Softwaretechnologie für Fortgeschrittene Wohce 7

Modelling across disciplines
What is a model?

For example, take a 3D computer-based artefact – which is based on a geometric expression.

The 3D visual artefact we see – is not (just) a visualisation.

It is a model:

– we create it
– we manipulate it
– we learn from it

The geometric expression is also a model – how are the two related?

This distinction is the core of media modelling.
What is modelling?

• Creative process of thinking/reasoning
  • meaning made and negotiated through creation and manipulation of external representations

• As research strategy:
  • process by which researchers make and manipulate external representations (“imaginary concreta”, Godfrey-Smith 2009) to make sense of conceptual objects and phenomena
Modelling in the sciences

- The Bohr model of the atom
- The double helix model of the DNA
- The Lotka-Volterra model of predator-prey interaction
- Actor based models of economic transactions
- Actor-network models
- Economic models
- Climate models
Modelling in the sciences

- Fundamental to science
- Important in society
  - still hard to define
- Not just static
  - tools for interactive inquiry
- Can have quite different forms
  - physical and fictional objects
  - set-theoretic structures
  - mathematical equations
  - ...
Original map made by John Snow in 1854. Cholera cases are highlighted in black. Wikimedia Commons. URL: http://en.wikipedia.org/wiki/File:Snow-cholera-map-1.jpg
Narrotological models: Propp

- Absentation
- Interdiction
- Violation Of Interdiction
- Reconnaissance
- Delivery
- Trickery
- Complicity
- Villainy Or Lack
- Mediation
- Beginning Counter-Action
- Departure
- First Function Of The Donor
- Hero's Reaction
- Receipt Of A Magical Agent
- Guidance
- Struggle
- Branding

- Victory
- Liquidation
- Return
- Pursuit
- Rescue
- Unrecognized Arrival
- Unfounded Claims
- Difficult Task
- Solution
- Recognition
- Exposure
- Transfiguration
- Punishment
- Wedding

Narratological models: Chatman

Modelling and storytelling

Charles Minard's 1869 chart showing the number of men in Napoleon's 1812 Russian campaign army, their movements, as well as the temperature they encountered on the return path. Lithograph, 62 x 30 cm. Wikimedia Commons. URL: http://commons.wikimedia.org/wiki/File:Minard.png
Modelling in Digital Humanities

- Purposes include
  - making things
  - understanding things
  - teaching
  - making implicit information explicit

- Basis for modelling
  - media products
  - other objects/structures

- Mediated models
  - thus, no focus on mind models

- Models are dynamic
  - sometimes in form
  - can be modified
  - always in creation
  - always in use

- Thus: modelling
Maps as models

Modelling a listing of place names

Maps as models

Modelling an interpretation of a listing of place names

Signal transfer

You can run through the forests; they will be wild and blooming, you will turn right, or left, or straight up and fly. You will never go through before you want to.

Signal transfer

Witness statement

Scribe’s understanding

<p>heeder
<n type="person">Anders Henningsen Miøsødal</n> Er Fød paa denne gaard
<n type="place">Stuedahlen</n>,...</p>
But...

PEER [...] (listens)
What’s that sound of childish grieving?
Grief, but halfway to a song. —
Underfoot there’s threadballs weaving — ! (lash out)
Give me room, now! Get along!

THREADBALLS (on the ground) We are thoughts;
you should have thought us; —

http://ibsen.nb.no/asset/114049/1/114049_1.pdf
you should have thought us

Witness statement

Scribe's understanding

<p>heeder
<name type="person">Anders Henningsen Miøsødal</name> Er Fød paa denne gaard <name type="place">Stuedahlen</name>,...</p>
Something is missing

- The model is a model
  - in a specific context
  - for somebody
  - based on interpretation

A large (infinite?) number of models were never created.
You should witness statement

Scribe's understanding

Anders Henningsen Miøsødal
Er Fød på denne gaard
Stuedahlen

Publisher: Eide
Models and their targets

- Complex relationship
- From representational view
  - e.g. isomorphism
- To pragmatic modelling
  - somebody creates a model of something with some purpose
- Models mediating
  - between theory and physical world
  - ‘autonomous agents’
Modelling in Digital Humanities

• Practice of modelling in DH
  – mainly theorised around understandings of modelling in the technosciences and computer science in particular
  – (Flanders and Jannidis 2015)
  ➢ Data modelling

• Recently model-making theorised within a semiotic framework
  – (Knuuttila 2010; Kralemann and Lattmann 2013; Ciula and Marras 2016)

Modelling as a process of signification (semiotic process – meaning making)
Three perspectives on data modelling:

- **Conceptual schema**: types of facts or propositions that can be expressed using the model.
  - Independence

- **Logical schema**: tables, columns, classes, XML tags, ...
  - Independence

- **Physical schema**: partitions, CPUs, tablespaces, ...
  - Independence

ANSI 1975
Abstract and concrete

"The abstract graph"
(a problem of representation)
The concrete need for the abstract

- Hamlet
- What connects things?
  - text
  - performance
  - film
  - comics
  - ...

Universität zu Köln
Digital Humanities – Historisch-Kulturwissenschaftliche Informationsverarbeitung
Prof. Dr. Eide
What is a model?

<table>
<thead>
<tr>
<th>Dance</th>
<th>Mathematical propositions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video</td>
<td>Virtual reality</td>
</tr>
<tr>
<td>Figures</td>
<td>Words</td>
</tr>
</tbody>
</table>

There is no general hierarchy
- no “more” or “better” type of model at the top
- The may still be relationships
- a model based on another abstraction/operationalisation of
E28 Conceptual Object

This class comprises non-material products of our minds and other human produced data that have become objects of a discourse about their identity, circumstances of creation or historical implication. The production of such information may have been supported by the use of technical devices such as cameras or computers.

Characteristically, instances of this class are created, invented or thought by someone, and then may be documented or communicated between persons. Instances of E28 Conceptual Object have the ability to exist on more than one particular carrier at the same time, such as paper, electronic signals, marks, audio media, paintings, photos, human memories, etc.

They cannot be destroyed. They exist as long as they can be found on at least one carrier or in at least one human memory. Their existence ends when the last carrier and the last memory are lost. (*CIDOC CRM 6.2.3: 2018*)
Shared conceptualisations

• Meaning can only be negotiated in the human mind
• Must link conceptual objects to shared objects
  – For human to human communication, but also
  – For a meaningful semantic web
• Based on agreed upon meaning between humans
  – With formal ontologies this enables meaningful automatic reasoning
Empirical model

Theoretical model

model for

Empirical model

comparison

calibration

verification

model of

Creating knowledge

comparison
evaluation

Thanks to Oliver Nakoinz for inspiration
The creative tension between concepts and implementation happens also *within* the modelling process.
Concepts

Programming
3D modelling
Database setup
Data entry

Model

doing

Implementation

learning
The creative tension between concepts and implementation happens also within the modelling process.
Oseberg
Oseberg

Modellerte dimensjoner:
Band: 80mm x 150mm
Bete: 125mm x 80mm
Kne: 55mm x 80mm
Snelle: 150mm x 40mm

\[
h(x, y, z) = |I_0|^2 + 2|I_1|^2 + |I_2|^2
\]

\[
I_0(x, y, z) = \int_0^\infty B_0(\theta, x, y, z) \left( \ell_1^{(1)} \ell_2^{(2)} + \ell_1^{(2)} \ell_2^{(1)} \frac{1}{\alpha_s} \sqrt{n_2^2 - n_1^2 \sin^2 \theta} \right) \, d\theta
\]

\[
I_1(x, y, z) = \int_0^\infty B_1(\theta, x, y, z) \left( \ell_1^{(1)} \ell_2^{(2)} \frac{n_z}{\alpha_s} \sin \theta \right) \, d\theta
\]

\[
I_2(x, y, z) = \int_0^\infty B_2(\theta, x, y, z) \left( \ell_1^{(1)} \ell_2^{(2)} + \ell_1^{(2)} \ell_2^{(1)} \frac{1}{\alpha_s} \sqrt{n_2^2 - n_1^2 \sin^2 \theta} \right) \, d\theta
\]

\[
B_m(\theta, x, y, z) = \sqrt{\cos \theta \sin \theta} J_m(k \sqrt{x^2 + y^2} \sin \theta) e^{iW(\theta)}
\]

\[
W(\theta) = k \left\{ \ell_{\theta} \sqrt{n_2^2 - n_1^2 \sin^2 \theta} + \ell_{\theta} \sqrt{n_2^2 - n_1^2 \sin^2 \theta} - \ell_{\theta} \sqrt{n_2^2 - n_1^2 \sin^2 \theta} + \ell_{\theta} \sqrt{n_2^2 - n_1^2 \sin^2 \theta} \right\}
\]
This is also a learning strategy
Fusing theory with practice

theory/modelling

implementation

= practice based theory

= theory based practice

➔ the role of modelling
The Cologne model
(established late 1990s, still going strong)

• Currently 400+ BA and 50+ MA students
• We train humanities candidates who are also developers
  – basis: Java or C++
  – then in projects: C#, javascript, python, prolog, ...
• This means, for instance:
  – students making VR systems do so in the context of media theory
  – tool use is based on knowing tool development
  – not programmer + humanities, as two distinct parties meeting

For us it is about the merging of two sets of competences/practices in one person
Research, practice, and theory

- Research based teaching
  - learning from researchers
- Practice based teaching
  - learning by doing
- The role of theory
  - what theory?
  - "The theory of the humanities" does not exist
Summary

• A model is a way to
  – make the abstract concrete
  – manipulate this concretisation (also during creation)

• Beneficial when the meaning and the tools are understood by the same person
  – works differently in computer scientist – humanist collaboration, but differently
  – still some people need to understand both
  – understanding for practical tasks (such as programming) is mastering practical work

• Digital + humanities is
  – practice + theory
  – operationalisation + abstraction

*Digital humanities ≠ computer science + humanities*
Thanks (but no responsibility):

- VW colleagues
  - Arianna Ciula, Cristina Marras, Patrick Sahle
- Students
  - from BA to PhD
- Manfred Thaller
- Other colleagues in Cologne & around the world
- All those who keep on asking questions
  - don't worry too much about answers
  - we can usually find them later