Informative modelling: from architectural modelling to Infovis

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

Informative modelling: from architectural modelling to Infovis

An illustrated introduction to concepts and legacies of Infovis, benefits in heritage architecture analysis.

Terminology, concepts & methods

(brief) historic background

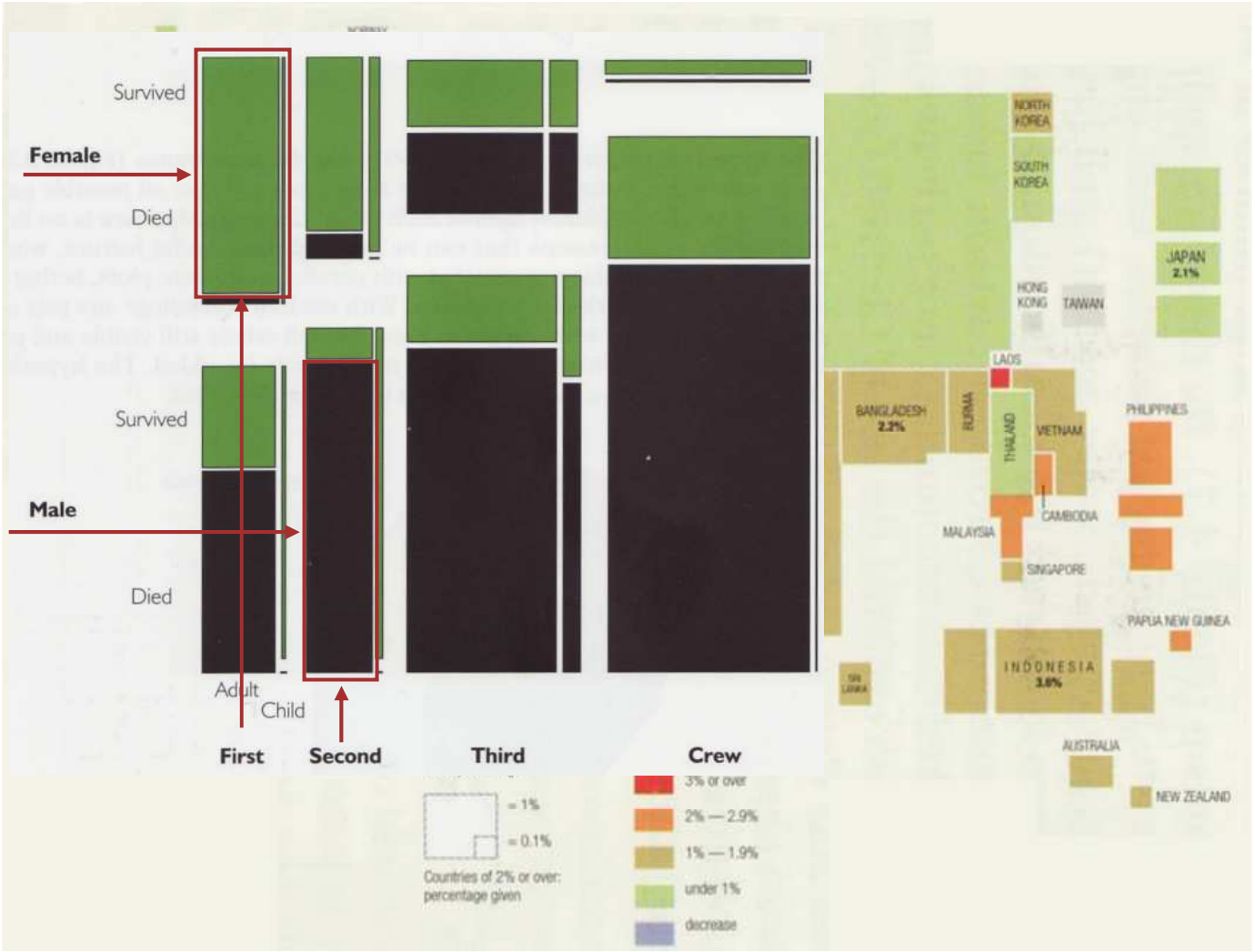
Benefits of Infovis (in heritage architecture analysis)

The Informative modelling paradigm

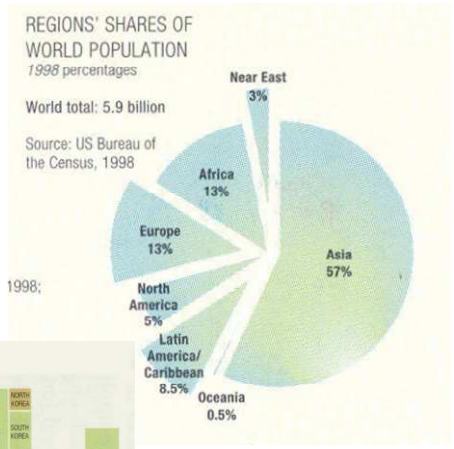
Mini-workshop

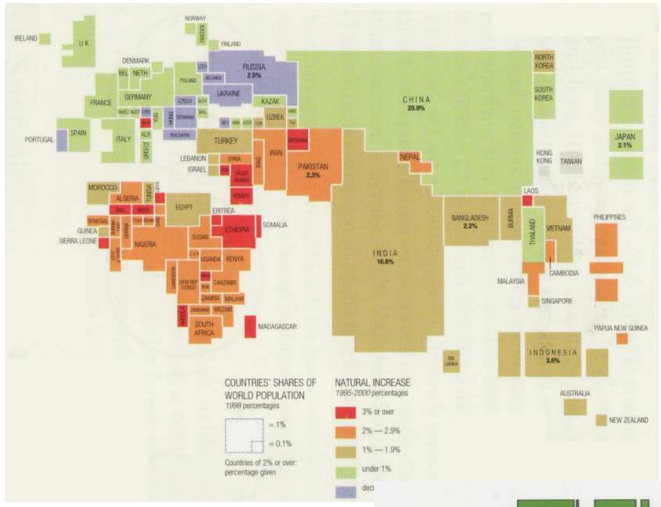
Analysis of a morpho-typology
through visual means.
Illustrated comments on precedents and method.

Which is which?



R.Spence Information Visualization
Addison Wesley 2001





?

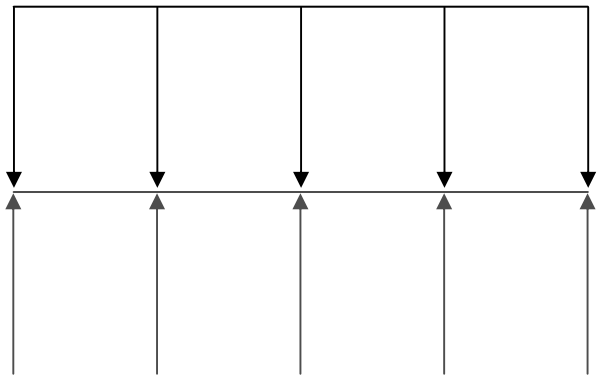
scientific visualisation,

Infovis
(Information Visualisation)

knowledge visualisation

Visual analytics,

Graphic Representation



Identify families of practices

(Graphic) Representation
Visualisation

Infovis
(Information Visualisation)

Scientific visualisation,

Knowledge visualisation

Visual analytics,

Methods, concepts, and examples

Formalisms, metaphors, models, integration, and some graphic design principles

(graphic) Representation

A description of a thing or person (mental or concrete)

* Graphic representation is one of the systems of signs that man has built in order to retain, understand and communicate observations that are necessary to him […]
[…] It constitutes the rational part of images.

J.Bertin Semiology of graphics : diagrams, networks, maps , Ann Arbor, Mich. : UMI, 2007.

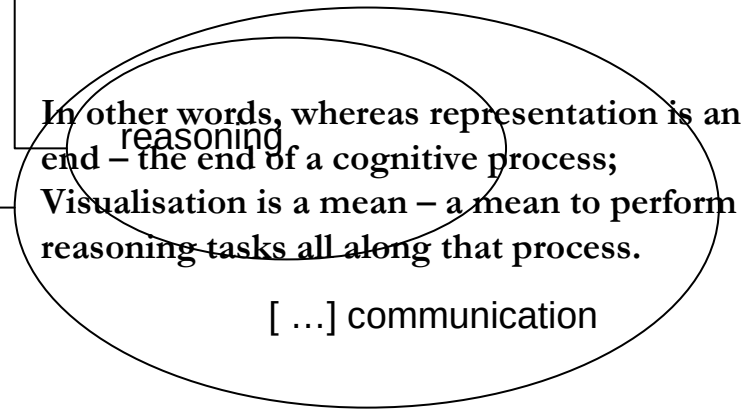
(graphic) Representation

A description of a thing or person (mental or concrete)

Visualisation

* Visualisation can be defined as the use of visual representations to aid in the analysis of quantitative or qualitative information.

** Visualisation […] is a cognitive activity

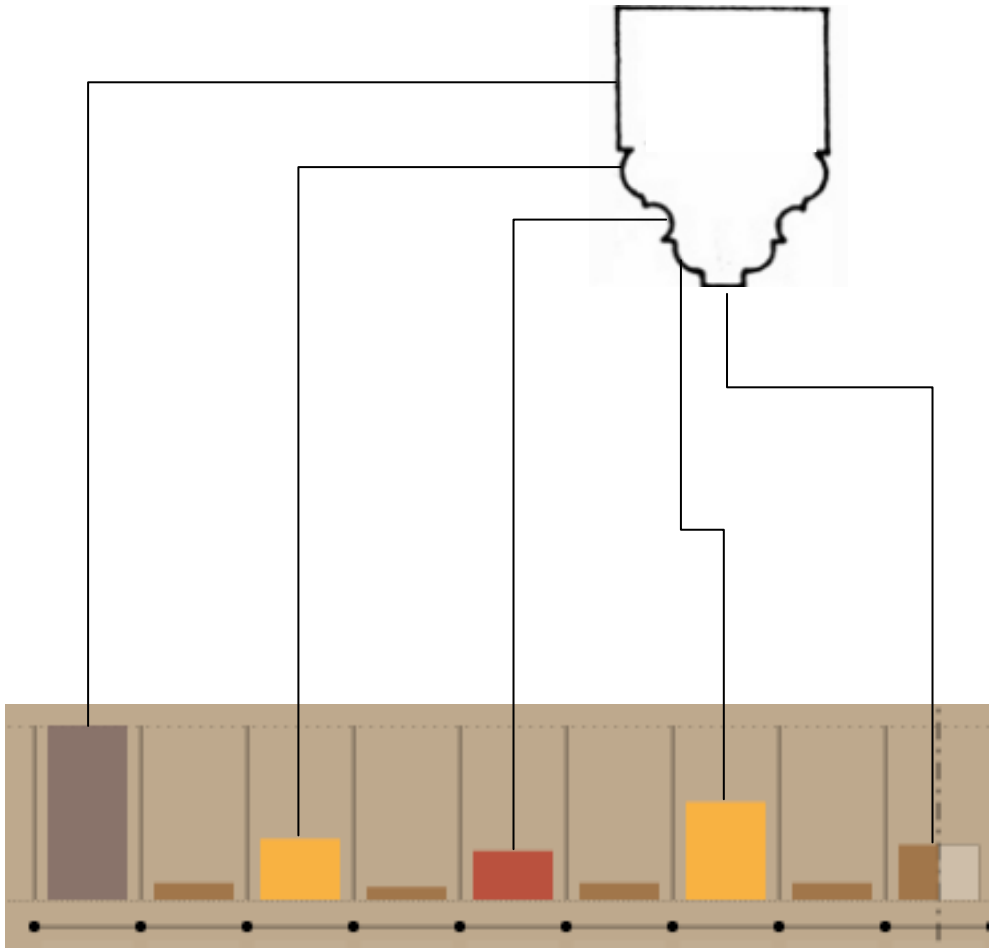


In other words, whereas representation is an end – the end of a cognitive process; Visualisation is a mean – a mean to perform reasoning tasks all along that process.

** W.Kienreich Information and knowledge visualisation: an oblique view,* MiaJournal vol0, 2006

*** R.Spence Information Visualization* Addison Wesley 2001

(graphic) Representation



Visualisation

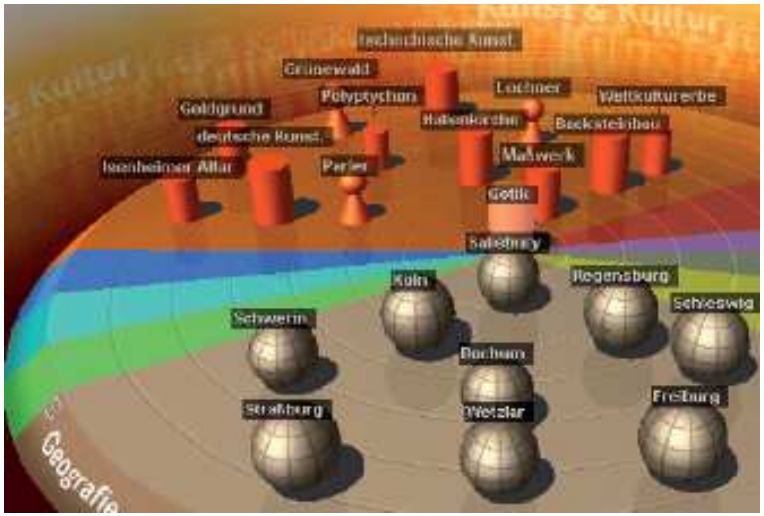
"Analysing architectural mouldings with 3Dobject-independant metrics and encoding" [in] Proceedings CGVCVIP ISBN 978-972-8939-22-9 pp201-209 (aut.)

Information Visualisation (Infovis)

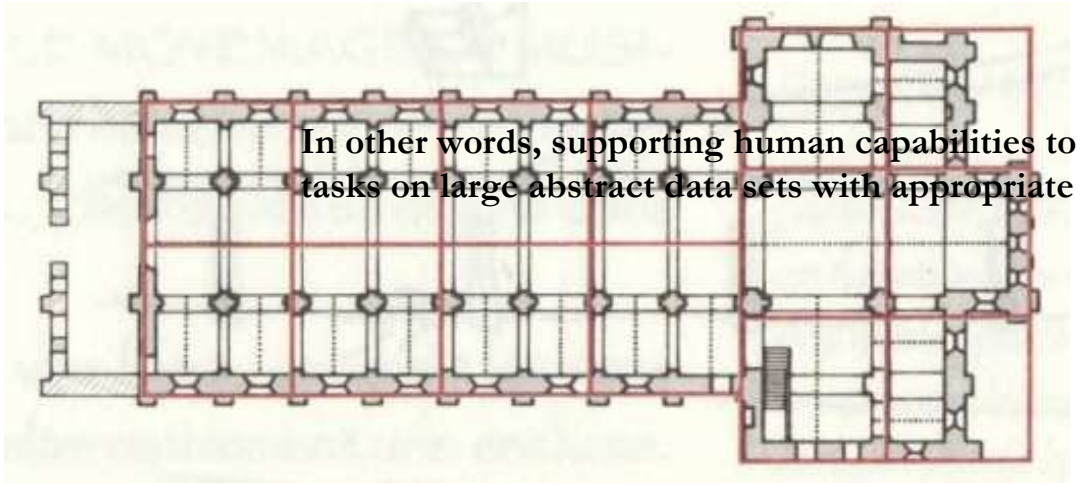
* Information Visualisation is commonly defined as the use of computer-supported, interactive, visual representations of abstract data to amplify cognition.

* Information Visualisation is distinguished by […] :
-abstract information
- information seeking […]
-large, complex information spaces

** W.Kienreich Information and knowledge visualisation: an oblique view,*
MiaJournal vol0, 2006



* Information Visualisation is distinguished by […] :
-abstract information
- information seeking […]
-large, complex information spaces



In other words, supporting human capabilities to perform reasoning tasks on large abstract data sets with appropriate graphics.

** W.Kienreich Information and knowledge visualisation: an oblique view,* MiaJournal vol0, 2006

[Visualisation of Encyclopaedia knowledge spaces, W.Kienreich, op.cit.]

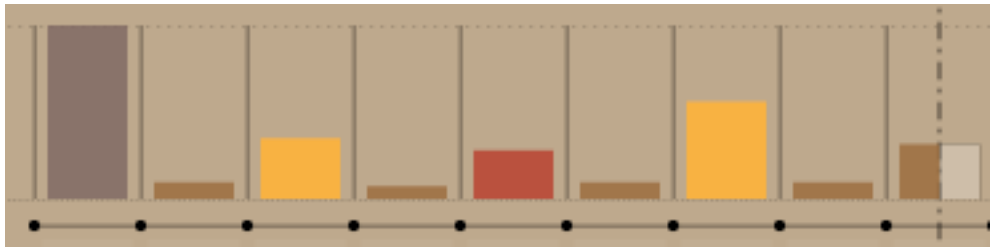
Scientific Visualisation

* A related, and somewhat overlapping field

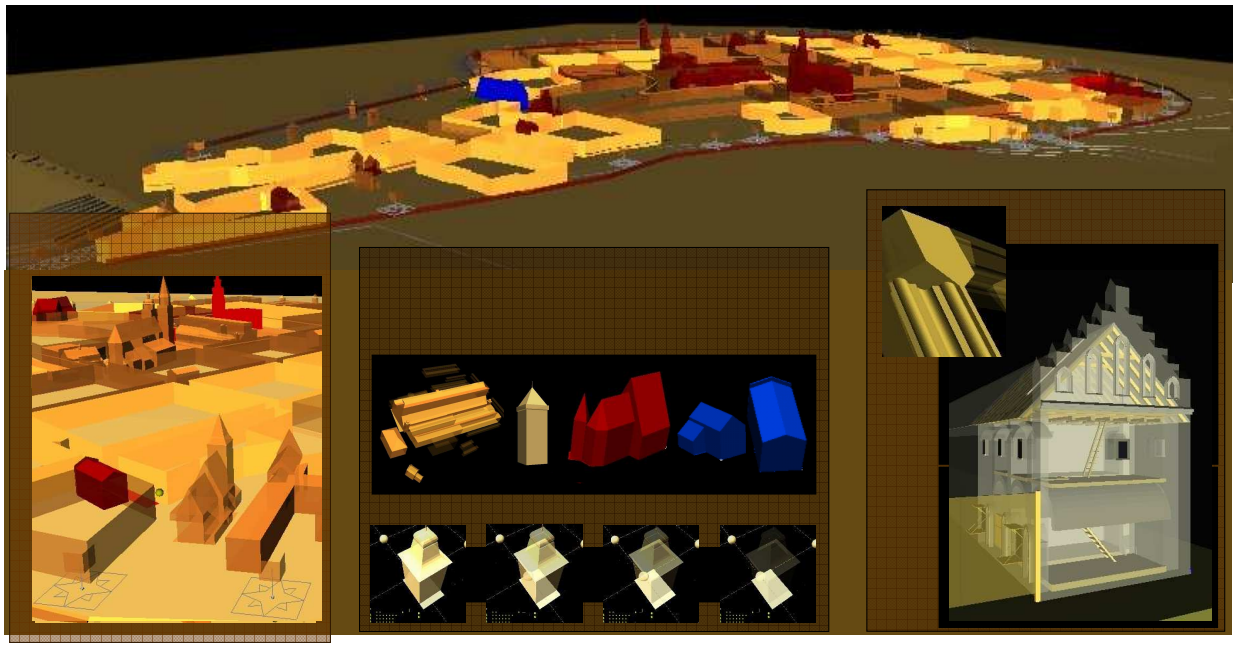
* In scientific visualisation […] what is primarily seen relates to, and represents visually a physical "thing" […].

* *R.Spence Information Visualization*
Addison Wesley 2001

Scientific visualisation or not?



* In scientific visualisation […] what is primarily seen relates to, and represents visually a physical "thing" […].



"Analysing architectural mouldings with 3Dobject-independant metrics and encoding" [in] Proceedings CGVCVIP ISBN 978-972-8939-22-9 pp201-209 (aut.)

«From artefact representation to information visualisation: genesis of informative modelling» (aut) Proceedings of 8th Smart Graphics International Conference, pp 230-236 Springer, LNCS (2005) ISBN 978-3-540-28179-5

** R.Spence Information Visualization* Addison Wesley 2001

Knowledge Visualisation

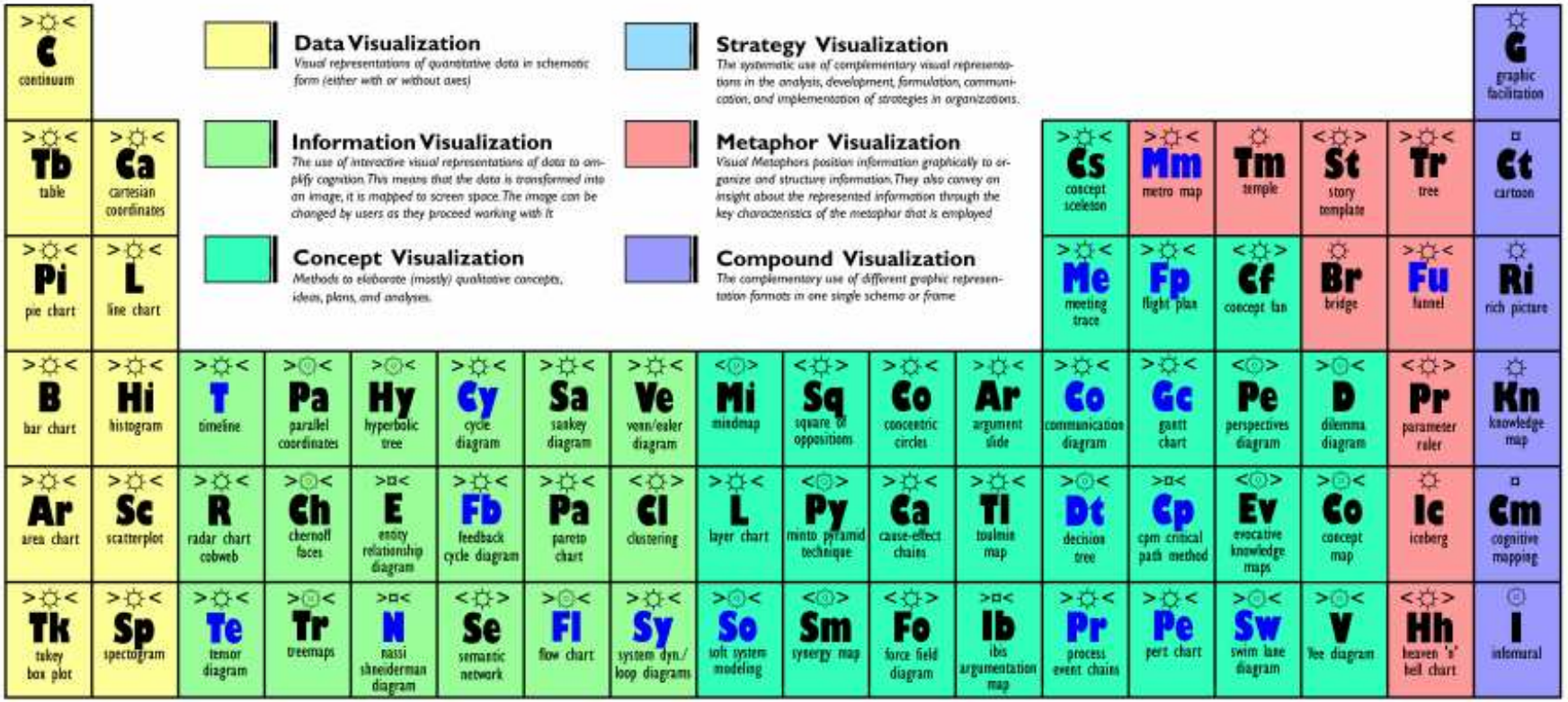
* […] focuses on the transfer of knowledge among persons.

* […] often works on smaller, but highly organized sets of information.

** W.Kienreich Information and knowledge visualisation: an oblique view,*
MiaJournal vol0, 2006

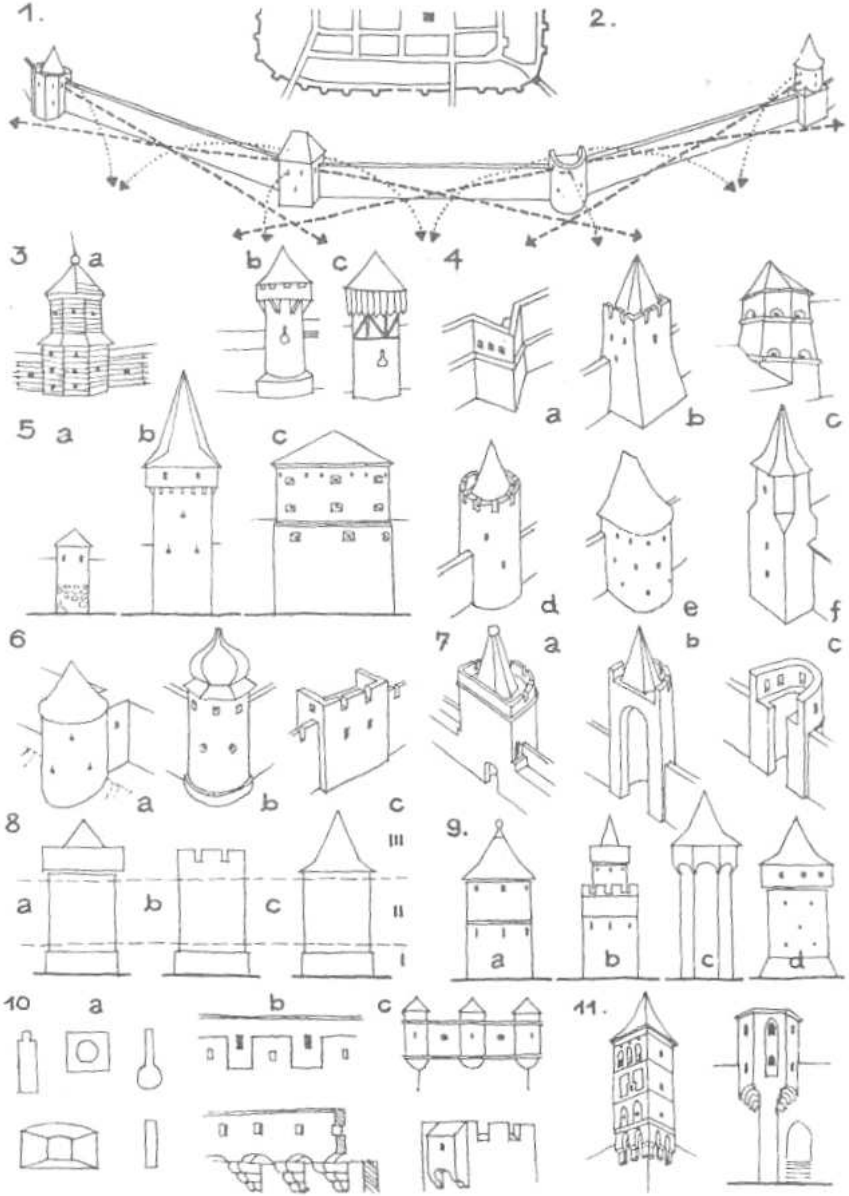
M.Eppler, http://www.visual-literacy.org/periodic_table/periodic_table.pdf

A PERIODIC TABLE OF VISUALIZATION METHODS

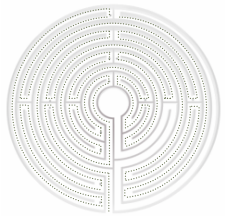


M.Eppler, http://www.visual-literacy.org/periodic_table/periodic_table.pdf

Knowledge visualisation or not?



J.Bogdanowski « Warownie i zielen twierdzy krakow » WLK 1979

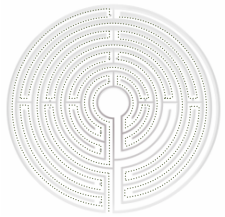


Visual analytics

* […] is an outgrowth of the fields of information visualization and scientific visualization, that focuses on analytical reasoning facilitated by interactive visual interfaces.

** Visual analytics has some overlapping goals and techniques with information visualization and scientific visualization. There is currently no clear consensus on the boundaries between these fields, but broadly speaking the three areas can be distinguished as follows:
- Scientific visualization deals with data that has a natural geometric structure.
- Information visualization handles abstract data.
- Visual analytics is especially concerned with sensemaking and reasoning.

** Pak Chung Wong and J. Thomas. "Visual Analytics".*
•IEEE Computer Graphics and Applications, Volume 24, Issue 5, 2004
** Wikipedia (en)



Visual analytics

> * […] is an outgrowth of the fields of information visualization and scientific visualization, that focuses on analytical reasoning facilitated by interactive visual interfaces.

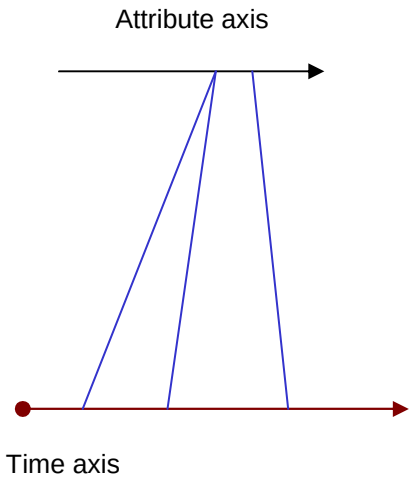
In other words:
For Infovis specialists– just a new word.

Otherwise whereas infovis is specifically targeted at abstract data, visual analytics is more generally targeted at reasoning tasks; through visual means.

** Pak Chung Wong and J. Thomas. "Visual Analytics".*
•IEEE Computer Graphics and Applications, Volume 24, Issue 5, 2004
** Wikipedia (en)

Visual analytics

* […] is an outgrowth of the fields of information visualization and scientific visualization, that focuses on analytical reasoning facilitated by interactive visual interfaces.

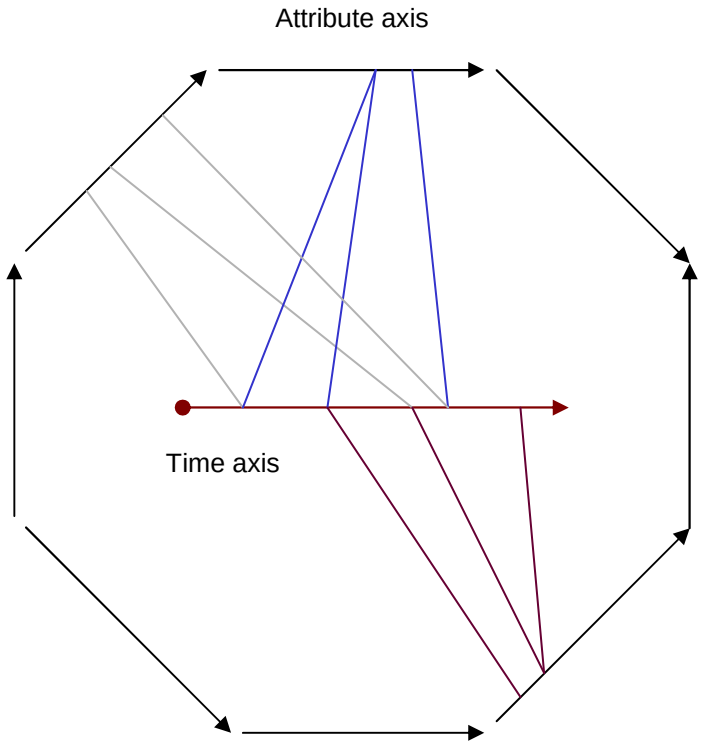


Time wheel

• Visual methods for analysing time-oriented data*
•W.Aigner, S.Miksch, W.Müller, H.Schumann, C.Tominski
•Transactions on visualization and computer graphics vol 14

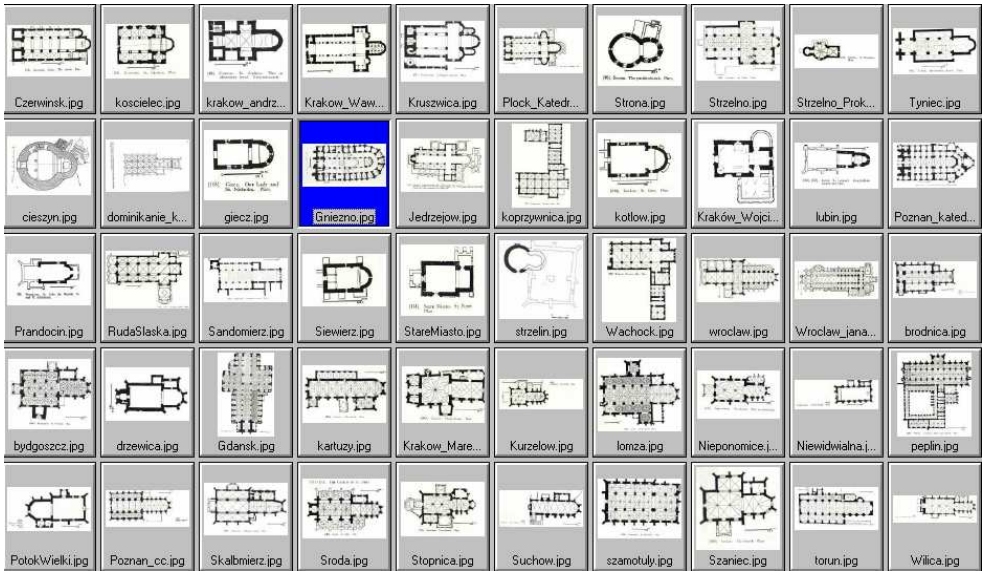
Visual analytics

* […] is an outgrowth of the fields of information visualization and scientific visualization, that focuses on analytical reasoning facilitated by interactive visual interfaces.



Time wheel

• Visual methods for analysing time-oriented data*
•W.Aigner, S.Miksch, W.Müller, H.Schumann, C.Tominski
•Transactions on visualization and computer graphics vol 14



An application to Dmochowski's classification

•Z.Dmochowski, "The architecture of Poland – an historical survey" published by The Polish research centre, London, 1956;

10 groups (stylistic affiliations)

Romanesque ecclesiastical architecture

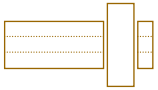
Group 2: basilican churches with transept

Group 3: basilican churches without transept

Group 4: single cell circular churches

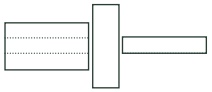
Group 5: single cell rectangular cell

Group 6: Cistercian churches and monasteries



Gothic ecclesiastical architecture

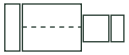
Group 9: early churches of the mendicant /preaching orders



Group 10: basilican churches

Group 11: Three nave hall churches

Group 12: Double-nave hall churches



Group 13: Single-nave hall churches

8 parameters

style : gothic

group : Double-nave hall churches

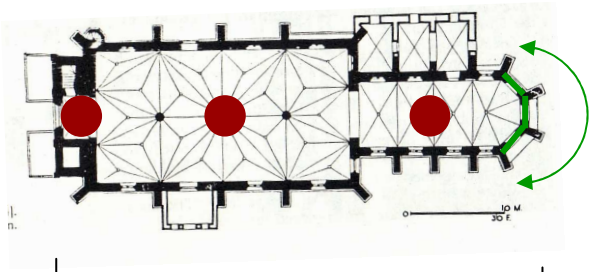
foundation : 1350

Max. length : 51,1 m

Volumes: 3

Apse: round

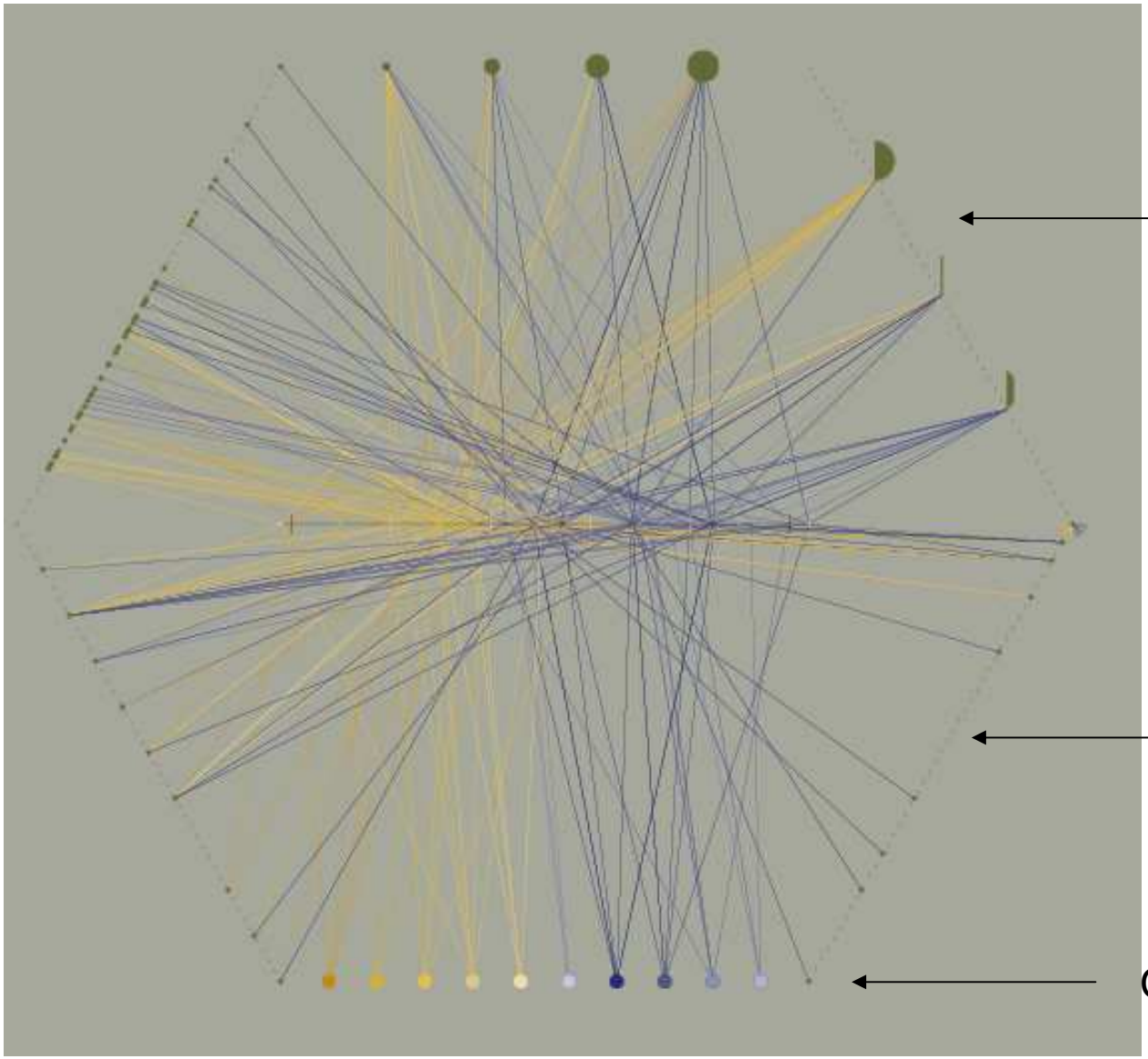
Number of chapels : 0



length (approx.)

- Style
- Group
- Foundation date
- Localisation (2D coordinates)
- Length
- Shape of the Apse
- Number of chapels
- Number of Interior volumes

A time wheel

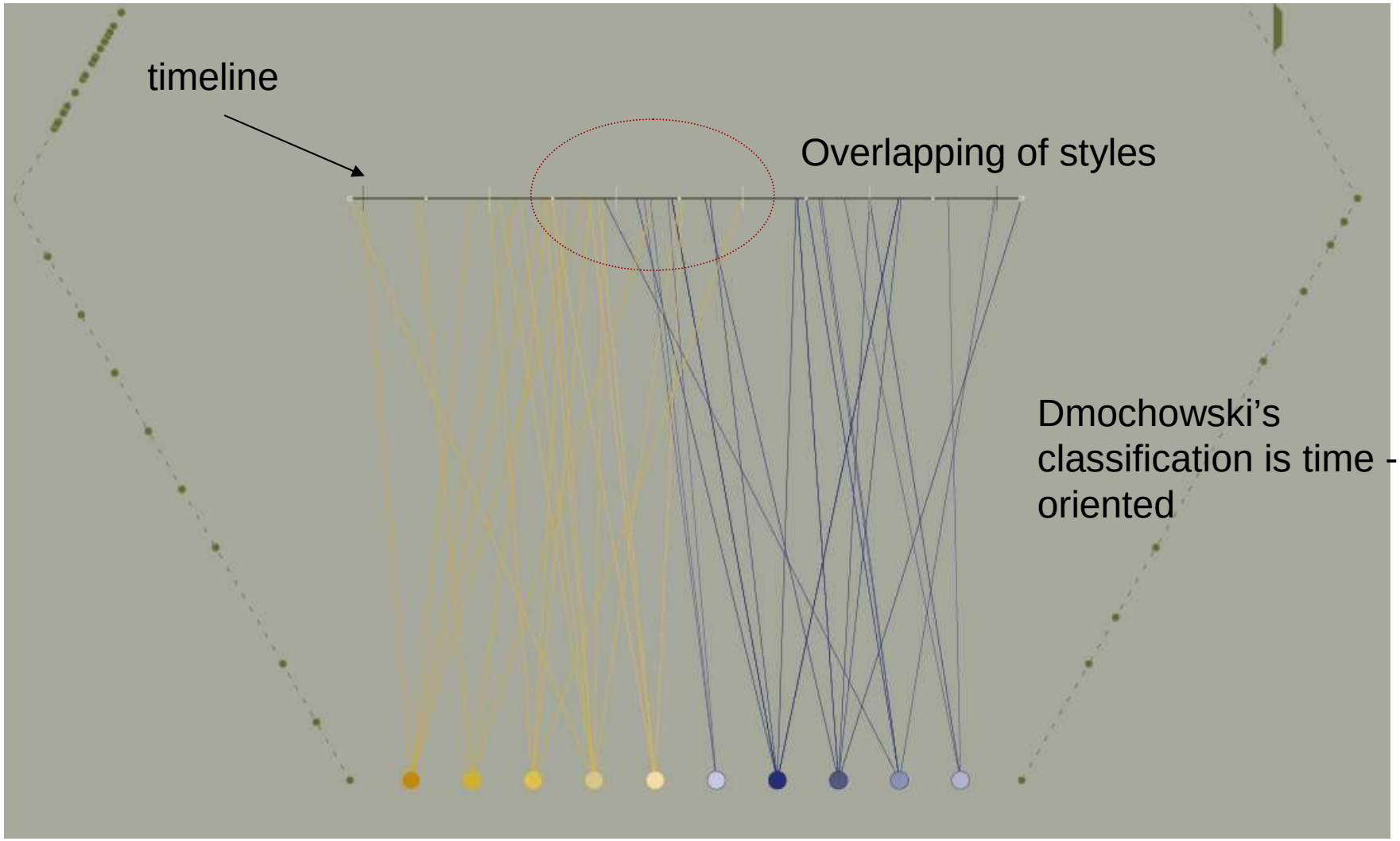


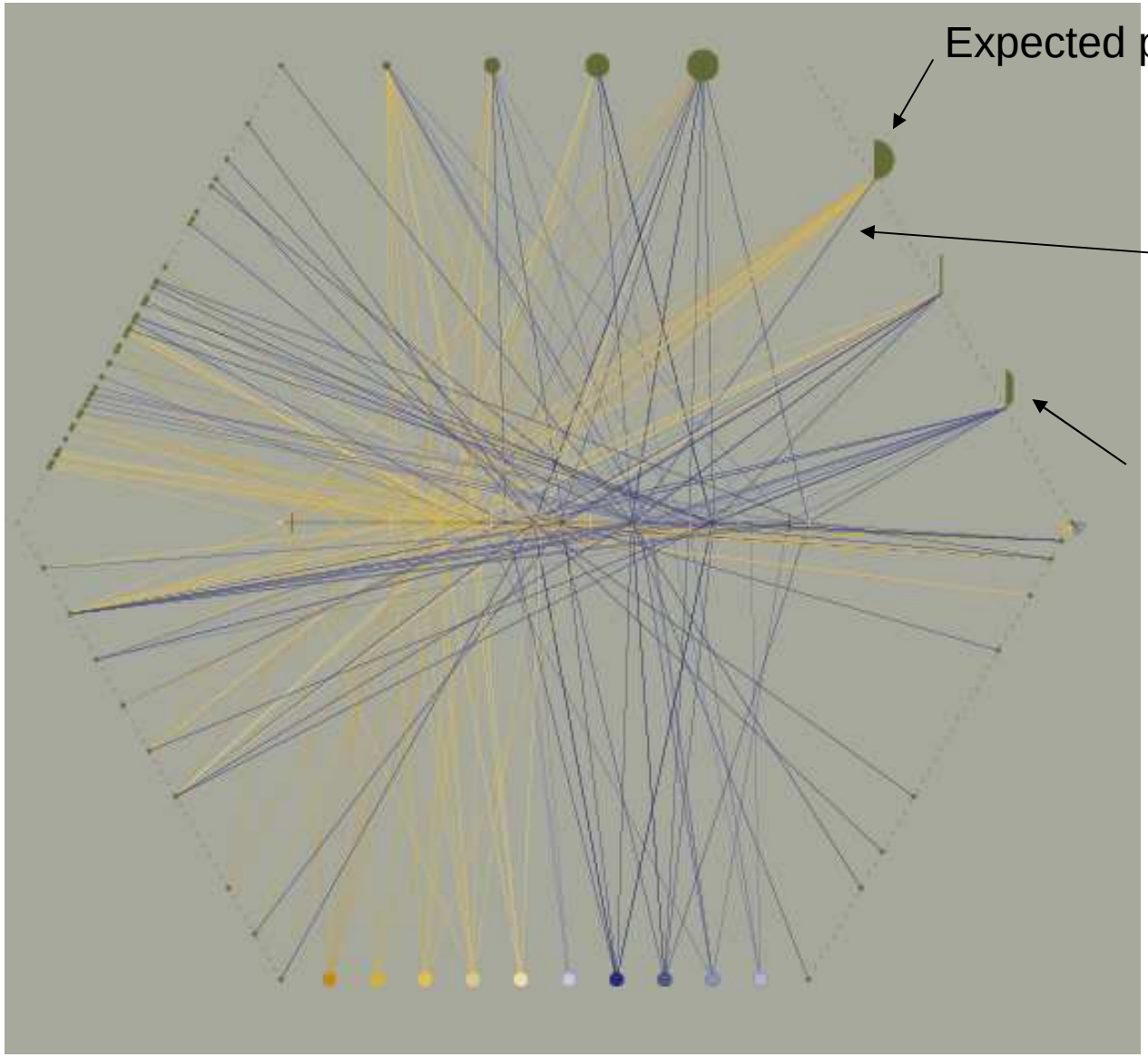
Shape of the apse

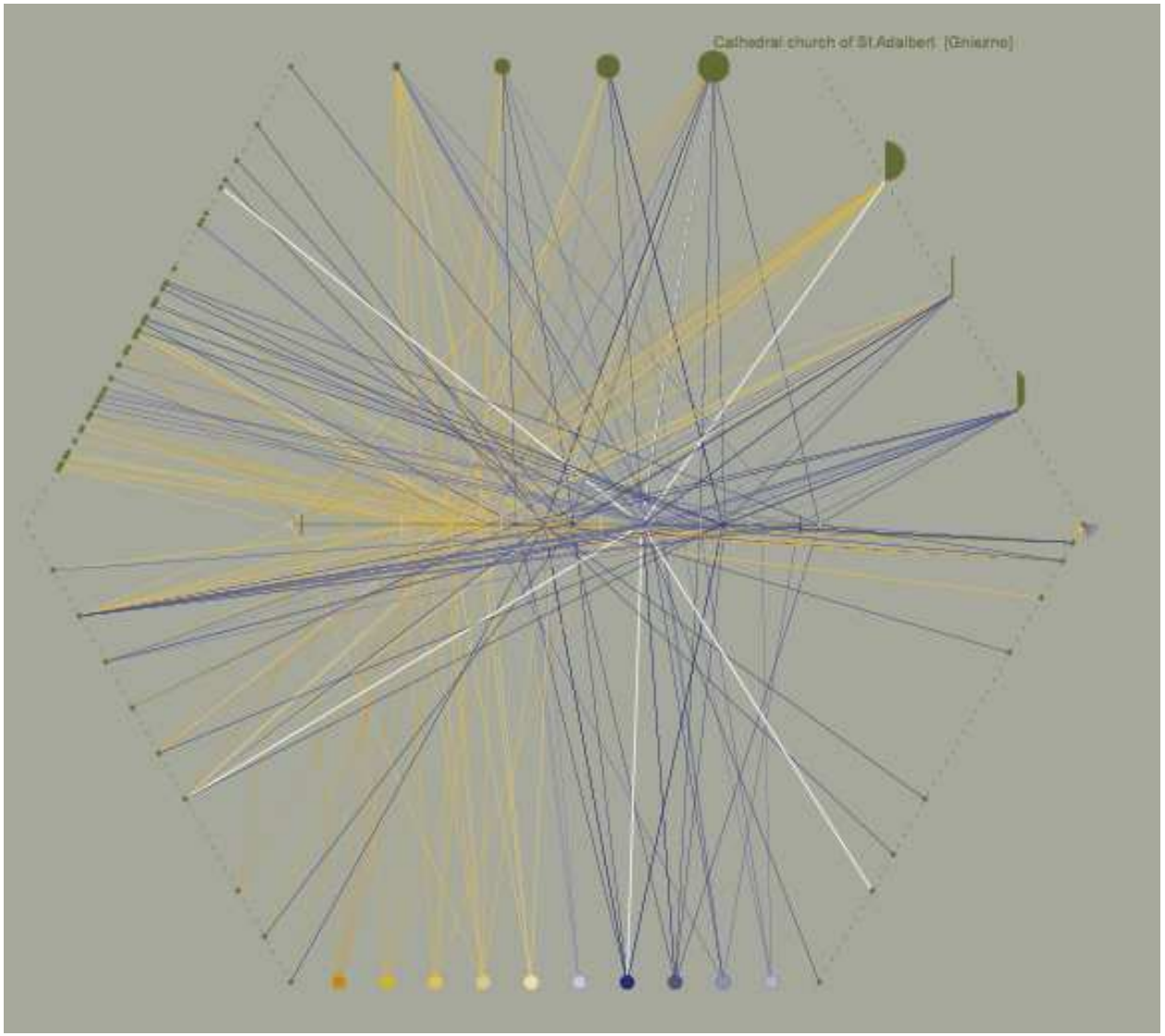
Number of chapels

Groups

8 parameters

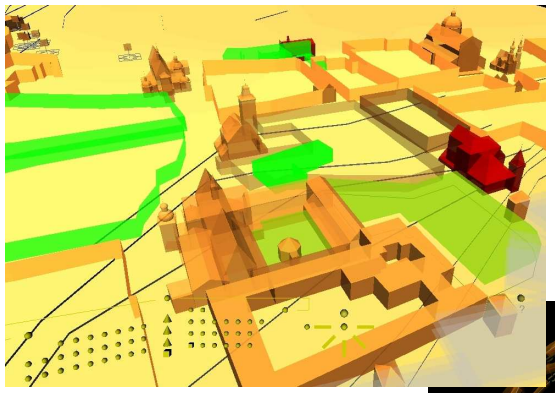


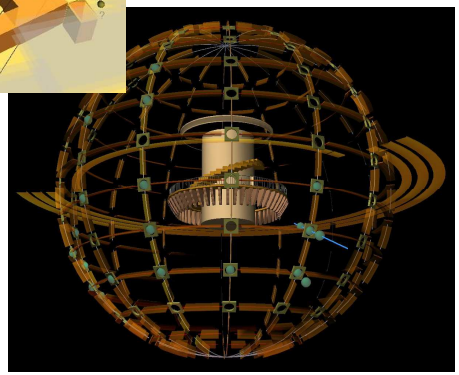

Expected pattern
Exception
Expected pattern

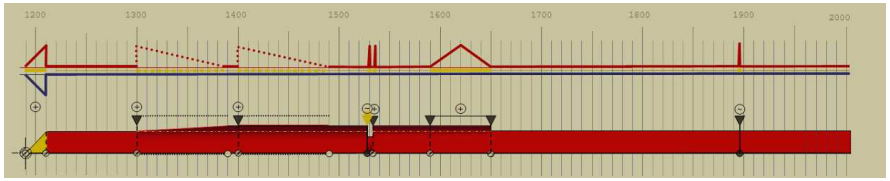


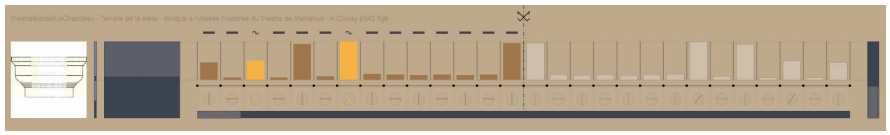
Exception

Exception









Needs in heritage architecture analysis

What are we concerned with?

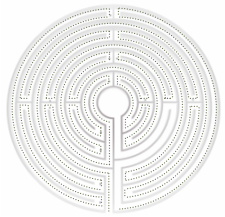
scientific visualisation,

Infovis
(Information Visualisation)

knowledge visualisation

Visual analytics,

Graphic Representation



Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

Visual formalisms

* […] diagrammatic visual representations displaying information in an abstract way.

Example?

Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

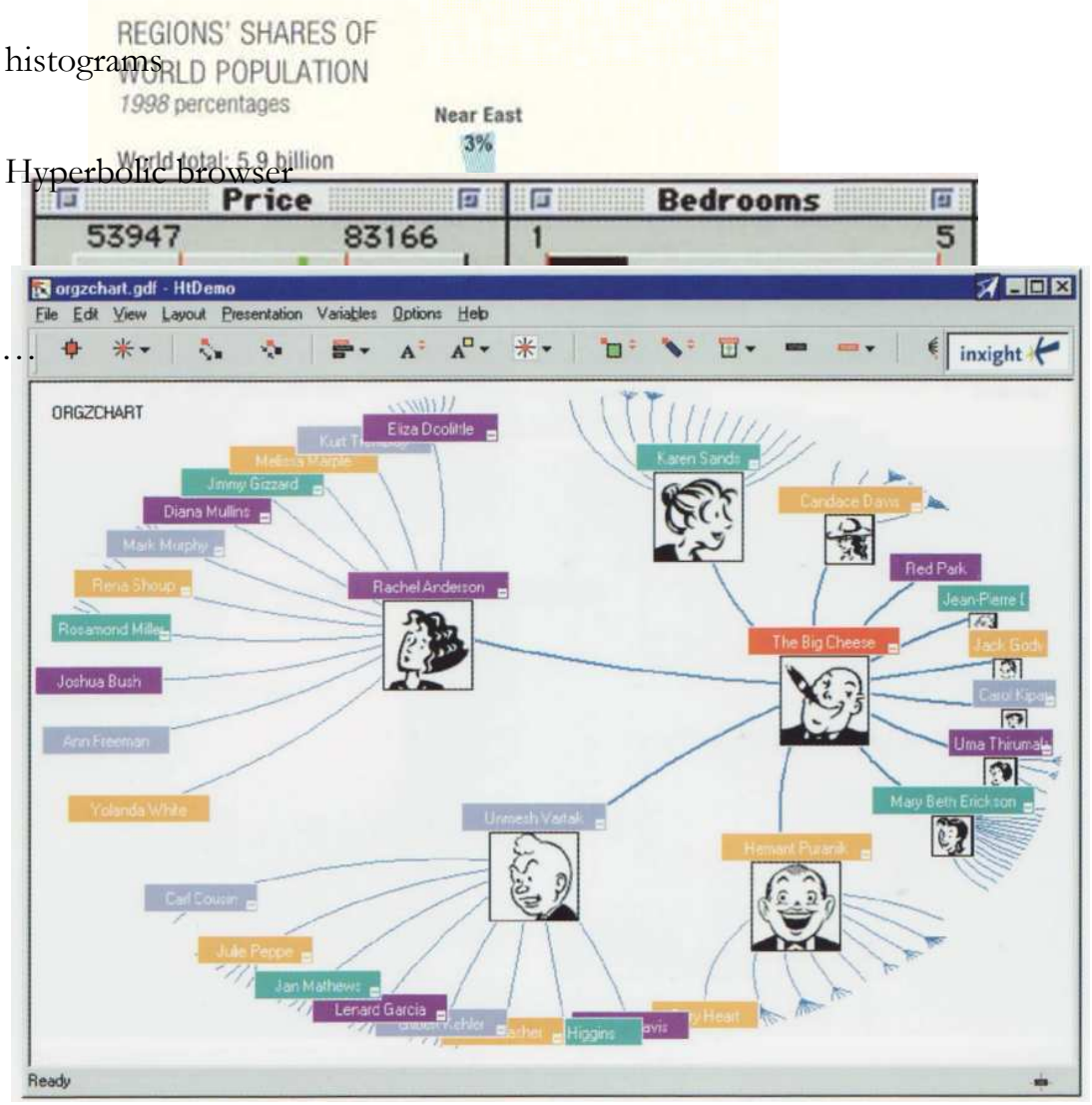
** W.Kienreich Information and knowledge visualisation: an oblique view,* MiaJournal vol0, 2006

pie charts

histograms

Hyperbolic browser

…



Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

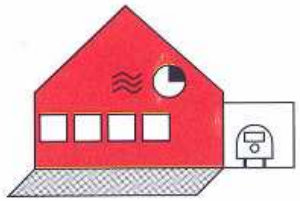
** R.Spence Information Visualization*
Addison Wesley 2001

Three fundamental units:

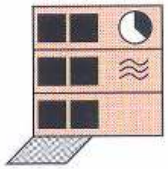
Visual formalisms,
Metaphors,
Models

From numerical data to ordinal/categorical data: symbolic encoding

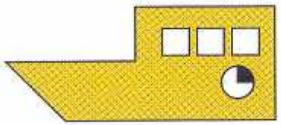
Multidimensional icons (multivariate data)



house
£400,000
garage
central heating
four bedrooms
good repair
large garden
Victoria 15 mins



Flat
£300,000
no garage
central heating
two bedrooms
poor repair
small garden
Victoria 20 mins



houseboat
£200,000
no garage
no central heating
three bedrooms
good repair
no garden
Victoria 15 mins

* *R.Spence Information Visualization*
Addison Wesley 2001

** R.Spence Information Visualization*
Addison Wesley 2001

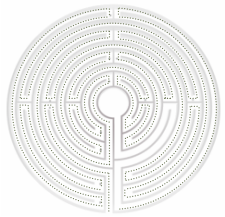
Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

** R.Spence Information Visualization*
Addison Wesley 2001



Metaphors

•[…] use a form of representation based on a real-world equivalent to display information. The semantics used by a visual metaphor are implicitly determined by the real-world equivalent.

Example?

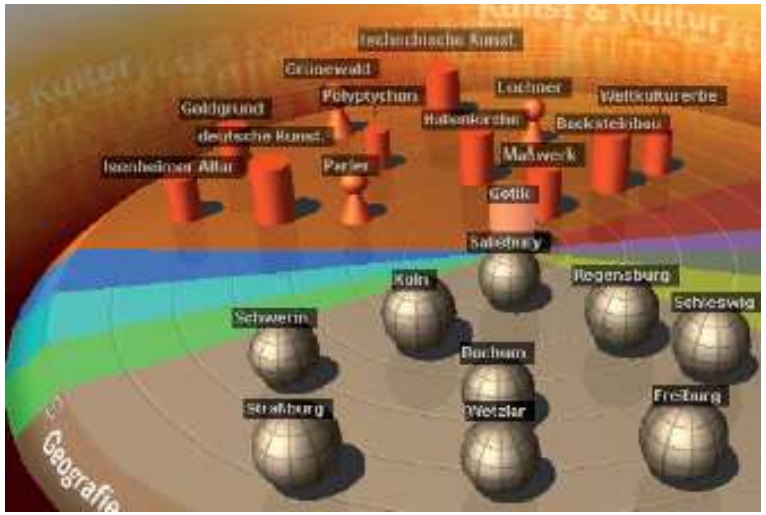
Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

** W.Kienreich Information and knowledge visualisation: an oblique view,*
MiaJournal vol0, 2006



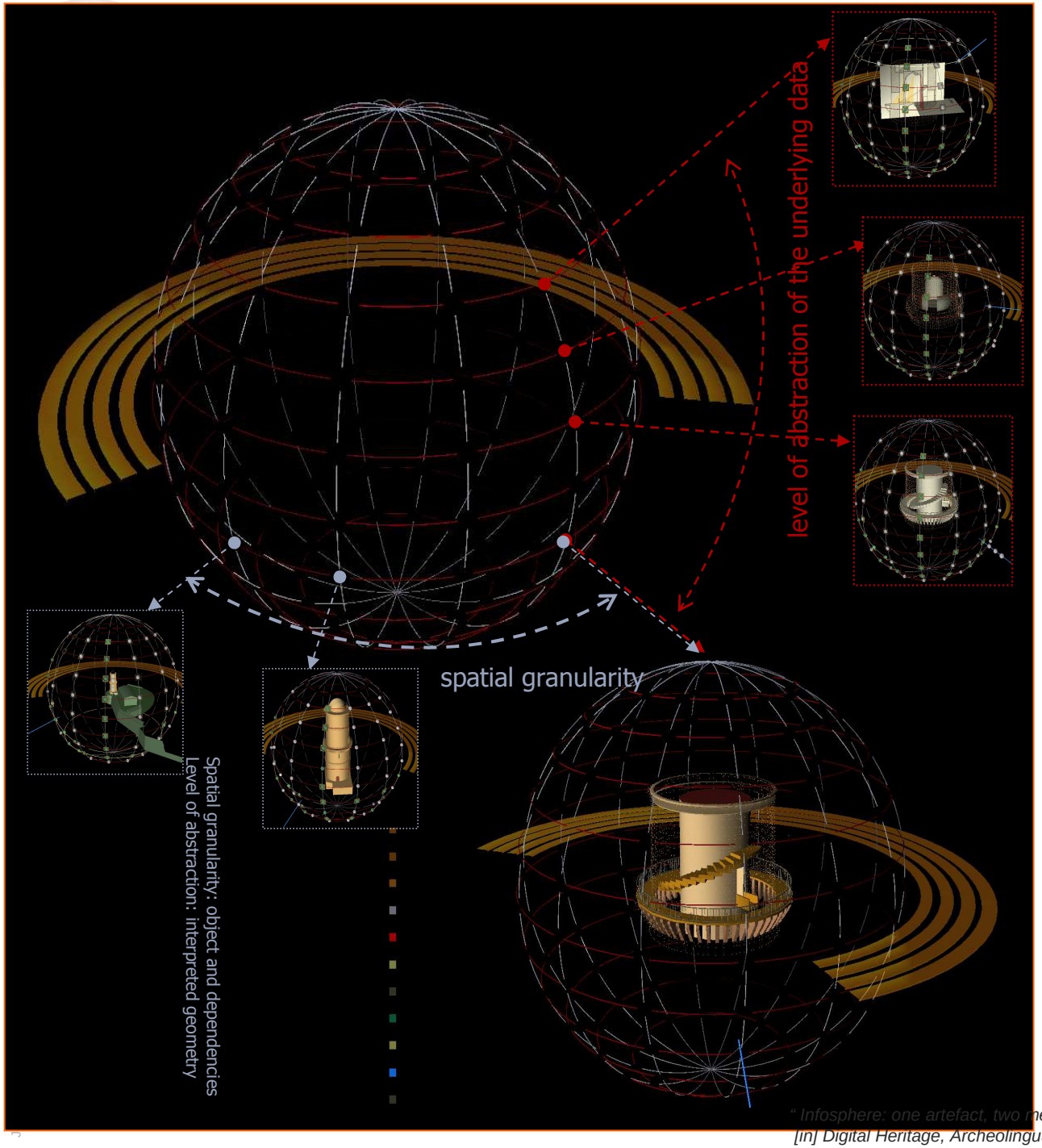
Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

[Visualisation of Encyclopaedia knowledge spaces, W.Kienreich, op.cit.]



Methods, concepts, techniques

Three fundamental units:

Visual formalisms,
Metaphors,
Models

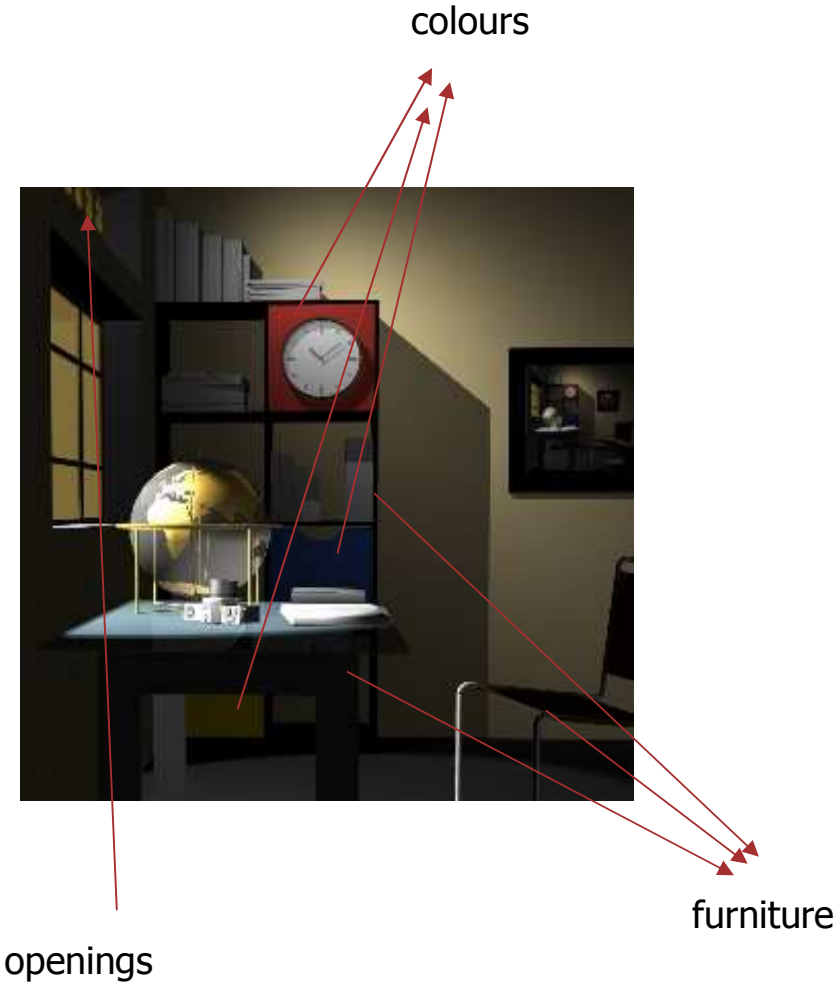
Integration disposals,

General Principles of graphic design

Real-world equivalent?

" Infosphere: one artefact, two metaphors, three sort criteria" (aut.)
[in] Digital Heritage, Archeolingua, Budapest 2008, ISBN 978-963-9911-01-7, pp. 362-367

The "three in one" metaphor



Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

A metaphor of 20th c architectural codes

Three fundamental units:

Visual formalisms,
Metaphors,
Models

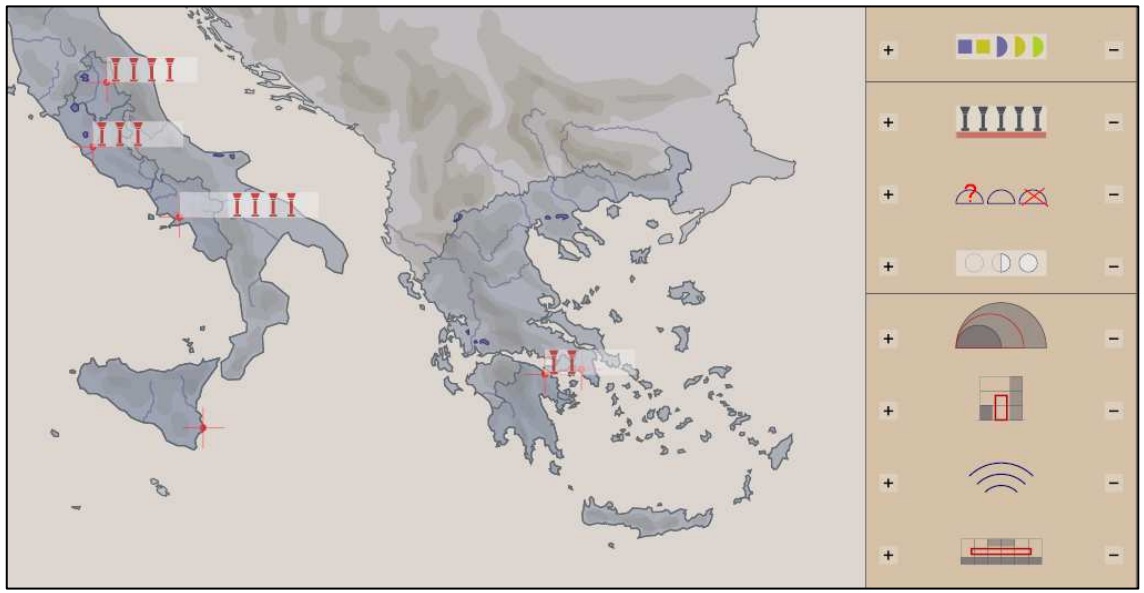
Integration disposals,

General Principles of graphic design

A metaphor of heritage

J.Vermeer, « The geographer »

www.map.archi.fr/UIA (aut)



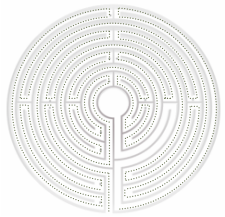
Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

«Spatial distribution and visual analysis of architectural semantic features» (aut.),
Journal Of Universal Computer Science, pp 498-506 I-Know 2006, ISSN 0948-695x



Models

* […] visual models are applied in cases where the information to be presented is itself based on a real-world equivalent […].

Example?

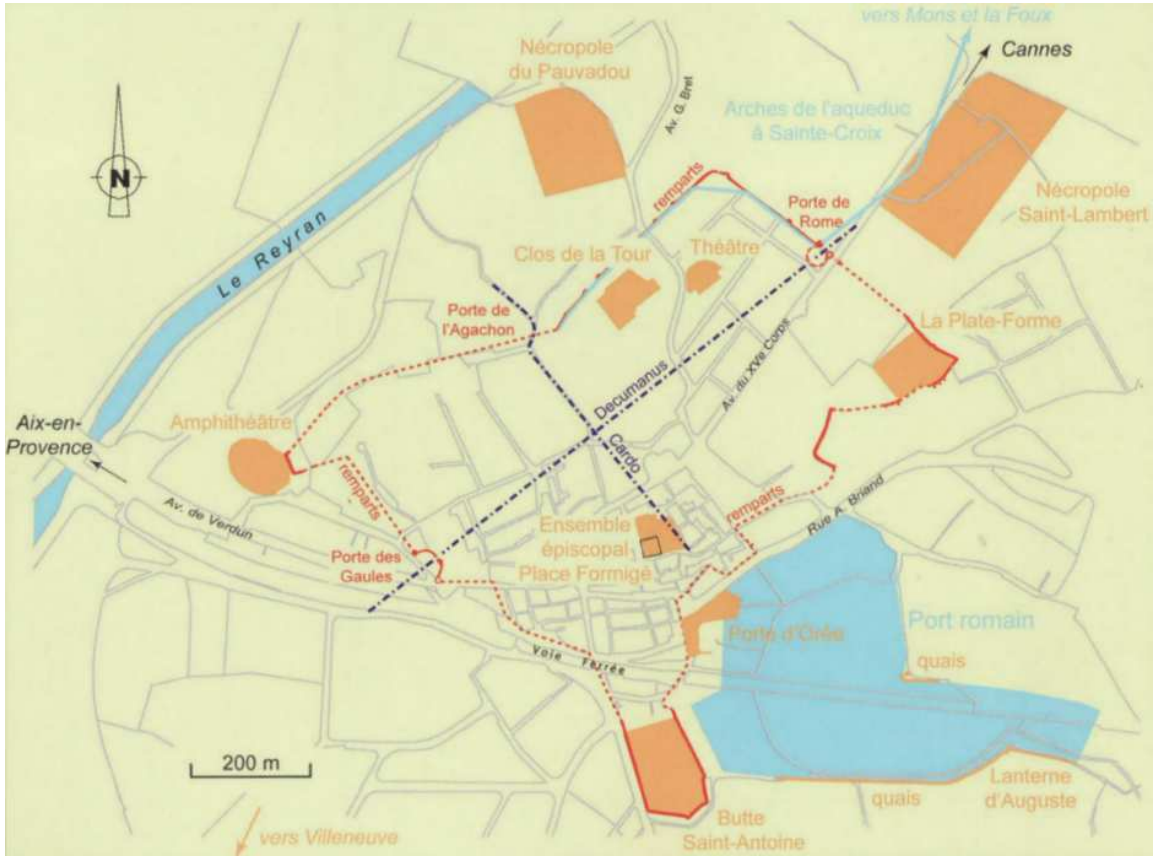
Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

** W.Kienreich Information and knowledge visualisation: an oblique view,* MiaJournal vol0, 2006



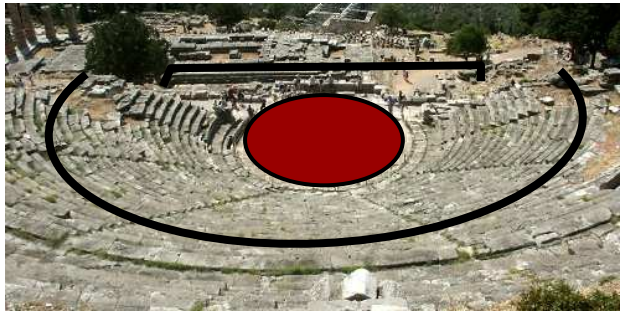
Three fundamental units:

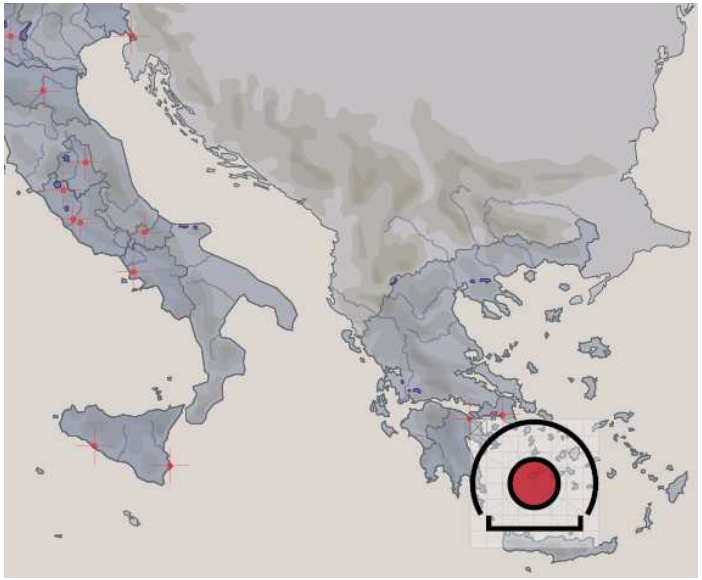
Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

** Pôle départemental archéologique du Var*





Three fundamental units:

Visual formalisms,
Metaphors,
Models

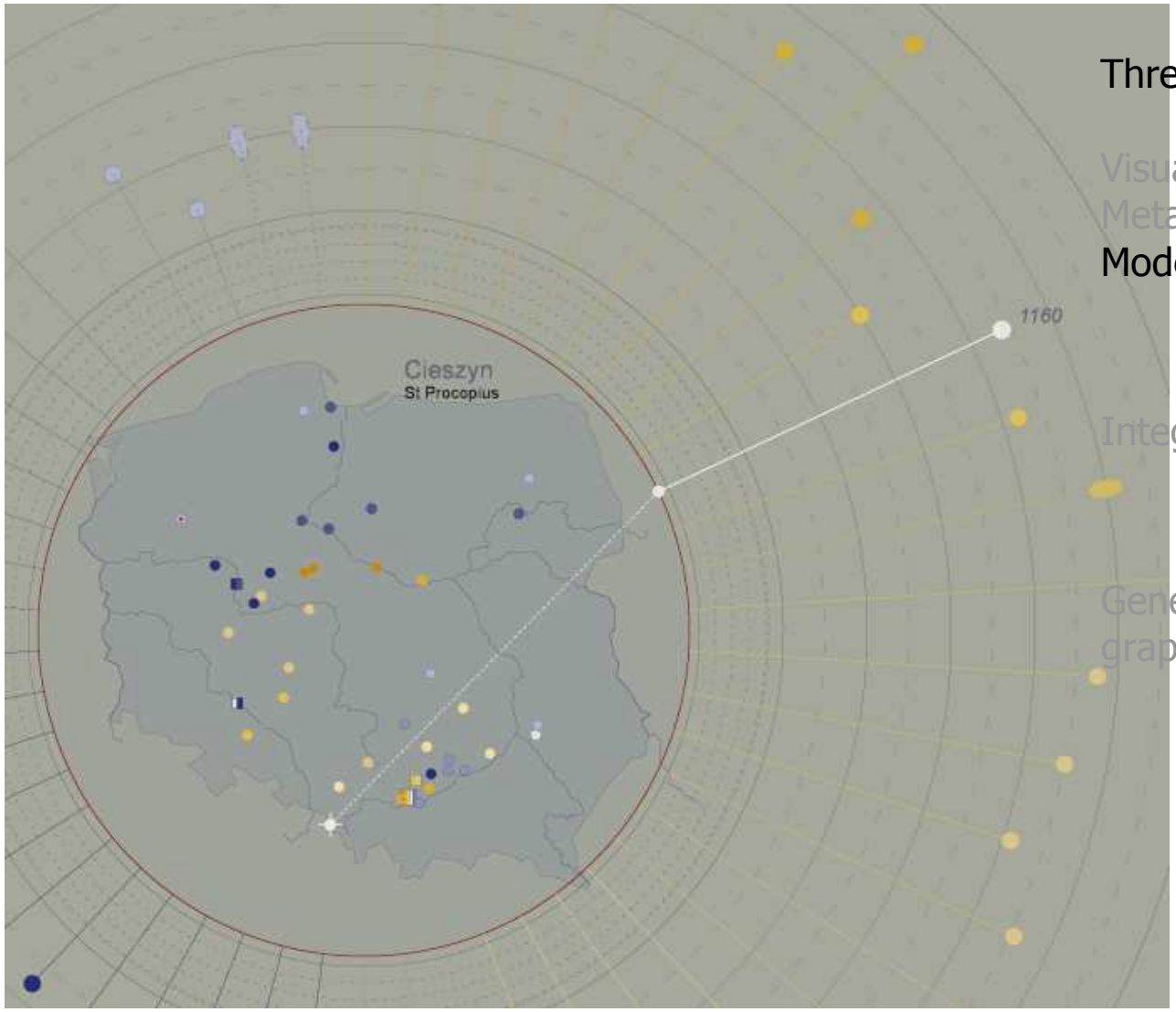
Integration disposals,

General Principles of graphic design

** Pôle départemental archéologique du Var*

«Spatial distribution and visual analysis of architectural semantic features» (aut.),
Journal Of Universal Computer Science, pp 498-506 I-Know 2006, ISSN 0948-695x

Models for time and space: the concentric time visualisation



Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

Master visualisation

* […] In most cases, the combined use of formalisms, metaphors and models will be required. Usually, one master visualisation will be employed[…].

Example?

Three fundamental units:

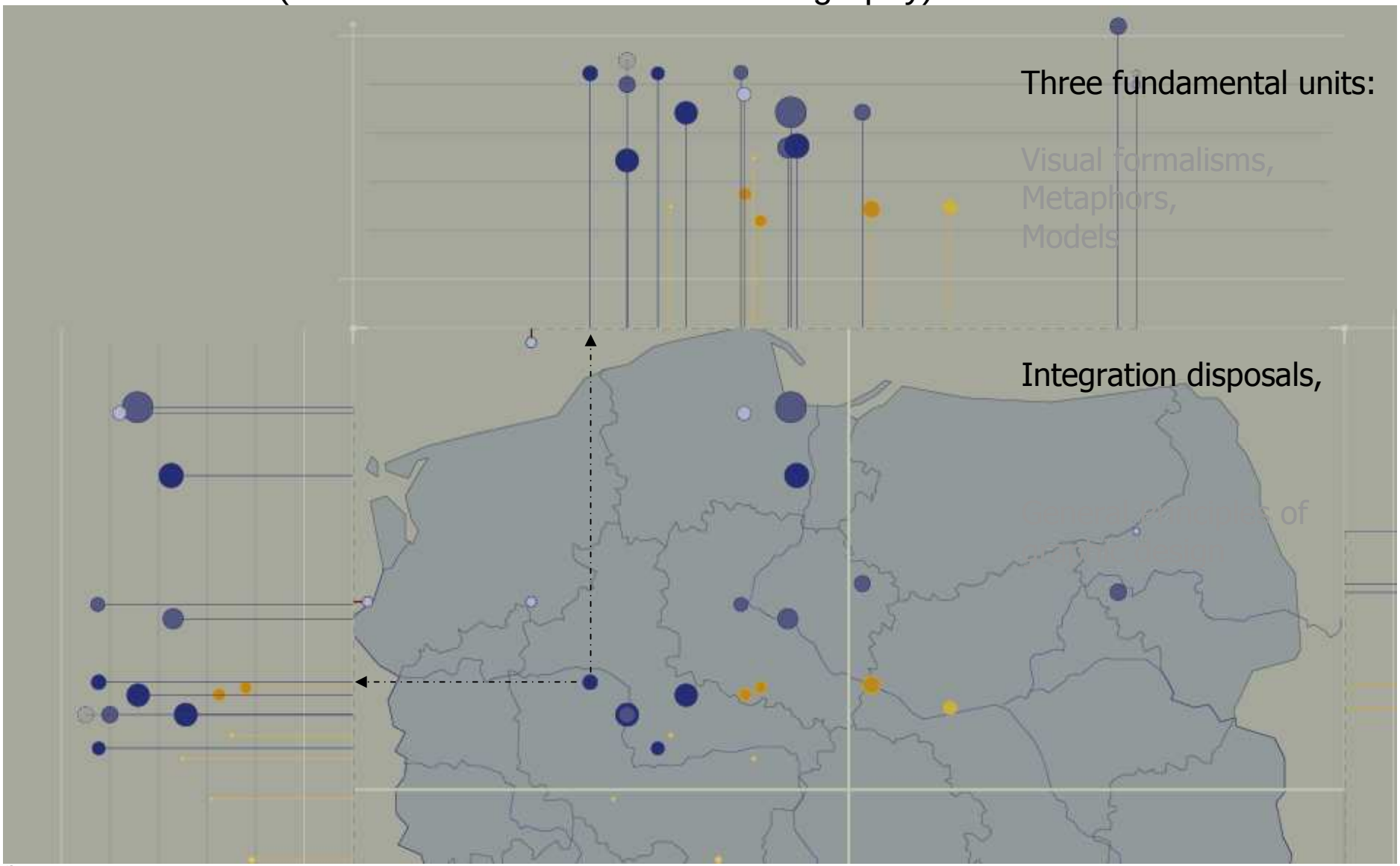
Visual formalisms,
Metaphors,
Models

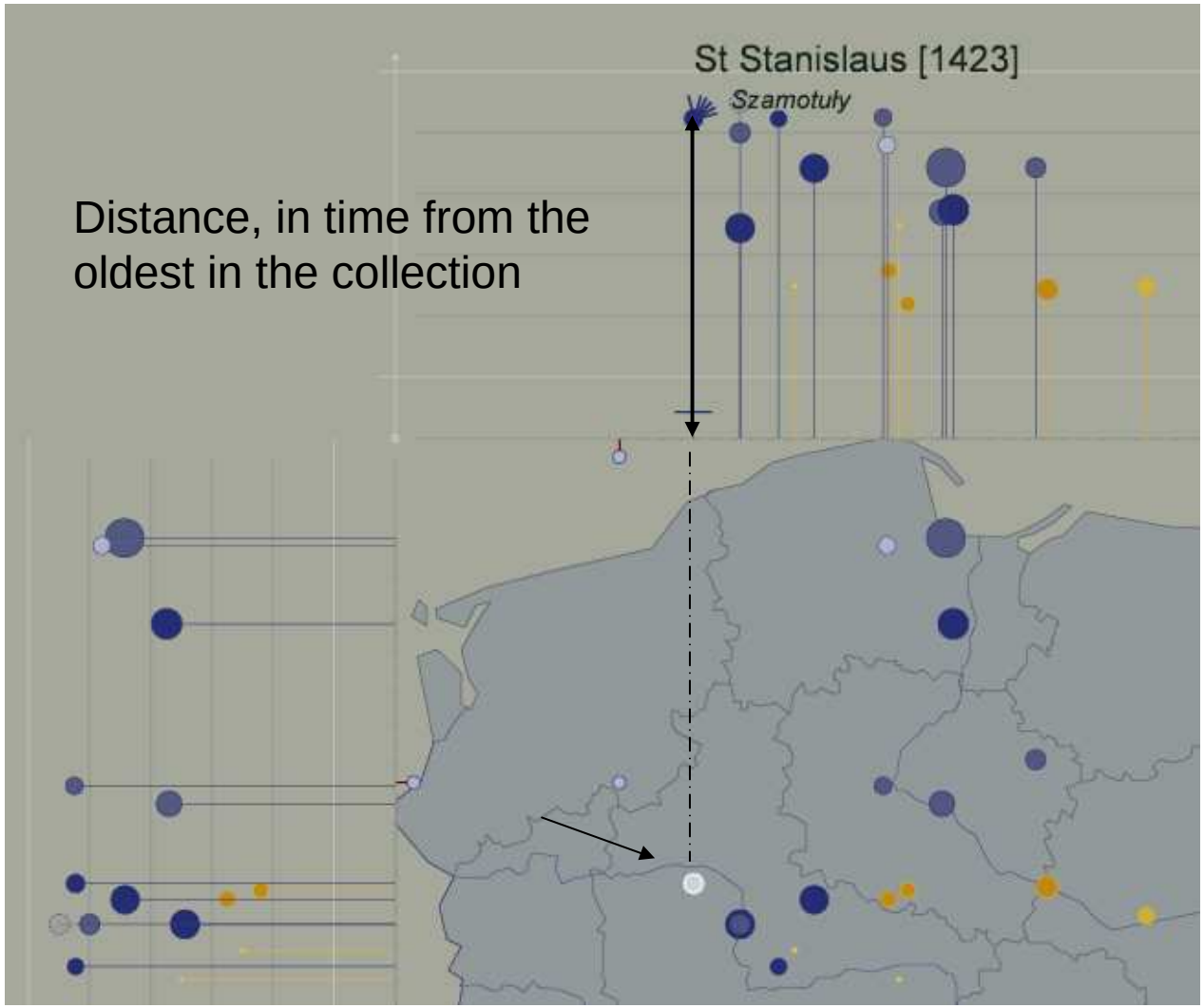
Integration disposals,

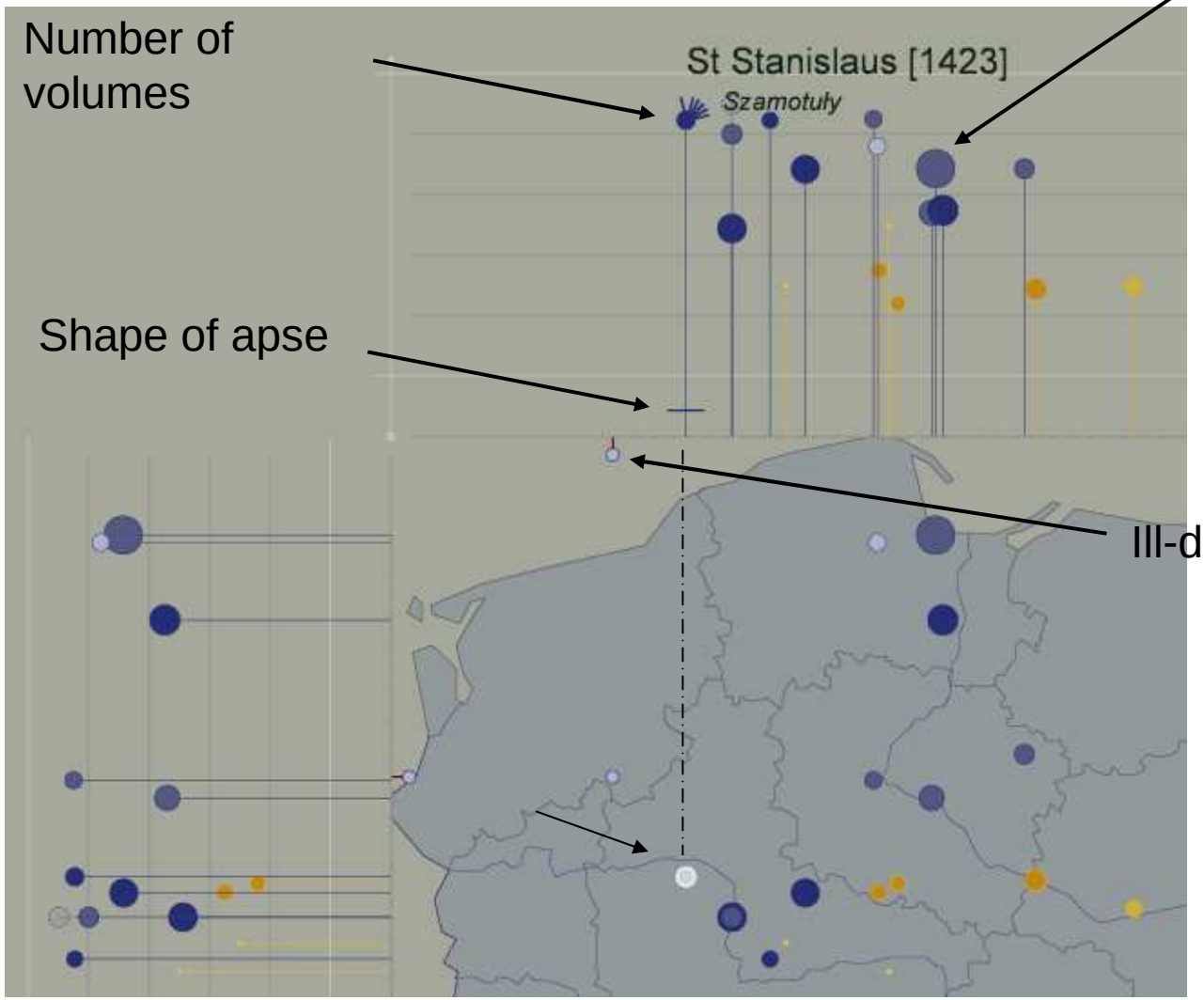
General Principles of graphic design

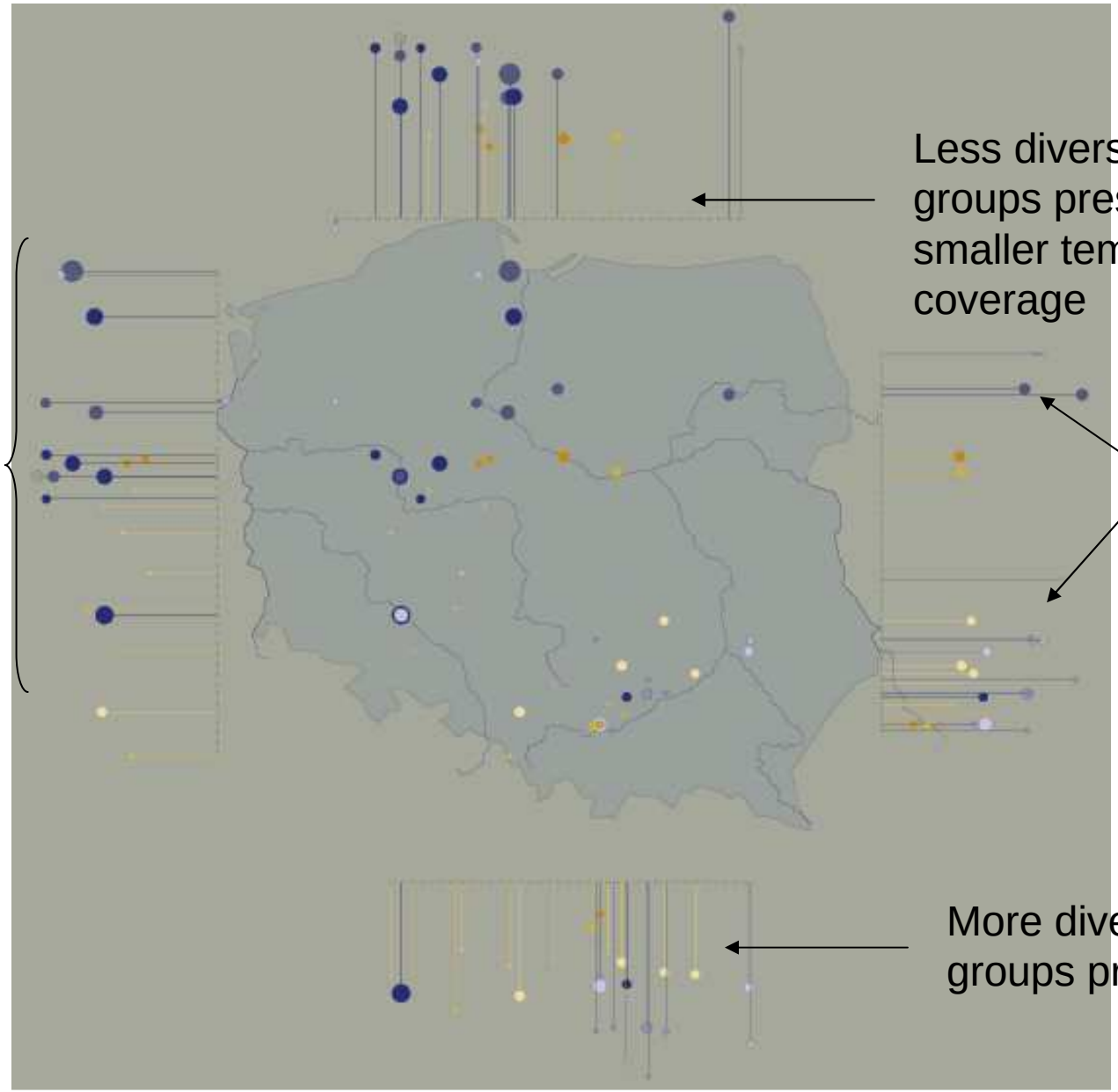
** W.Kienreich Information and knowledge visualisation: an oblique view,* MiaJournal vol0, 2006

Combining formalisms and models (multidimensional icons with cartography)

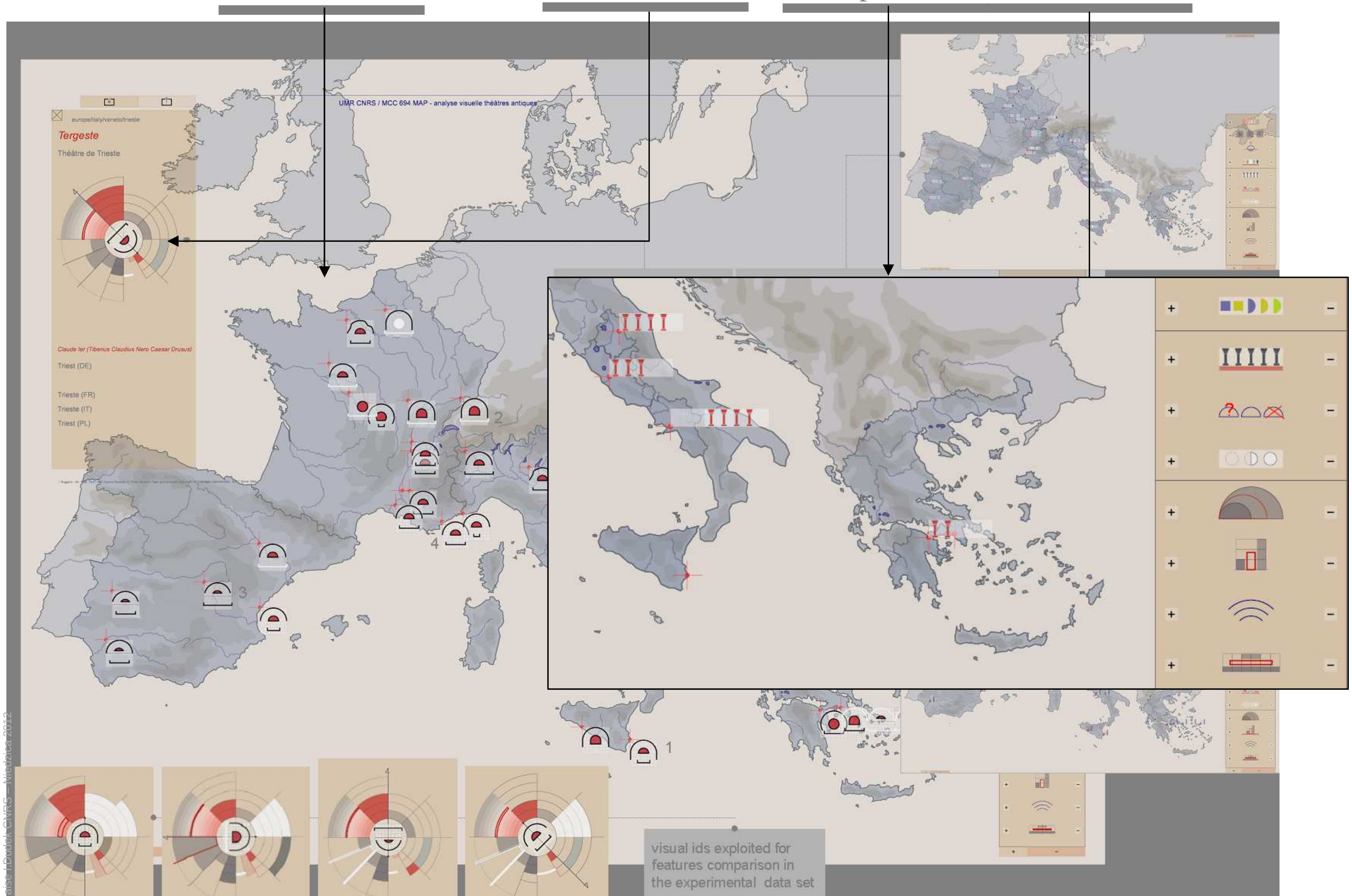



St Stanislaus [1423]
Szamotuły
Distance, in time from the oldest in the collection


Length
Number of volumes
St Stanislaus [1423]
Szamotuły
Shape of apse
Ill-defined


Less diversity in groups present, smaller temporal coverage
Regular distribution
imbalance
More diversity in groups present

Master visualisation // visual Formalisms // metaphors // models



«Spatial distribution and visual analysis of architectural semantic features» (aut.),
Journal Of Universal Computer Science, pp 498-506 I-Know 2006, ISSN 0948-695x

*** Enforce comparisons within the eyespan**

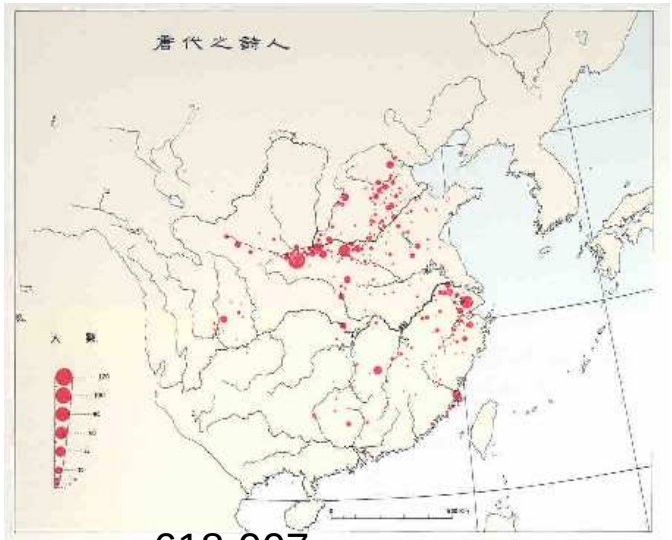
Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

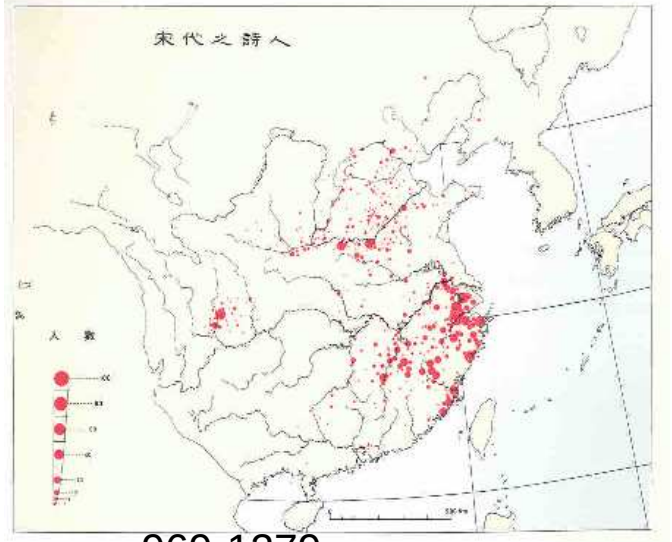
General principles of graphic design (more to come)

* *E.R Tufte Visual explanations*
Graphics Press 2001



618-907

1368-1644

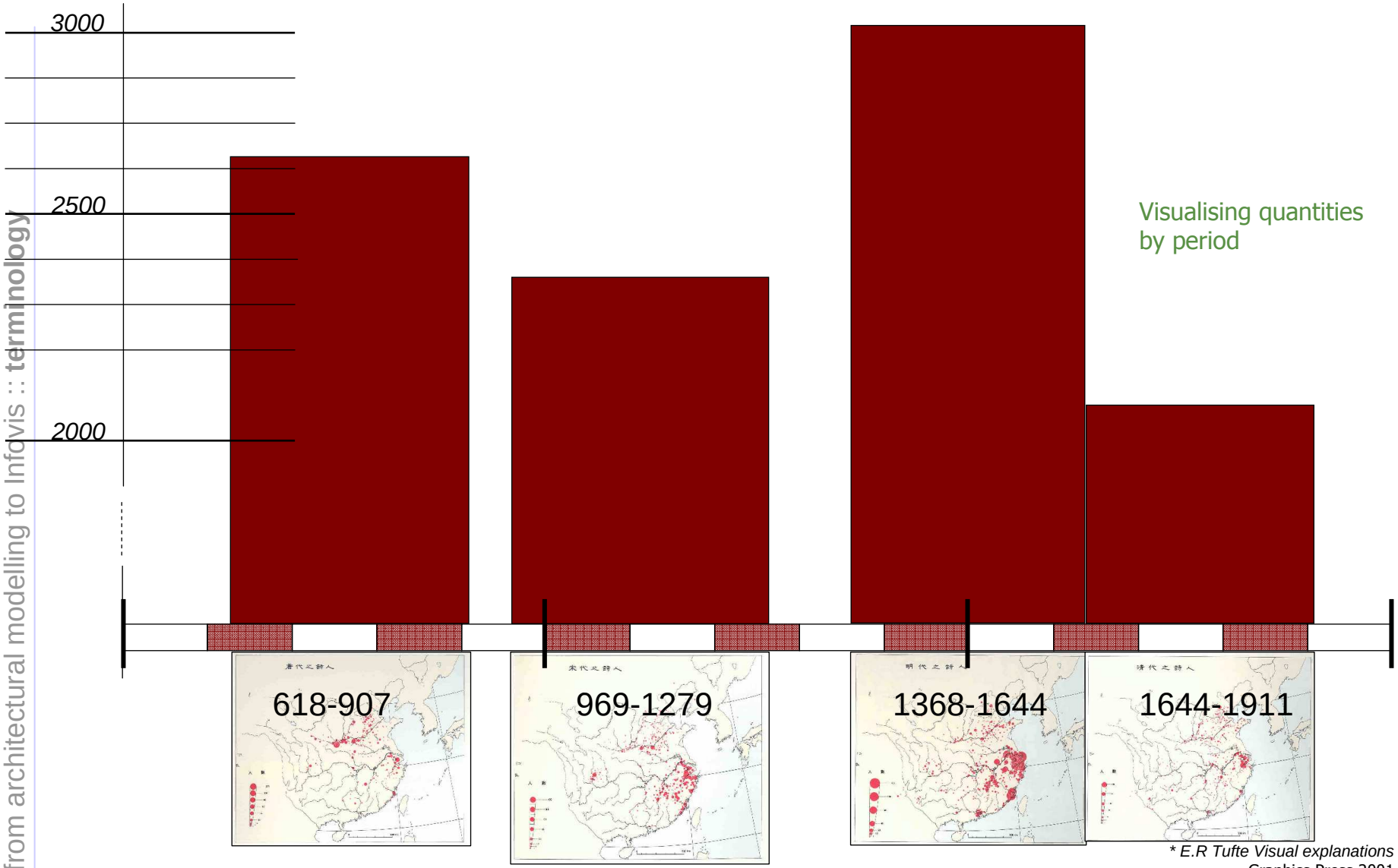


969-1279

1644-1911

Anything wrong now?

* *E.R Tufte Visual explanations*
Graphics Press 2001



Visualising quantities by period

** E.R Tufte Visual explanations*
Graphics Press 2001

W.Kienreich
Information and knowledge visualisation: an oblique view, MiaJournal vol0, 2006
http://www.infovis-wiki.net/index.php

R.Spence
Information Visualization Addison Wesley 2001

E.R Tufte
The visual display of quantitative information , Graphic Press, Cheshire 2001
Envisioning Information, Graphic Press, Cheshire 1990
Visual Explanations, Graphics Press, Cheshire 1997
Beautiful evidence, Graphics Press, Cheshire 2006

J.Bertin
Semiology of graphics : diagrams, networks, maps , Ann Arbor, Mich. : UMI, 2007.

M. Friendly
Milestones in the history of thematic cartography, statistical graphics, and data visualization".
http://www.math.yorku.ca/SCS/Gallery/milestone/milestone.pdf
http://datavis.ca/milestones
http://www.datavis.ca/papers/hbook.pdf

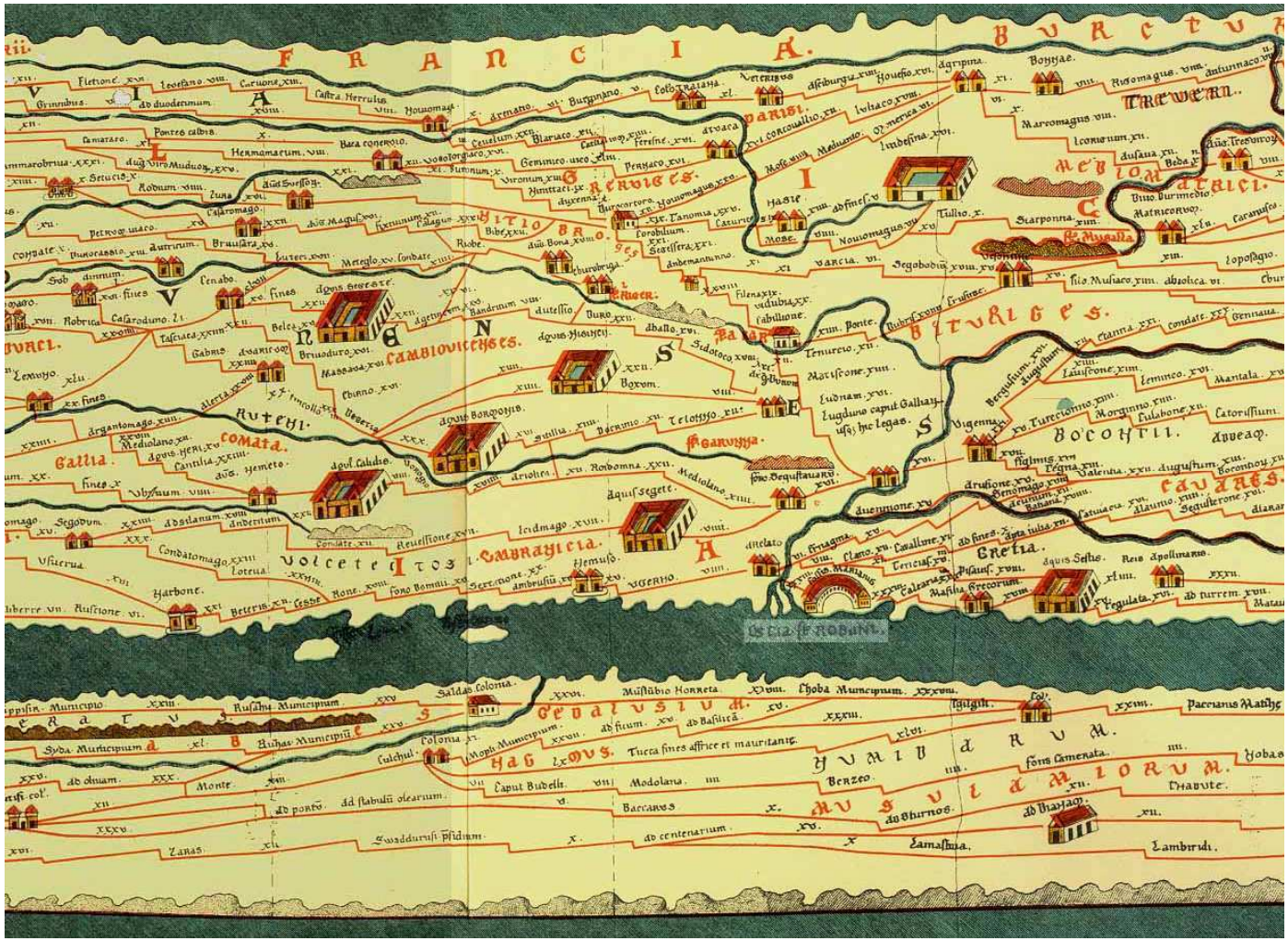
D. Keim, J.Kohlhammer, G.Ellis, F.Mansmann
Mastering The Information Age – Solving Problems with Visual Analytics.
http://www.vismaster.eu/

S.K. Card, J.D. Mackinlay, B. Shneiderman
Readings in information visualization: using vision to think - Morgan Kaufmann, 1999

The map of Bedolina (2000 – 1000 B.C)
Land divisions with fields, paths, houses and inhabitants.

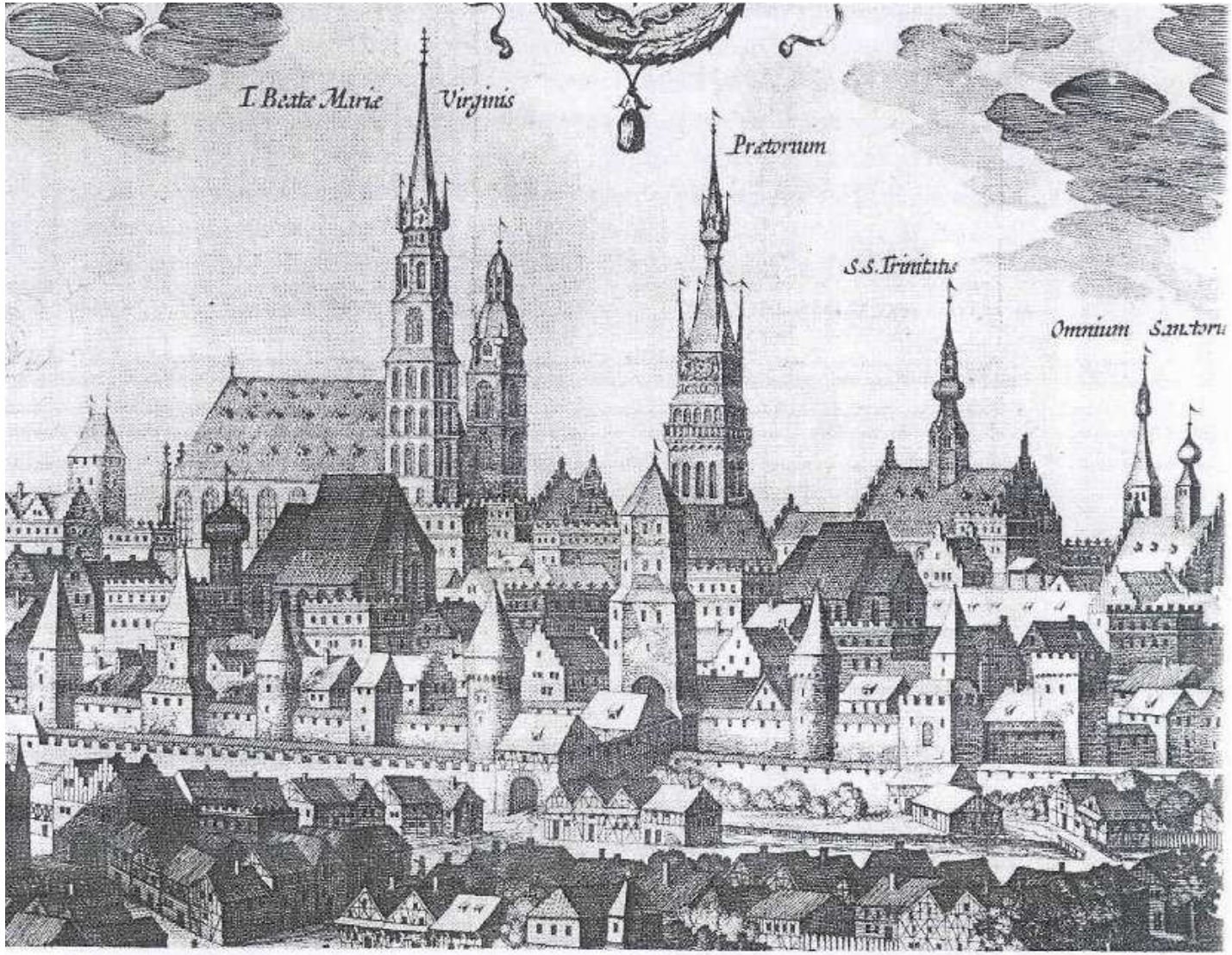
B. Holtzmann (Ed)L'art de l'antiquité 1. Les origines de l'Europe
Editions de la Réunion de musées nationaux, Editions Gallimard 1995]

The Peutinger map of Roman routes.



a XIIIth c copy of a Roman map

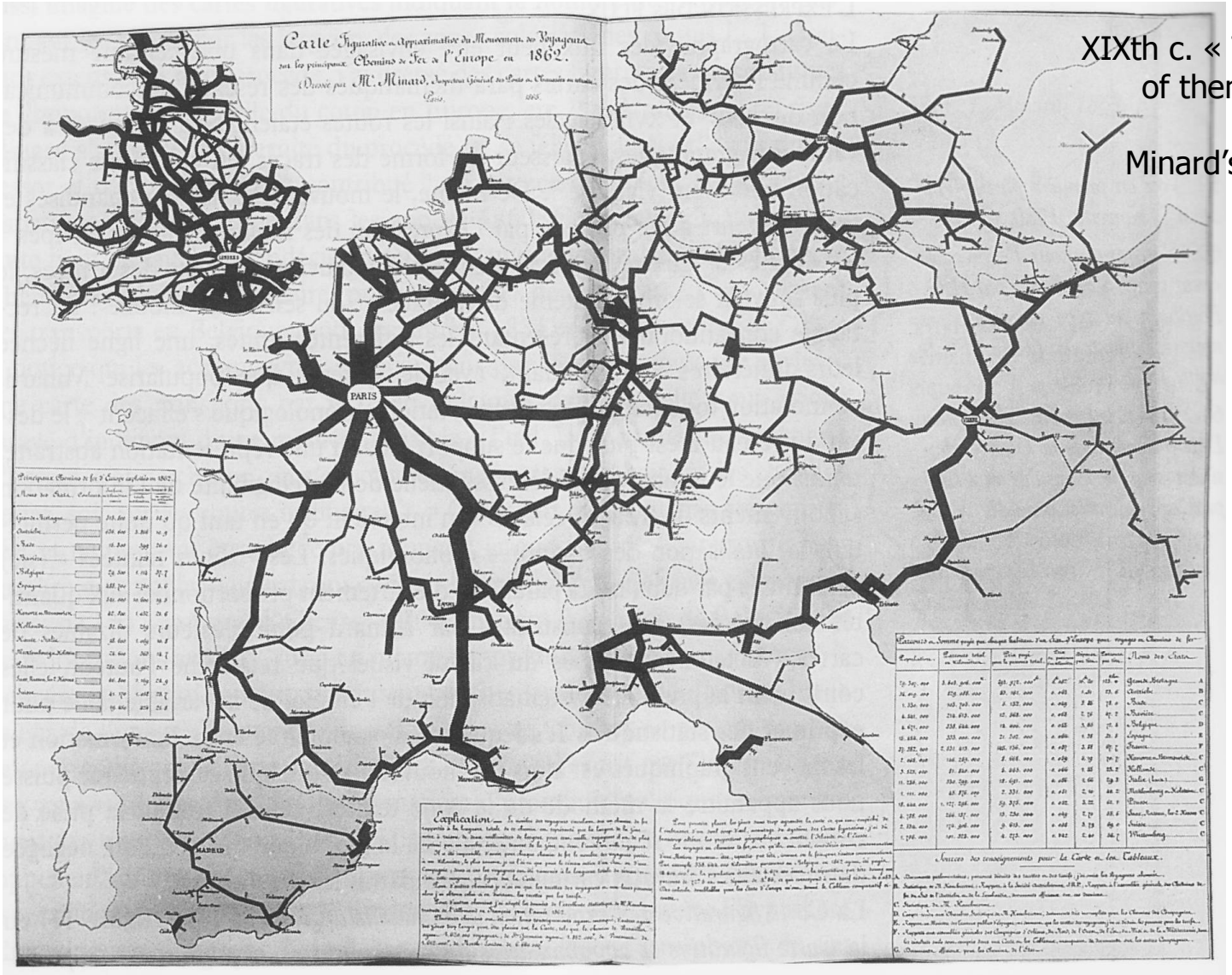
[http://fr.wikipedia.org/wiki/Table_de_Peutinger]



Panoramas.

A visualisation?

[M.Merian (1619) in J.Banach, « dawny widoki Krakowa » WL]

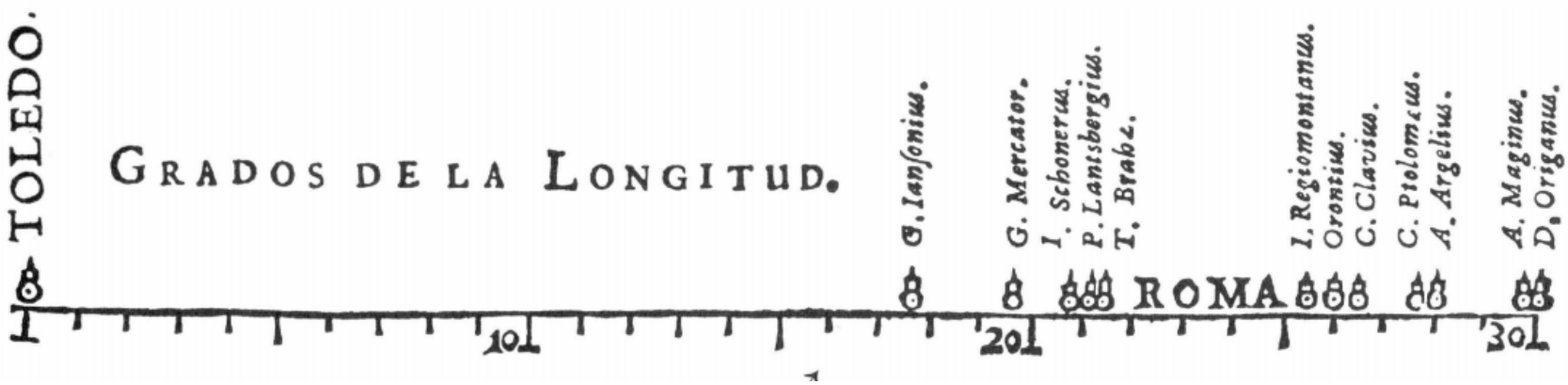


XIXth c. « The golden age »
of thematic cartography

Minard's figurative maps.

G.Palsky Des chiffres et des cartes. La cartographie quantitative au XIXe siècle CTHS 1996

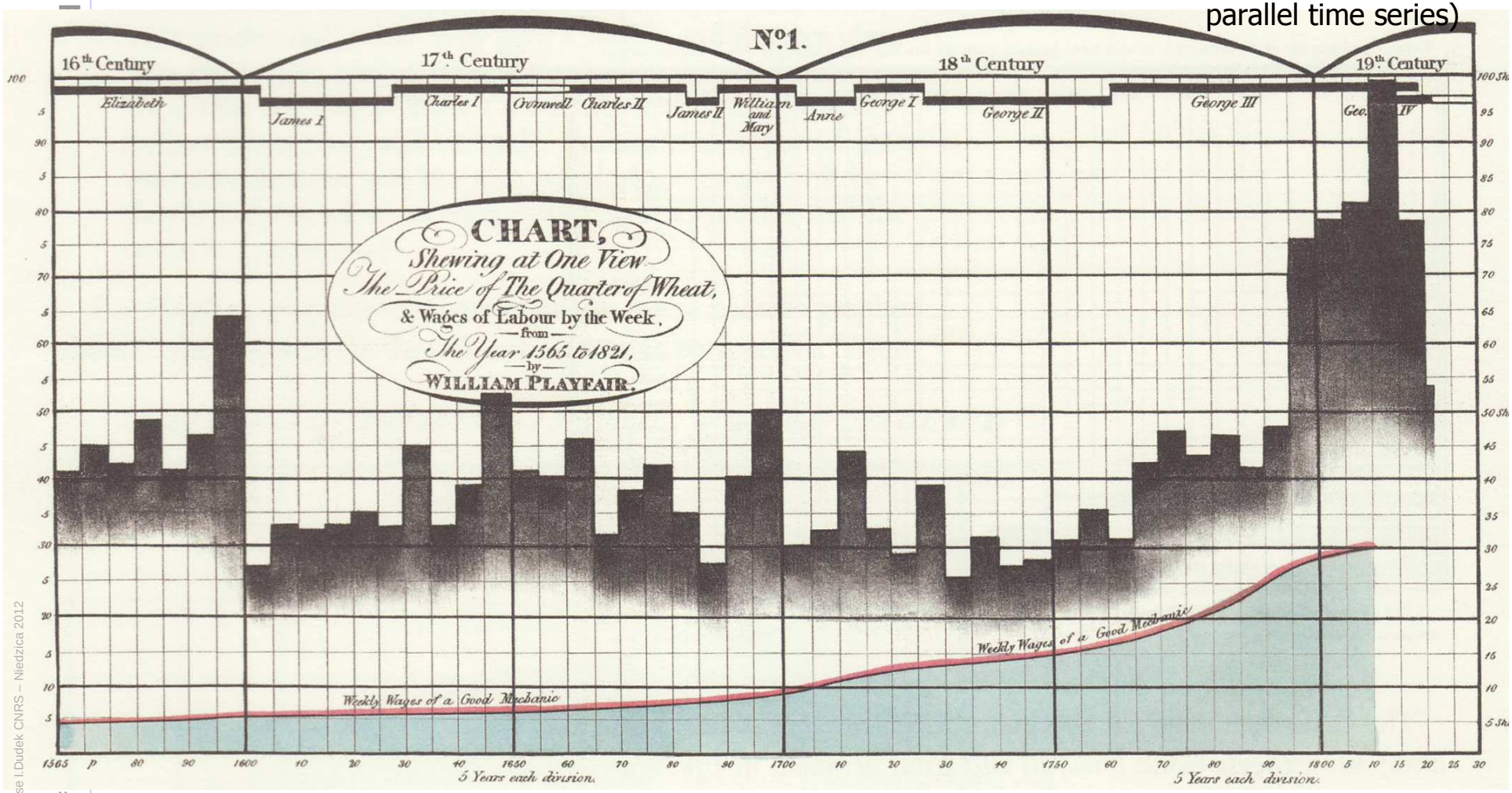
12 knows estimates of the difference in longitude between Toledo and Rome (1644 , M.F Van Langren)



* The first visual representation of statistical data

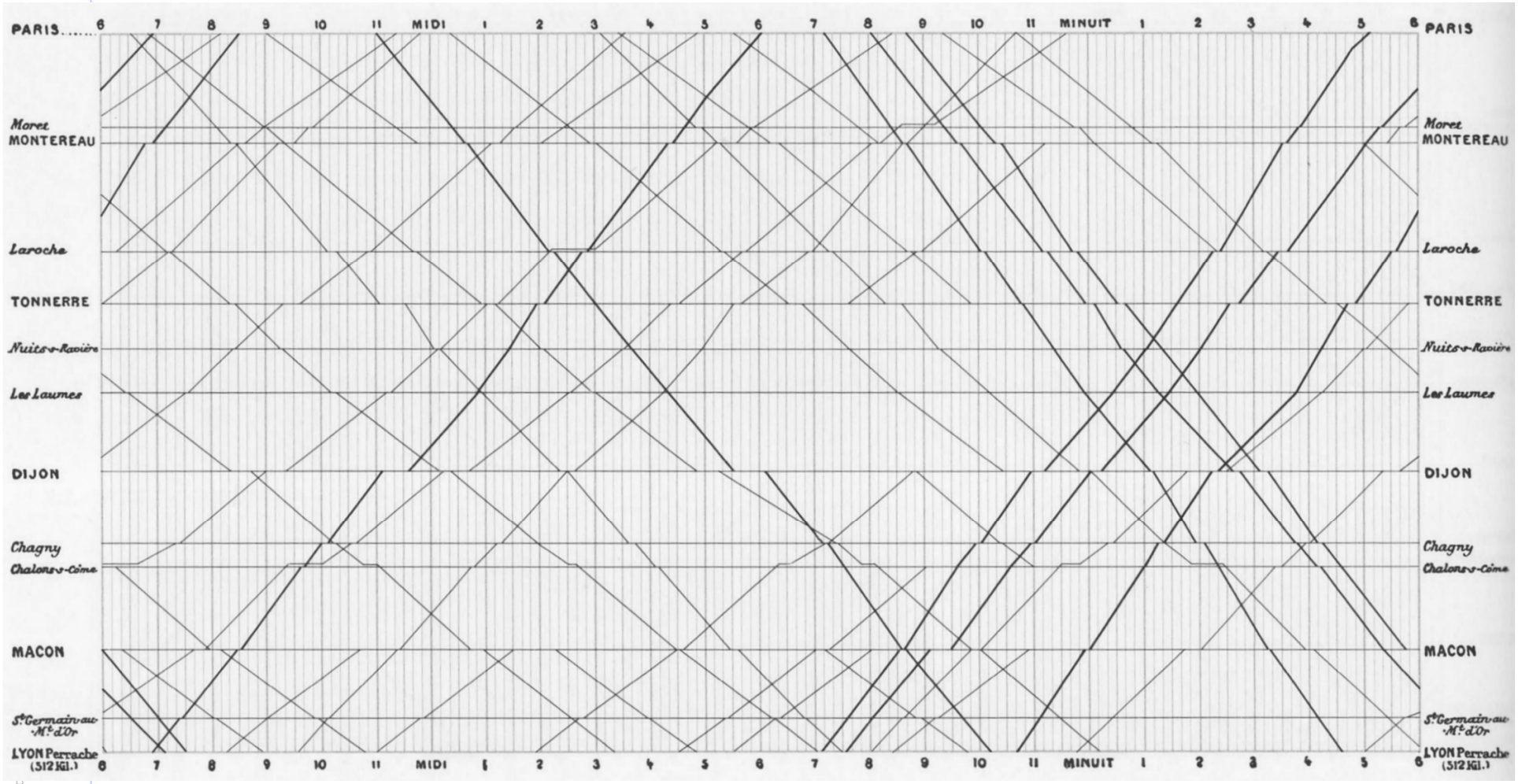
** M. Friendly A brief history of data visualisation*
http://www.datavis.ca/papers/hbook.pdf

W.Playfair. Price of wheat relatively to wages (three parallel time series)

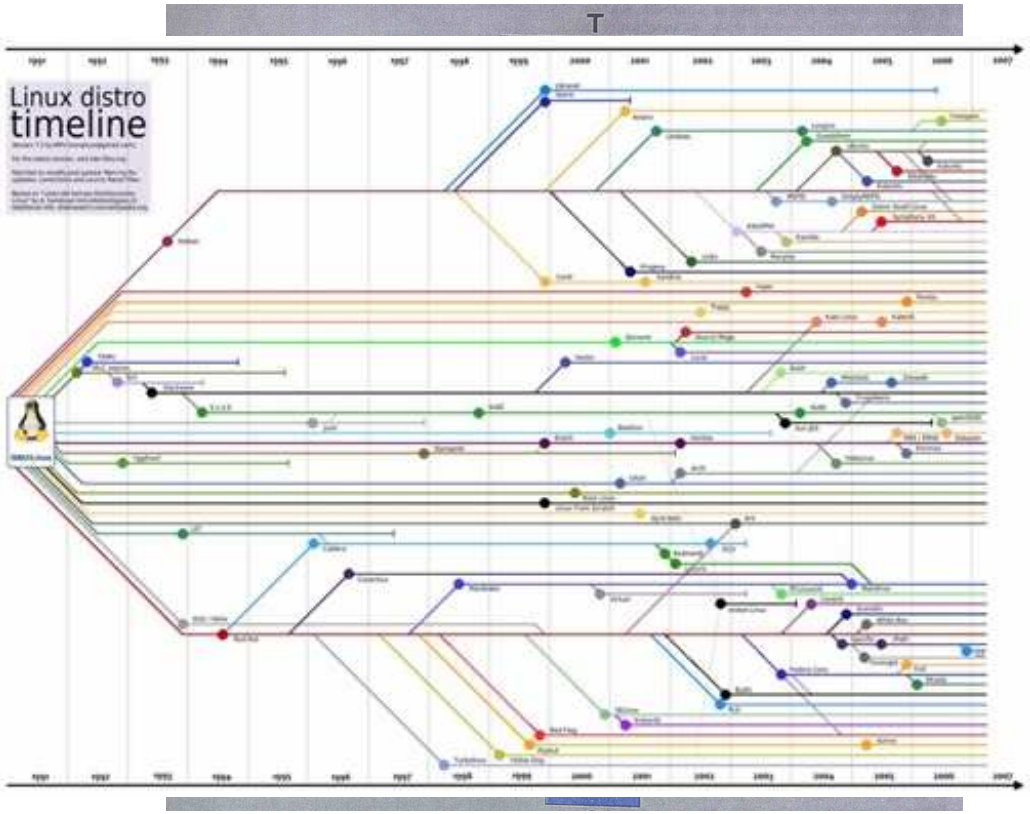


E.R Tufte The visual display of quantitative information , Graphic Press, Cheshire 2001

A graphic that allows us to dig in our data
and to shed light on *all* that we know but did not see



E.R Tufte The visual display of quantitative information ,
Graphic Press, Cheshire 2001

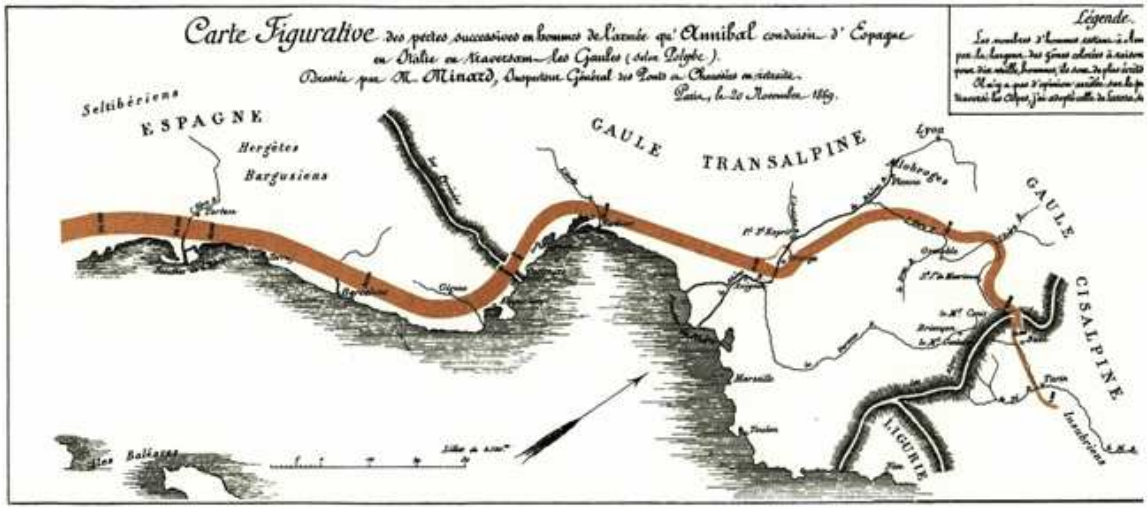


*Gestalt theory (early 20th c)

J.Bertin. Graphic Semiology (1967)

Time for computer-based solutions

* Perception of form
http://en.wikipedia.org/wiki/Gestalt_psychologyinformation ,



***Graphical excellence** exists.

It is **not a matter of technology**. Computer-based tools do not *create* graphical excellence

It often meets Maeda's laws of **simplicity**.

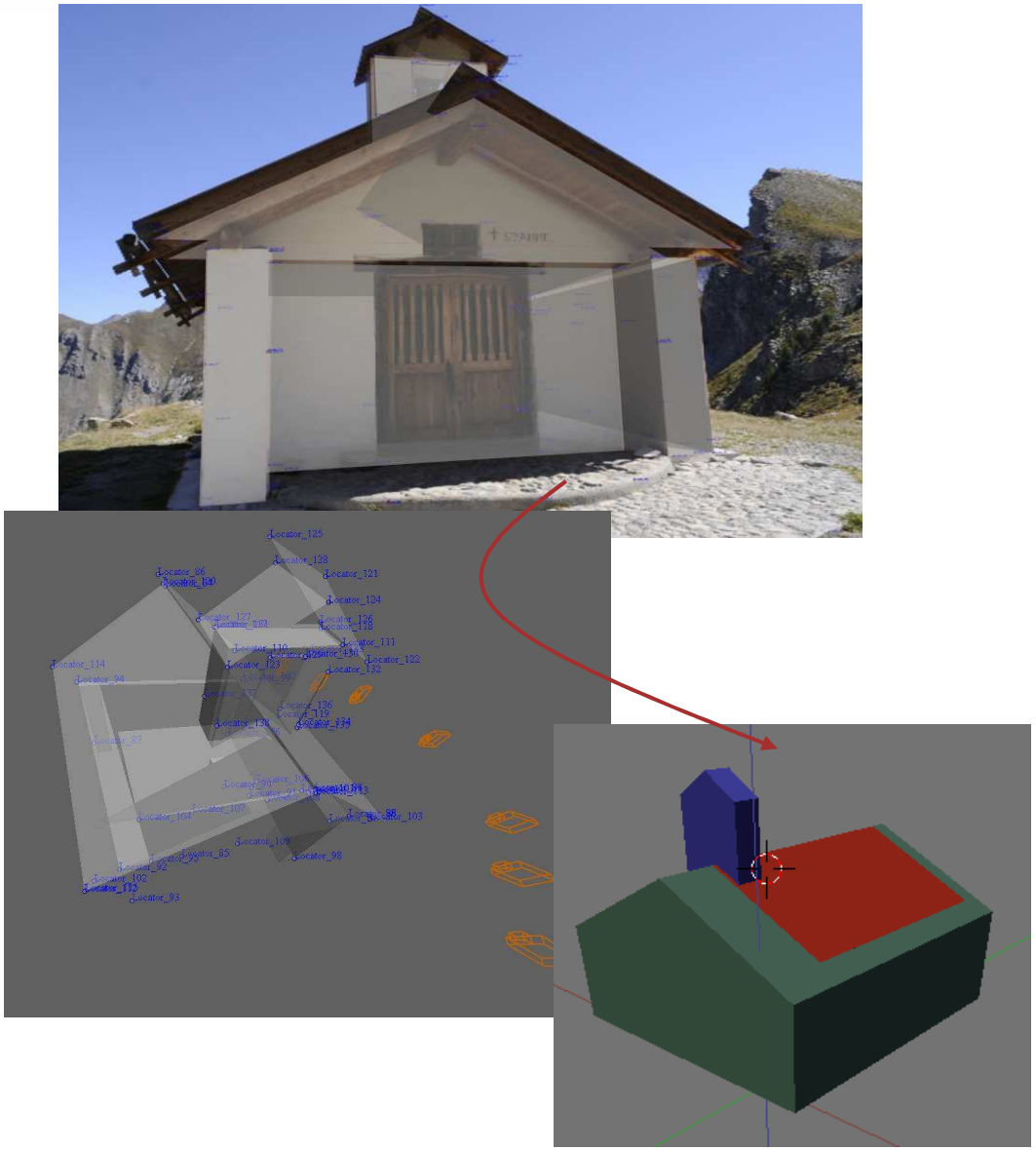
Computer-based solutions offer ***new* opportunities**, that should not stray us from seeking graphical excellence.

** E.R Tufte The visual display of quantitative information ,* Graphic Press, Cheshire 2001

J. Maeda. No simplicity without complexity, In G.Schuller, Designing universal knowledge, Lars Muller Publisher 2008

Benefits of Infovis (in heritage architecture analysis)

information



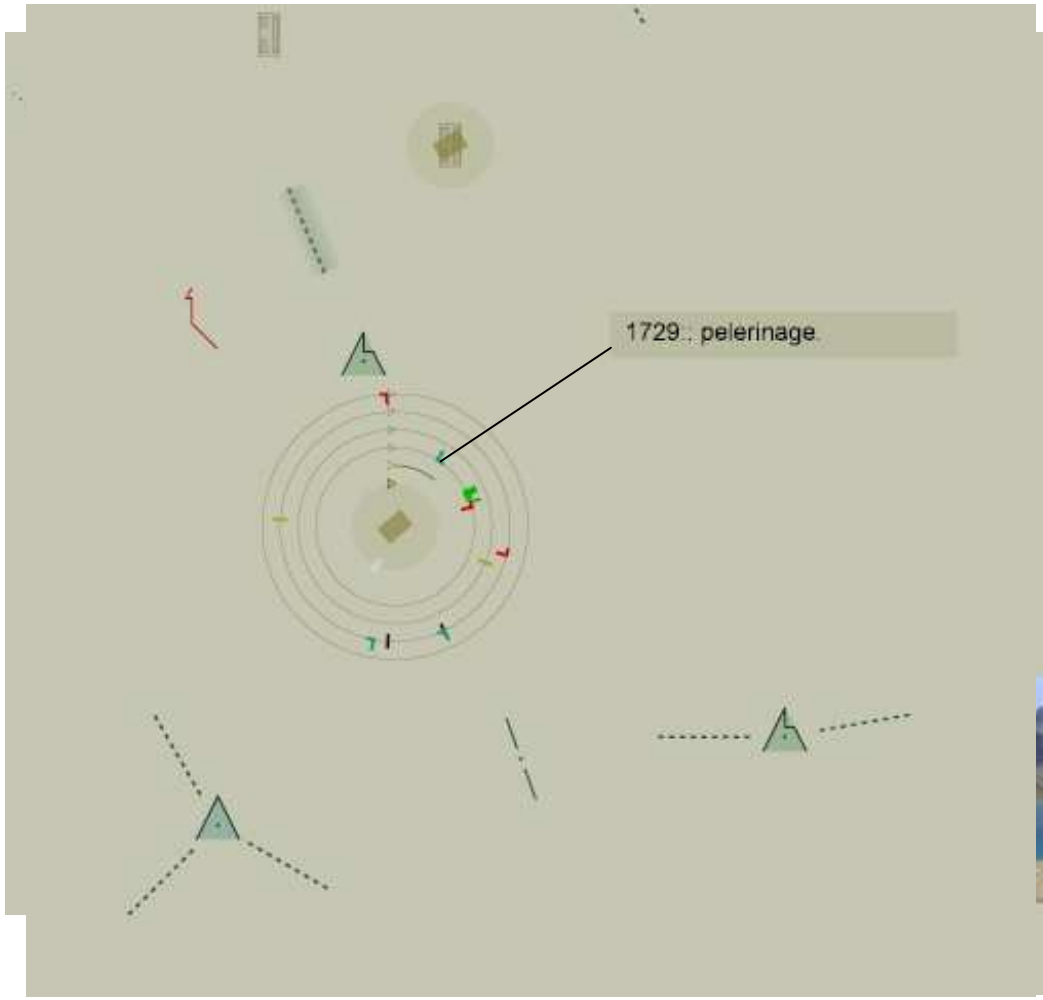
We deal with information about architecture

morphology

"innomine" research protocol (aut.)

Benefits of Infovis (in heritage architecture analysis)

information



Events distributed in time

Number of sources, panoramic views

"innomine" research protocol (aut.)

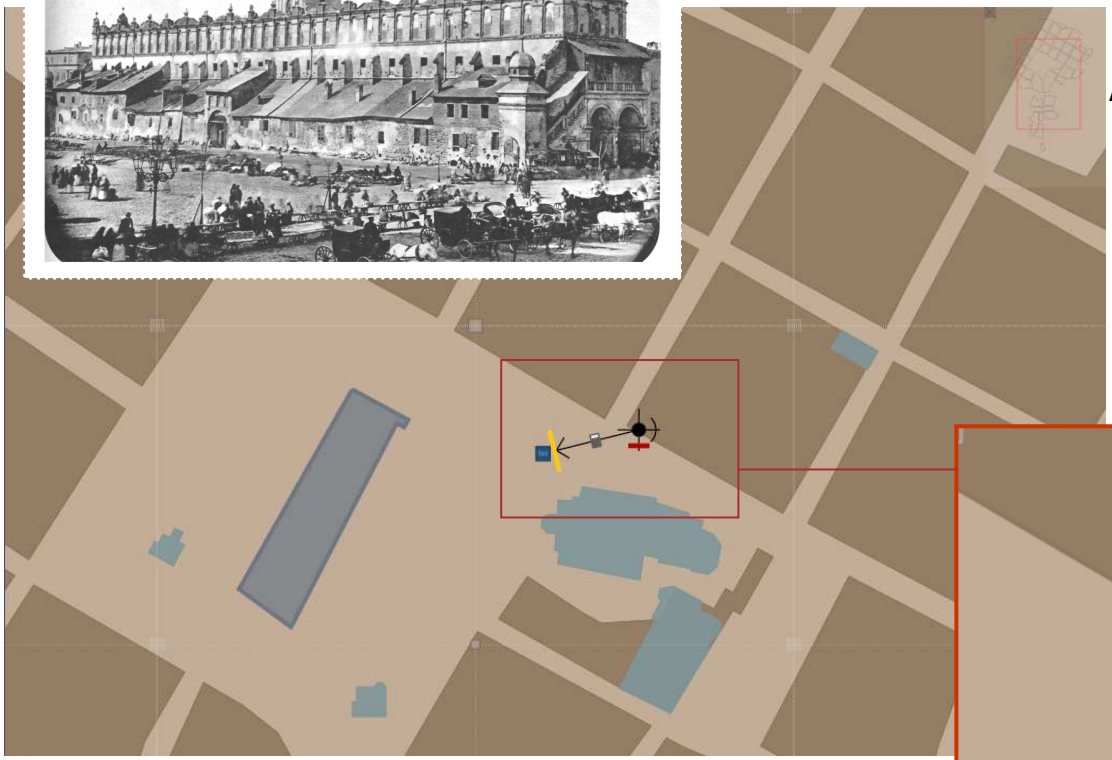
Benefits of Infovis (in heritage architecture analysis)

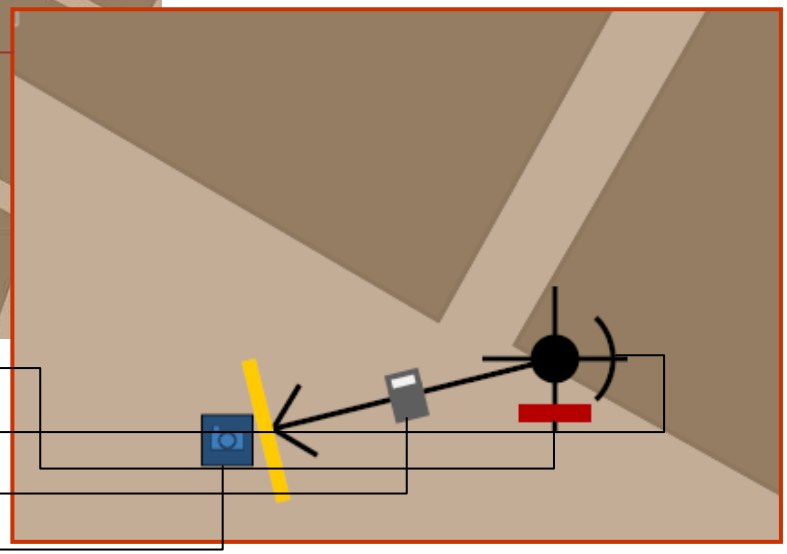
information

We deal with information about architecture

And questionable information – lacks, imprecision, doubts

Experimenting solutions inspired by Infovis: "approximate" localisation of visual documents using multidimensional icons



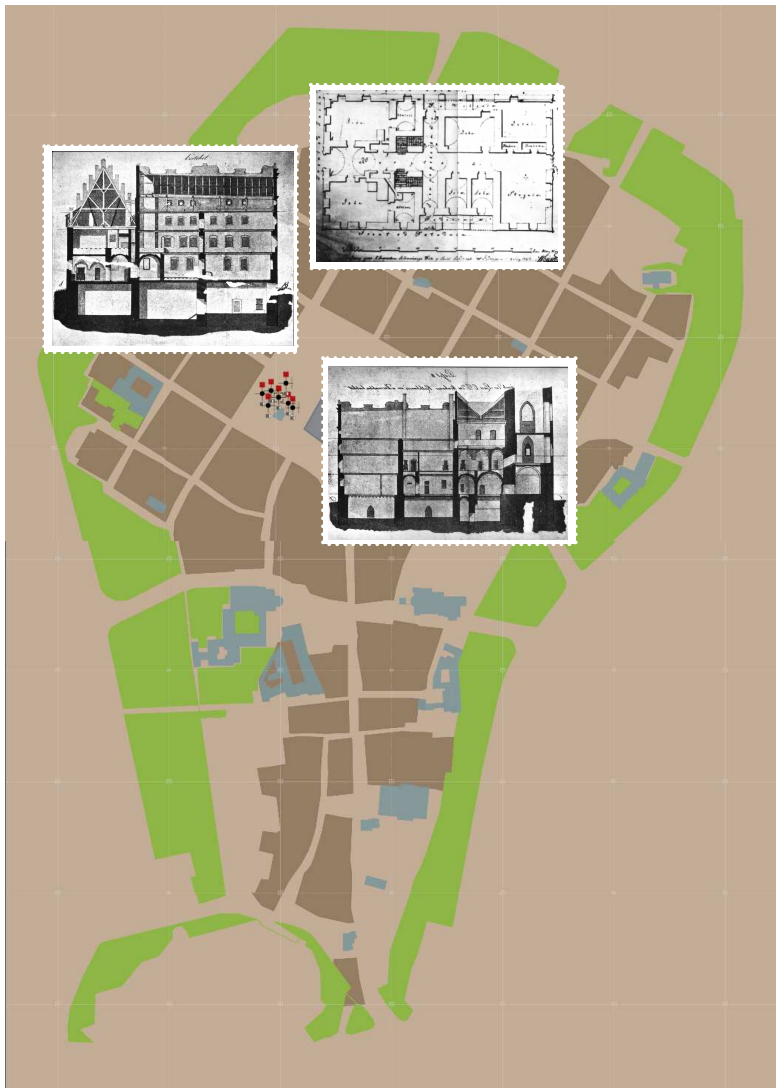


« Visual tools decipher historic artefacts documentation» (aut)
Journal Of Universal Computer Science, I-Know 07, ISSN 0948-695x

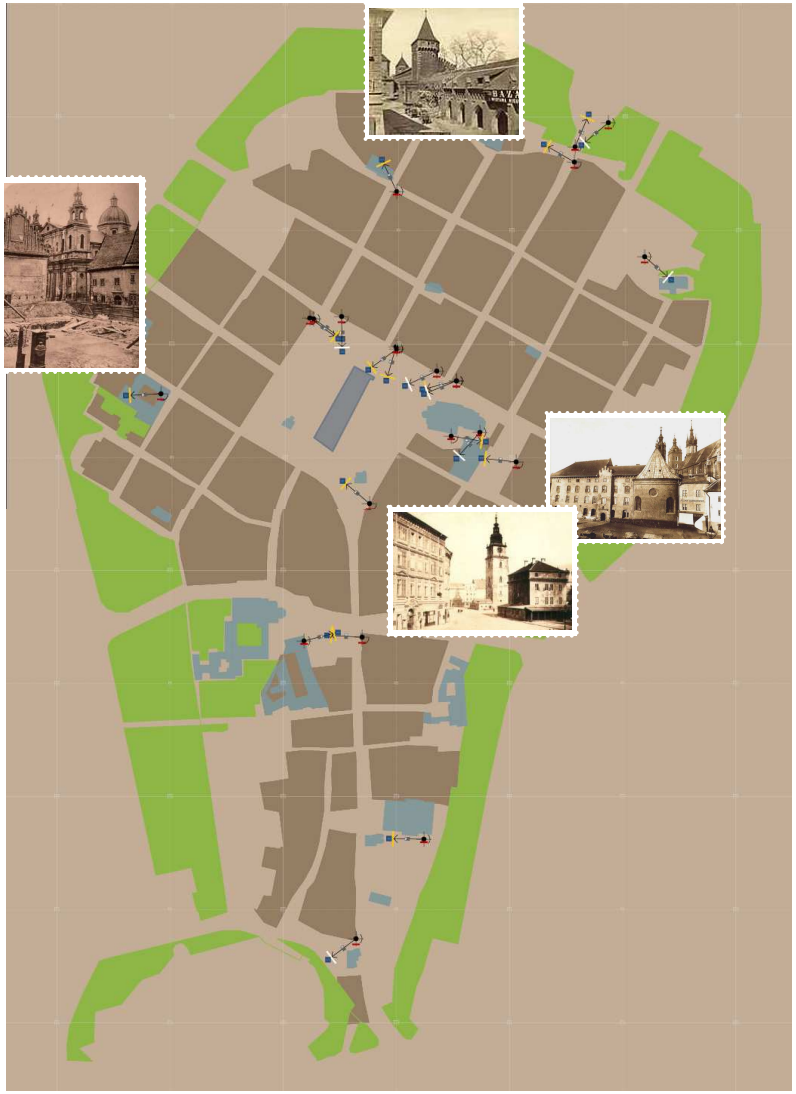
Benefits of Infovis (in heritage architecture analysis)

information

Compare positions of the production of authors



Schmaus von Livonegg



Ignacy Krieger

« Visual tools decipher historic artefacts documentation» (aut)
Journal Of Universal Computer Science, I-Know 07, ISSN 0948-695x

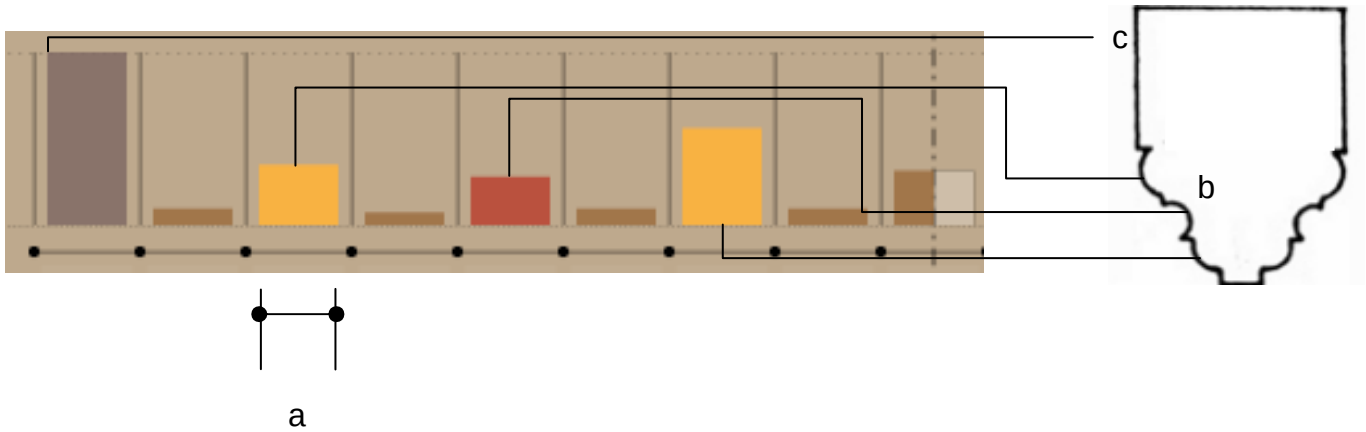
(a) Segments are represented by fixed-width coloured rectangles

(b) Coulours indicate concavity:
Yellow :: *convex*
Red :: *concave*
Brown :: *flat*

(c) Unmoulded segments are represented by fixed-width greyish rectangles

We deal with information about architecture

this information can also be abstracted, and used for comparisons

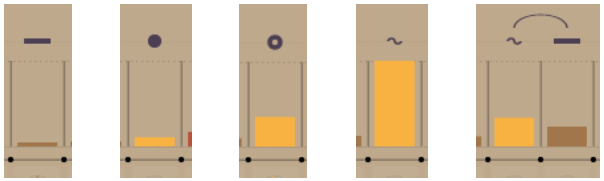


"Analysing architectural mouldings with 3Dobject-independant metrics and encoding" [in] Proceedings CGVCVIP ISBN 978-972-8939-22-9 pp201-209 (aut.)

(f) With a symmetric composition, an axis icon is added, and the right side of the graphic contains whitish rectangles

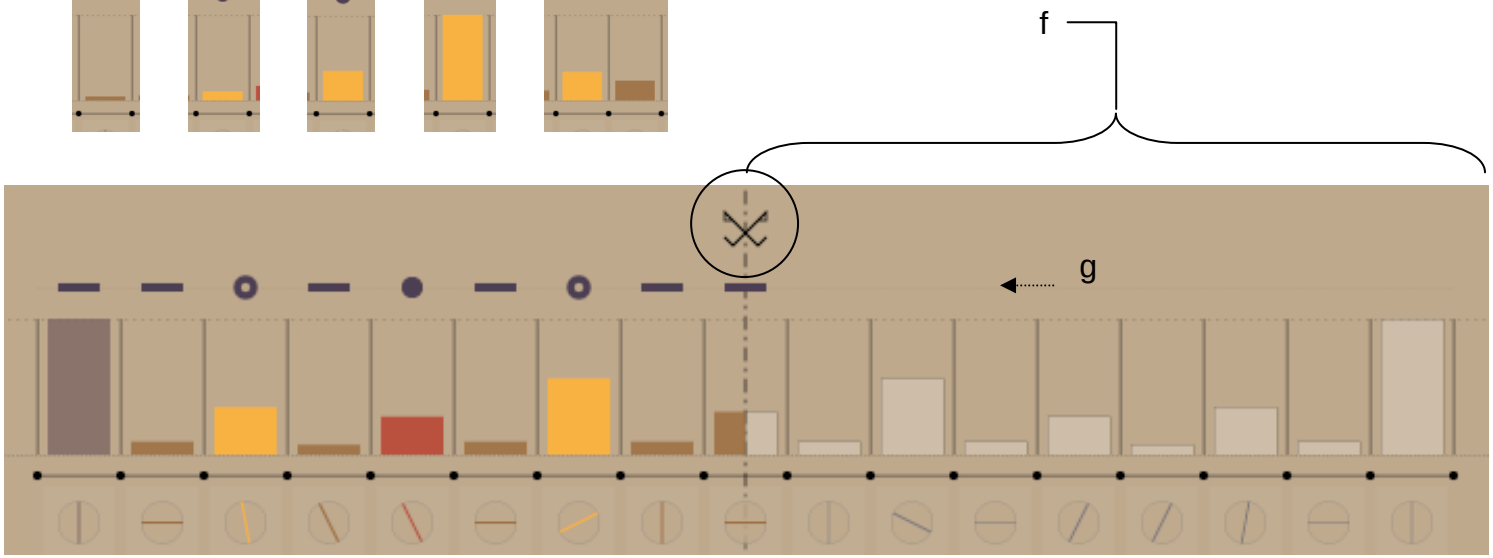
(g) Rhythms and moulding complexity :

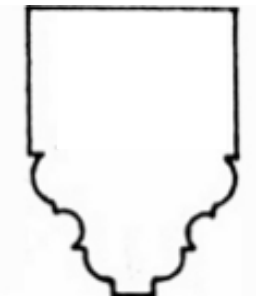
0 1 2 3 Ligature



We deal with information about architecture

this information can also be abstracted, and used for comparisons



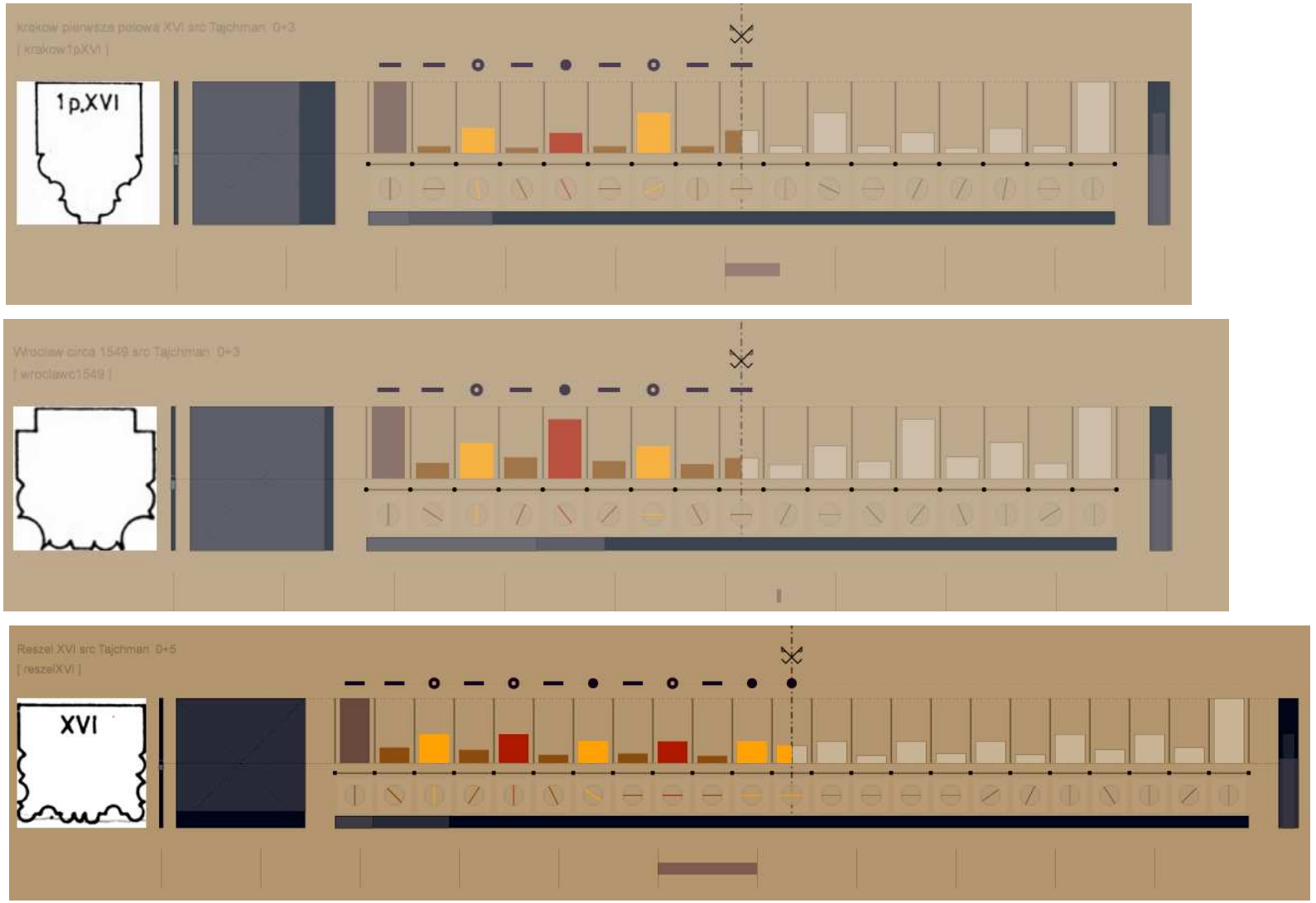


"Analysing architectural mouldings with 3Dobject-independant metrics and encoding" [in] Proceedings CGVCVIP ISBN 978-972-8939-22-9 pp201-209 (aut.)

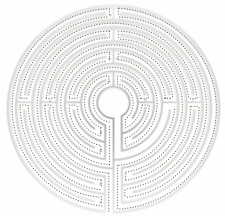
Benefits of Infovis (in heritage architecture analysis)

information

Spot any patterns ?



"Analysing architectural mouldings with 3Dobject-independant metrics and encoding" [in] Proceedings CGVCVIP ISBN 978-972-8939-22-9 pp201-209 (aut.)



Benefits of Infovis (in heritage architecture analysis)

information

We deal with information about architecture

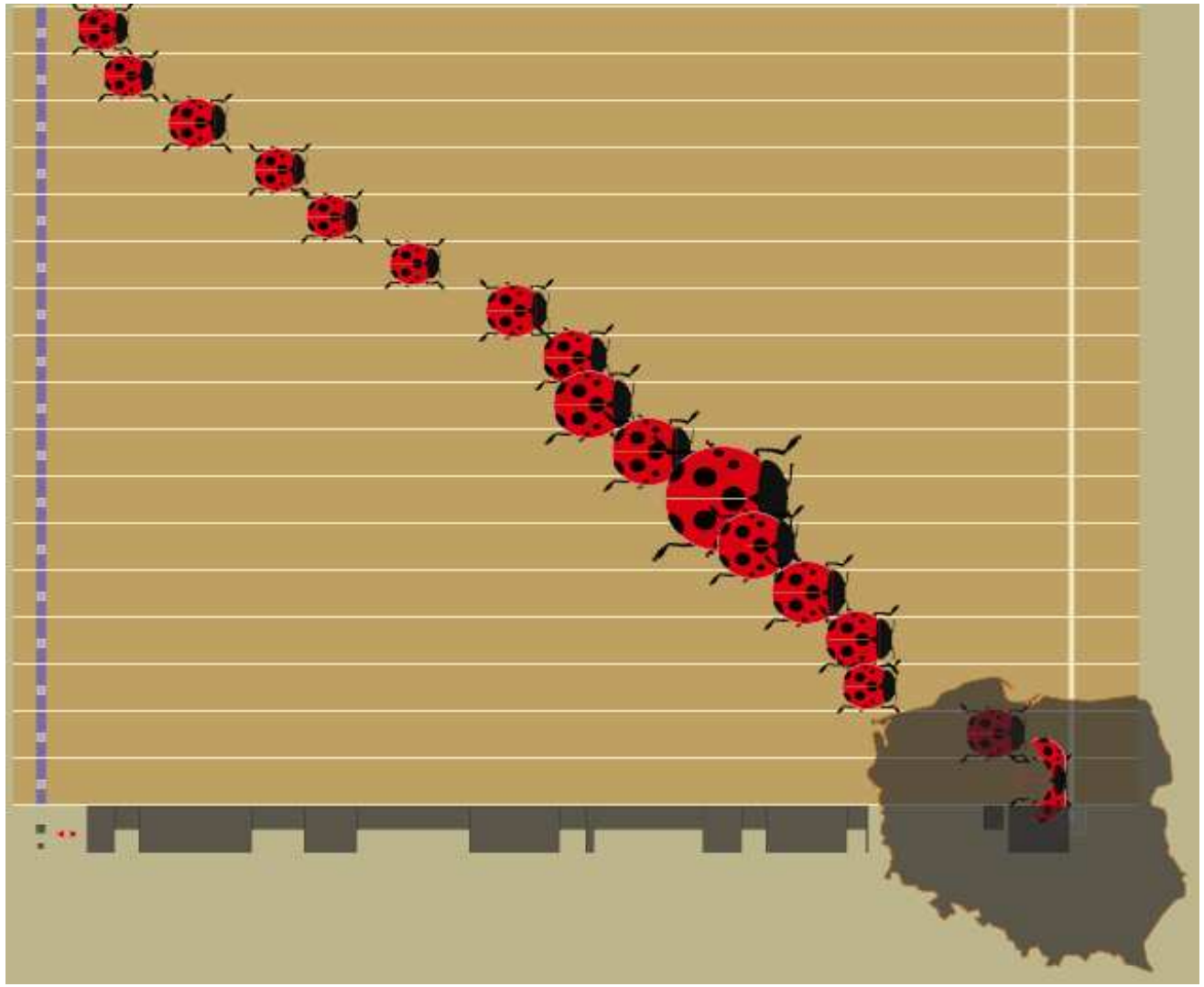
As in cartography*, graphics we are concerned with can be targeted at communication or visualisation.

If targeting the latter, Infovis concepts, methods and techniques can be relevant or at least inspiring.

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

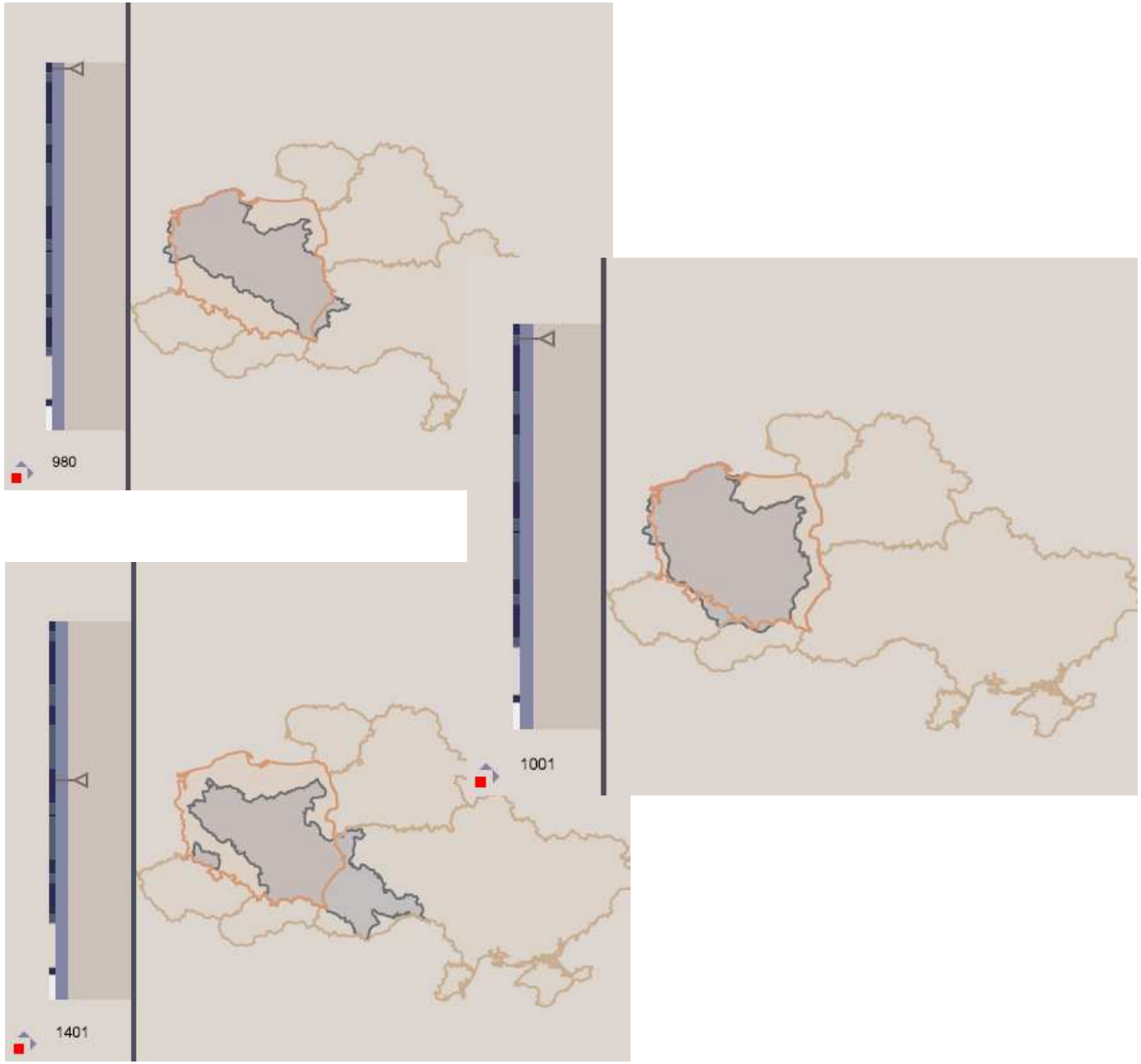
Benefits of Infovis (in heritage architecture analysis)

information



Benefits of Infovis (in heritage architecture analysis)

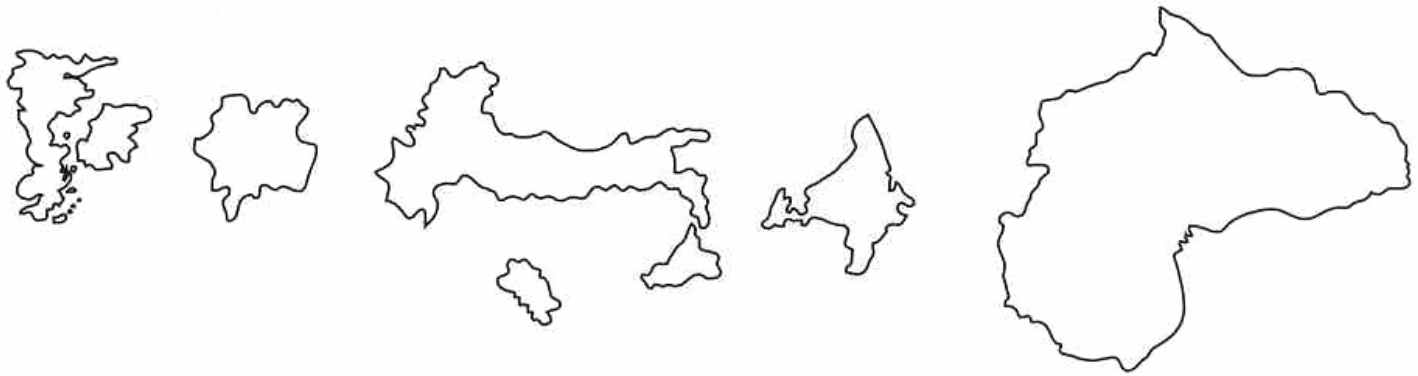
information



Benefits of Infovis (in heritage architecture analysis)

evaluation

We produce graphics. A graphic, may it be 1D, 2D, 3D, may not be clearly understood.



* *R.Spence Information Visualization*
Addison Wesley 2001

Benefits of Infovis (in heritage architecture analysis)

evaluation

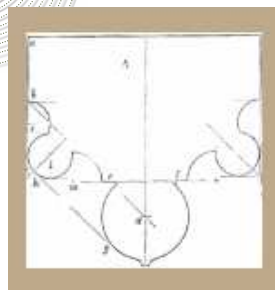
It is important to weigh users responses to graphics.

Among common practices in Infovis is **evaluation** (of graphics).

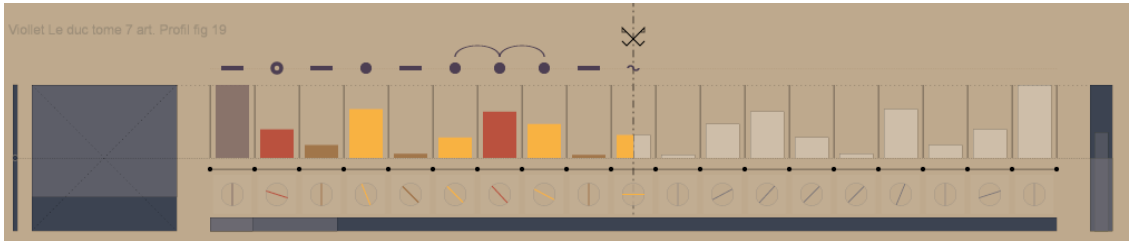
Benefits of Infovis (in heritage architecture analysis)

evaluation

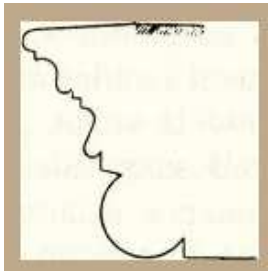
Pair matching test



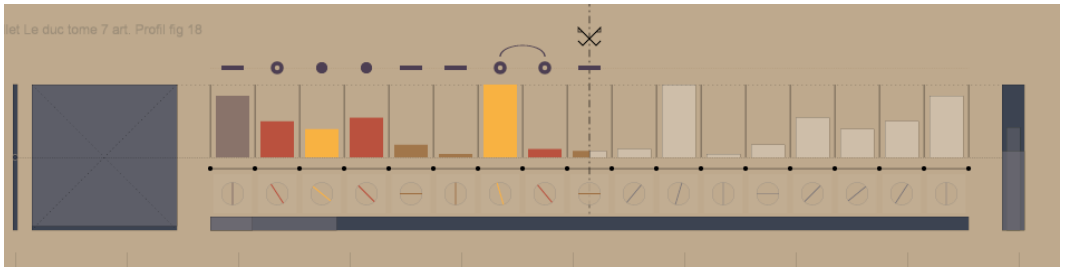
1



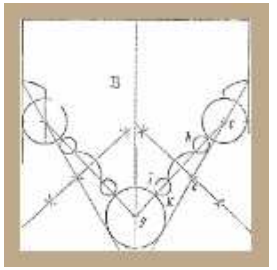
a



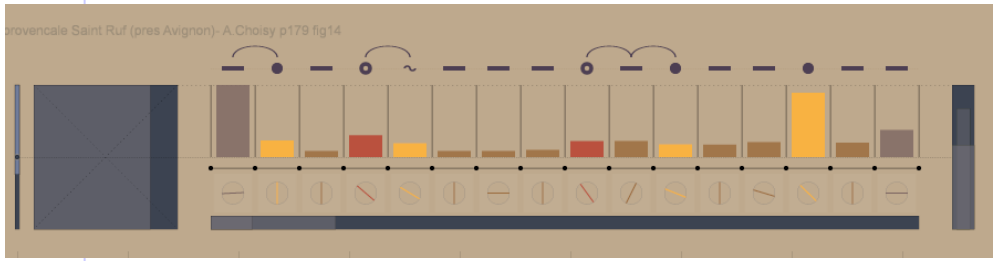
2



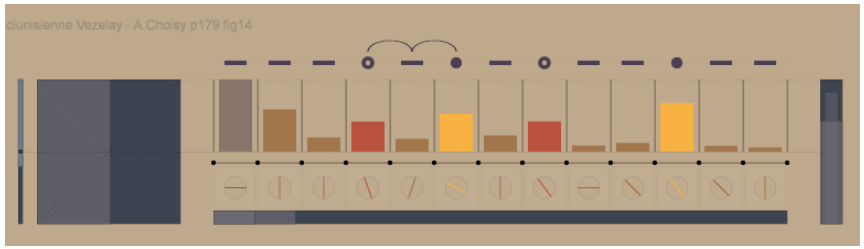
b



3

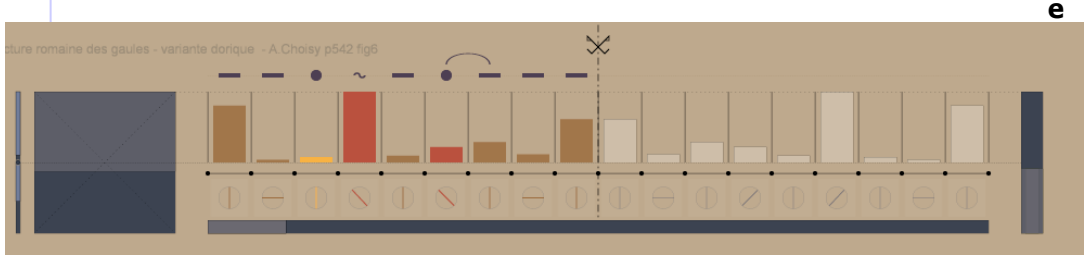


c

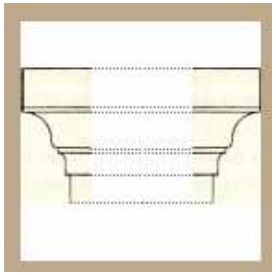


d

e



4



5

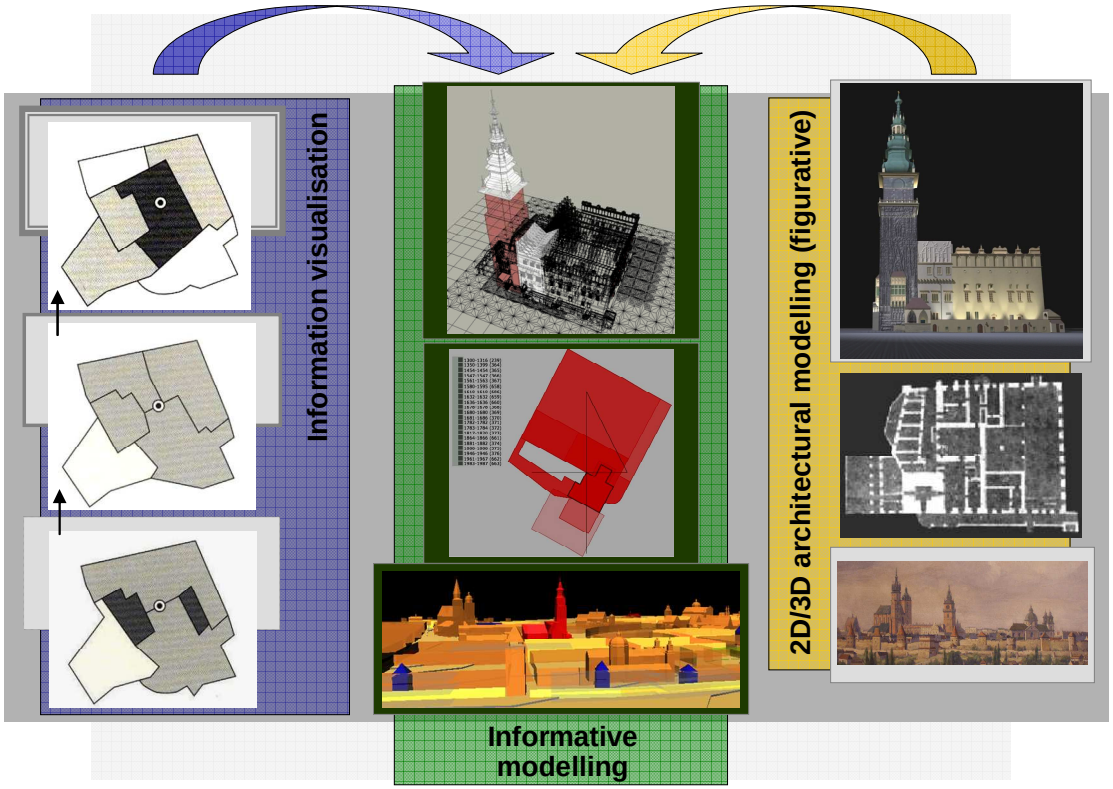
"Analysing architectural mouldings with 3Dobject-independant metrics and encoding" [in] Proceedings CGVCVIP ISBN 978-972-8939-22-9 pp201-209 (aut.)

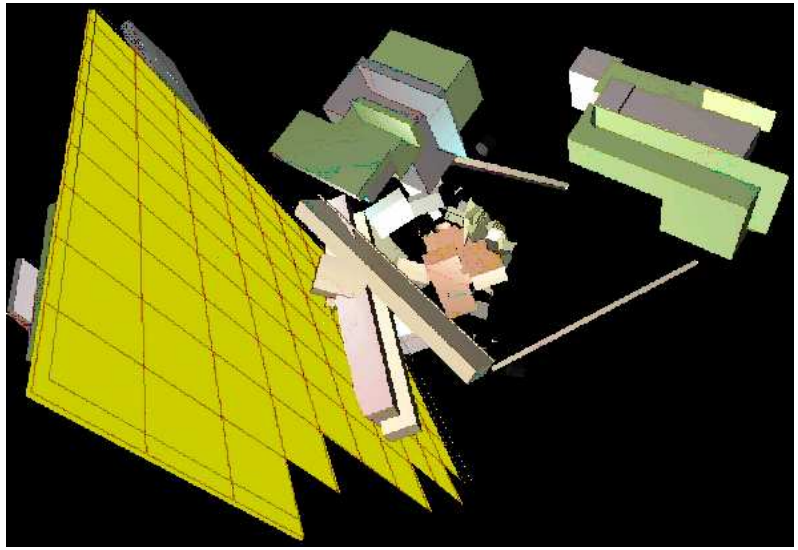
J.Y Blaise I.Dudek CNRS – Niedzica 2012

The Informative modelling paradigm

A best practice grid

Our experiences are about bridging the gap between architectural modelling – with a tradition of figurative representation- and Infovis – with practices centred on abstraction and visual reasoning.





If a 2D/3D model does not produce a gain of insight into the underlying information - it should be considered worthless.

Our experiences are about bridging the gap between architectural modelling – with a tradition of figurative representation- and Infovis – with practices centred on abstraction and visual reasoning.

This approach has been formalised through a grid of best practices:

14+1 rules.

http://www.map.archi.fr/mia/journal/articles/vol1S/num1/bookMia_en.pdf

Key points learnt from experiences

Inspiration has to be captured wherever it hides

J.Bertin Semiology of graphics : diagrams, networks, maps , Ann Arbor, Mich. : UMI, 2007.

just about the same

Politechnika Krakowska
im. Tadeusza Kościuszki

ul. Warszawska 24
31-155 Kraków

12 628 20 00
12 628 20 71
kancelaria@pk.edu.pl
http://www.pk.edu.pl

KONTAKT

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

KAPITAŁ LUDZKI
NARODOWA STRATEGIA SPÓJNOŚCI

PK

UNIA EUROPEJSKA
EUROPEJSKI
FUNDUSZ SPOŁECZNY