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?
Which is which?

scientific visualisation,

Infovis (Information Visualisation)

knowledge visualisation

Visual analytics,

Graphic Representation
Two categories of terms

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.

(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.

[ …] communication

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

** R.Spence Information Visualization Addison Wesley 2001
Defining the activity

Which is which?

( graphic ) Representation

Visualisation

"Analysing architectural mouldings with 3D object-independant metrics and encoding" [in]
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
Defining the activity

Infovis or not?

* 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 vol10, 2006

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

Scientific Visualisation

* A related, and somewhat overlapping field

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

Defining the activity
Knowledge visualisation or not?

A PERIODIC TABLE OF VISUALIZATION METHODS

<table>
<thead>
<tr>
<th>Element</th>
<th>Data Visualization</th>
<th>Strategy Visualization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tb</td>
<td>Visual representations of quantitative data in schematic form (either with or without axes)</td>
<td>The systematic use of complementary visual representations in the analysis, development, formulation, communication, and implementation of strategies in organizations.</td>
</tr>
<tr>
<td>Ca</td>
<td>Information Visualization</td>
<td>Metaphor Visualization</td>
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<tr>
<td>It</td>
<td>The use of interactive visual representations of data to simplify cognition. This means that data is transformed into an image, it is mapped in a 2D or 3D space where the image can be changed by users as they proceed working with it.</td>
<td>Visual Metaphors position information graphically to organise and structure information. They also convey an insight about the represented information through the key characteristics of the metaphor that is employed.</td>
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<tr>
<td>Pi</td>
<td>Concept Visualization</td>
<td>Compound Visualization</td>
</tr>
<tr>
<td>L</td>
<td>Methods to elaborate (mostly) qualitative concepts, ideas, plans, and analyses.</td>
<td>The complementary use of different graphic representations in one single scheme or frame.</td>
</tr>
</tbody>
</table>

from architectural modelling to Infovis :: terminology

Defining the activity

Knowledge visualisation or not?
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.

** 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.
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 analytics

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

![Diagram of Time wheel with Attribute and Time axes]
Defining the activity

An application to Dmochowski’s classification

Defining the activity

10 groups (stylistic affiliations)

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

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
Defining the activity

8 parameters

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

style: gothic

group: Double-nave hall churches

foundation: 1350

Max. length: 51.1 m

Volumes: 3

Apse: round

Number of chapels: 0

length (approx.)
Defining the activity

A time wheel

Shape of the apse

Number of chapels

Groups

Defining the activity

A time wheel

Shape of the apse

Number of chapels

Groups

Defining the activity

A time wheel

Shape of the apse

Number of chapels

Groups
Defining the activity

8 parameters

timeline

Overlapping of styles

Dmochowski’s classification is time-oriented
Defining the activity

Expected pattern

Exception

Expected pattern
Needs in heritage architecture analysis

What are we concerned with?

scientific visualisation,

Infovis
(Information Visualisation)

knowledge visualisation

Visual analytics,

Graphic Representation
from architectural modelling to Infovis :: terminology

Methods, concepts, techniques

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
Methods, concepts, techniques

Three fundamental units:
Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

pie charts

histograms

Hyperbolic browser

* R.Spence Information Visualization
Addison Wesley 2001
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

Three fundamental units:

Visual formalisms,
Metaphors,
Models

* R.Spence Information Visualization
Addison Wesley 2001
Methods, concepts, techniques

Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of graphic design

* R.Spence Information Visualization
Addison Wesley 2001
Methods, concepts, techniques

Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of
graphic design

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?

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

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.)

Methods, concepts, techniques

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

www.map.archi.fr/UIA (aut)
Methods, concepts, techniques

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)
Methods, concepts, techniques

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
Methods, concepts, techniques

Three fundamental units:

Visual formalisms,
Metaphors,
Models

Integration disposals,

General Principles of
graphic design

Models

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

Example?

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

Three fundamental units:

Visual formalisms, Metaphors, Models

Integration disposals,

General Principles of graphic design

* Pôle départemental archéologique du Var
Methods, concepts, techniques

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

Methods, concepts, techniques
Master visualisation

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

Example?

Methods, concepts, techniques

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)

Three fundamental units:

Visual formalisms, Metaphors, Models

Integration disposals,
Distance, in time from the oldest in the collection
Number of volumes
Shape of apse
Length
Ill-defined

Methods, concepts, techniques

from architectural modelling to Infovis :: terminology
Methods, concepts, techniques

Less diversity in groups present, smaller temporal coverage

Imbalance

More diversity in groups present

Regular distribution
Methods, concepts, techniques

* 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
from architectural modelling to Infovis :: terminology

Methods, concepts, techniques

* E.R Tufte Visual explanations
  Graphics Press 2001

Anything wrong now?
from architectural modelling to Infovis :: terminology

Methods, concepts, techniques

Visualising quantities by period

618-907
969-1279
1368-1644
1644-1911

* 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

J. Bertin

M. Friendly
Milestones in the history of thematic cartography, statistical graphics, and data visualization.
http://datavis.ca/milestones

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
Historical precedents: pre-computer era

Cartographic problems

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

Historical precedents: pre-computer era

Cartographic problems

The Peutinger map of Roman routes.

[http://fr.wikipedia.org/wiki/Table_de_Peutinger]
Historical precedents: pre-computer era

Cartographic problems

Panoramas.

A visualisation?

[M.Merian (1619) in J.Banach, « dawny widoki Krakowa » WL]
Historical precedents: pre-computer era

Cartographic problems

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
Historical precedents: pre-computer era

Statistic problems

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
Historical precedents: pre-computer era

Statistic problems

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.
Historical precedents

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

* Gestalt theory (early 20th c)
J.Bertin. Graphic Semiology (1967)

Time for computer-based solutions

* Perception of form
http://en.wikipedia.org/wiki/Gestalt_psychology
Historical precedents

The lesson to learn

*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.


J. Maeda. *No simplicity without complexity*, In G. Schuller, *Designing universal knowledge*, Lars Muller Publisher 2008
We deal with information about architecture morphology.

Benefits of Infovis (in heritage architecture analysis)

"innomine" research protocol (aut.)
Benefits of Infovis (in heritage architecture analysis)

Orientation, altitude
Number of sources, panoramic views
Events distributed in time

"innomine" research protocol (aut.)
Benefits of Infovis (in heritage architecture analysis)

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

viewer’s estimated position
Vertical bearing (looking up/down etc.)
image ratio
source type

* 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)

Compare positions of the production of authors
We deal with information about architecture this information can also be abstracted, and used for comparisons.

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

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

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

“Analysing architectural mouldings with 3D object-independent metrics and encoding” [in]
Benefits of Infovis (in heritage architecture analysis)

We deal with information about architecture this information can also be abstracted, and used for comparisons

(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:

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<th>1</th>
<th>2</th>
<th>3</th>
<th>Ligature</th>
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</tbody>
</table>

Benefits of Infovis (in heritage architecture analysis)

Spot any patterns?

“Analysing architectural mouldings with 3D object-independent metrics and encoding” [in]
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,
Benefits of Infovis (in heritage architecture analysis)
information
Benefits of Infovis (in heritage architecture analysis)

from architectural modelling to Infovis :: benefits
Benefits of Infovis (in heritage architecture analysis)

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

* R.Spence Information Visualization
Addison Wesley 2001
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)

Pair matching test

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.
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.

Key points learnt from experiences

Inspiration has to be captured wherever it hides

just about the same

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