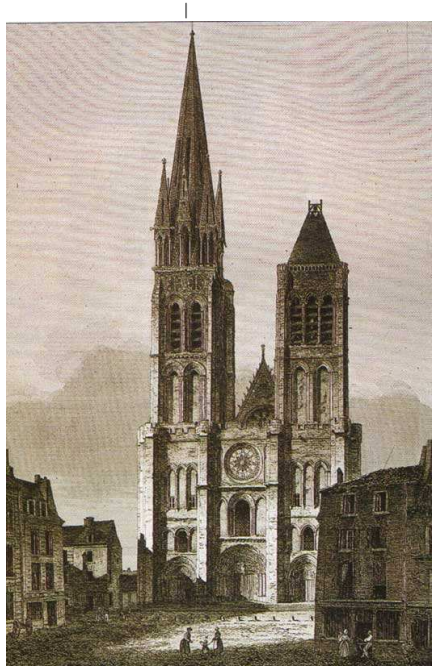
composition



Saint-Denis



Reims

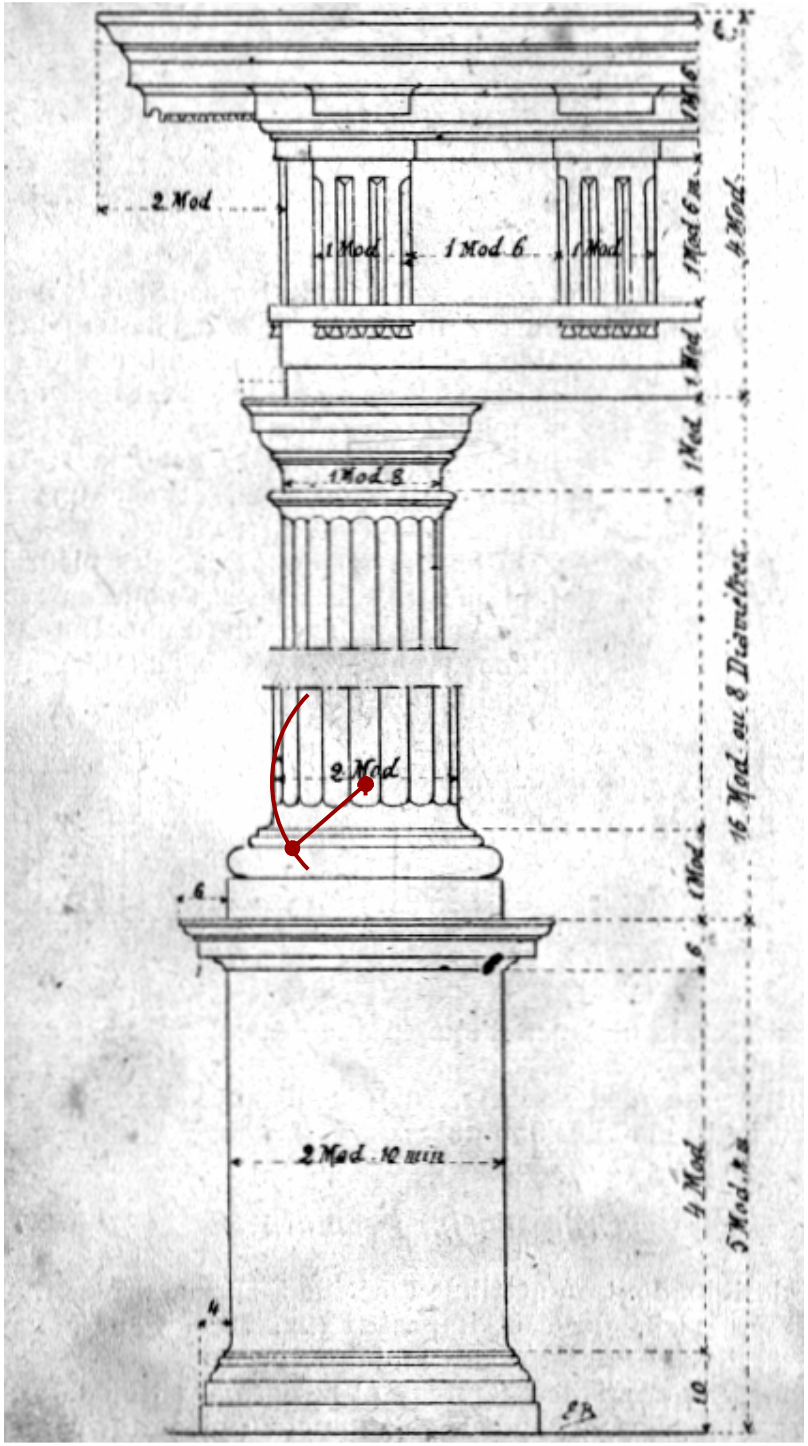


Artefacts contain components that are organised, composed, in a specific manner, according to composition rules.

Spatial relations

Dimensions

Proportions



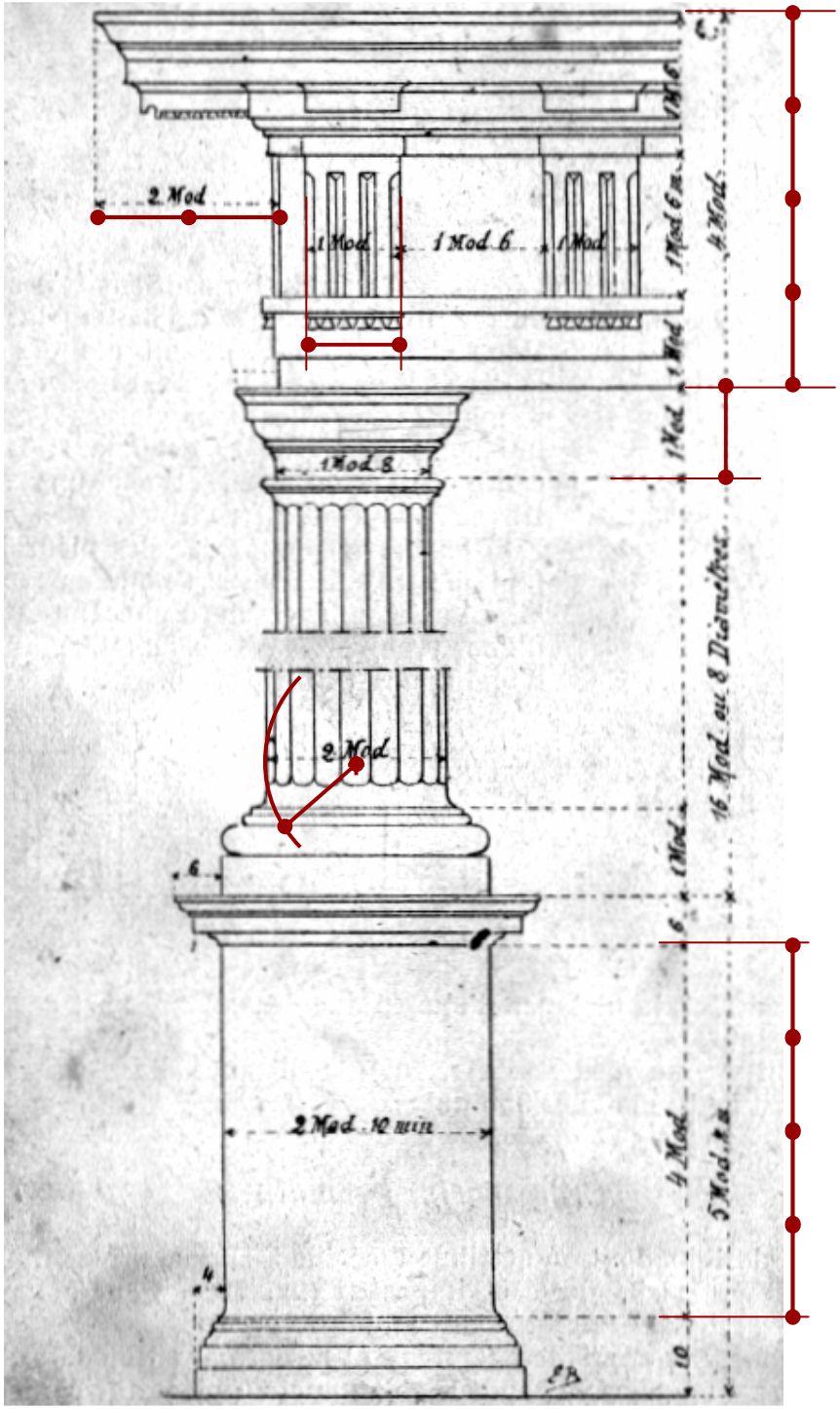
Modelling biases

composition

Rules of composition have been identified, discussed, and described all along the history of architecture.

The modulus

E. Barberot
Aide mémoire de l'architecte et du constructeur
Ch. Béranger 1922



Modelling biases

composition

Rules of composition have been identified, discussed, and described all along the history of architecture.

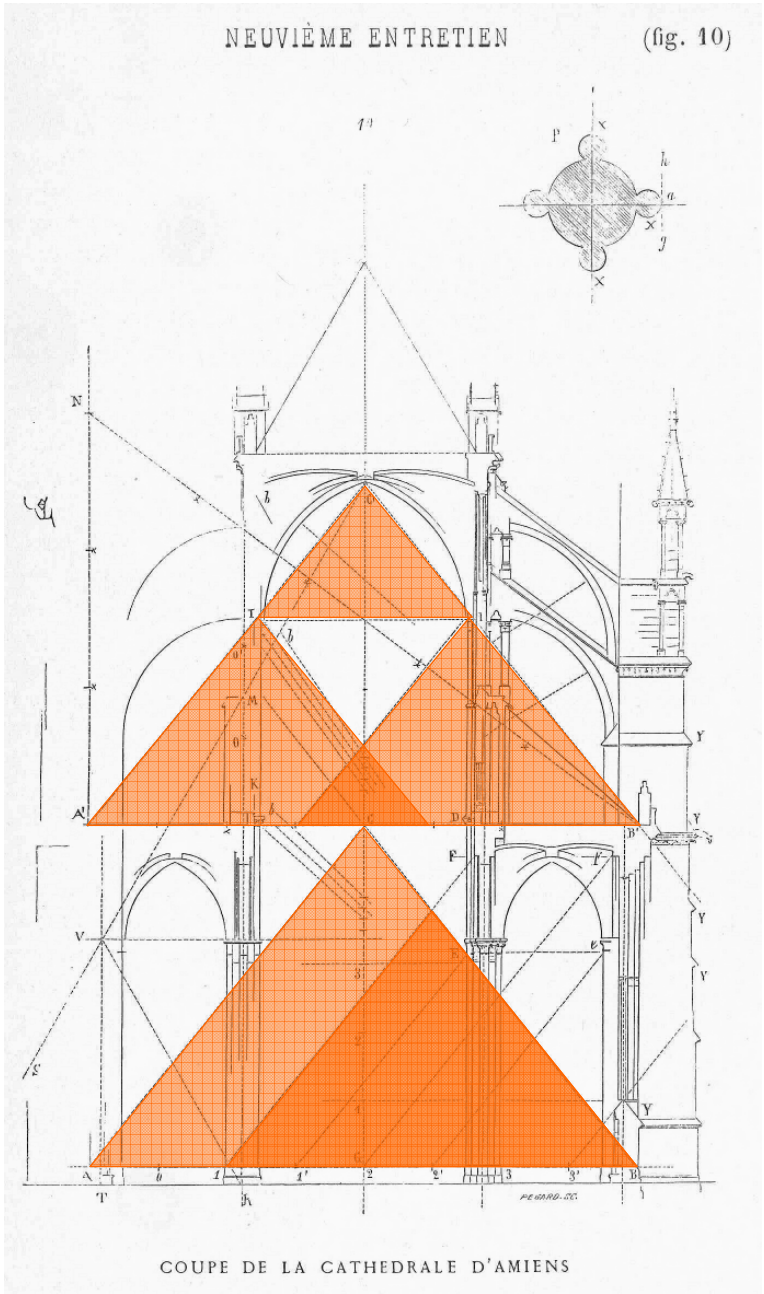
The modulus

[local unit of measure *vs.* universal unit of measure]

[a system of proportion that may need to be uncovered]

E. Barberot
Aide mémoire de l'architecte et du constructeur
Ch. Béranger 1922

composition



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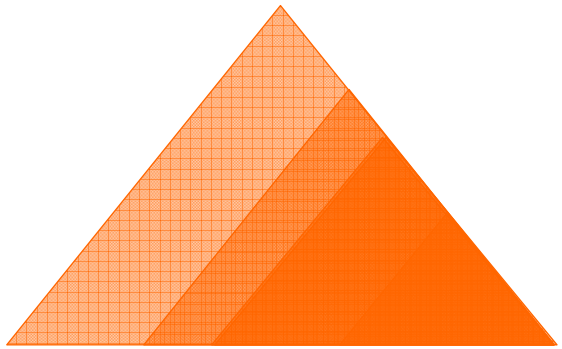
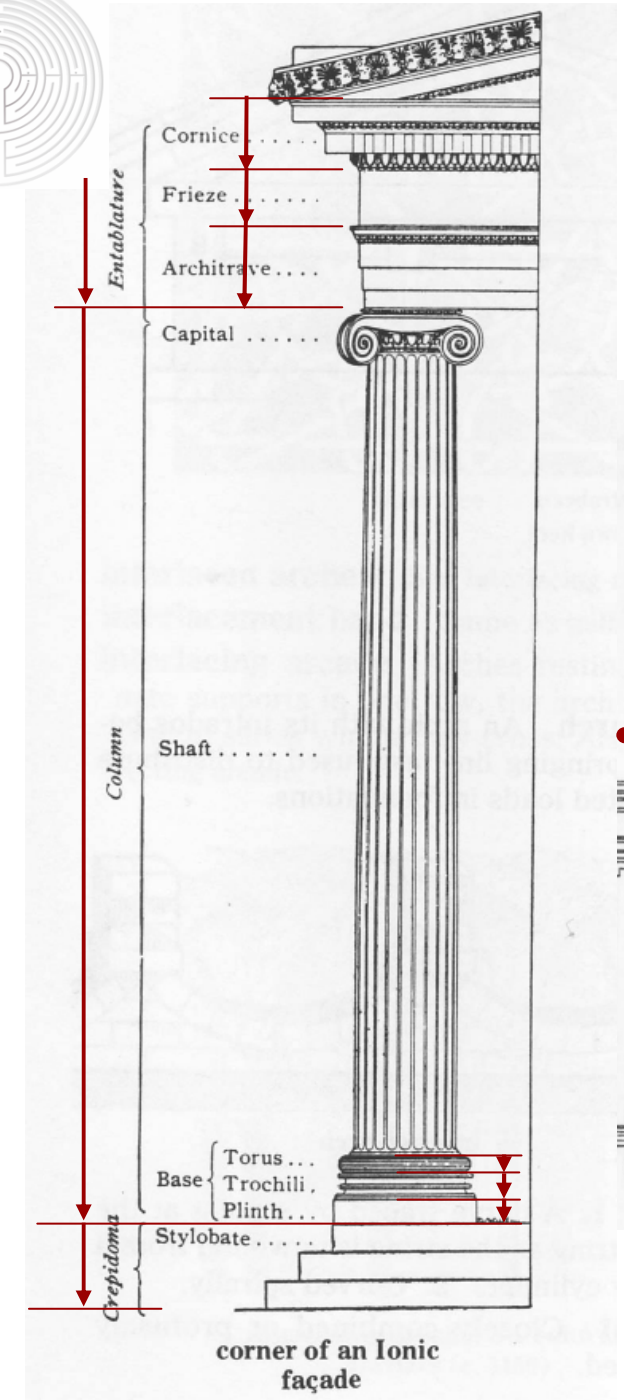
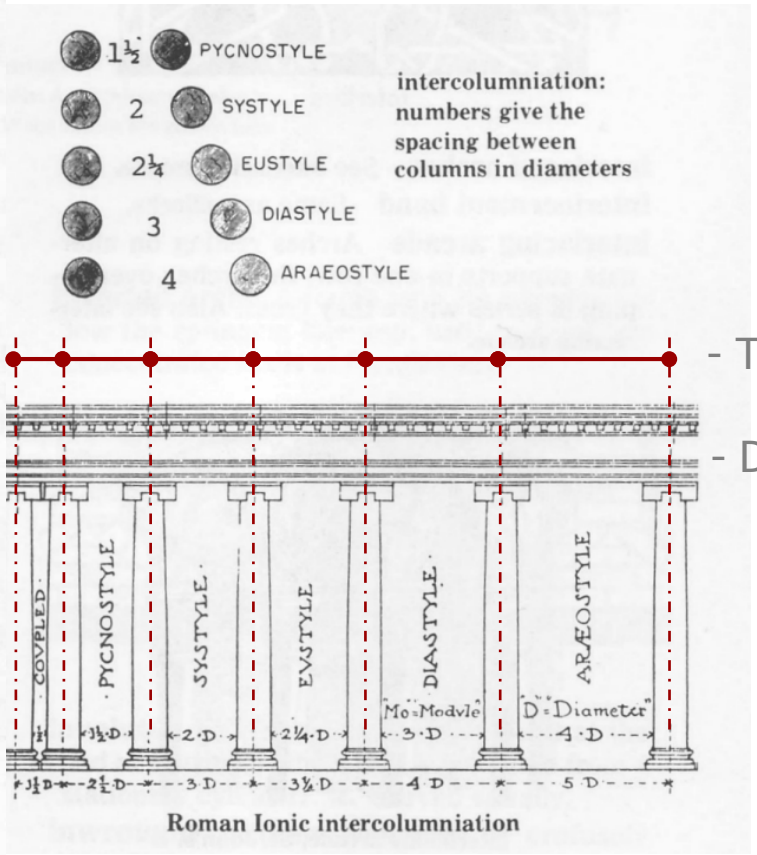


E. Viollet Le Duc
Entretiens sur l'Architecture
Éditions Pierre Mardaga 1977 (ed.orig 1863)



corner of an Ionic façade



Roman Ionic intercolumniation

Briefly said, two families of descriptors.

- Topological relations
- Distribution in space

C.R Harris
Illustrated dictionary of historic architecture ,
Dover Publications 1983

composition

Composition can be understood *both* as rules bound up with geometry (Ching), and as grouping mechanisms (Alexander).

literature : F.D.K Ching (Form, space, order),C.Alexander (and a good proportion of the architectural theory).

.

F.D.K. Ching, Architecture: form, space and order. Van Nostrand Reinhold (NY) 1979

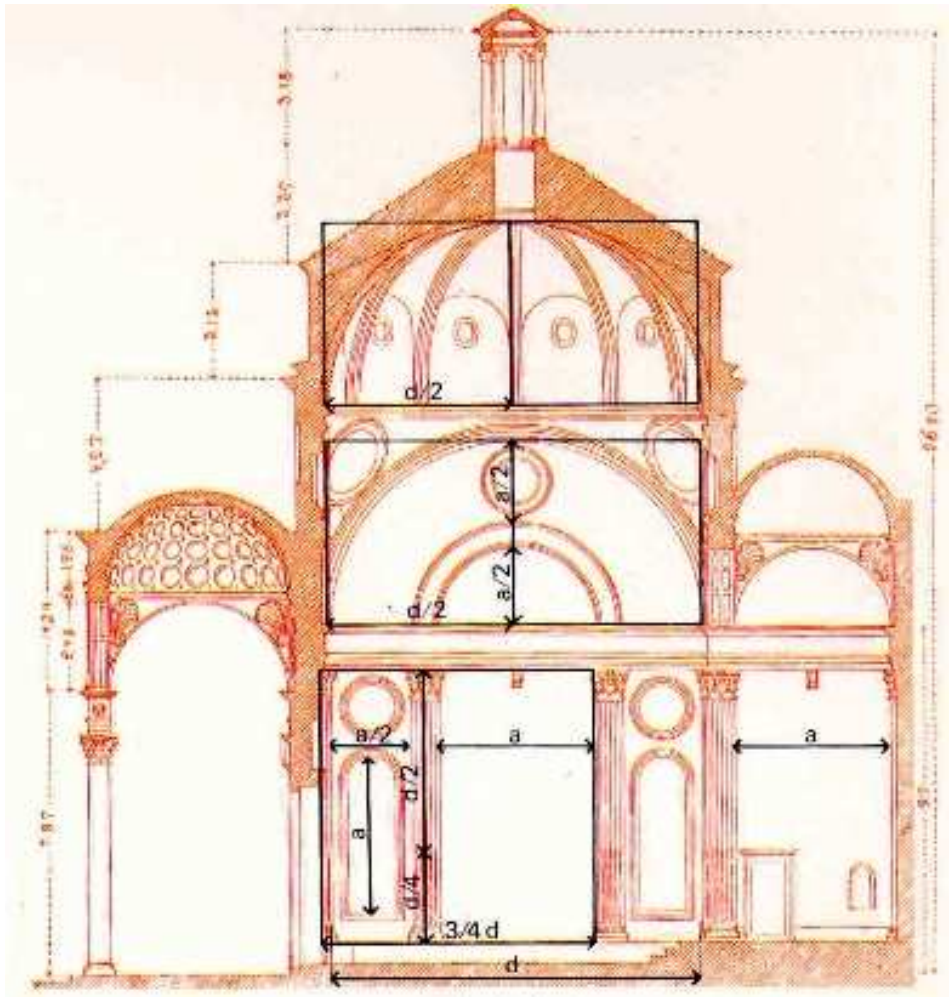
Juliusz Żórawski
O budowie formy architektonicznej, Arkady, Warszawa 1973

E. Viollet Le Duc
Entretiens sur l'Architecture, Éditions Pierre Mardaga 1977 (ed.orig 1863)

W. Koch,
Style w Architekturze, Bertelsmann Publishing 1996

R. Wittkower Architectural principles in the age of humanism.
John Wiley & Sons 1998

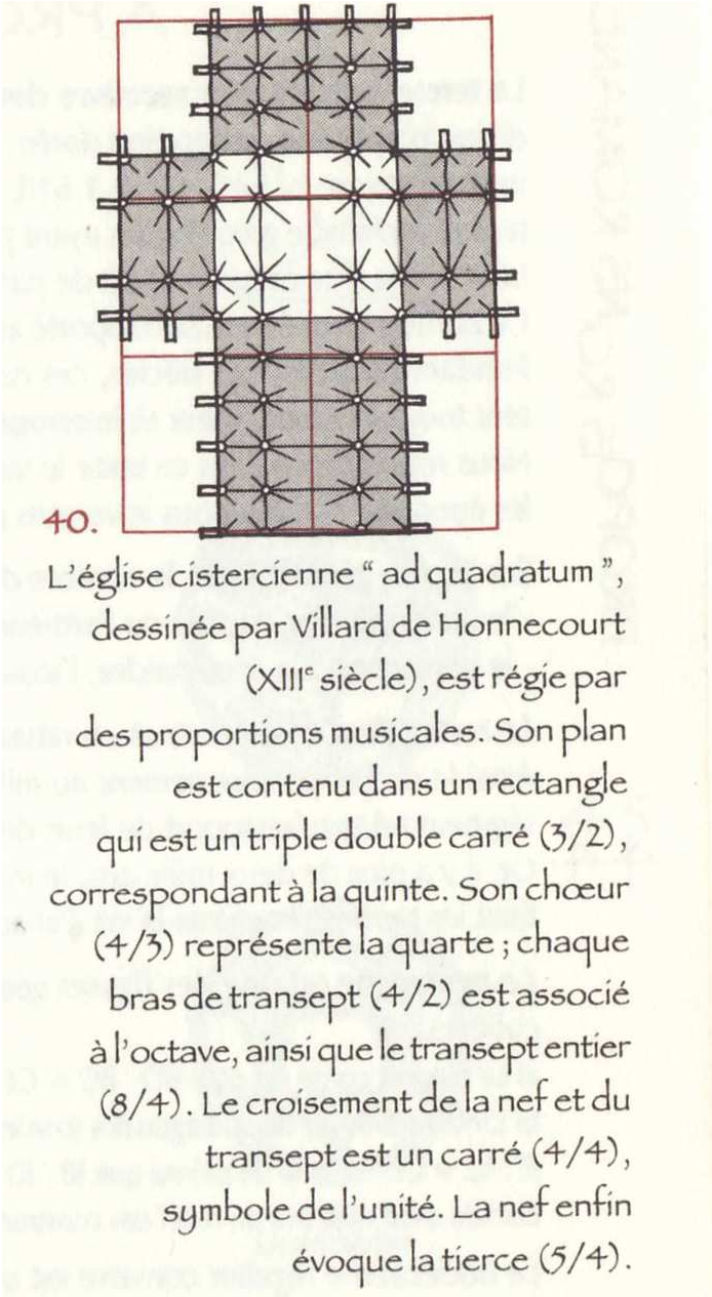
Components + composition : design bias



Components and composition are chosen with regards to a ***design bias*** – sometimes depicted by a few words like "austerity" for Cistercian architecture or "clarity" for early gothic cathedrals.

Design biases are also often expressed (or analysed) through rules of proportion.

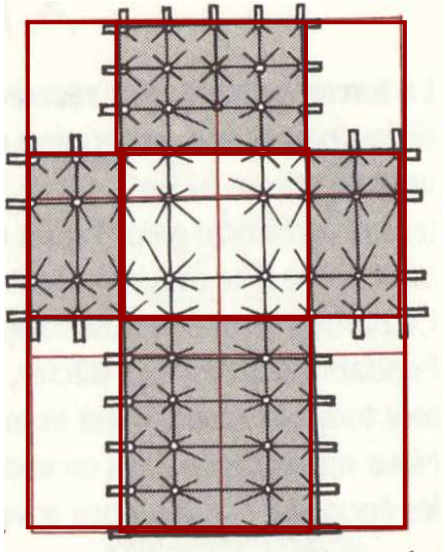
Components + composition : design bias



Simple ratios in spatial designs are common in historic architecture.

T. Hatot
Bâtisseurs au Moyen-Age. L'instant Durable 1999

Components + composition : design bias



4/3

4/2

8/4

4/4

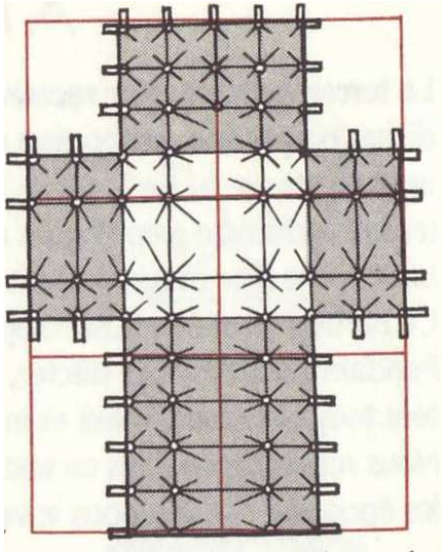
3/2

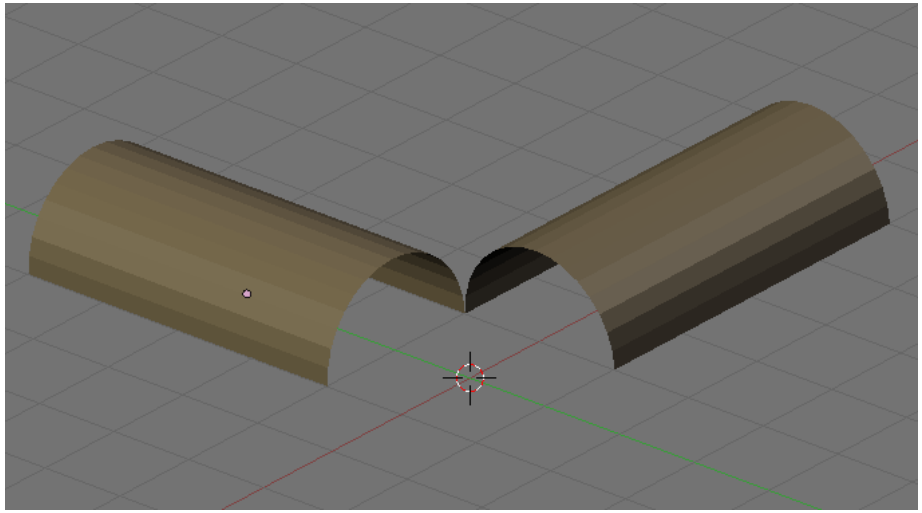
5/4

Simple ratios in spatial designs are common in historic architecture.

T. Hatot
Bâtisseurs au Moyen-Age. L'instant Durable 1999

Components + composition : design bias



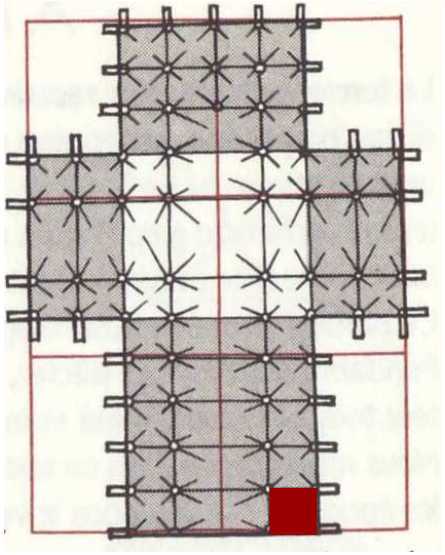


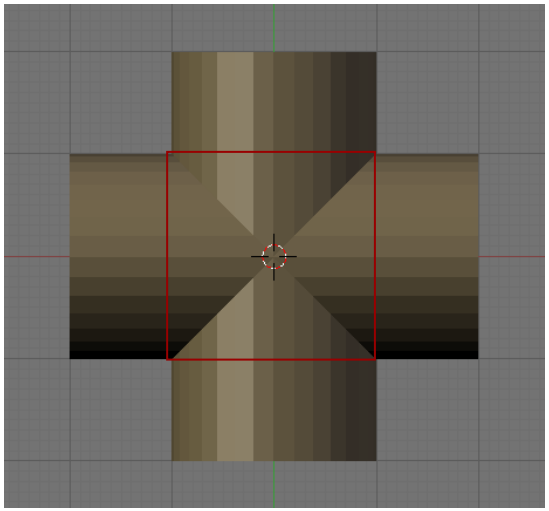
Beyond simplicity there is in fact most often also a connection of the design bias to the constraints imposed by the material nature of architecture.

What is the intersection of two barrel vaults?

T. Hatot
Bâtisseurs au Moyen-Age. L'instant Durable 1999

Components + composition : design bias





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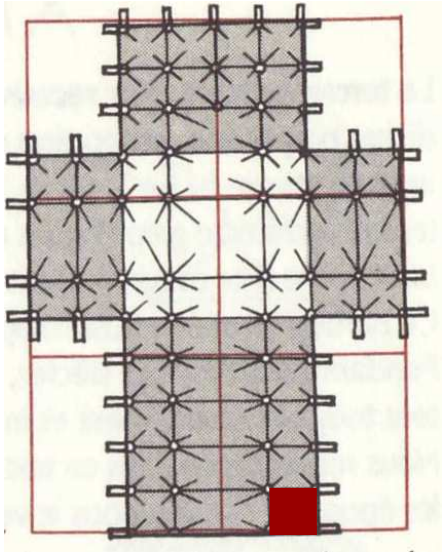
What is the intersection of two barrel vaults?

T. Hatot
Bâtisseurs au Moyen-Age. L'instant Durable 1999

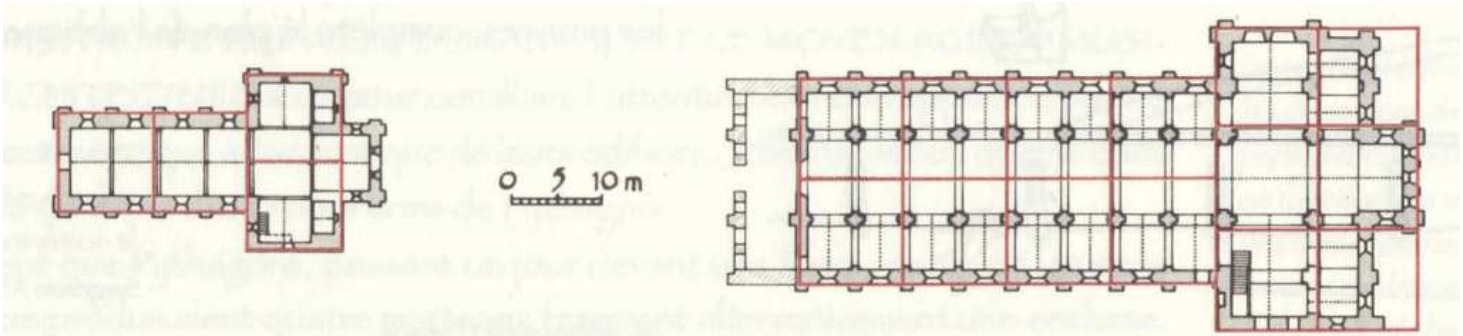
Components + composition : design bias



Beyond simplicity there is in fact most often also a connection of the design bias to the constraints imposed by the material nature of architecture.

What is the intersection of two barrel vaults?

A questionable classification?



27. Abbayes de Boscodon à gauche et de Fontenay à droite inscrites dans des carrés

T. Hatot
Bâtisseurs au Moyen-Age. L'instant Durable 1999

Components + composition : design bias

Not that different today

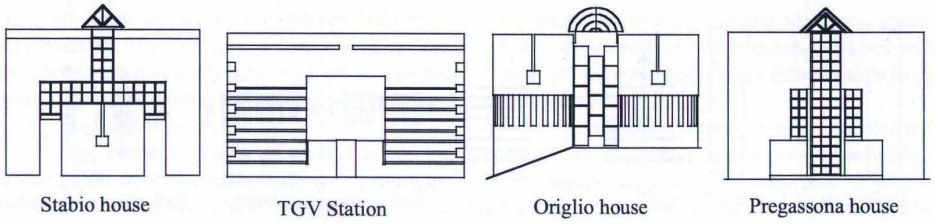
only design biases are drifted outside of "architecture" as a craftsmanship

What is the design bias here?

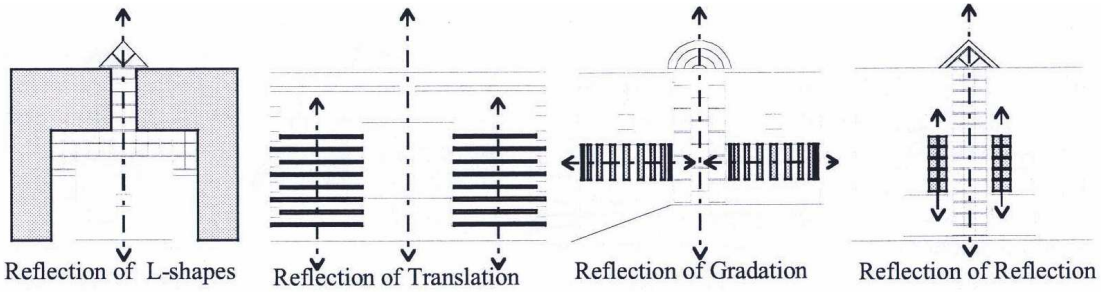
Mario Botta Style

From four of Botta's architectural buildings in Figure 9, we can induce replicate form elements and

Some schemas are constructed from low level elements or relationships. In the reflection schema, its subelements are various, such as, L-shapes, translation, gradation, reflection in Figure 10.



Architectural Computing: The Intelligent Machine 2: Genetic and Generative 639



640 Architectural Computing: The Intelligent Machine 2: Genetic and Generative

Myung Yeol Cha, J.Gero
Style learning: inductive generalisation of architectural shape patterns,
In Proc. Ecaade 1999

Components + composition : design bias

Components and composition are chosen with regards to a ***design bias.***

A questionable classification?

literature : Architects - E.Viollet Le Duc, A.Choisy, T.Hatot, Le Corbusier.

T. Hatot
Bâtisseurs au Moyen-Age. L'instant Durable 1999

W. Koch,
Style w Architekturze, Bertelsmann Publishing 1996

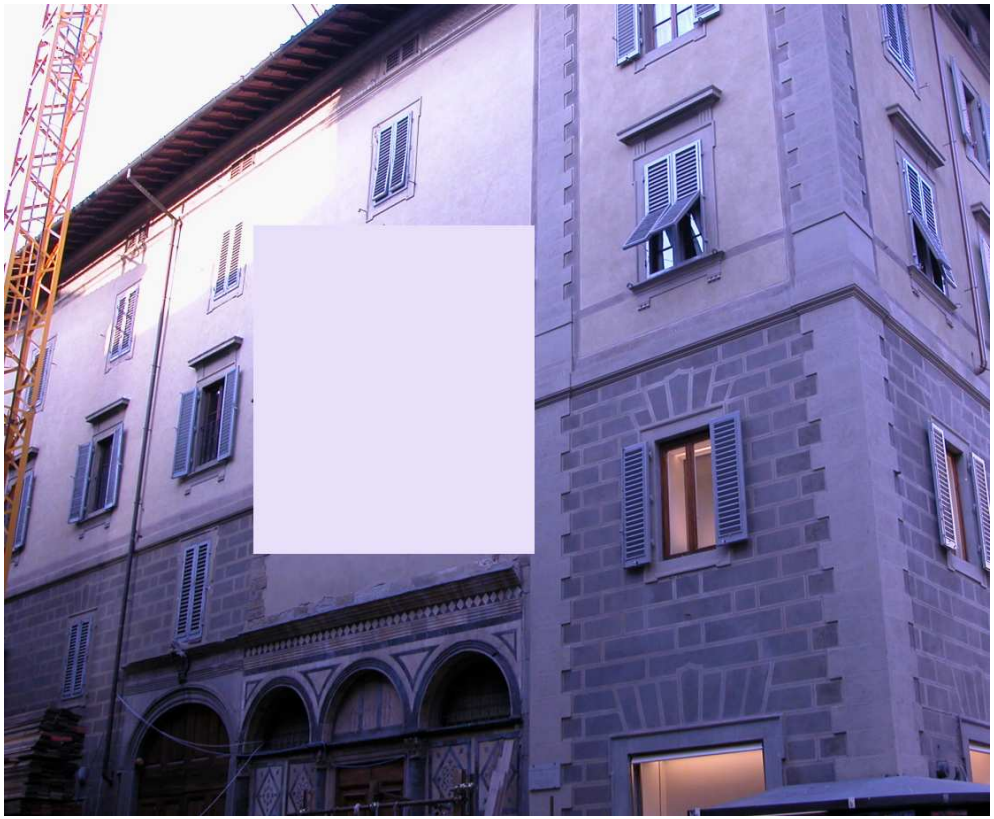
A. *Choisy, History of Architecture*, 1899

E. Viollet Le Duc
Entretiens sur l'Architecture, Éditions Pierre Mardaga 1977 (ed.orig 1863)

Juliusz Żórawski
O budowie formy architektonicznej, Arkady, Warszawa 1973

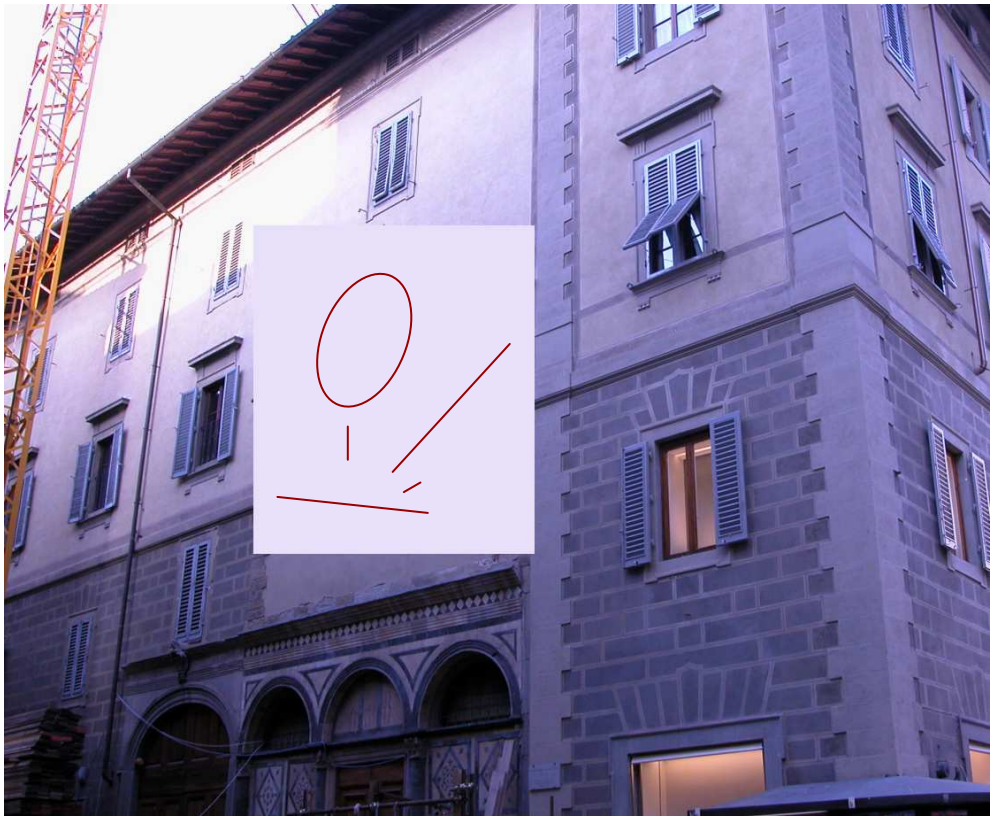
Role as a symbol

Constraints, components, composition and design bias.



Role as a symbol

What kind of edifice is hidden behind the white square ?



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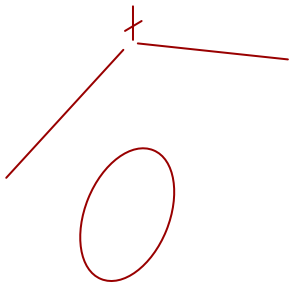
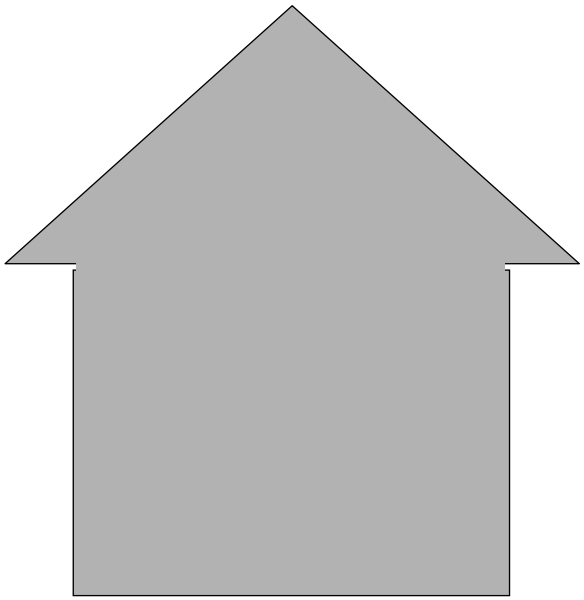


Role as a symbol

There is a symbolic aspect
in architecture - you expect something
when you are shown some familiar
arrangement of shapes



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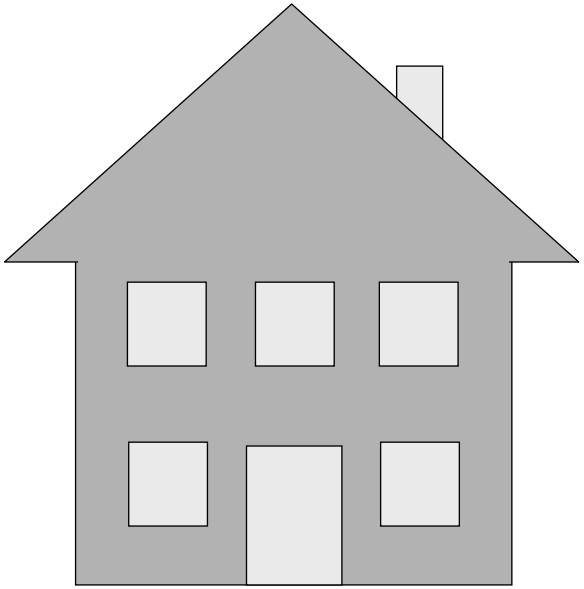
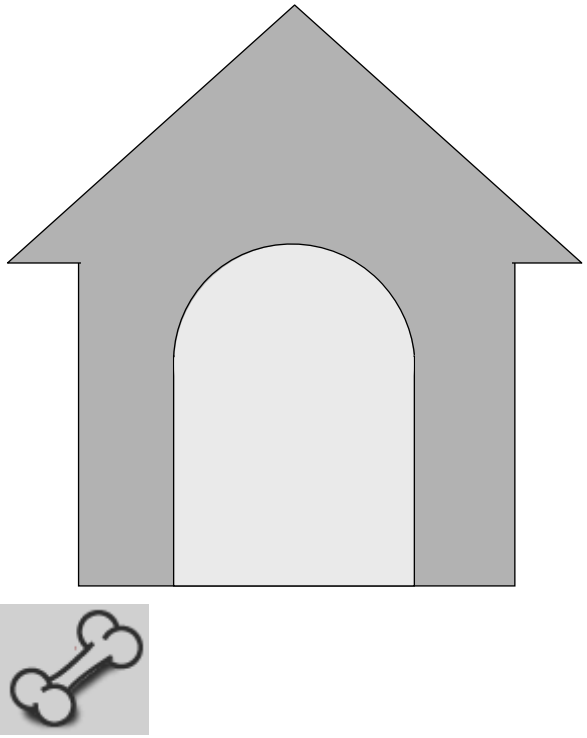


Role as a symbol



There is a symbolic aspect in architecture - you expect something when you are shown some familiar arrangement of shapes

Not only do you expect something, but something that would remains within "a range of reasonable sizes" – this is often called "scale" in architecture.

Role as a symbol

Symbols can be observed and classified.

They may not be universal…

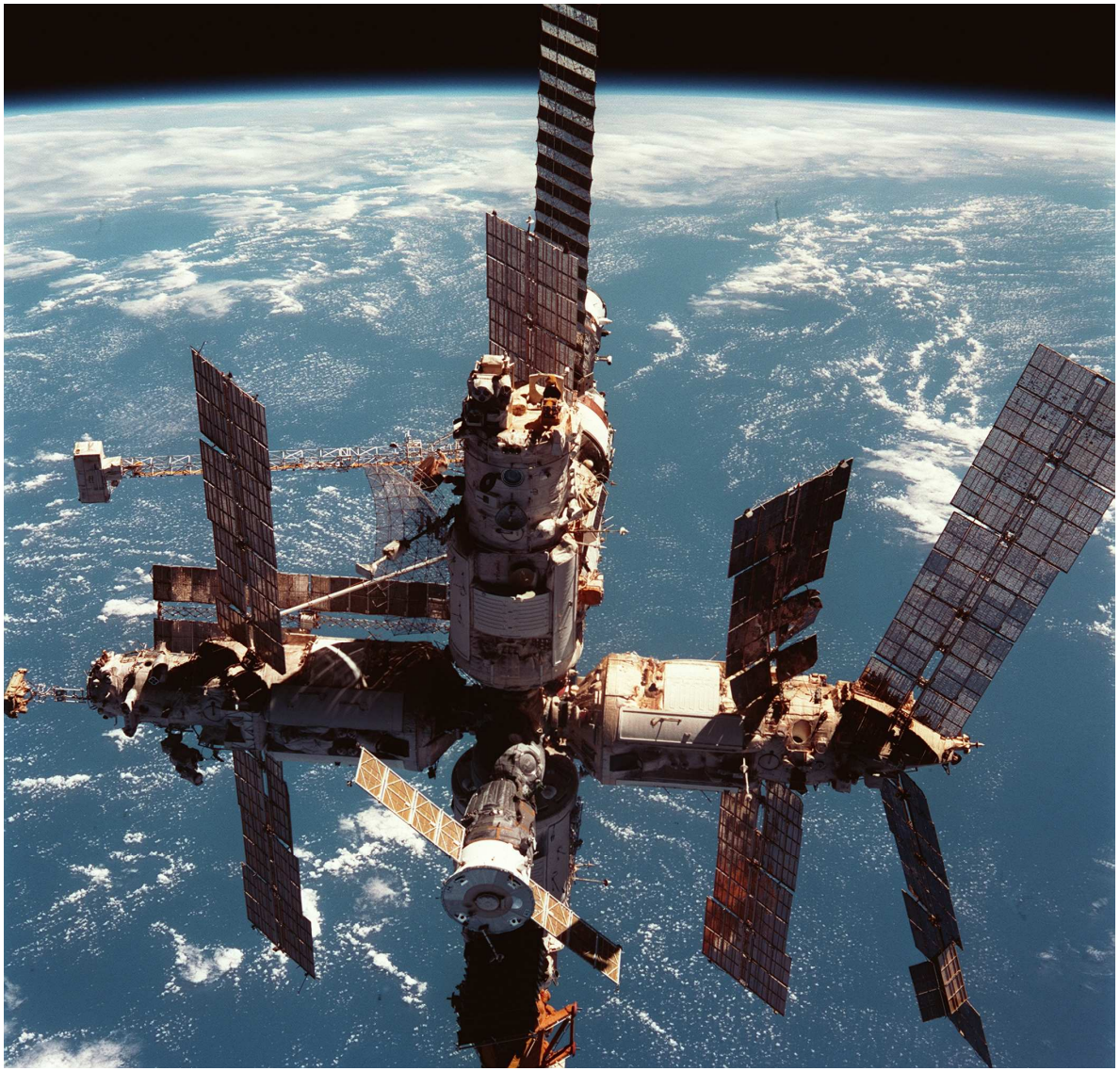
Formal references + Expected size = cultural a priori.

literature : Ethnologists, urban planners.

E. Viollet Le Duc
Entretiens sur l'Architecture
Éditions Pierre Mardaga 1977 (ed.orig 1863)

Philippe Boudon
Échelles, Economica, 2002

J. Cuisenier
La maison rustique, logique sociale et composition architecturale, PUF 1991



Another difference?

Architecture is context - neighbourhood in particular

[we here focus on relations to man-made landscape - the rest we called constraints earlier]

Were these two objects designed to be parked like this, one close to the other?

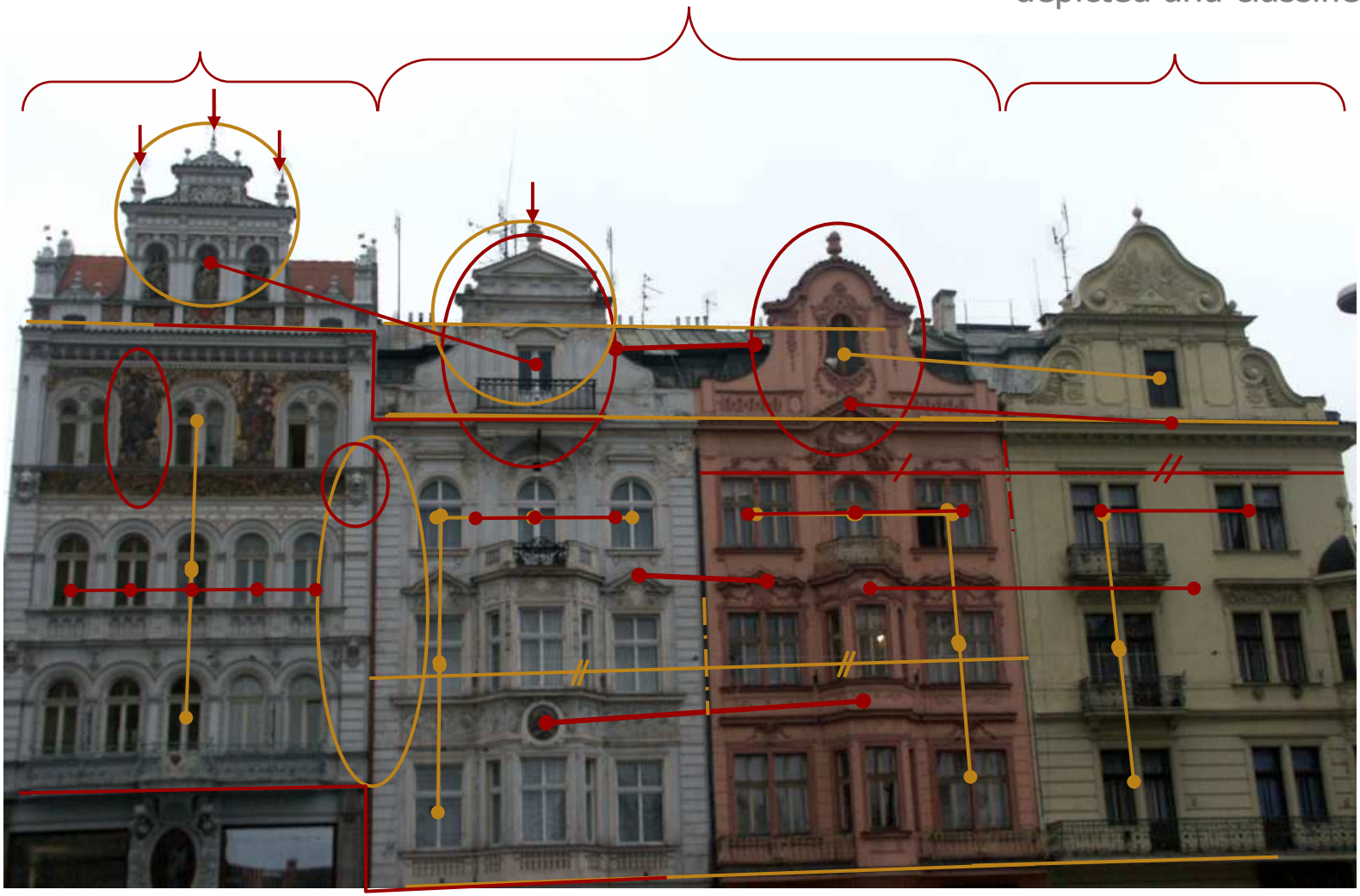
Architecture is context - neighbourhood in particular

Derivation of the type

Variations of a type

Continuity

And this context can be depicted and classified

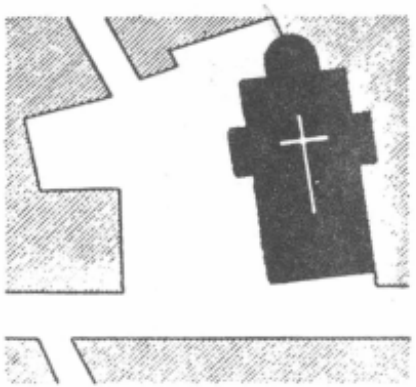


Context

Architecture is context - neighbourhood in particular

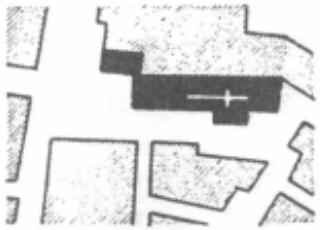
An artefact is impacted by its neighbourhood, its neighbourhood is impacted by the artefact

Fig. 14.



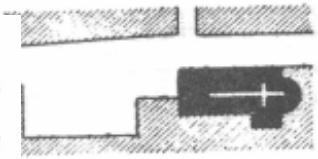
PALERME : S. Cita.

Fig. 12.



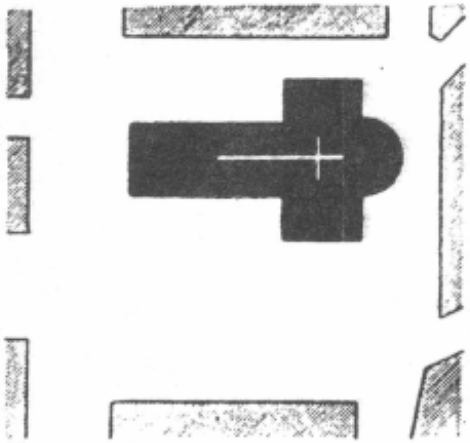
VERONE : S. Anastasia.

Fig. 11.



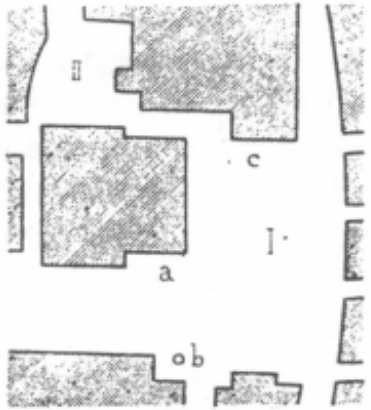
VERONE :
S. Fermo Maggiore.

Fig. 15.



LUCQUES : S. Michele.

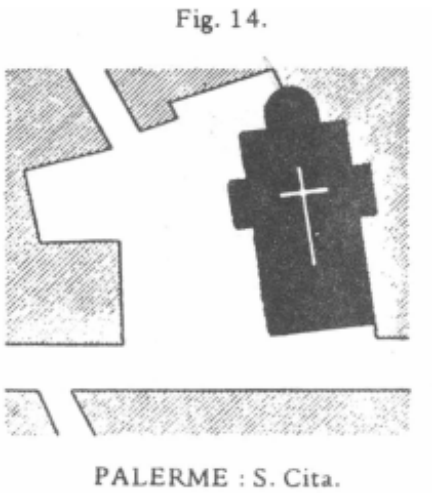
Fig. 8.

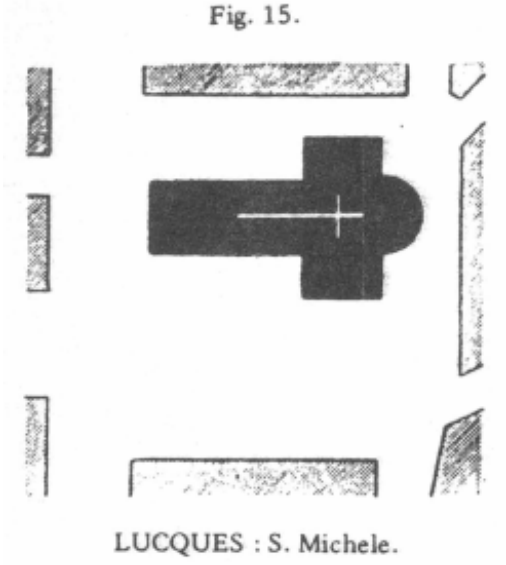


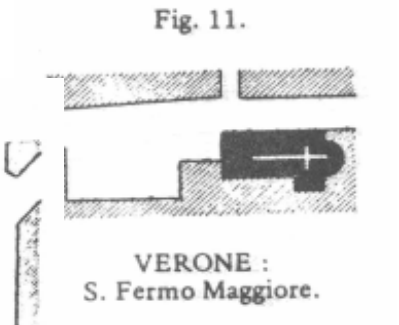
ROTHENBOURG
I. Marktplatz.
a. Hôtel de Ville
b. Fontaine
c. Caveau des Échevins.

C. Sitte
l 'art de bâtir les villes, Editions L 'équerre

Context







Architecture is context - neighbourhood in particular

An artefact is impacted by its neighbourhood, its neighbourhood is impacted by the artefact

literature : C.Sitte, L.Benevolo (and urban studies).

C. Sitte
l 'art de bâtir les villes, Editions L 'équerre

L.Benevolo
History of the city MIT Press 1980

Last and least

Stylistic affiliations are a common division line in historic analyses

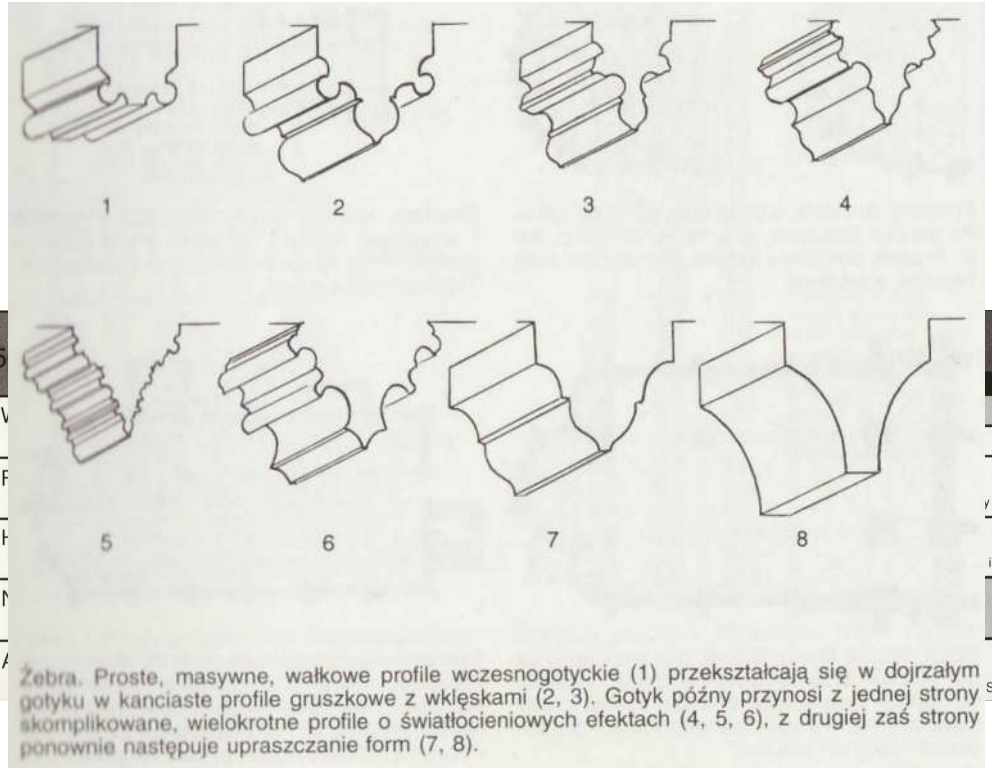
Gothic or not Gothic?

Baroque dome
No Flying buttresses

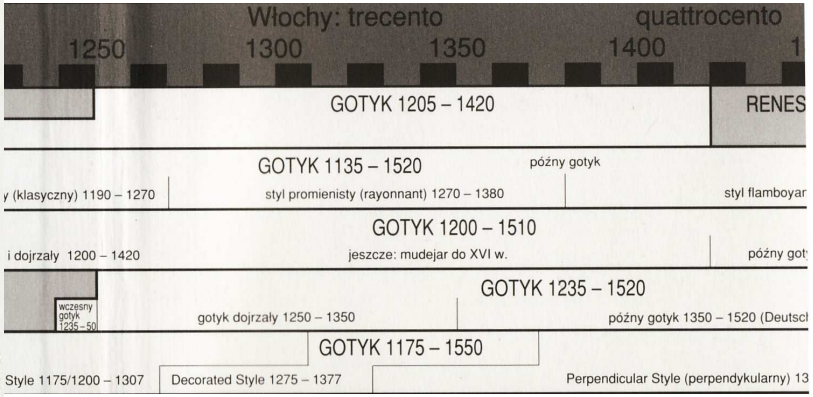
Stylistic affiliations

Stylistic affiliations are apparently imprecise

reason one: division lines of stylistic classifications, depending on authors, correspond either to time slots or to specific morphological features (or to a bit of both)

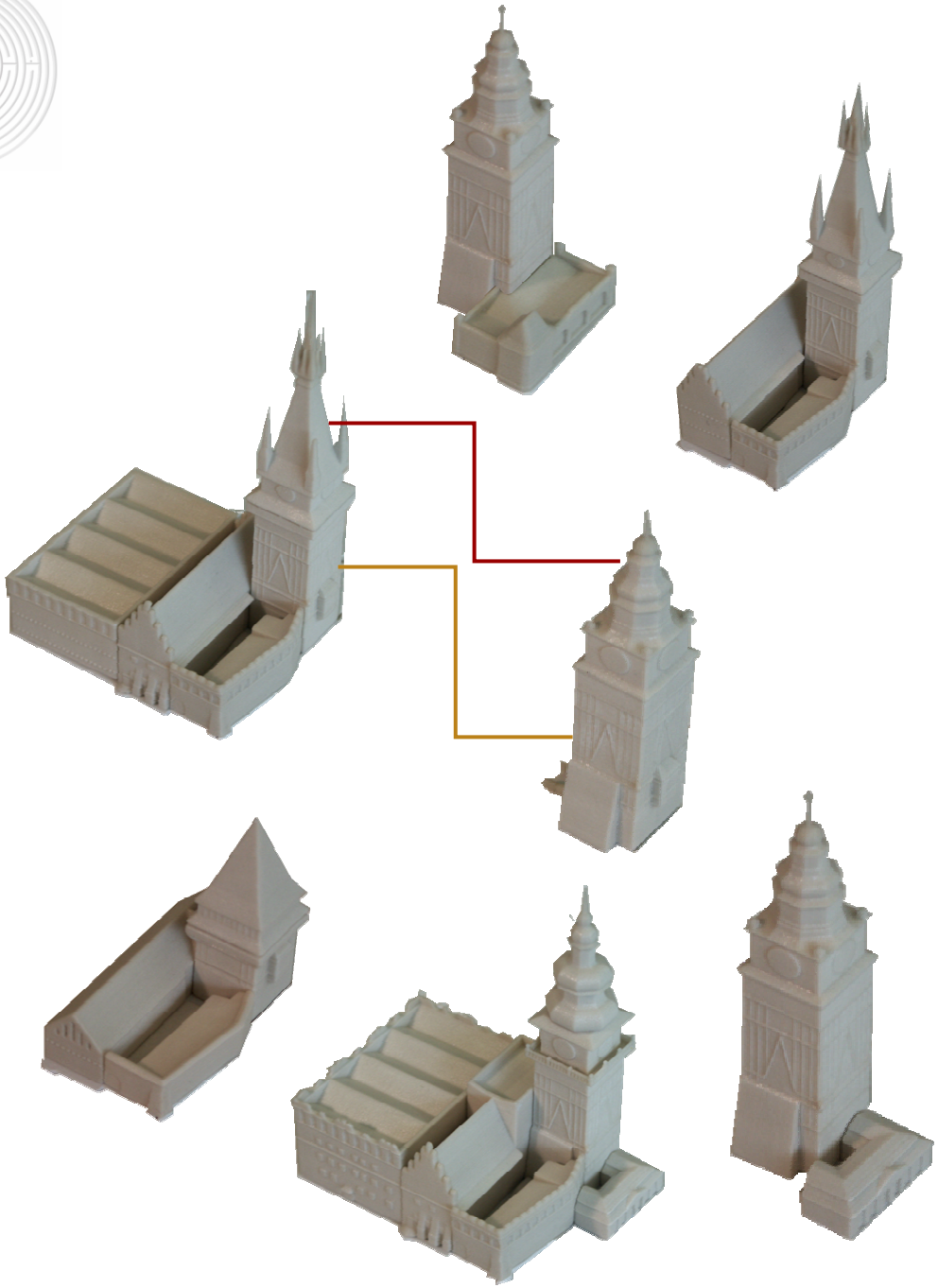


Żebra. Proste, masywne, wałkowe profile wczesnogotyckie (1) przekształcają się w dojrzałym gotyku w kanciaste profile gruszkowe z wklęskami (2, 3). Gotyk późny przynosi z jednej strony skomplikowane, wielokrotne profile o światłocieniowych efektach (4, 5, 6), z drugiej zaś strony ponownie następuje upraszczanie form (7, 8).



W. Koch,
Style w Architekturze, Bertelsmann Publishing 1996

Stylistic affiliations



Stylistic affiliations are apparently imprecise

reason two: quite often artefacts get transformed over time, with "newer" styles added one over the other

Any idea on how to classify this?

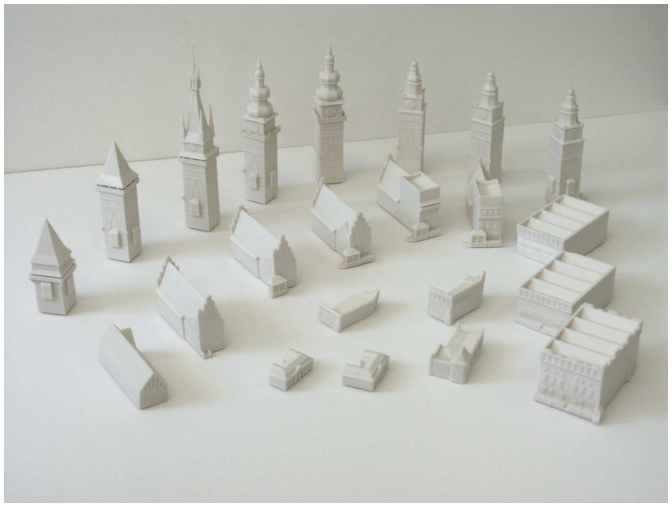
Stylistic affiliations

Stylistic affiliations are convenient, but most often inefficient

Stylistic affiliations

Stylistic affiliations : false friends

"identification of shapes much precede any stylistic classification"



literature : W.Koch, J.M Perouse de Montclos (otherwise a long list of false friends).

W. Koch,
Style w Architekturze, Bertelsmann Publishing 1996

J.M. Pérouse de Montclos,
Architecture – principes d'analyse scientifique, Imprimerie Nationale, 1988

Summary

Knowledge modelling in heritage architecture, as we have discussed it : **a classification effort** (*Identifying facts, significant elements putting them in relation)*

There are several possible division lines you can choose to extract features and try to classify (Environmental constraints, Social uses, Components, Composition, Design bias, Role as a symbol, Context, Stylistic affiliation, …)

Understanding architecture means trying to integrate descriptors that go beyond shapes and uses.

Modelling is not duplicating reality, but interpreting reality with regards to understanding needs.

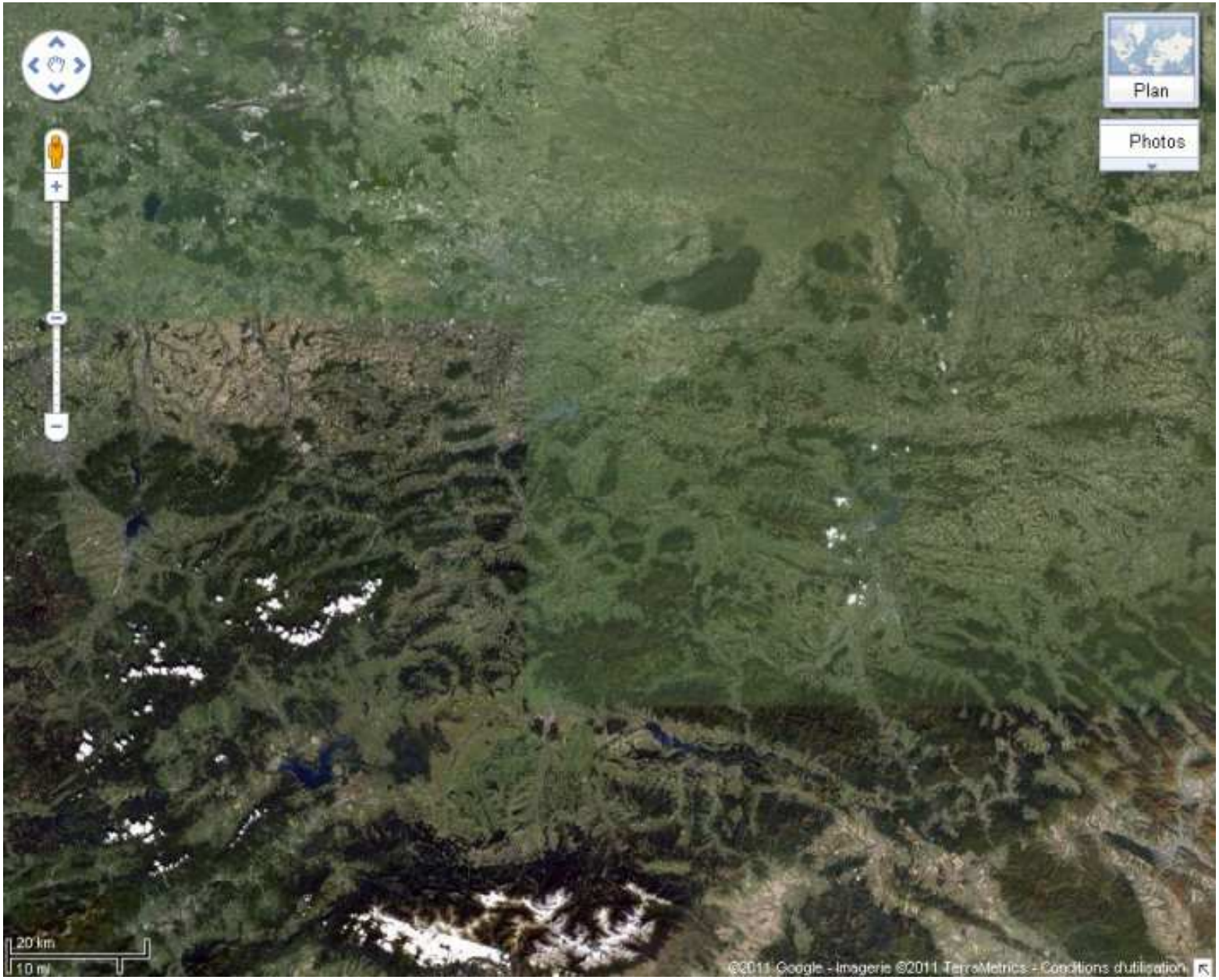
Knowledge modelling in heritage architecture :: **the need**

Why do we create models?

What difficulties when facing historic sciences information sets?

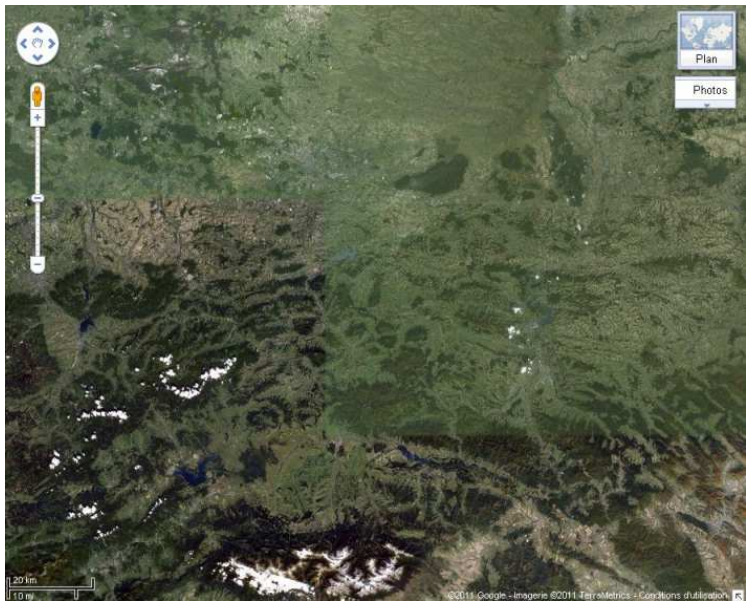
On distributing information in time and space.

From the item to the collection (comparative and cumulative analyses)



Source: Google Maps

Source: Via Michelin



Why do we create models?

We create models to perform reasoning tasks / analyses

because of our limited cognitive abilities we need to **reduce reality** to a set of features we can perform reasoning on

"The end product of the cartographic process is an ordered conception of reality which for certain purposes is asserted to serve the map user better than reality itself"

P. Muercke, quoted by J.K Rød

Source: Google Maps, Via Michelin

Why do we create models?

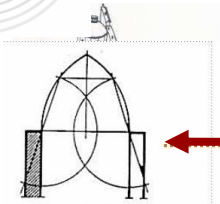
We create models to perform reasoning tasks / analyses

because of our limited cognitive abilities we need to **reduce reality** to a set of features we can perform reasoning on

The way we reduce reality (the features we decide to choose or leave aside) must fit our needs, and is key to the quality of our model.

Source: Google Maps

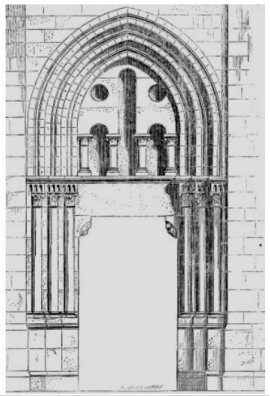
Reduction mechanism



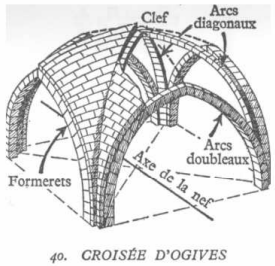
2 centres,
2 rayons égaux
Une assise,
...

<arc brisé>
<arc ogival>

<łuk ostry><(PL)>
<pointed arch><(EN)>



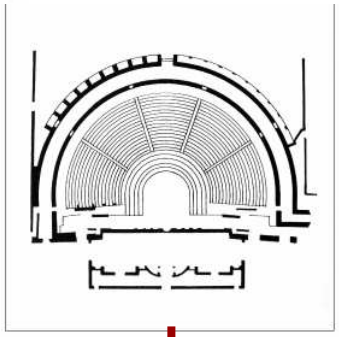
E.Viollet Le Duc, *Entretiens sur l 'architecture* 1863, Réed. Pierre Mardaga 1977.

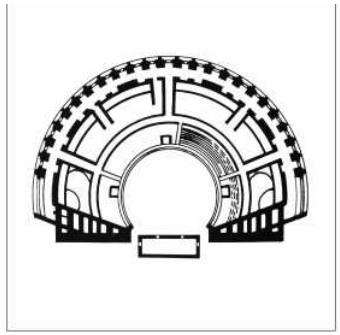


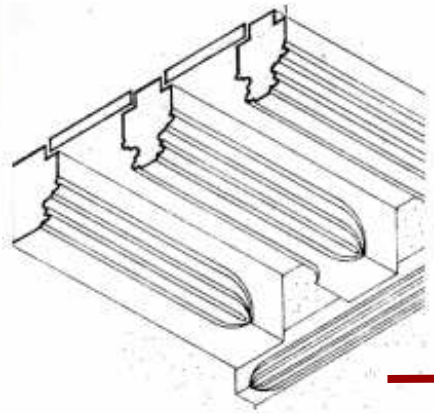
40. CROISÉE D'OGIVES

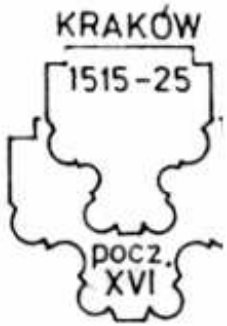
J.Le Goff, *Civilisation de l 'occident médiéval,* Arthaud, 1967.

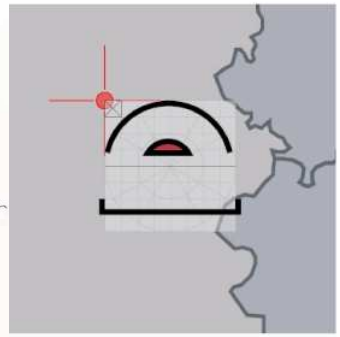
Reduction is not a cartographer's privilege.
(But the process is well studied and depicted in cartography)

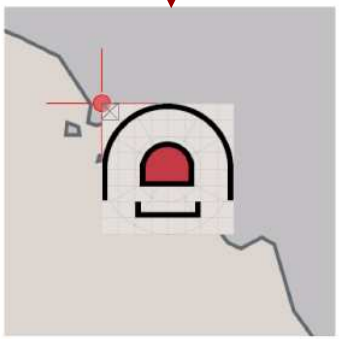


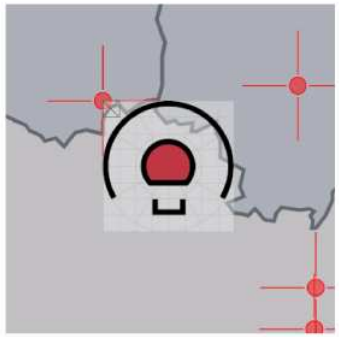










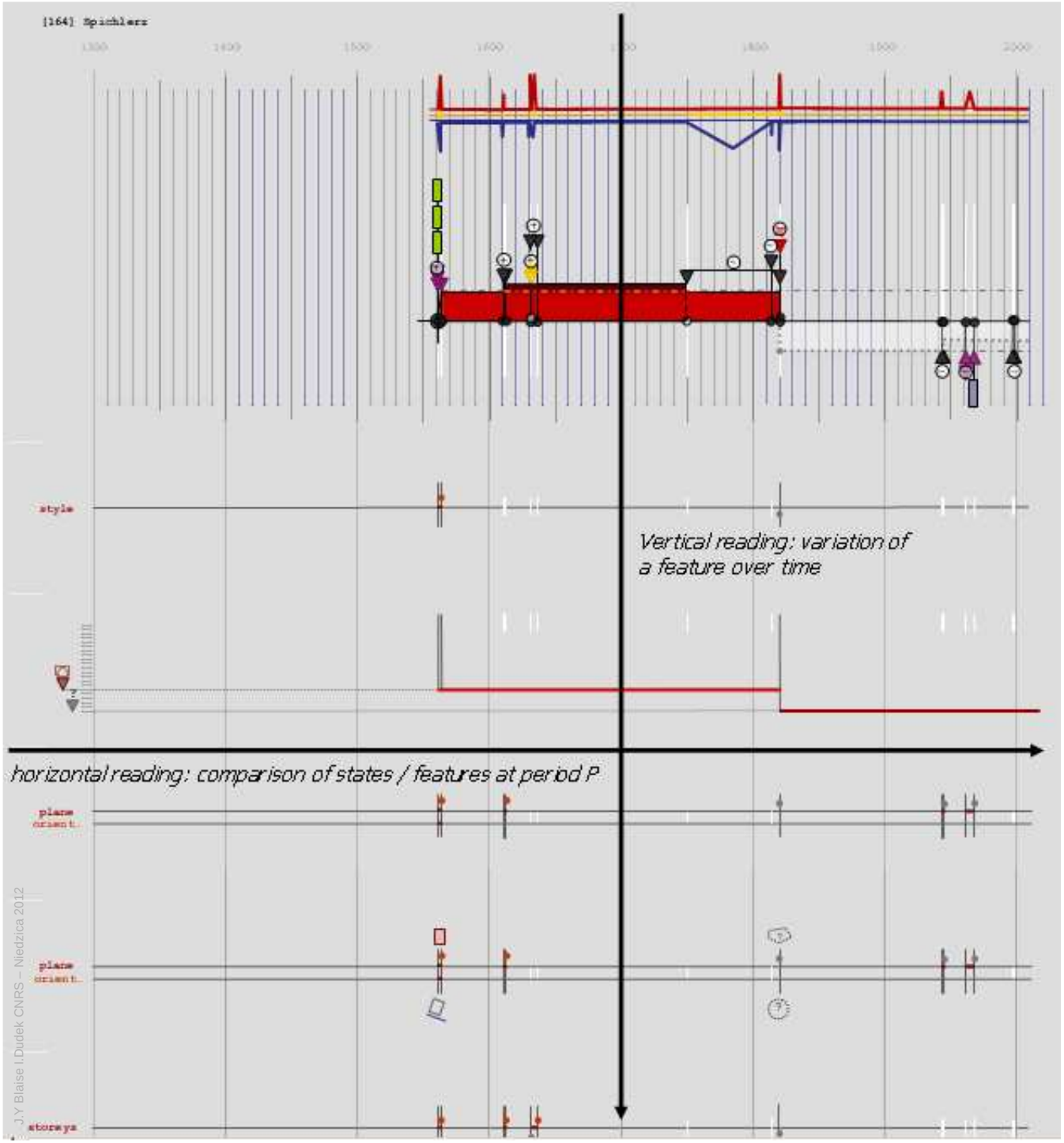


Source: J.Tajchman (op.cit)

G.Fanelli Brunelleschi

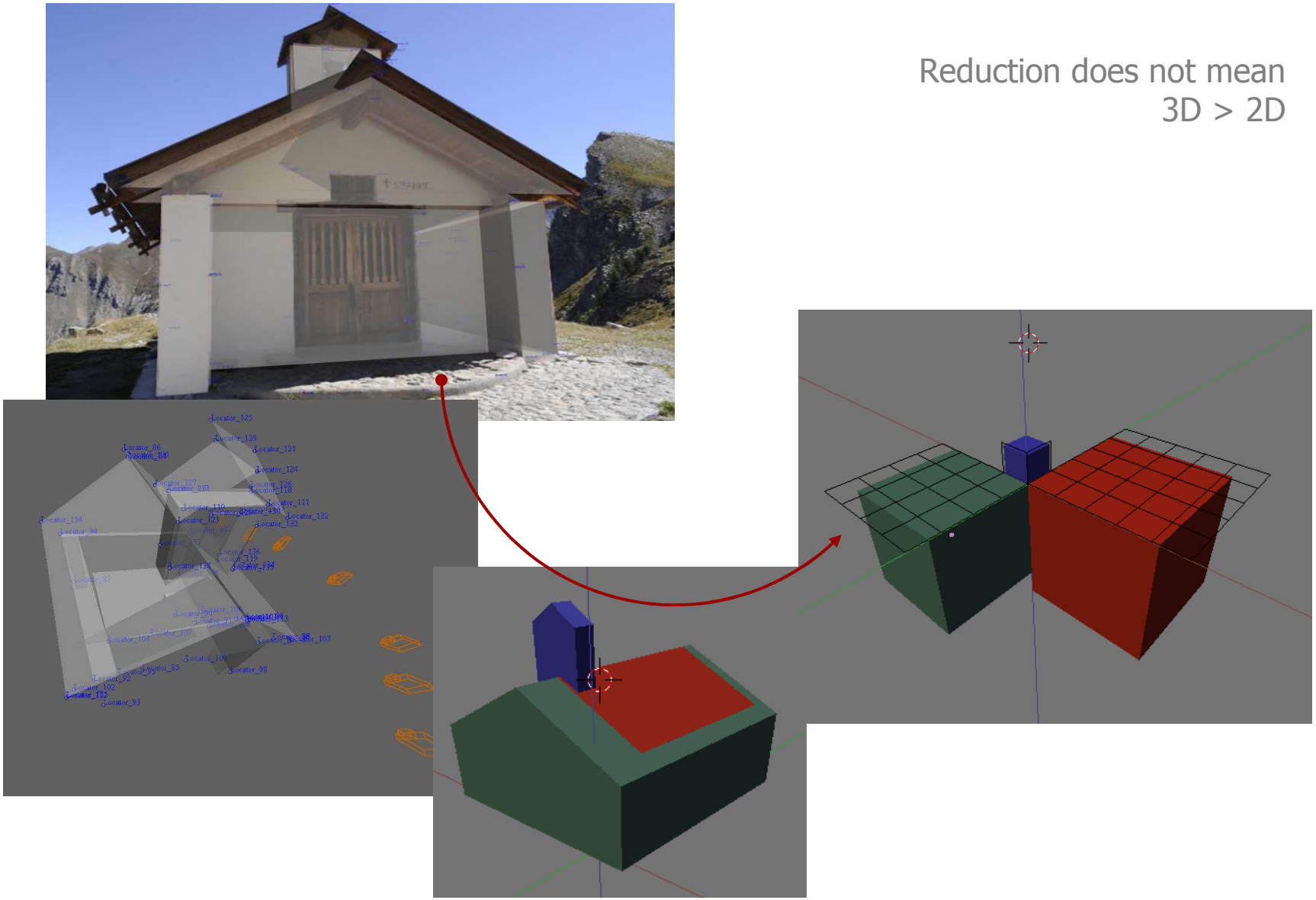
Reduction mechanism

Both spatial and temporal features are concerned



Reduction mechanism

Reduction does not mean
3D > 2D

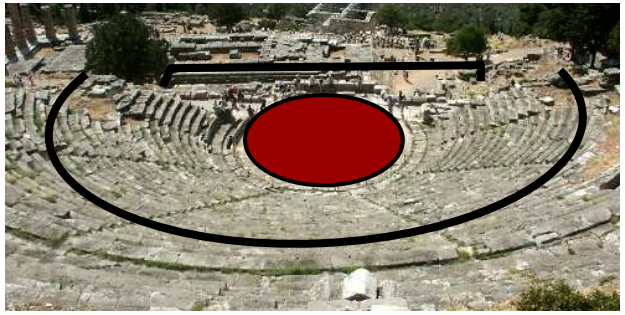


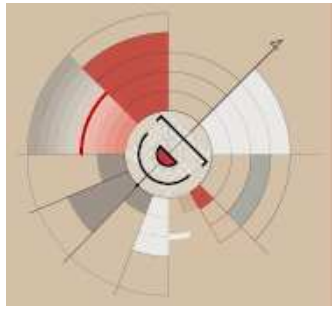
Reduction mechanism

Reduction does not have to be the same for each and every element under scrutiny

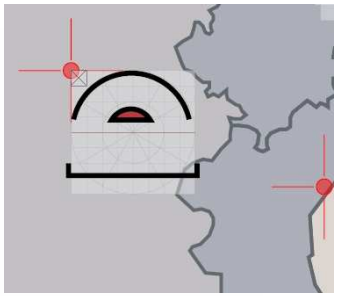
C:\dd_mia\strabon\index.htm

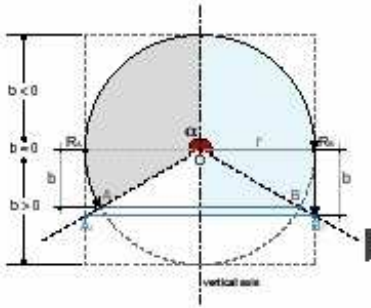
Reduction mechanism





Reduced, or not reduced?





O = geometrical centre at the orchestra's construction

A, B = the points of orchestra's delimitation

R_A, R_B = diameter markers

r = radius

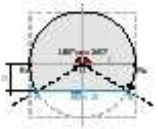
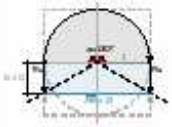
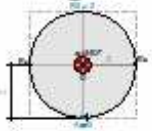
α = angle $\widehat{AB}$

$\overline{AB}$ = distance between the points A and B

b = vertical distance between the orchestra delimitation points (A, B) and the diameter markers (R_A, R_B)

Or = ? difficulties with an interpretation of the archeological remains

Or = T only textual descriptions

Parameters, set I	1	2	3	4	5
					
r	r	r	r	r	r
α	$0 < \alpha < 180°$	$\alpha = 180°$	$180° < \alpha < 360°$	$\alpha > 180°$	$\alpha = 360°$
$\overline{AB}$	$\overline{AB} < 2r$	$\overline{AB} = 2r$	$\overline{AB} < 2r$	$\overline{AB} = 2r$	$\overline{AB} = 0$
b	b < 0	b = 0	b > 0	b > 0	b = r

Typo-plan	1	2	3	4
	Or < 180°	Or = 180°	Or > 180° Ou	Or > 180° Pr

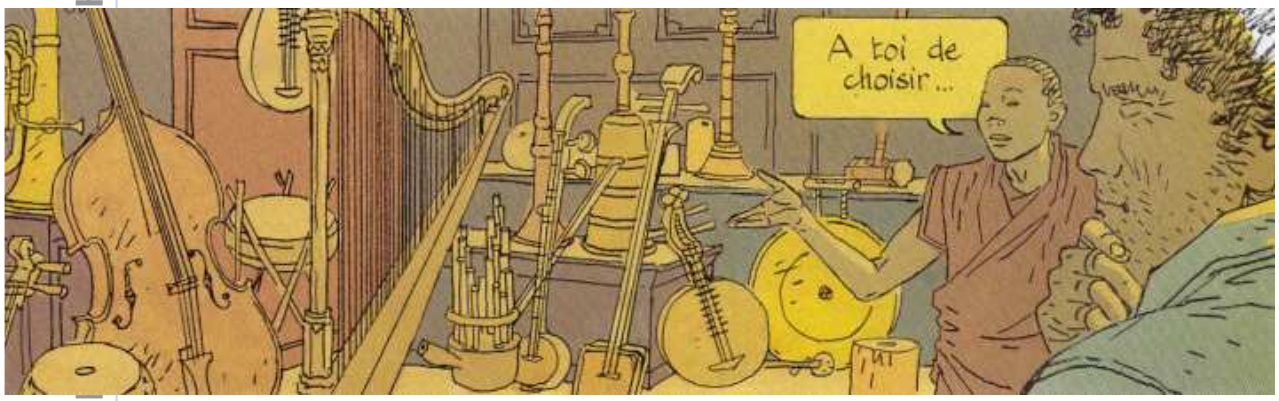
Symbol	1	2	3	4
				

Reduction mechanism

We need models so as to perform reasoning tasks. This is done by extracting relevant features from reality, by reducing reality

"Without reduction, a model duplicating totally the reality uncovers no knowledge"

literature : J.Bertin, J.K Rød (and many cartographers).



Cosey, Celui qui mène les fleuves à la mer,
Éditions Le Lombard, 1997

J. Tricart, Cours de géographie humaine.
Fascicule II, Habitat Urbain, Centre de Documentation Universitaire, Paris 1952

N. Verdier
L'échelle dans quelques sciences sociales: Petite histoire d'une absence d'interdisciplinarité,

J. Bertin, Sémiologie graphique, EHESS (1967) 1998

J.K. Rod,
The third choice, [on-line] *<http://193.55.107.3/semiogra/rod/rod.htm>*

Philippe Boudon, *Échelles*, Economica, 2002

What is specific to the reality of heritage architecture? What challenges when dealing with historic sciences information sets?

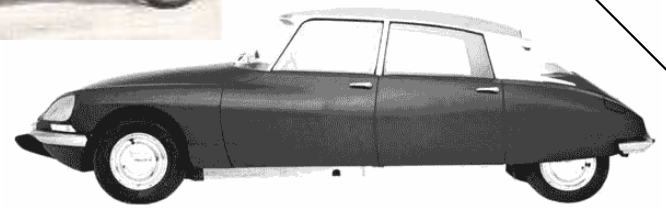
- changes over time

- uncertain, imprecise clues

-imperfect data sets, ending with ill-defined objects

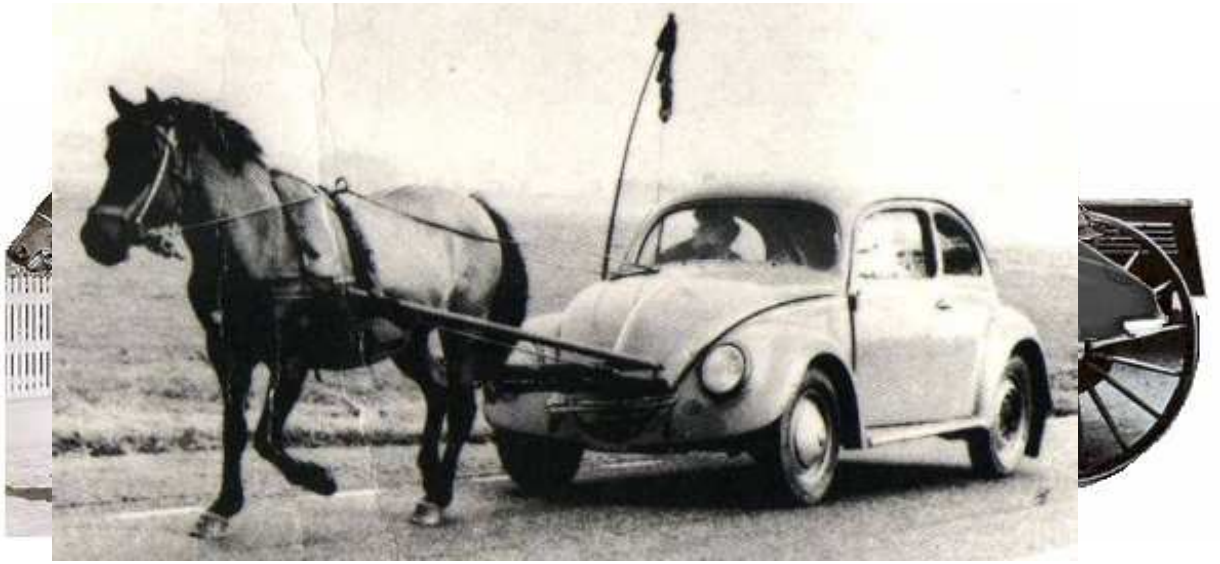
Changes over time

t



Sources:
http://annbourgogne.files.wordpress.com/2010/01/phaeton.jpg
http://farm6.static.flickr.com/5001/5238045874_594a6ed9ae.jpg
http://www.avem.fr/img/gen/jamaiscontente.jpg
http://autoautomobiles.narod.ru/autoautomobiles/citroen/citroen-ds-21-19-id-19.gif
http://flepi.net/

Changes over time



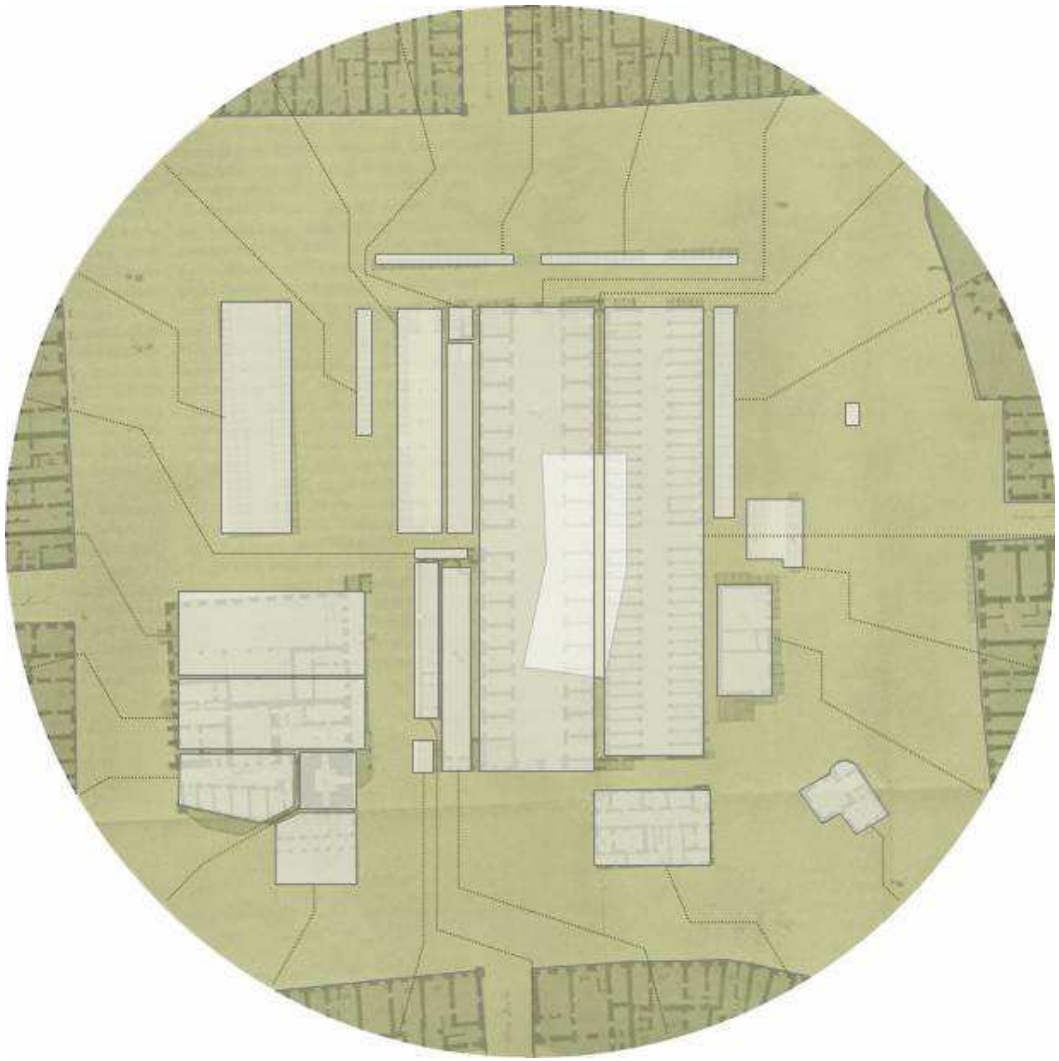
Source:http://hippotese.free.fr/blog/index.php/post/2008/03/05/336-voiture-hippomobile-ou-hippautomobile

Specificities of heritage architecture-1

Changes over time

Source: wikipedia

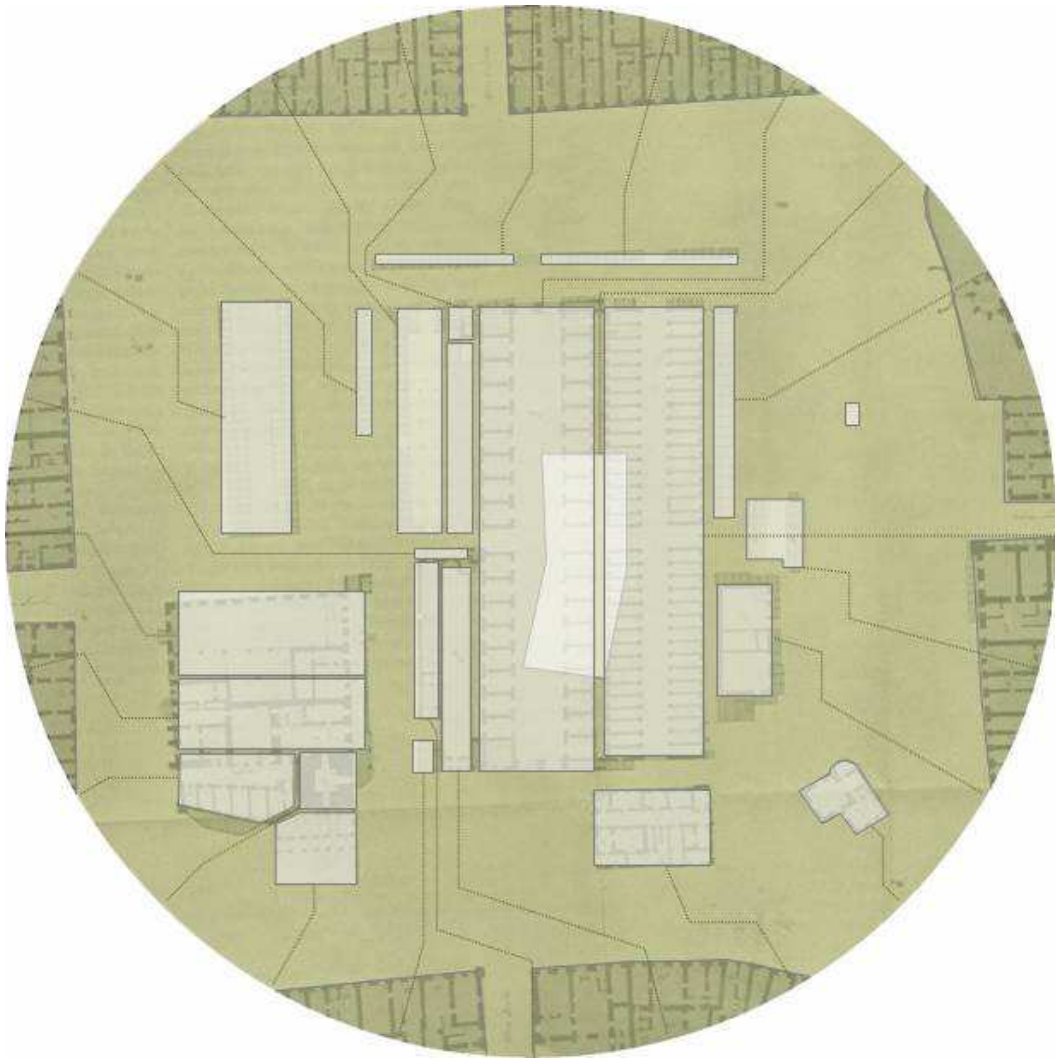
Changes over time: consequences



Which of
these artefacts was built
first?

Which was the most often
transformed?

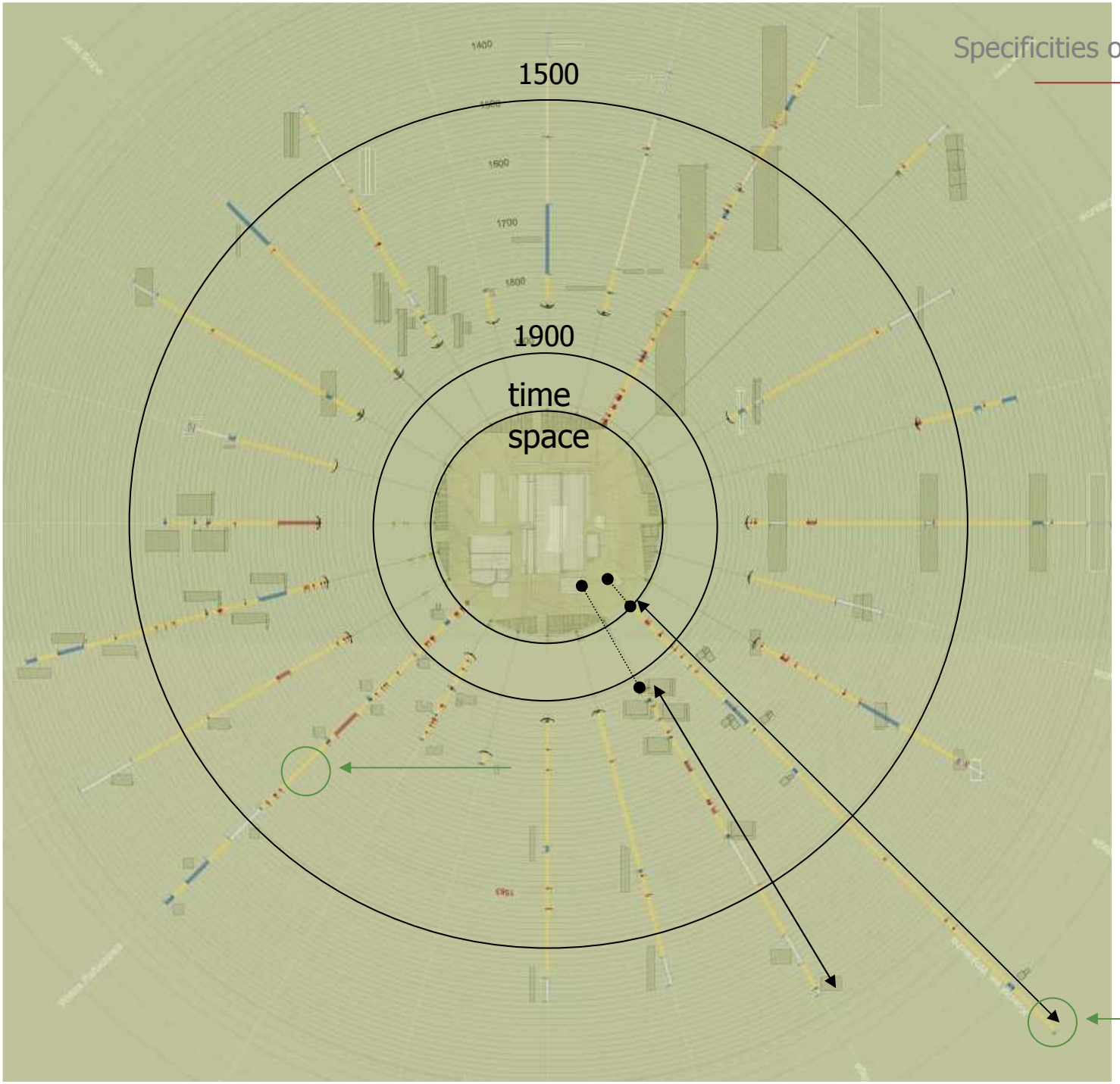
Changes over time: consequences



Which of
these artefacts was built
first?

Which was the most often
transformed?

not visible
when reducing spatial
features alone

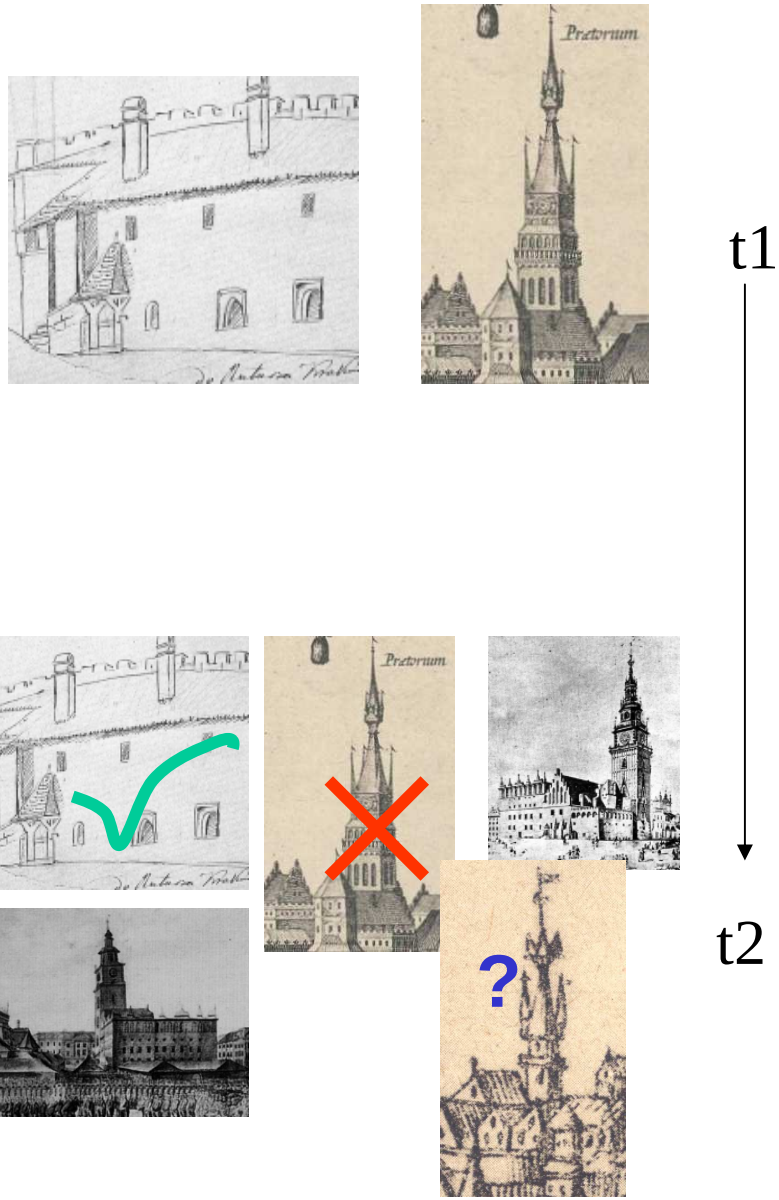


Which of these artefacts was built first?

Which was the most often transformed?

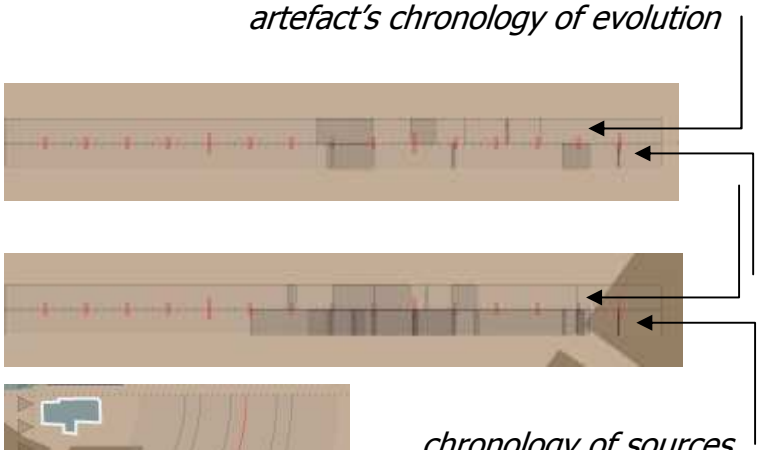
Uncertain, imprecise clues

Clues given by material (archaeology) or archival sources are heterogeneous, uncertain, imprecise, sometimes contradictory, unevenly distributed in time and space.



Uncertain, imprecise clues

Align the artefact and its documentation

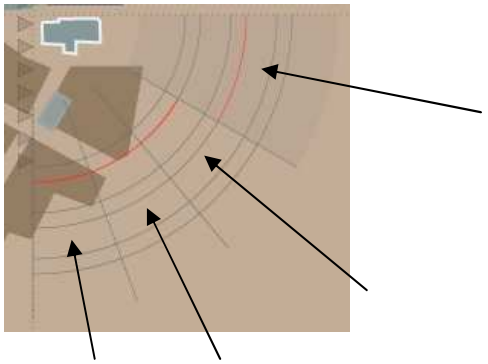


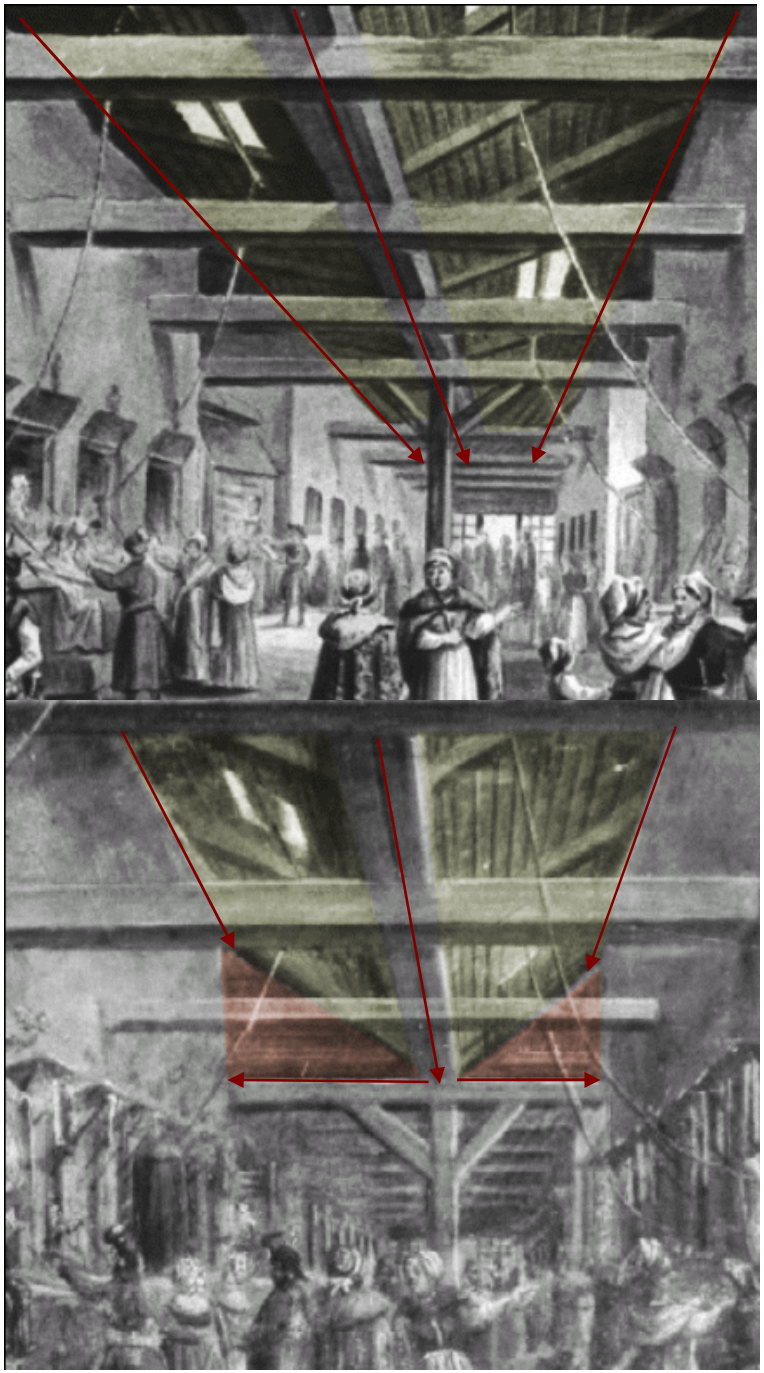
Uncertain, imprecise clues

Align the artefact and its documentation

Weigh uncertainties

certainty assessment (period, morphology, structure, function) represented by a value inside a lexical scale (closest to centre most certain)





Specificities of heritage architecture-3

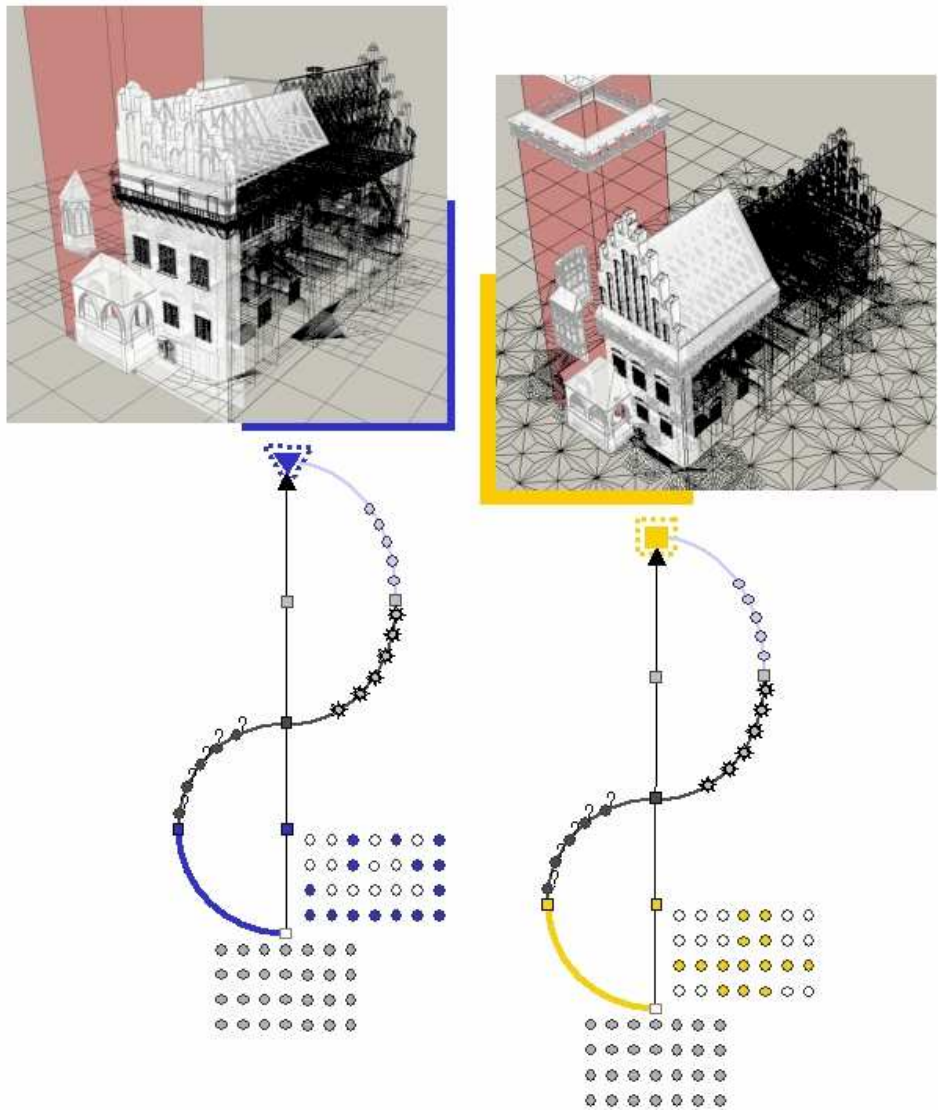
ill-defined objects

Because of different imprecision, because of lacks and contradictions: *imperfect knowledge*

which should be trusted?

Specificities of heritage architecture-3

ill-defined objects

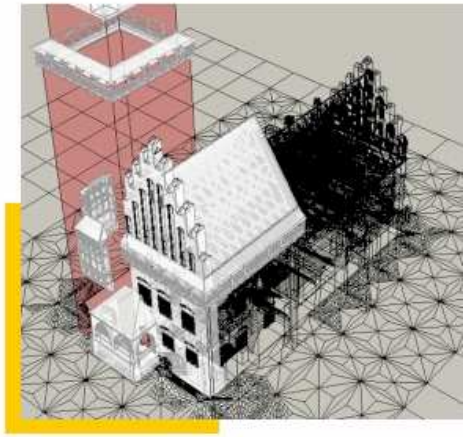


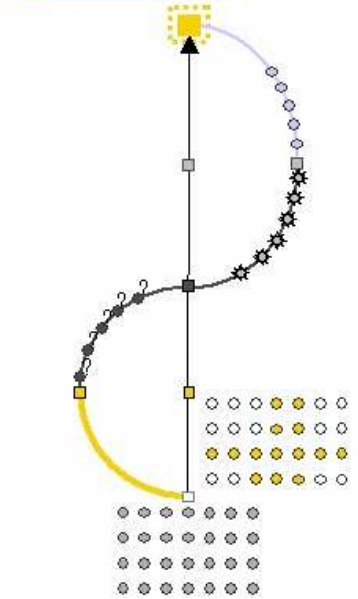
Because of different imprecision, because of lacks and contradictions: *imperfect knowledge*

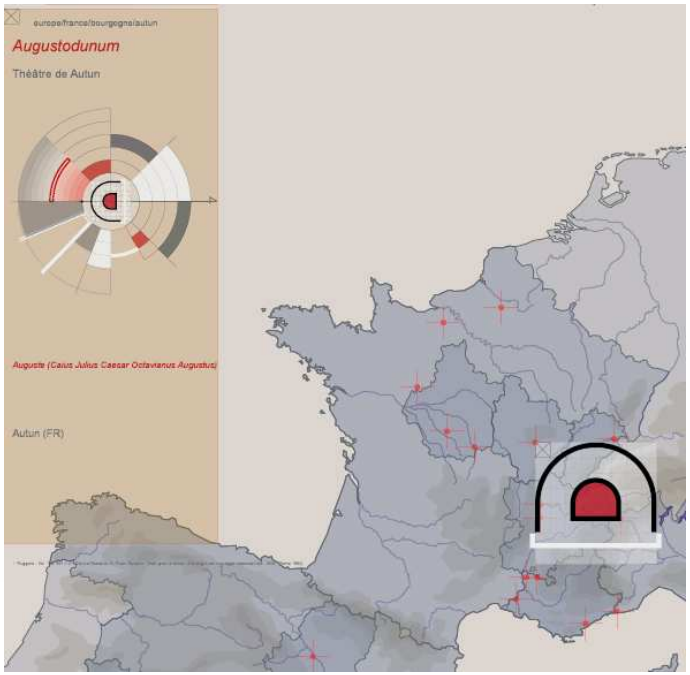
ending with ill-defined objects

One set of clues, several possible "correct" solutions (interpretations)

ill-defined objects

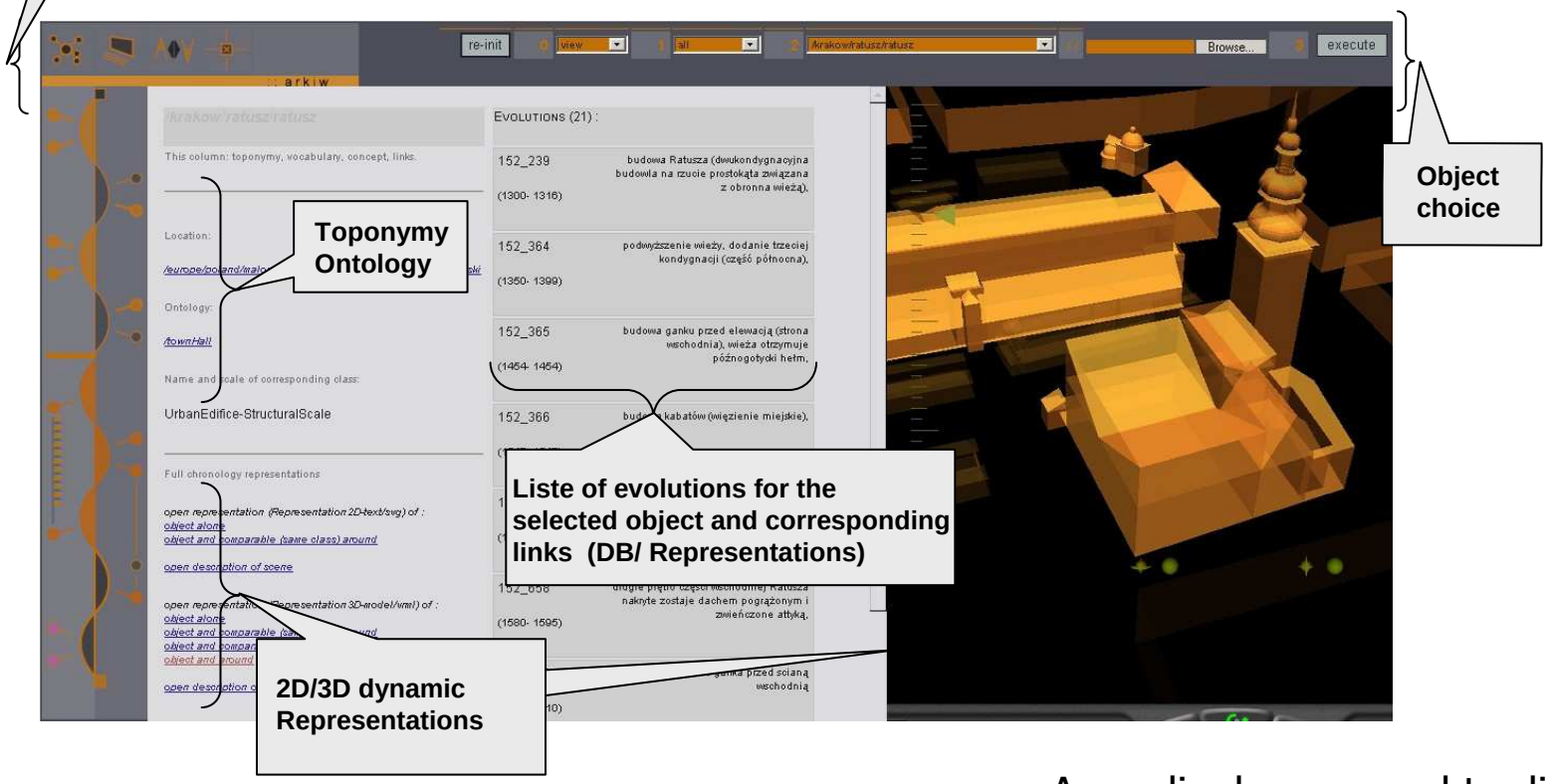






If we are to act as scientists what we need to say is what we know as well as what we ignore

We need models to perform reasoning tasks, on historic sciences information sets used to depict architectural changes



Accordingly, we need to distribute information in time and space.

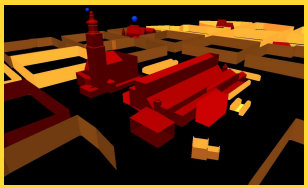
Distributing information in time and space

Free-standing Edifice	Urban Block	Street	Square	Green Area	Fortifications	...

class selection

****

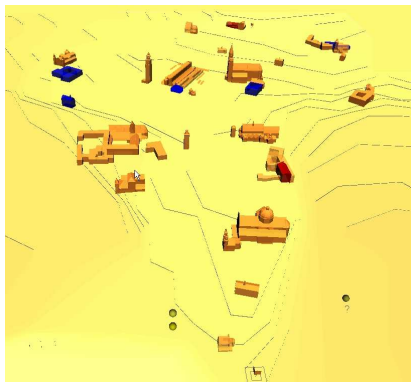
year selection



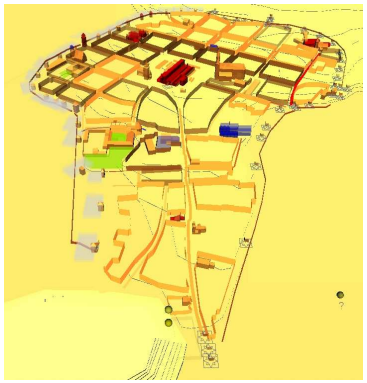
calculation of a scene

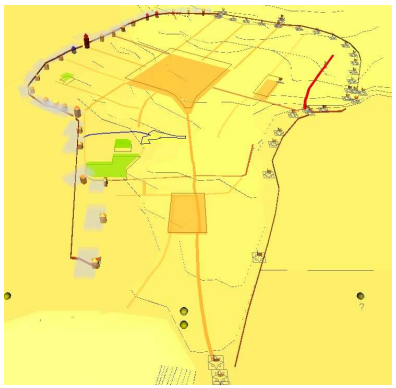
Link sources to pieces of architecture

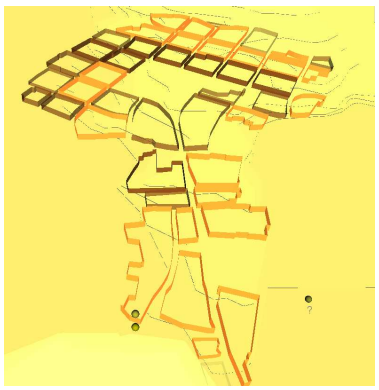
1998

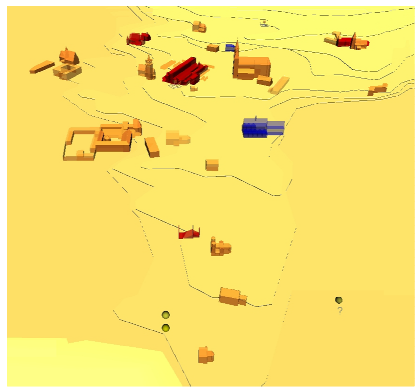


1841



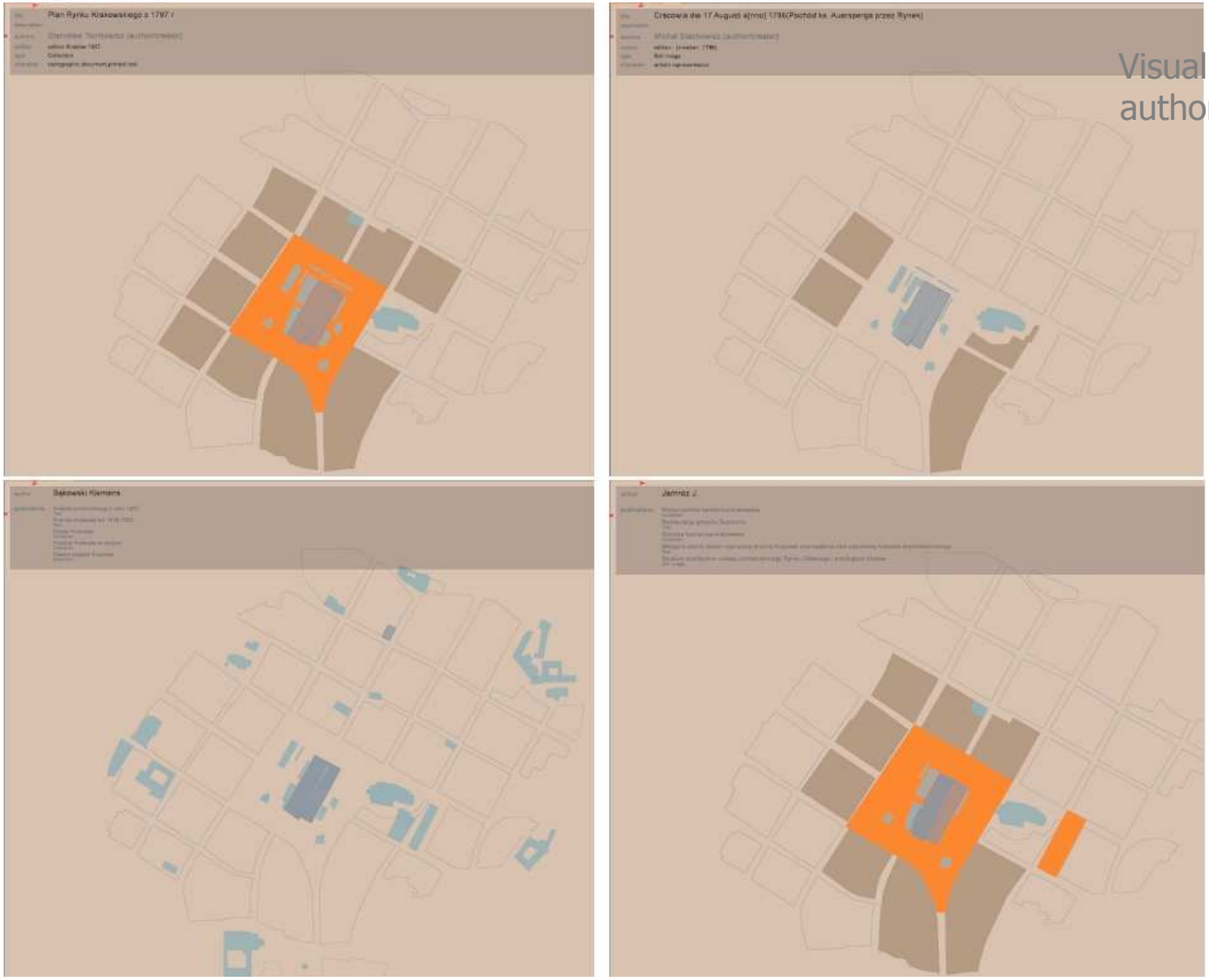






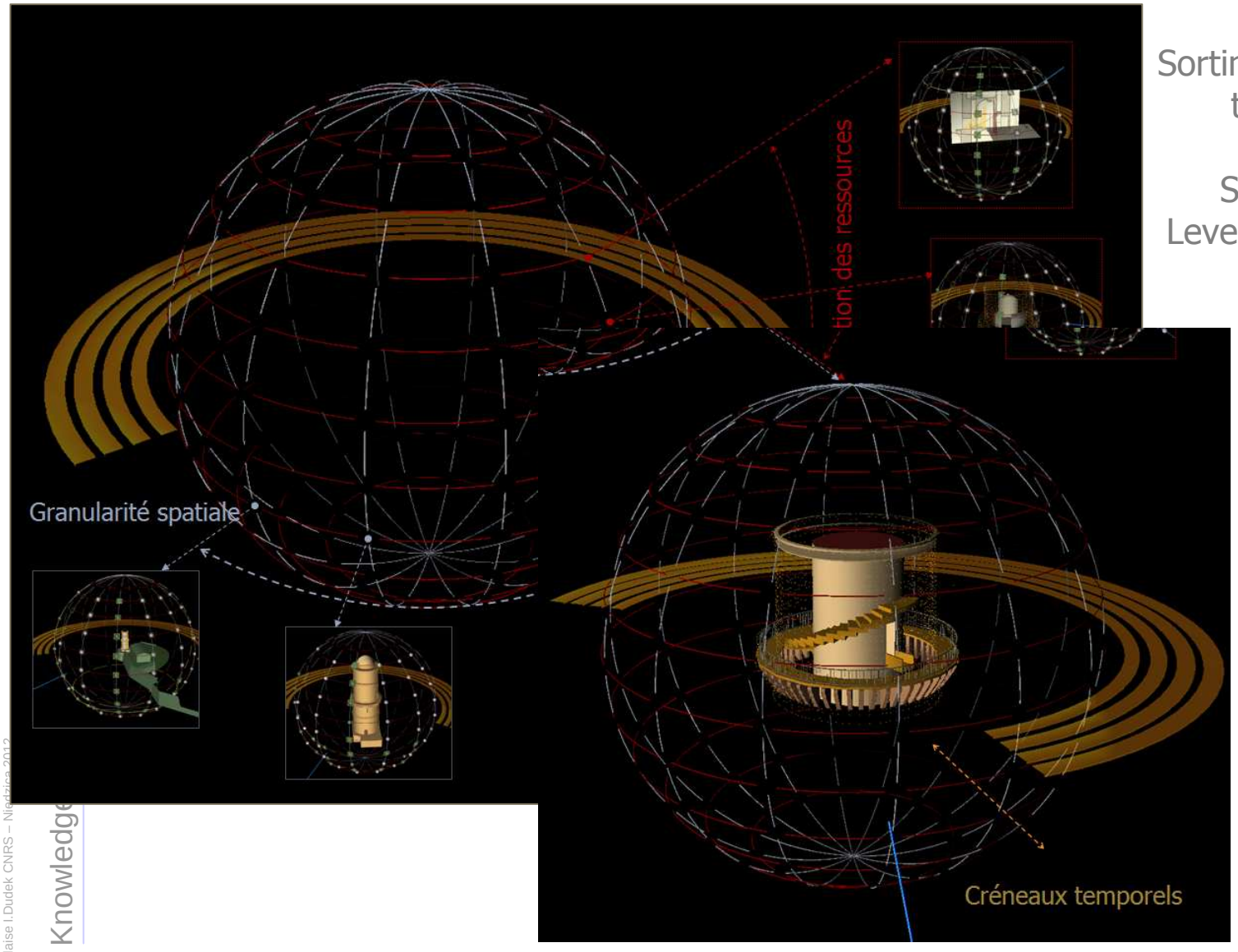
1503

artefact<>source relation



Visualise a source / an author's "spatial span"

Interfacing problem?

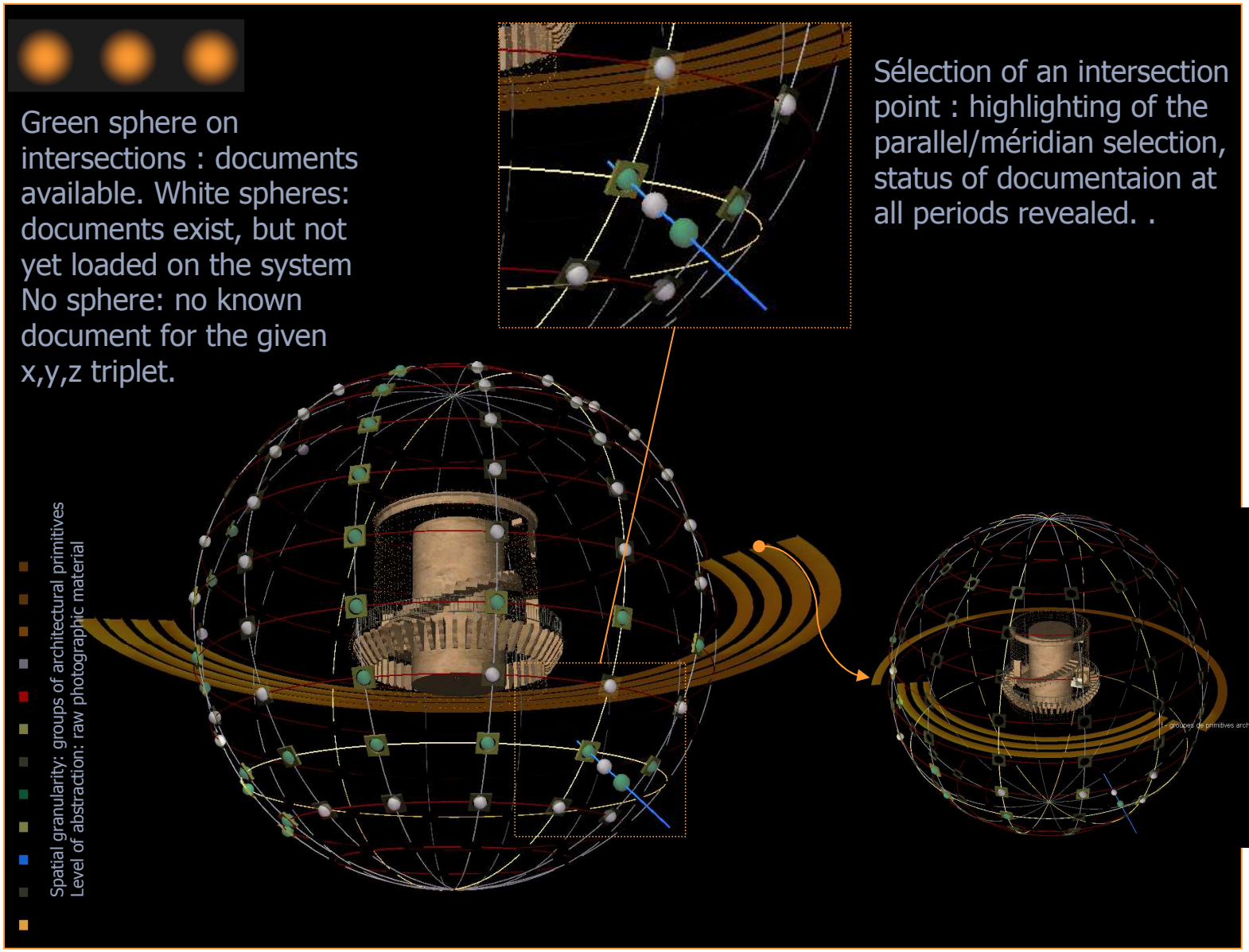


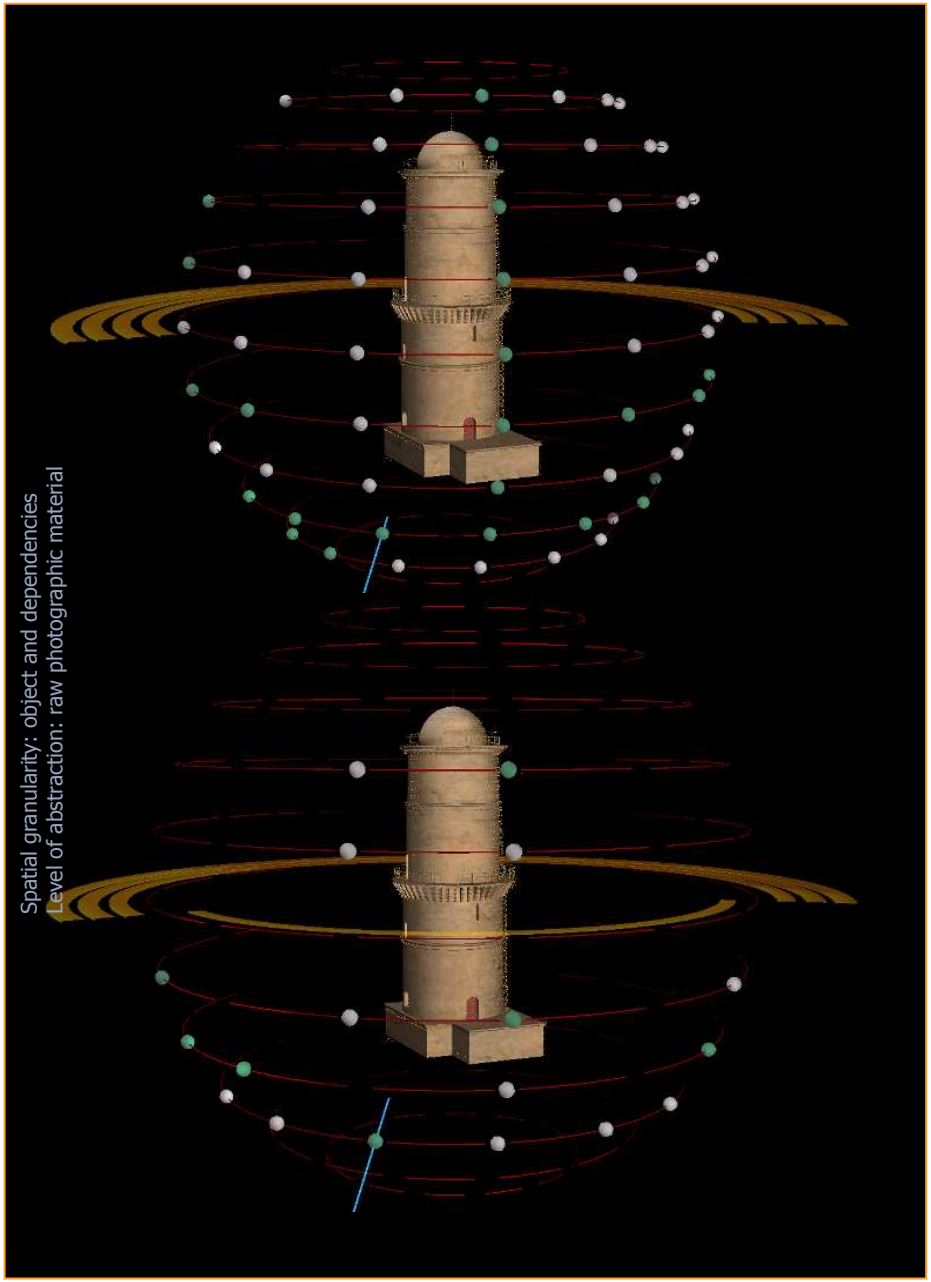
Sorting out clues using three parameters:

Spatial granularity,
Level of abstraction of sources,
Time slots

[and a metaphor]

Interfacing problem?





Distributing information in time and space

Interfacing problem?

A view over the data collection

[which is XIXth century,
which is XXth century]

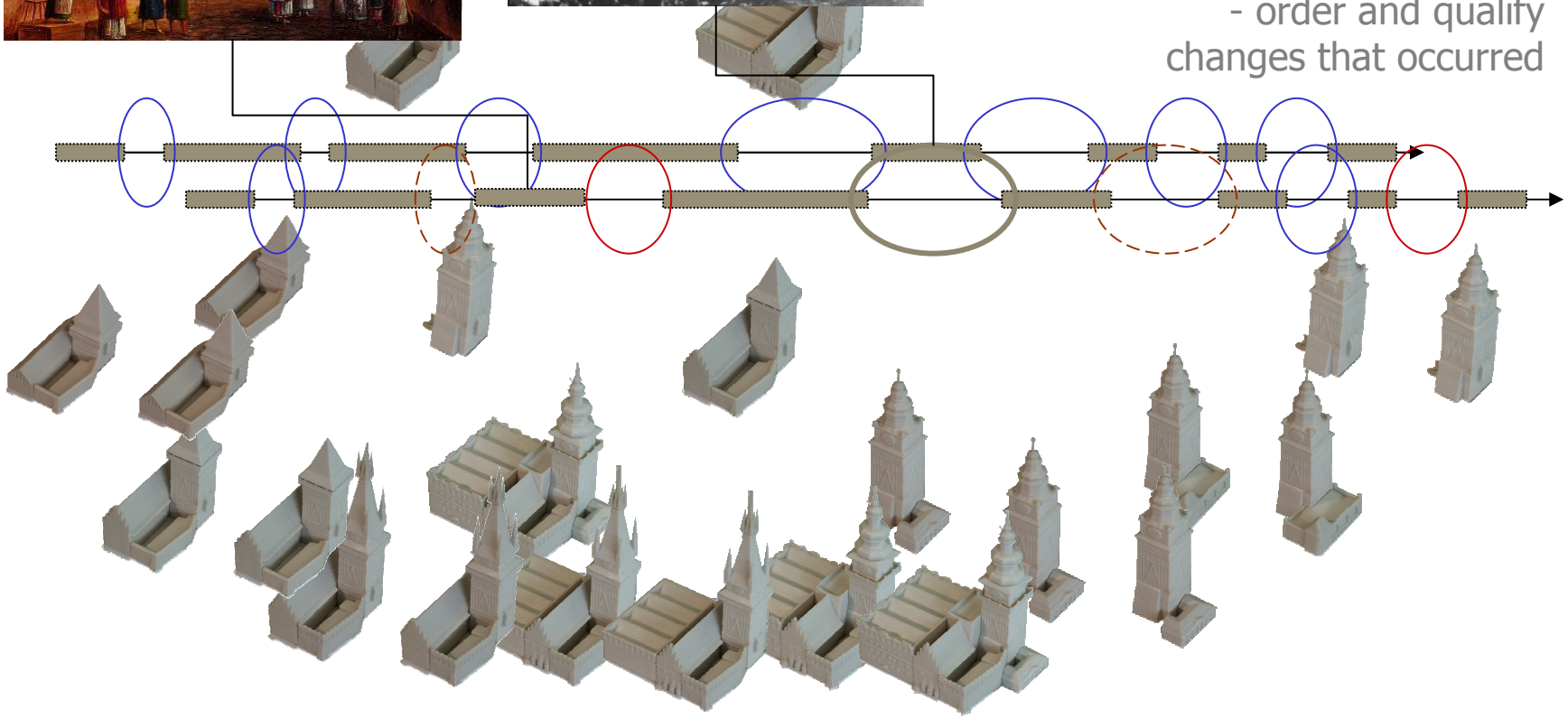
Distributing information in time and space

a modelling effort

Beyond distributing information in time and space, we need to

- analyse the information,

- order and qualify changes that occurred



Distributing information in time and space

a modelling effort

decay

segmental anaesthesia

split

secession

creation

abandon

hibernation

demolition

merge

extinction

modification

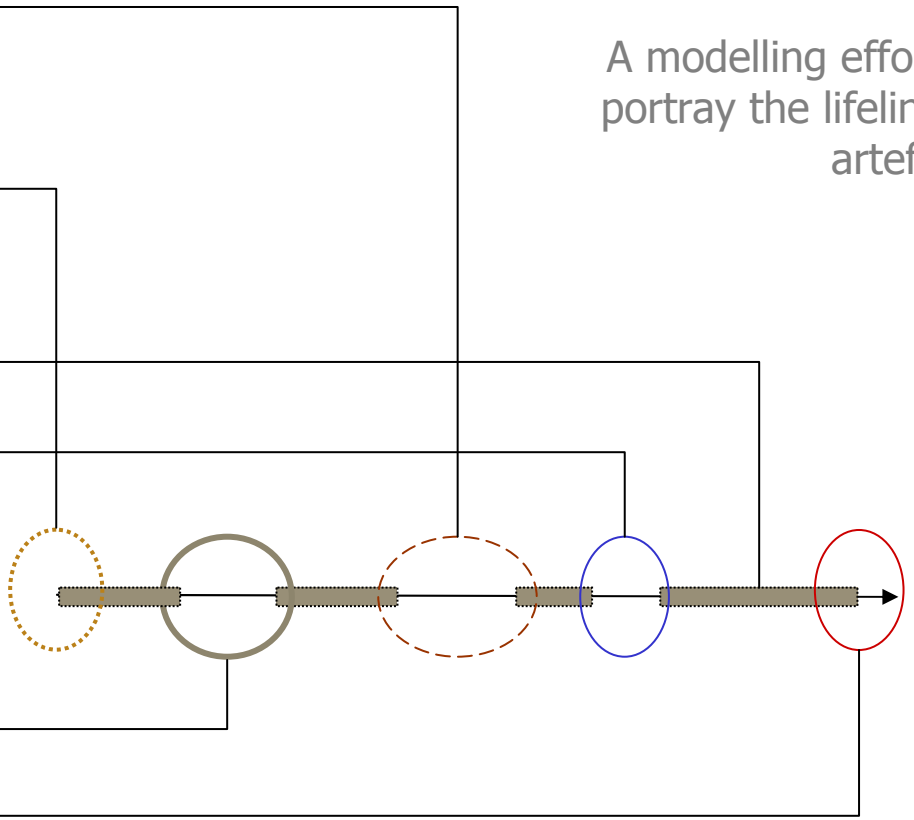
reincarnation

annexation

interment

translocation

translocation

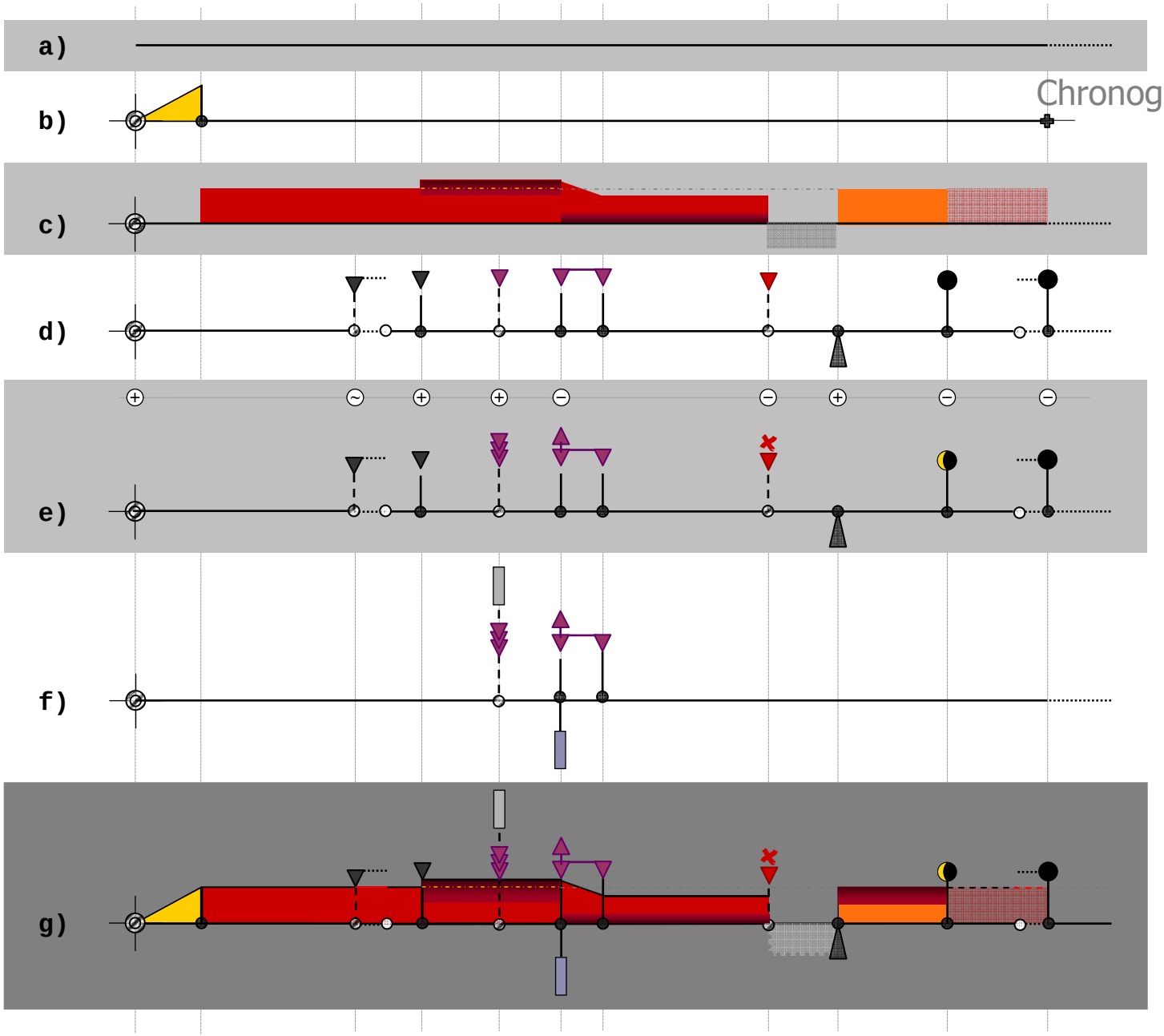


A modelling effort to portray the lifeline of artefacts

States and transitions

a modelling effort

Chronographs: a visualisation of the analysis grid



(a) the time axis;

(b) symbols marking start and end of the artefact's evolution;

(c) the artefact's bar,

(d) markers of transitions.

(e) additional transition qualifiers,

(f) vertical rectangles indicate that portions or artefacts are added or withdrawn.

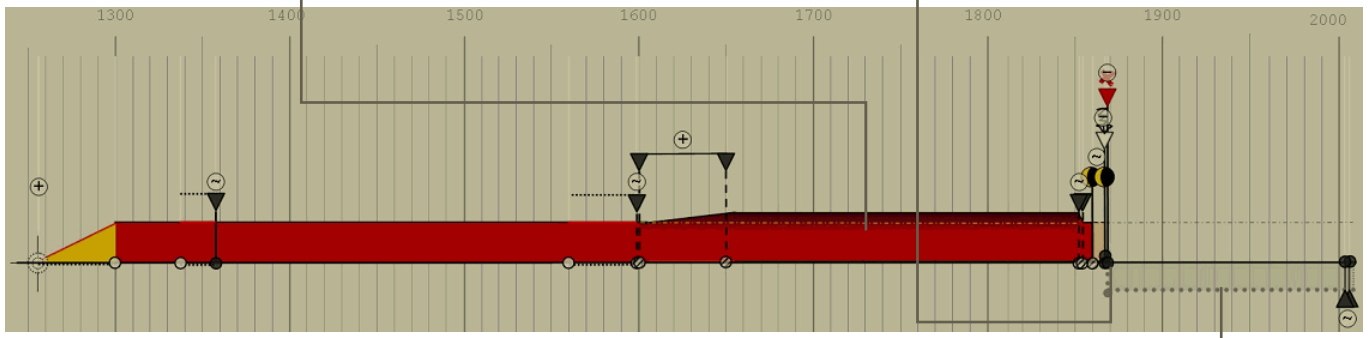
(g) a combination of the basic components.

Distributing information in time and space

a modelling effort

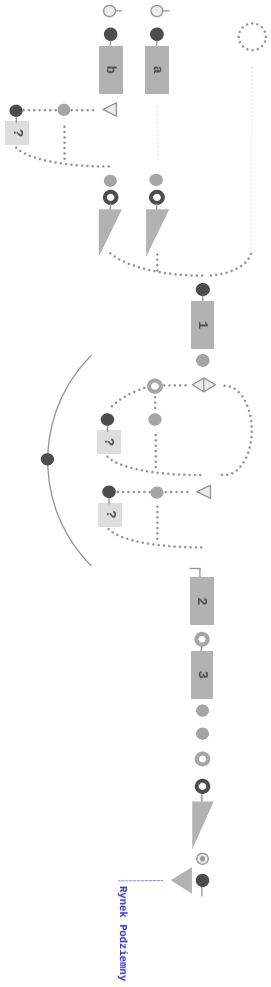
A modelling effort to portray the lifeline of artefacts

A visualisation of the analysis grid



Where is “hibernation”

Knowledge modelling in heritage architecture :: **the need**



1257	Fundacja kramów w rynku (przywilej lokacyjny)
1260 ?? - 1302 ??	Możliwa budowa pierwszych kramów bogatych
1358	
1370 ?? - 1375 ??	Opuszczenie kramów sukiennych i częściowa ich rozbiórka
1372 ? - 1390 ?	Budowa (nowych?) murowanych kramów - jednolita koncepcja
1490 ?? – 1515 ??	Modyfikacje wewnętrzne
1555	Pożar Sukiennic I być może dachów Kramów Bogatych
1555 ? – 1570 ??	Ewentualna odbudowa lub przebudowa z możliwą zmianą konstrukcji dachu - dach pogrążony
1752 - 1766	Remont dachów - i być może konstrukcja dachu pogrążonego
1555 ?? – 1787 ??	Dach pogrążony przekrywa przejście poprzeczne i podłużne
1801 ?? – 1825 ??	Likwidacja lub stopniowa degradacja prowadząca do zaniku dachu pogrążonego
1852 - 1854	Część kupców przenosi się do kramów bogatych
1860 - 1867	Miasto zaczyna wykupywać kramy od prywatnych właścicieli
1867	Samoistne zawalenie się dachu nad kramami bogatymi, podjęcie decyzji o rozbiórce kramów
1868	Rozbiórka
2003 - 2004	Badania archeologiczne E. Zaitz
2005 - 2010	Badania archeologiczne w związku z wymianą nawierzchni (C. Buśko, budowa podziemnych kubatur dla MHmK, realizacja projektu Śladem europejskiej tożsamości Krakowa - szlak turystyczny po podziemiach Rynku Głównego. Wyodrębniono i udostępniono do zwiedzania część komór Kramów Bogatych, które włączone zostały do Muzeum Rynku Podziemnego.

Distributing information in time and space

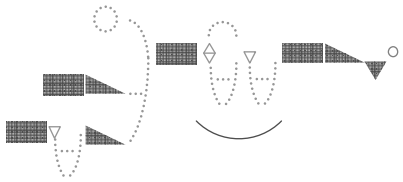
a modelling effort

Chronographs privilege one scenario over others - we in parallel need to reason on alternative scenarios

Distributing information in time and space

a modelling effort

Chronographs privilege one scenario over others - we in parallel need to reason on alternative scenarios

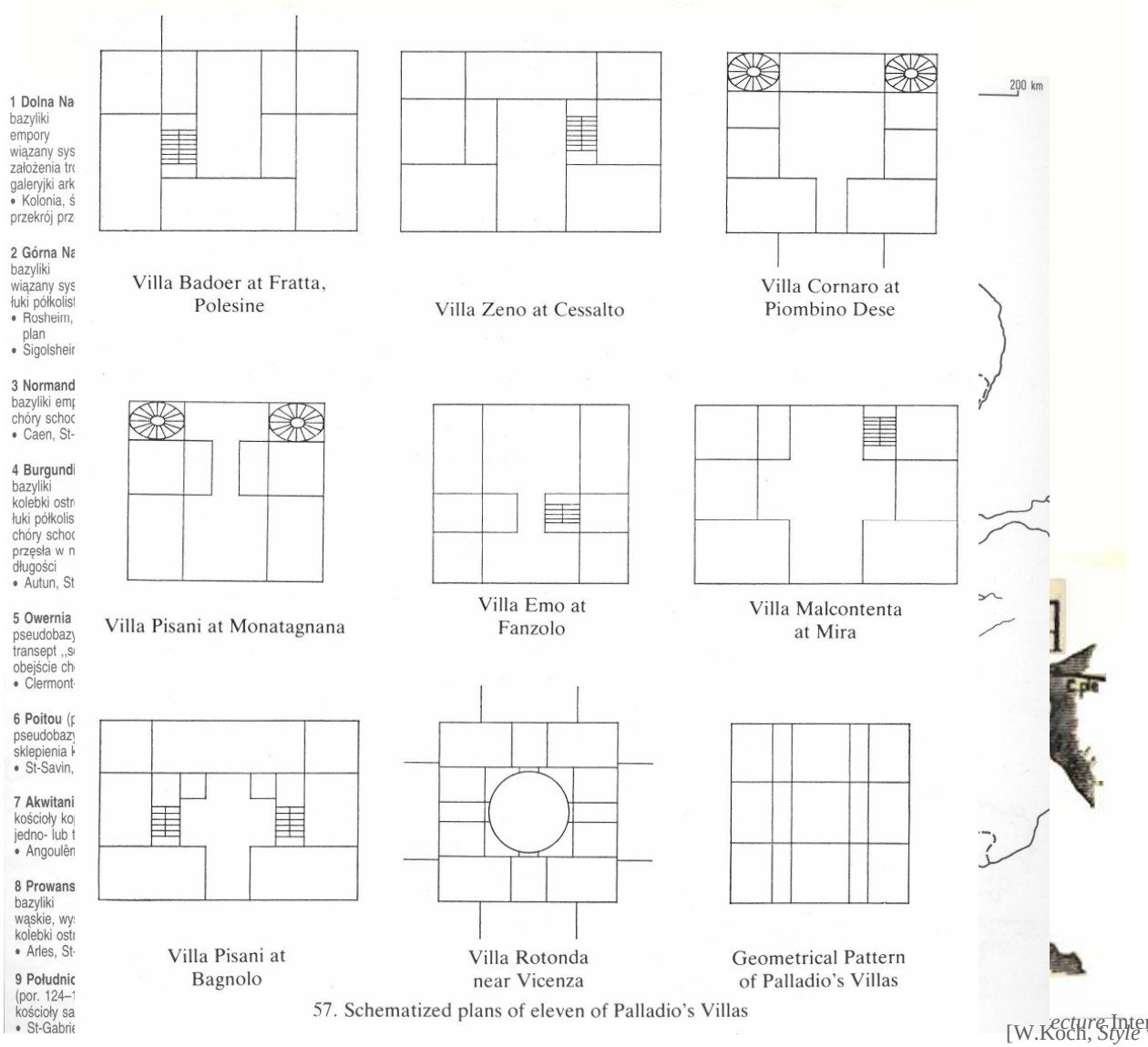


Kramy Bogate

Agnar Renolen
Modelling Spatiotemporal Information: The Spatiotemporal Object Model, 1997

W. Komorowski, A. Sudacka
Rynek Główny, Ossolineum, Wrocław 2008

L.Sanders, (Ed) Models in Spatial Analysis,
ISTE London 2007



57. Schematized plans of eleven of Palladio's Villas

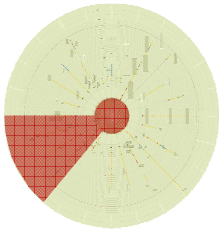
Gaining some insight about a given artefact often implies taking in consideration, cross-examining, "others around"

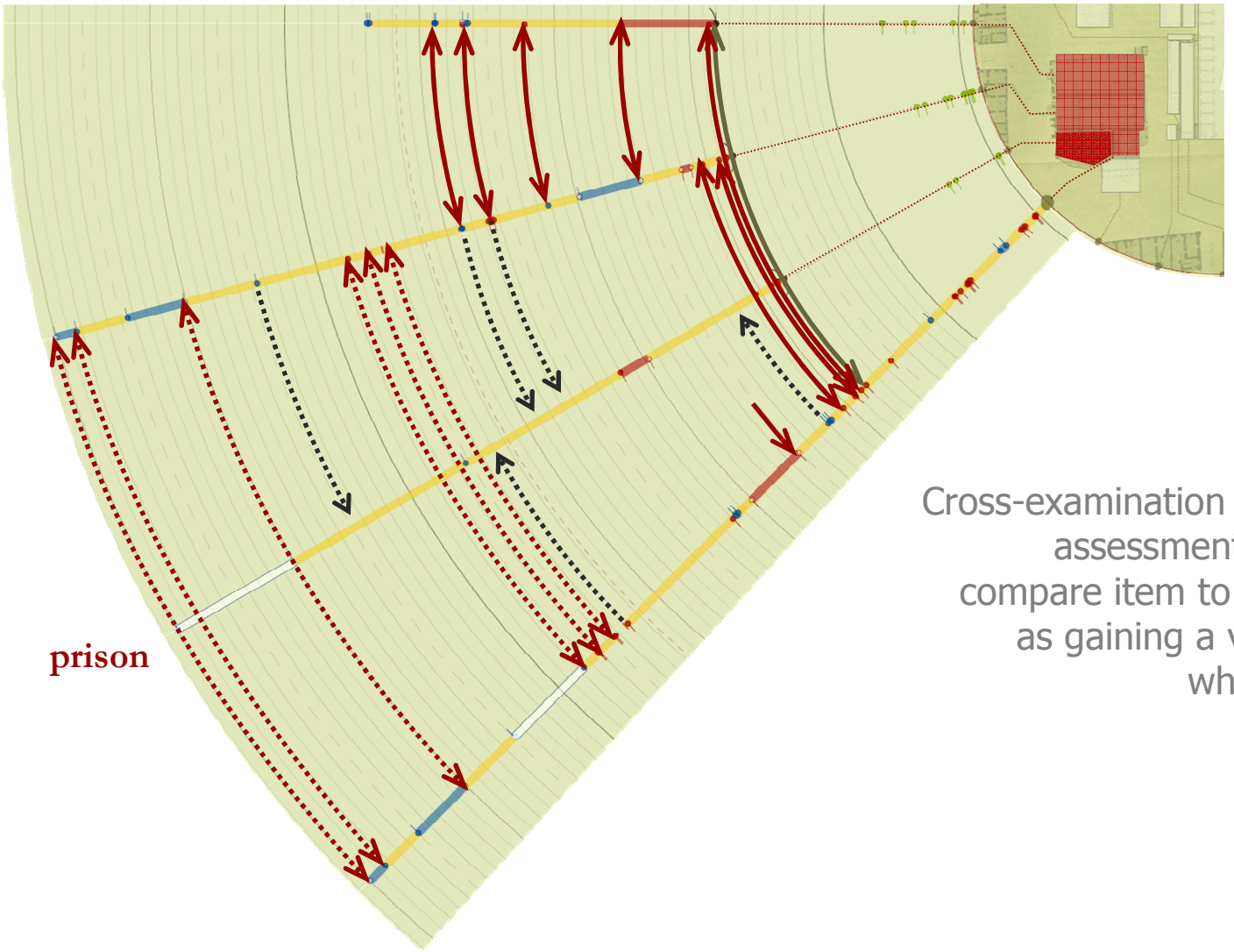
[space, time, type]

ecture Inter-Livres 1991 (ed.orig 1899)]

[W.Koch, *Style w Architekturze*, Bertelsmann Publishing 1996]

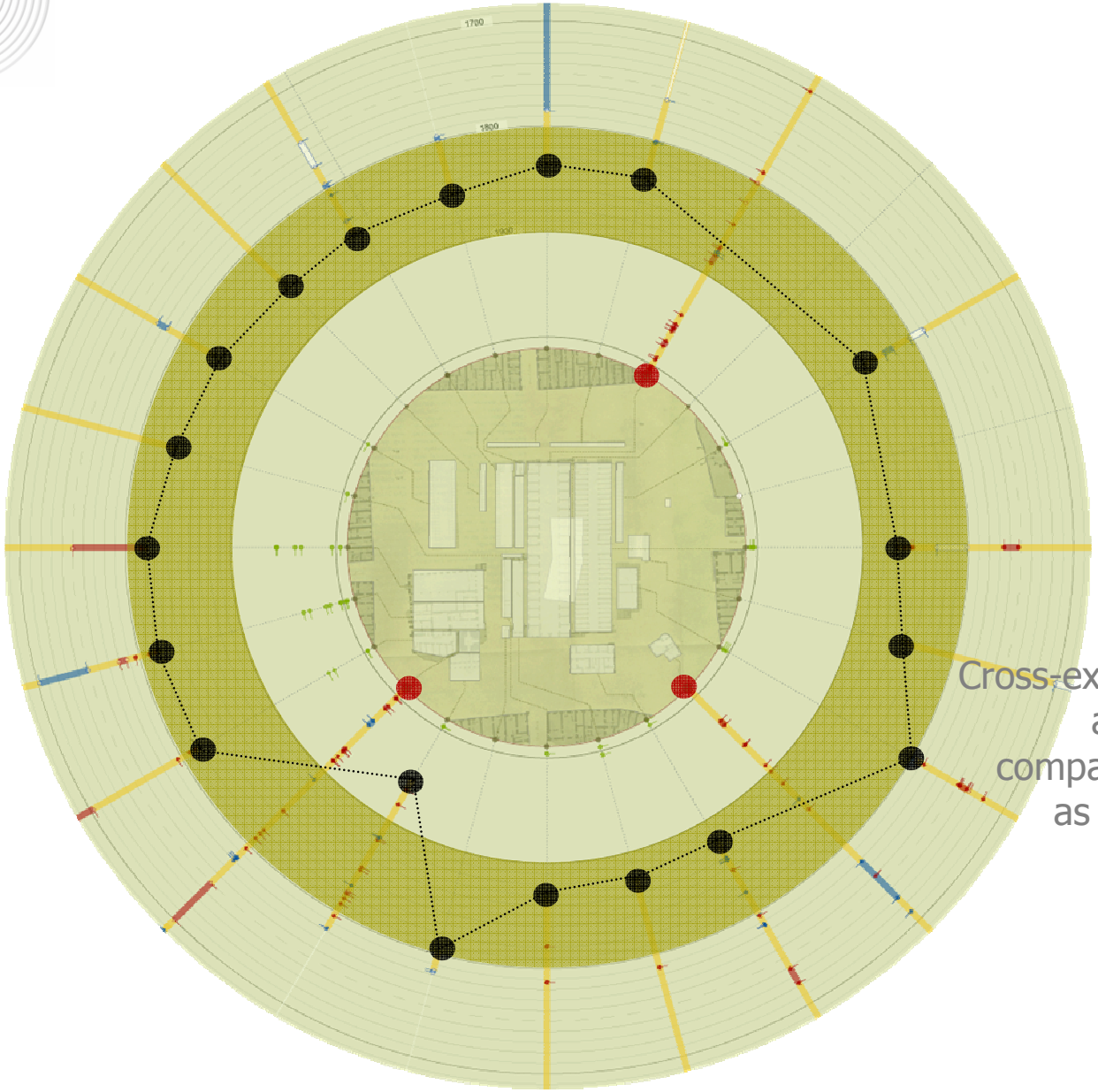
[R. Wittkower *Architectural principles in the age of humanism* Academy editions 1998 (ed.orig 1949)]





Cross-examination and relations assessments : means to compare item to item, as well as gaining a view over the whole collection

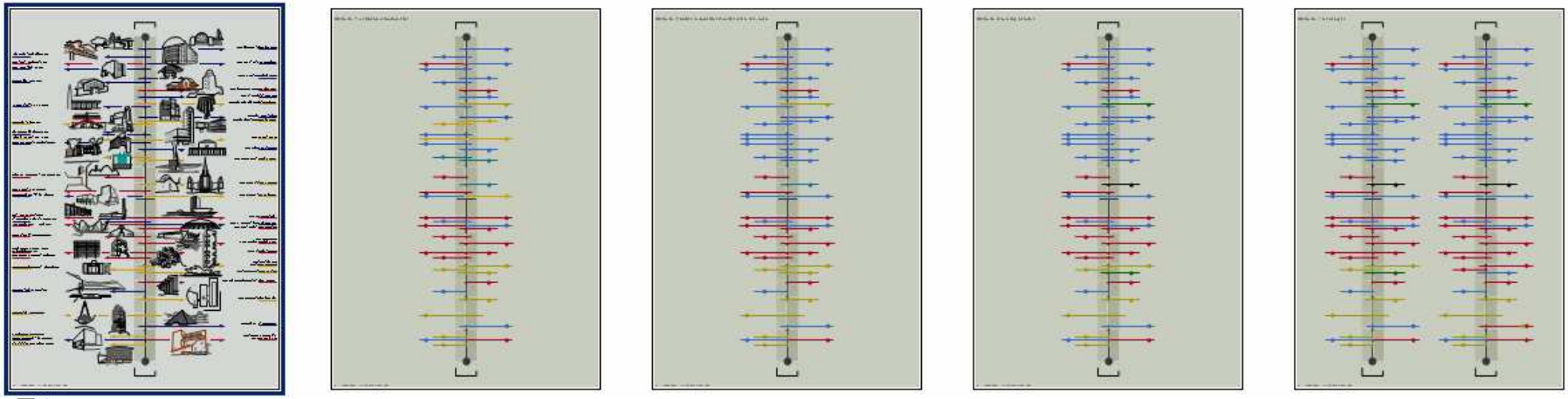
objectives



Cross-examination and relations assessments : means to compare item to item, as well as gaining a view over the whole collection

limitations

Biases in the cross-examination



www.map.archi.fr/UIA

A. Choisy, History of Architecture, 1899

Henri Piontcaré, La Valeur de la Science, 1902

E. R. Tufte, Envisioning Information, Graphic Press, Cheshire 1990

E. R. Tufte, Visual Explanation, Graphics Press, Cheshire 1997

Summary

We create models in order to **perform reasoning tasks**

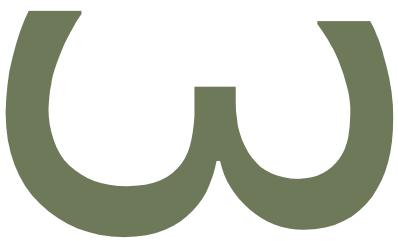
Because of our limited cognitive abilities, we **reduce reality** to a set of features corresponding to our knowledge modelling point of view.

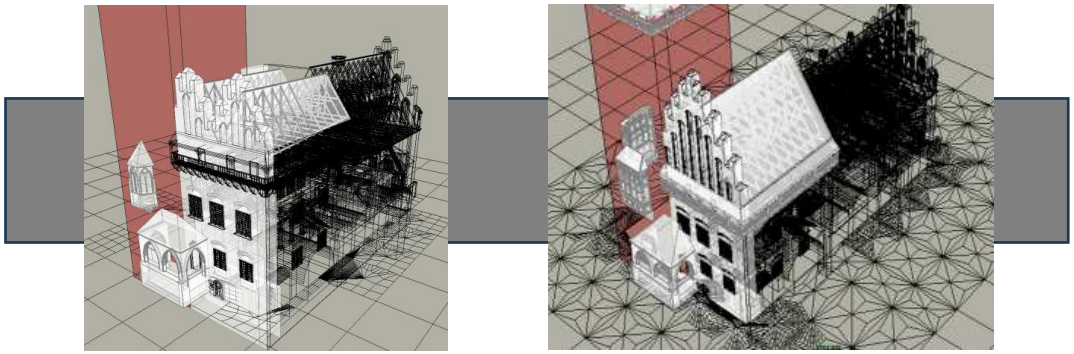
The reality of historic architecture: as a result of the integration of inconsistent, questionable data and information sets, **imperfect knowledge**

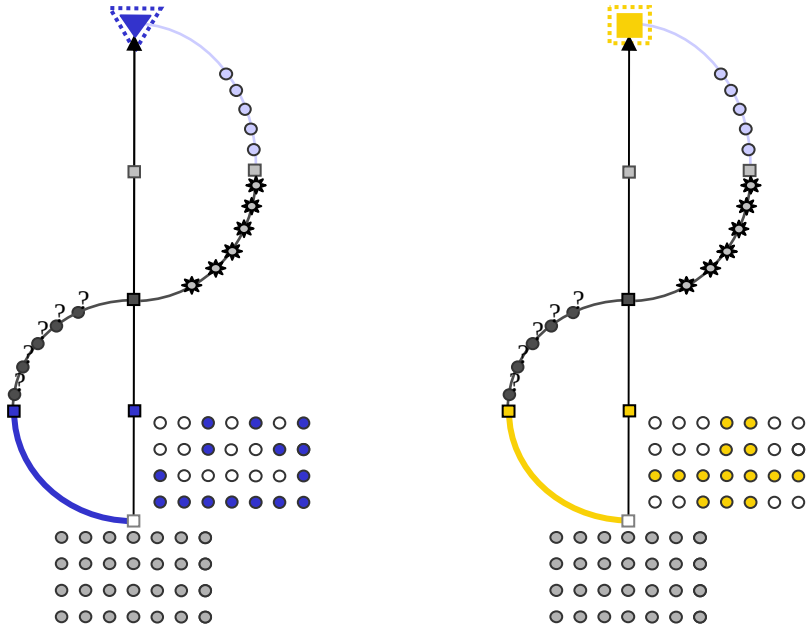
Clues need to be **distributed in time and space** in order to portray the lifeline of artefacts

Reasoning on a given artefact should be complemented with cross-examination and **collection reading**.

Knowledge modelling in heritage architecture :: **terminology**







Before
(data, information, knowledge)

During
(hypothesis, probability; Classification, Taxonomy, Ontology

After
(reconstruction, simulation, anastylosis)

Data, information, knowledge

data -

> [...] facts, documents, results (for instance of archaeological excavations or of surveys) that will serve as basis of an interpretation process. [...]

information -

> [...] Result of the interpretation of [raw] data in a specific context. [...]

**R. STENVERT
Constructing the past: computer-assisted Architectural-Historical Research,
Thèse de doctorat de l 'Université d'Utrecht (Pays-bas), décembre 1991

Data, information, knowledge

data
(container)

Object type
author
Dating (when was this bas-relief done?)
localisation
owner
...

information
(content)

Objects represented
Dating (what period does it show?)
...

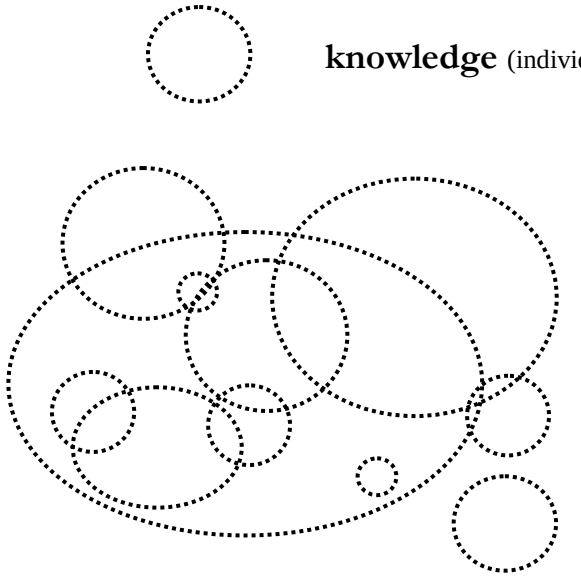
[A Map of medieval Rome, Bas –relief of Sant Maria Zobenigo Church, Venice , phot. Aut.]

Data, information, knowledge

knowledge

- knowledge is […] mental, […] it is to be found in the mind and only there
- knowledge[…] is a state;
- cognition comes about through a mental process, the result of this process is knowledge;

Things, properties, relations are represented by concepts, states by propositions.



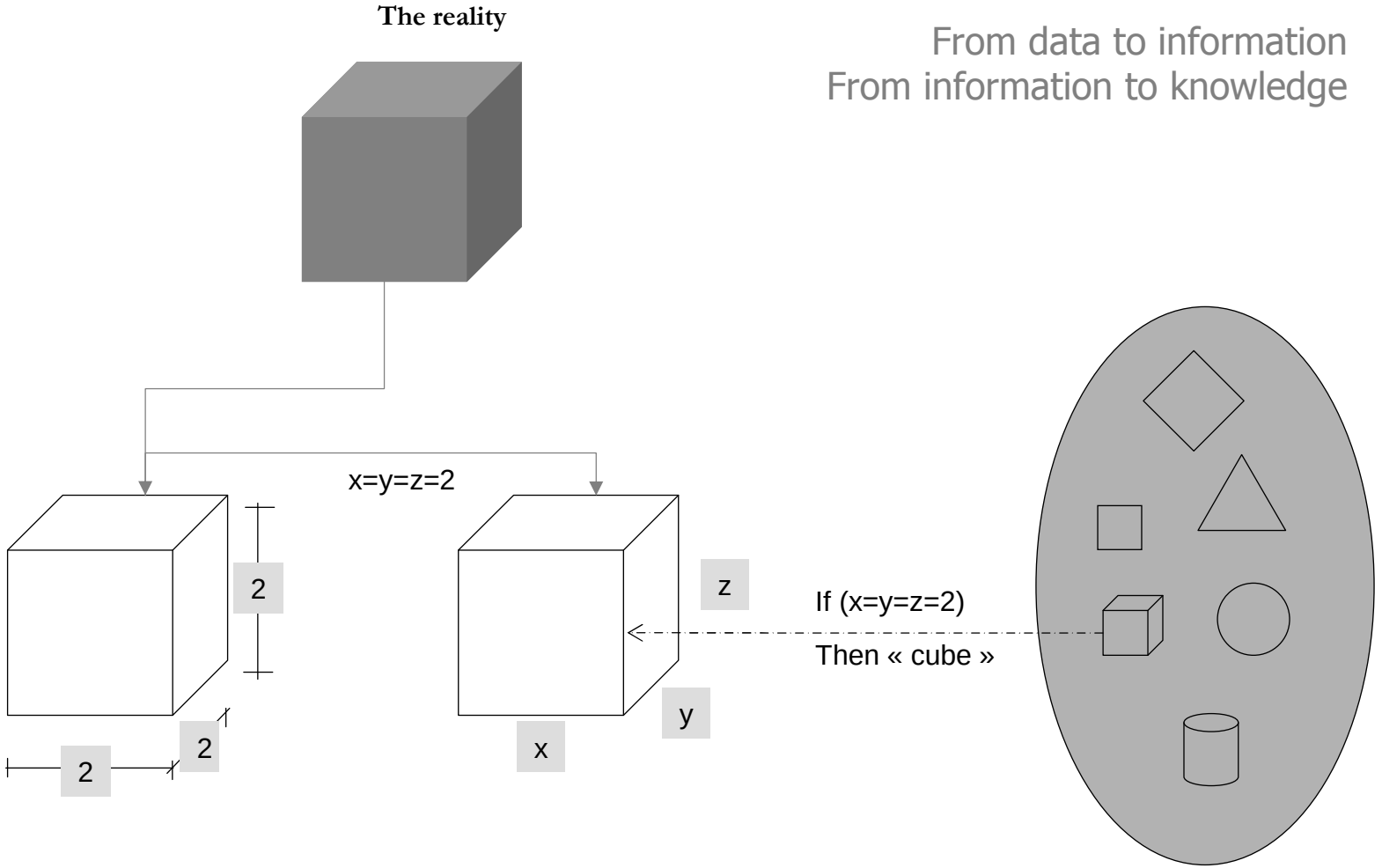
knowledge (individual)

science (collective knowledge)

Józef M. BOCHEŃSKI
Współczesne metody myślenia,
" W drodze", Poznań 1988

Data, information, knowledge

From data to information
From information to knowledge



Classification, Taxonomy, Ontology

From philosophy to Computer Science

* **Classify** : divide [things] into groups or types so that things with similar characteristics are in the same group

**Originally, ontology […] science of being,
* the branch of philosophy that deals with the nature of existence
** The Computer science community uses the term "**ontology**" in the context of information sharing to refer to formal descriptions of particular domains.

*** An **ontology** is a formal specification of a conceptualisation.

** The most common form of ontology is a **taxonomy**. A taxonomical ontology typically provides a hierarchy of concepts related with specialisation ("is-a") relationships and normally represented as a tree.

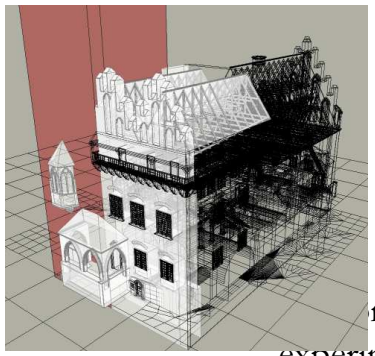
•*Collins Cobuld english dictionary,* Harper Collins 1995

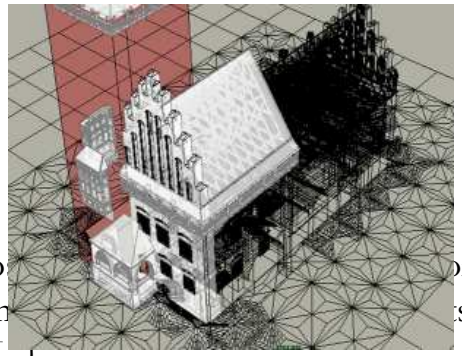
***Lee W Lacy. OWL: Representing Information using the Web Ontology Language*
Trafford, 2005

**** T.Gruber. A translation approach to Portable Ontology Specifications*, Knowledge Acquisition 5:199-220

Hypothesis, probability

Hypothesis building,
probability weighing





propo n of a natural
menon s control by
experiment [...]

Probability cannot be expressed numerically

probability - [...] ratio expressing the number of cases in favour of an event in comparison to the overall number of possibilities [...]

Probability of an event: can be expressed numerically

Probability of a hypothesis : cannot be determined numerically

Choices can be weighed objectively

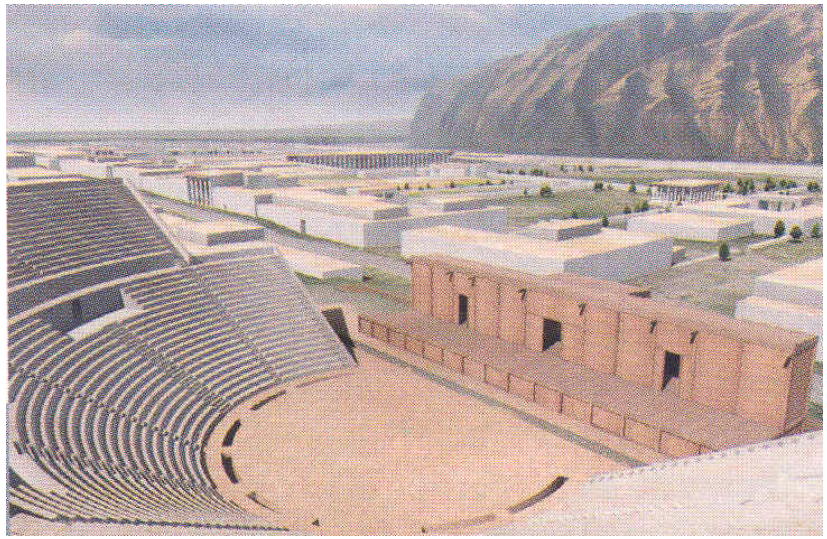
Józef M. BOCHEŃSKI
Współczesne metody myślenia,
" W drodze", Poznań 1988, p. 125

**Le Petit Robert. Dictionnaire de la langue française,*
Dictionnaire le Robert
Paris 1993

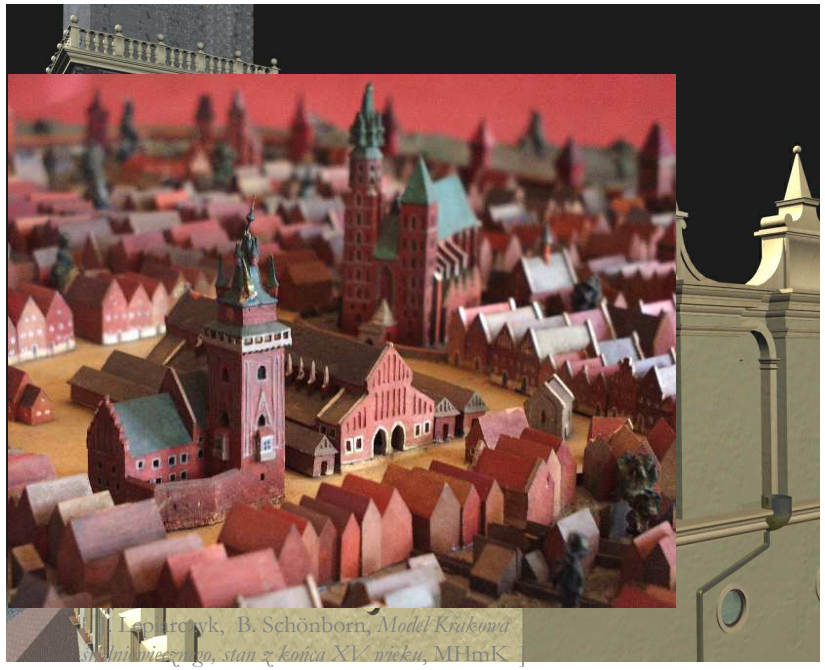
Reconstruction, simulation, anastylosis

Simulations? Virtual reconstructions? 3D models? (...)

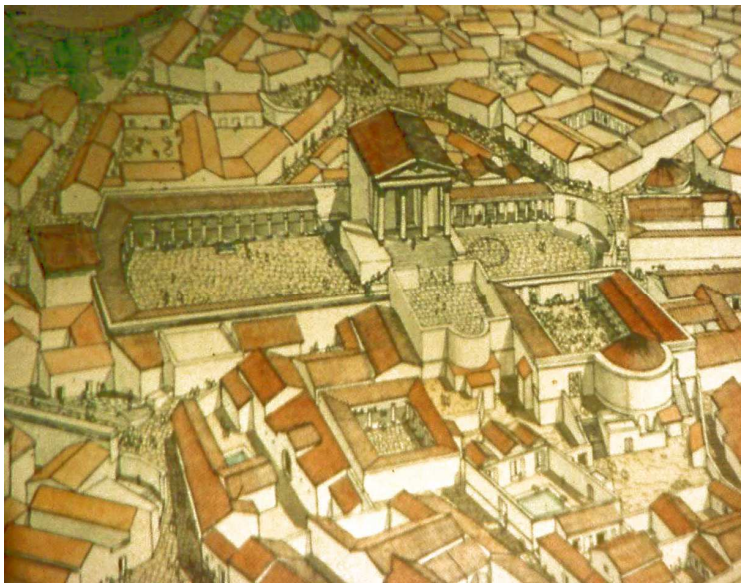
What is key here is not what is said but what is unsaid



[TAISEI/AOROC/ENS, Journal du CNRS, déc. 2004]



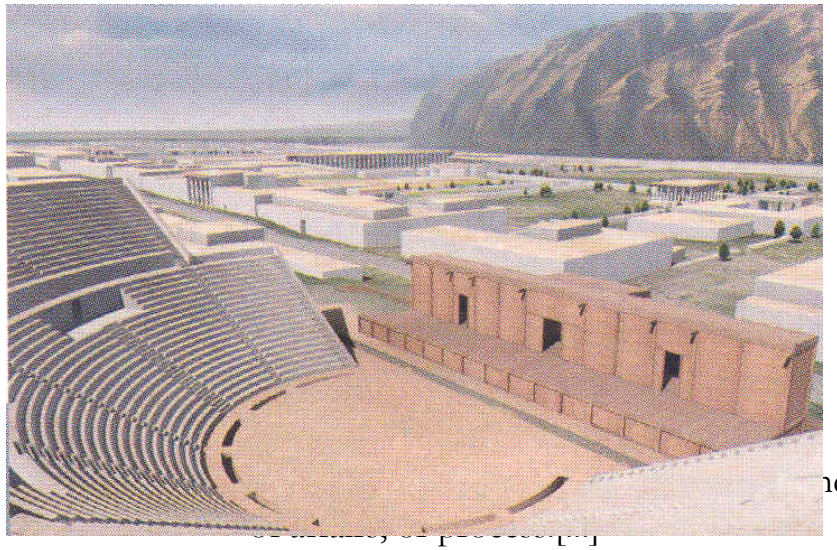
[J. Lipiarowk, B. Schönborn, *Model Krakowa średniowiecznego, stan z końca XV wieku*, MHmK]



[*J.C. Golvin, villes romaines - évocations*]

[*aut. And C.Radi*]

Reconstruction, simulation, anastylosis



[TAISEI/AOROC/ENS, Journal du CNRS, déc. 2004]

*[...] A computer simulation (or "sim") is an attempt to

[*aut. And C.Radi*]

Simulations? Virtual reconstructions? 3D models? (...)

A simulation implies some tests on the behaviour/properties of a system – here architecture. If there is no such intent when producing the 3D model then the word simulation should be avoided

As standalone images, do not allow to conduct experiments

*Wikipedia (en) 21-06-2011

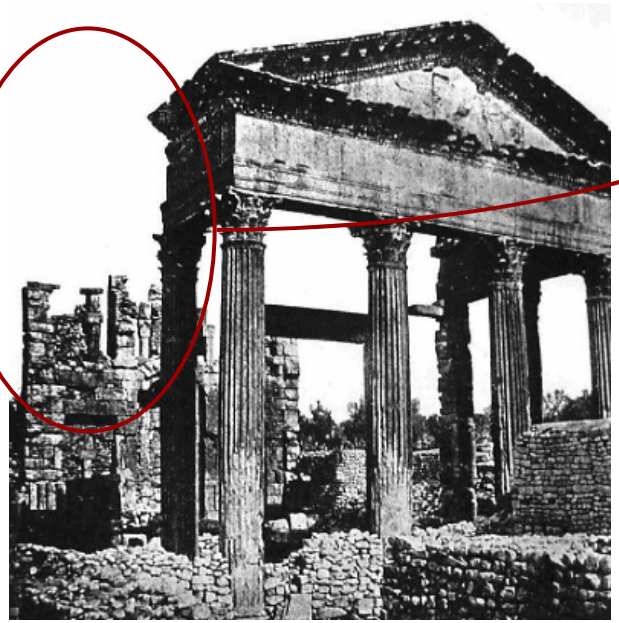
Reconstruction, simulation, anastylosis

Simulations? Virtual reconstructions? 3D models? (...)

reconstruction -

*[...] The act of constructing again; [...]

[...] **Anastylosis is an archaeological te
for a reconstruction technique whereby a ruined build
or monument is restored using the original architectur
elements to the greatest degree possible.[...].

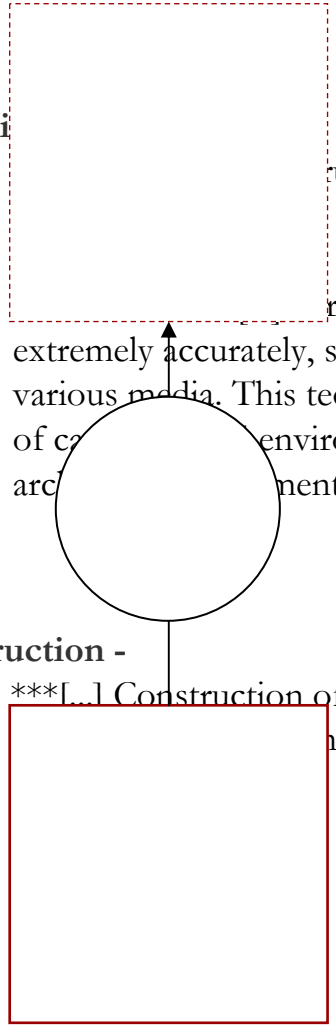


*http://www.dictionary.net/reconstruction 21-06-2011

*Wikipedia (en) 21-06-2011

Reconstruction, simulation, anastylosis

reconstructi



ucting again; [...]

rtual reality enables heritage sites to be recreated extremely accurately, so that the recreations can be published in various media. This technology can be used to develop virtual replicas of ca environment, old towns, monuments, sculptures and arc ments.

3D reconstruction -

***[...] Construction of a three-dimensional model of an object **from** al views of it.; [...]

Reconstruction, technological processes, and sources

A reconstruction means re-constructing an object FROM some clues on how it was like

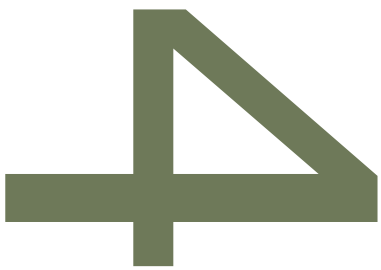
Whatever technology, whatever virtuality, the "from" indication is a key to the understanding of the resulting reconstruction

*http://www.dictionary.net/reconstruction 21-06-2011

**Pimentel, K., & Teixeira, K.

***http://www.everythingbio.com 21-06-2011

Knowledge modelling in heritage architecture :: **open challenges**



Some recurrent methodology or technology related bottlenecks:

Orphan instances,
concept/instance overlapping,
instance migration & reuse,
templates,
3D survey
granularity
time parameter
(and a number of others).

Orphan instances

Non reproducible objects (from the point of view of geometry)

Semi circular arch concept has feature "radius"

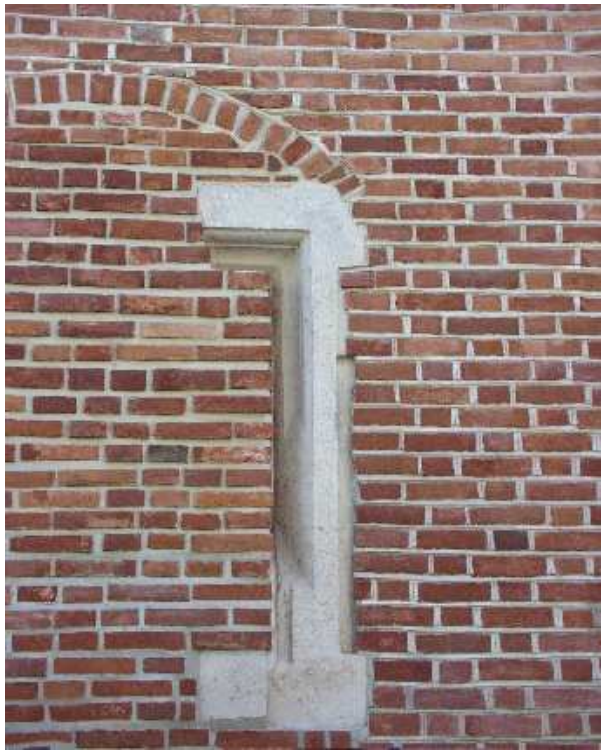
But what about a statue

Instances without a concept?

Concepts without instances?

From a more general point of view, instances of a "meta" concept where geometry is not a feature of the concept

concept/instance overlapping



The classic "filled opening" problem

Is this an opening?

If yes, why?

Because of degradations or reuse instances may cease to overlap the definition of their related concept

Inconsistent reuses

If reused in an inconsistent manner, does an element remain instance of the original concept ?

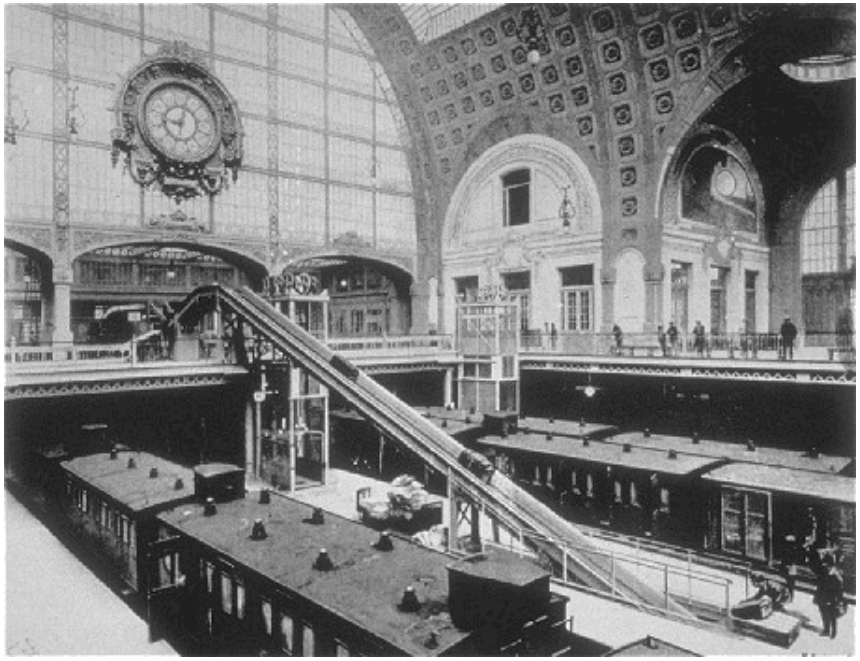
Because of inconsistent reuses instances may here again cease to overlap the definition of their related concept and better match another concept

Versioning, multi-identity

[what has this artefact turned into?]

Does a reuse mean two independent lives? If so to which of these lives should I attach on archaeological findings I do on the latter, but about the former?

Distributing data across varying identities



http://www.musee-orsay.fr/
http://www.insecula.com/musee

templates

Copies of instances

[Which is which?]

Eiffel tower, acts as concept in Las Vegas?

But the Eiffel tower is an instance, does it act as a sister instance?

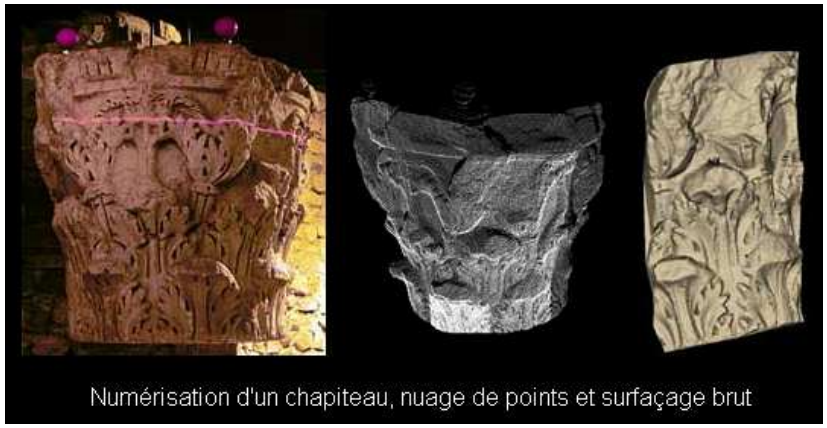
In heritage architecture, distinguishing the original from the copies is meaningful.

A relation of template to substitute to concept/instances relations.

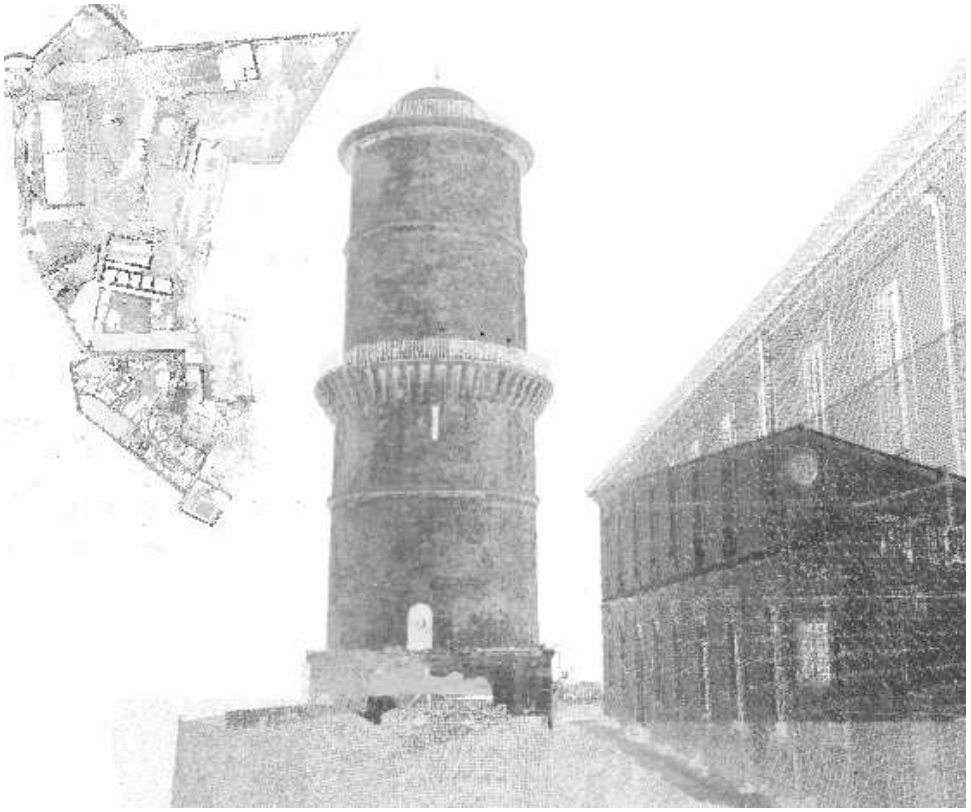
Inconsistency between outputs of surveying platforms and needs of knowledge modelling

(too much, too few, never just enough)

3D survey



Numérisation d'un chapiteau, nuage de points et surfaçage brut



Inconsistency between outputs of surveying platforms and needs of knowledge modelling

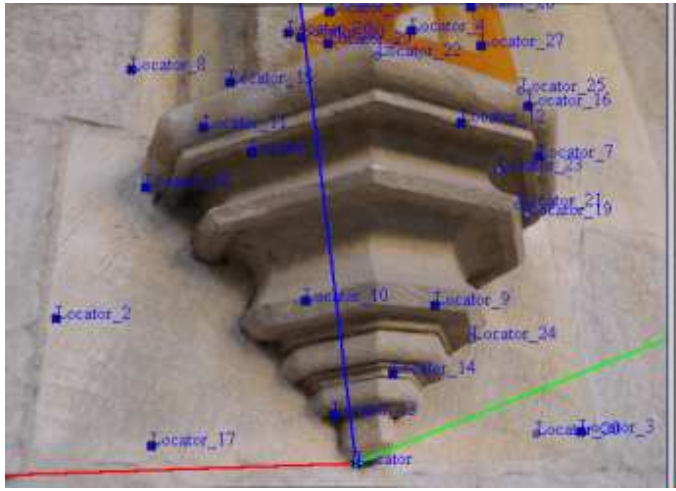
(too much)

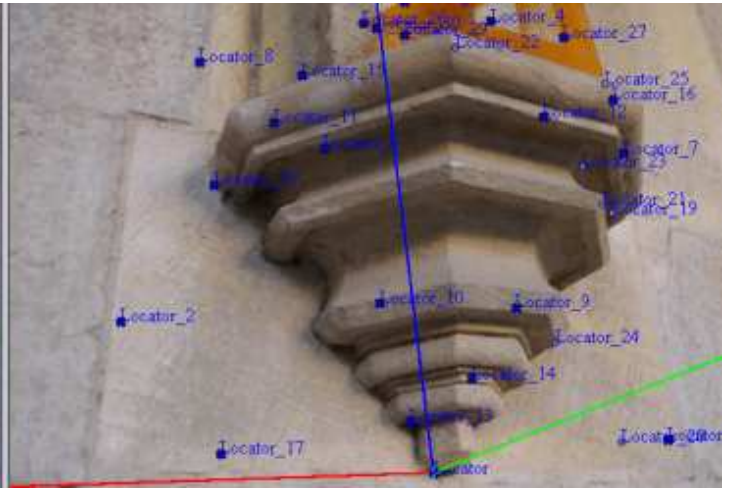
Global captures : huge quantities of 3D points, no easy method to discriminate among them

Inconsistency between outputs of surveying platforms and needs of knowledge modelling

(too few)

Selective capture: a limited number of points, user-selected





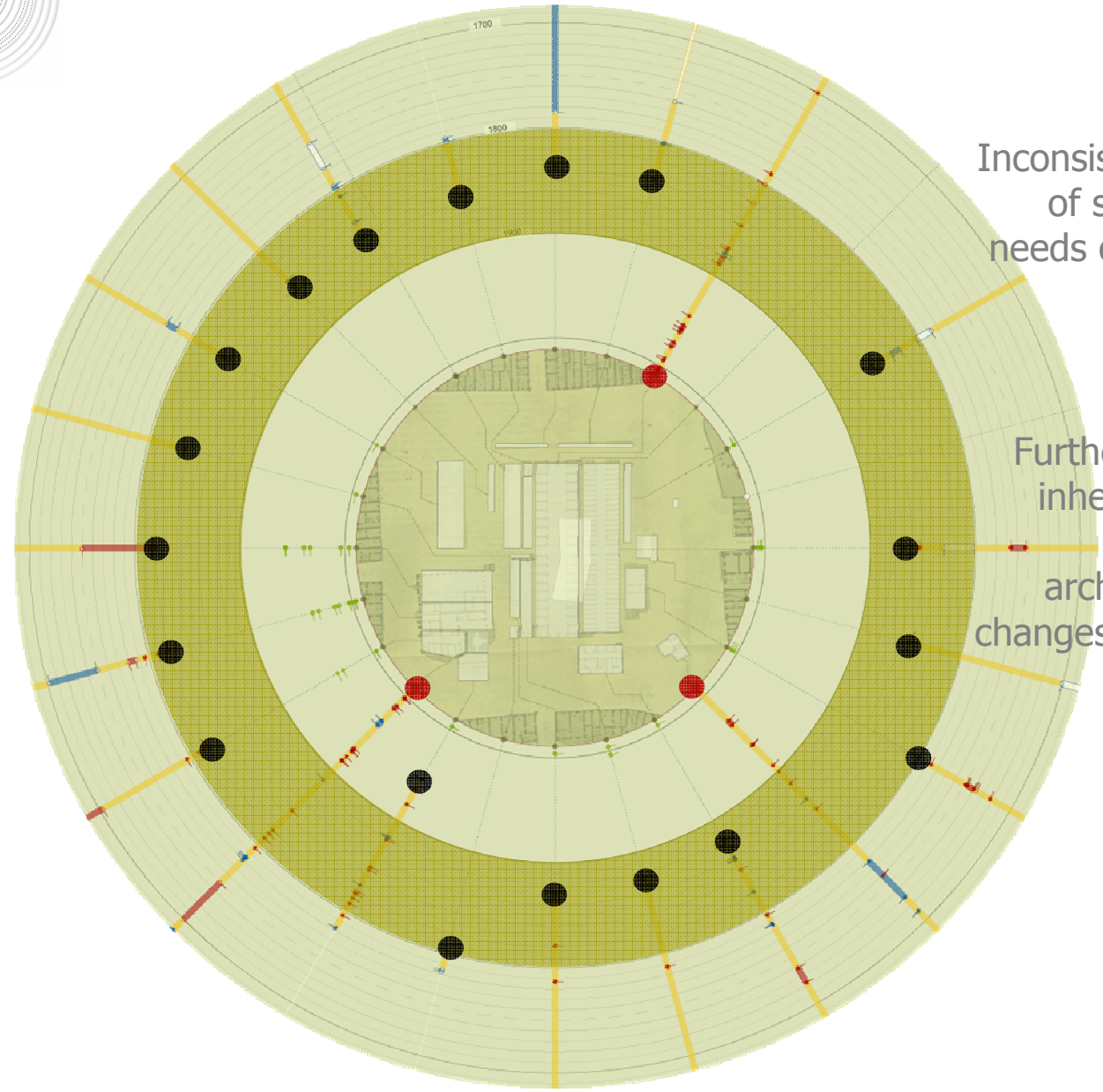
3D survey

Inconsistency between outputs of surveying platforms and needs of knowledge modelling

(never just enough)

Furthermore, there are limits inherent to a contemporary observation of heritage architecture (degradations, changes, artefacts demolished)

3D survey

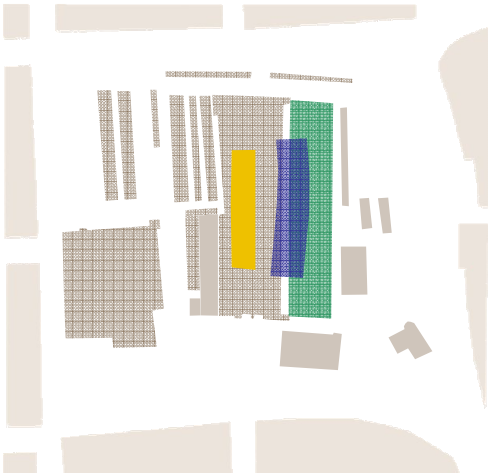


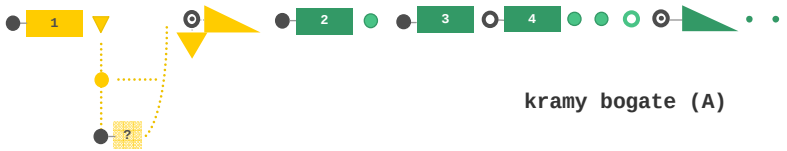
Inconsistency between outputs of surveying platforms and needs of knowledge modelling

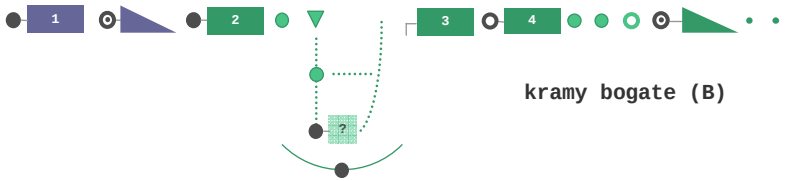
Furthermore, there are limits inherent to a contemporary observation of heritage architecture (degradations, changes, artefacts demolished)

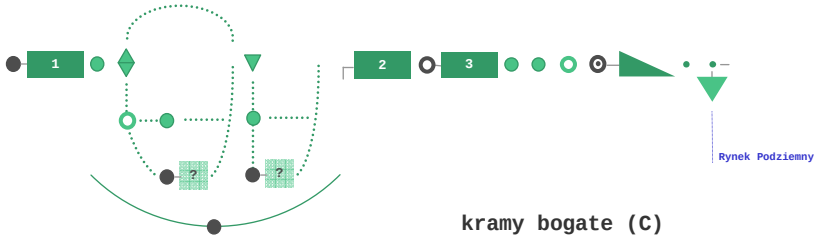
Multiple hypothesis

Finally, some methodological problems
In heritage architecture, the researcher's objective is not to end up with one explanation, but with as many as needed.



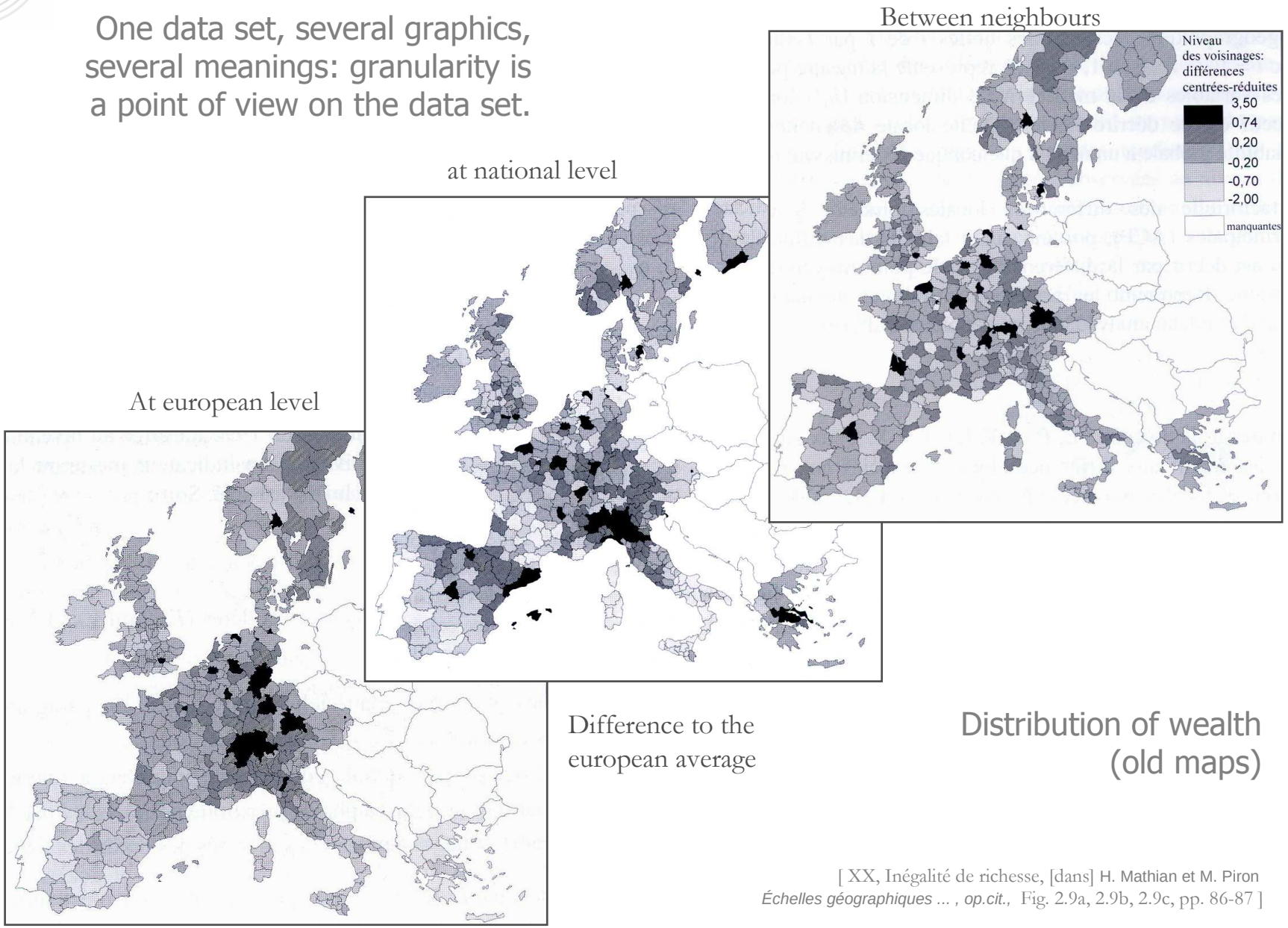






Granularity

One data set, several graphics, several meanings: granularity is a point of view on the data set.



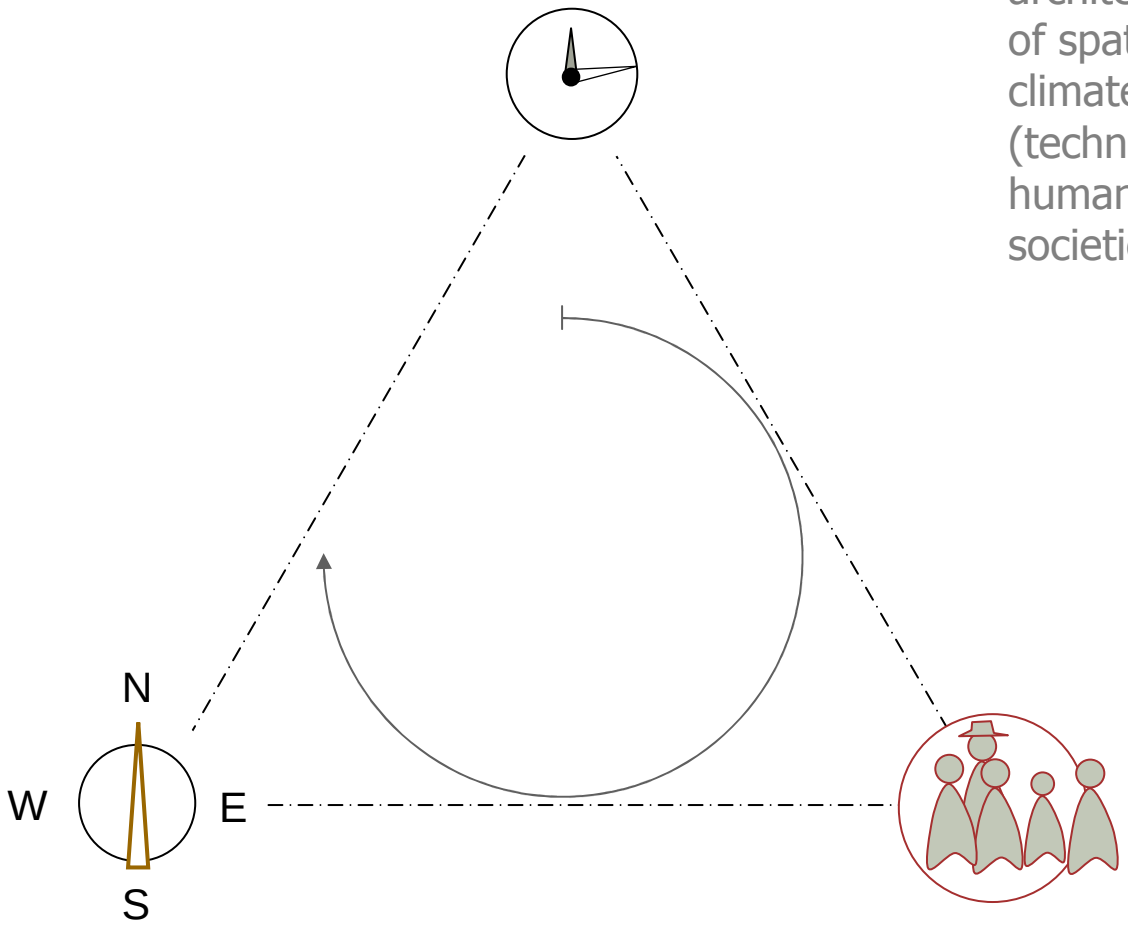
Difference to the european average

Distribution of wealth (old maps)

[XX, Inégalité de richesse, [dans] H. Mathian et M. Piron *Échelles géographiques ... , op.cit.,* Fig. 2.9a, 2.9b, 2.9c, pp. 86-87]

time parameter

Models , Parameters
[dating, cycles, intensities]

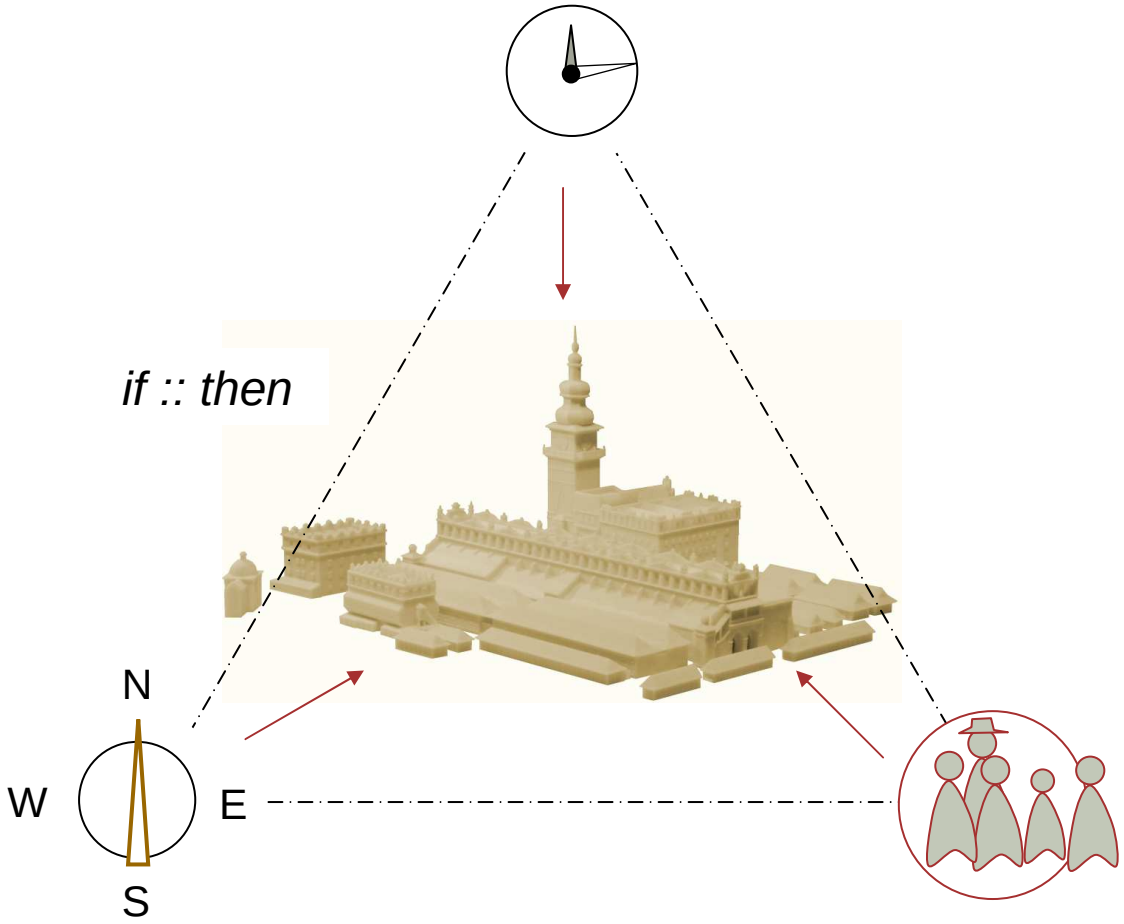


Creation and transformations of architecture at the intersection of spatial constraints (slope , climate), of a time in history (techniques available), and of human factors (organisation of societies / individuals).

Models , Parameters
[Localisation, scale, etc.]

Models , Parameters
[Organisation, culture, language, etc.

Models , Parameters
[dating, cycles, intensities]



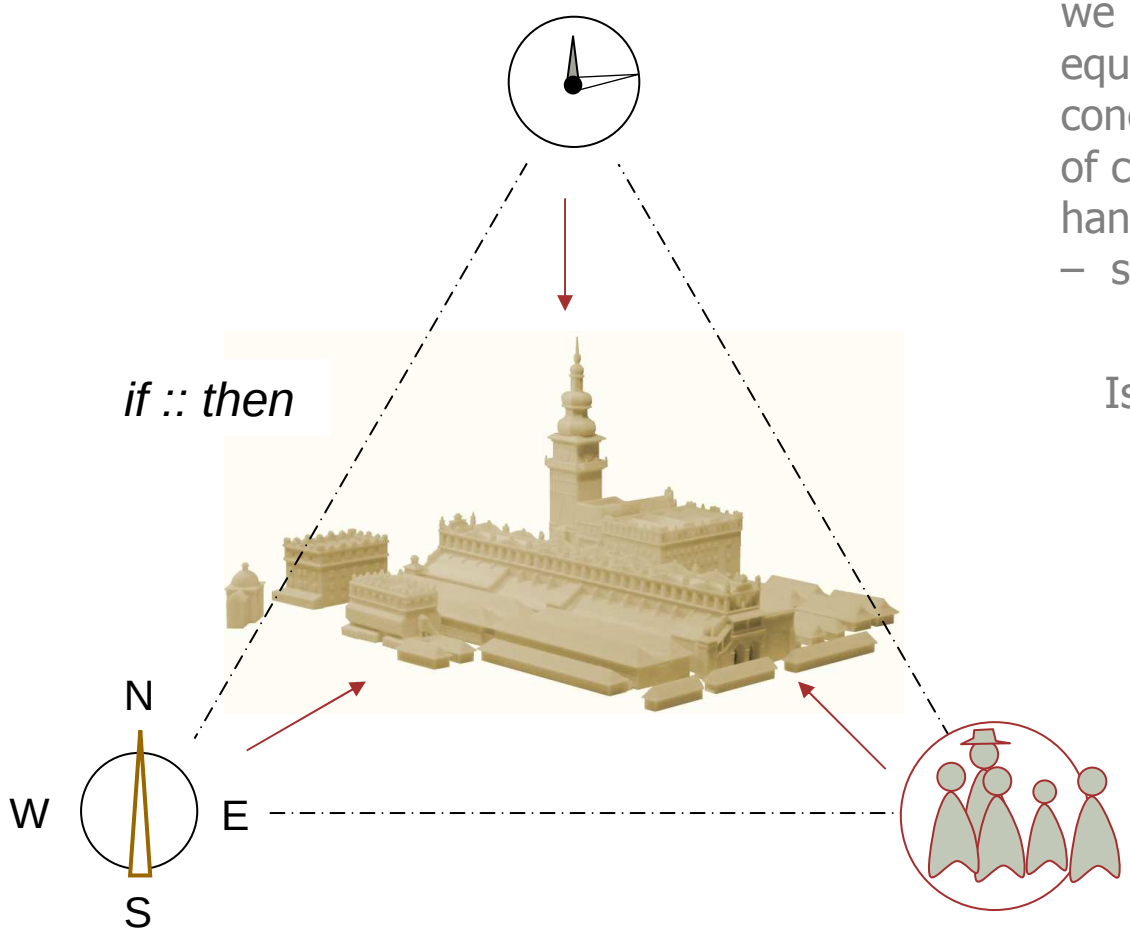
Correlating the apexes

“ Shape S appears at time T because of a social event E ”

Models , Parameters
[Localisation, scale, etc.]

Models , Parameters
[Organisation, culture, language, etc.]

Models , Parameters
[dating, cycles, intensities]



Models , Parameters
[Localisation, scale, etc.]

Models , Parameters
[Organisation, culture, language, etc.]

To perform such reasoning, we need to be equally equipped (in terms of conceptual models, in terms of computer solutions) to handle each of the three apex – space, time, societies.

Is is so?

The time parameter, in particular, remains ill-formalised.

Key points

wledge modelling is a **classification effort** (*Identifying facts, significant elements putting them in relation).*

t duplicating reality, but interpreting reality with regards o understanding needs, **reducing** it to a set of features corresponding to a point of view.

dels are created in order to **perform reasoning tasks**.

When analysing historic architecture we face **imperfect ledge**, and try to **distribute clues in time and space** in order to portray the lifeline of artefacts.

Reasoning on historic architecture benefits from **cross-examination** and **collection reading**.

Baltazar Behem "Codex Picturalis Baltasaris Behem« 1501-1506

Methodology or technology related bottlenecks:
Orphan instances, concept/instance overlapping, instance migration & reuse, templates,
3D survey (and a number of others).

Thank you
(as well as the organisers)

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Szkolenie współfinansowane ze środków Unii Europejskiej
w ramach Europejskiego Funduszu Społecznego.

Politechnika XXI wieku
Program rozwojowy Politechniki Krakowskiej
najwyższej jakości dydaktyka dla przyszłych polskich inżynierów

http://www.pk21.pk.edu.pl

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NARODOWA STRATEGIA SPÓJNOŚCI

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