

Models as Forms, Models as Concepts

Øyvind Eide

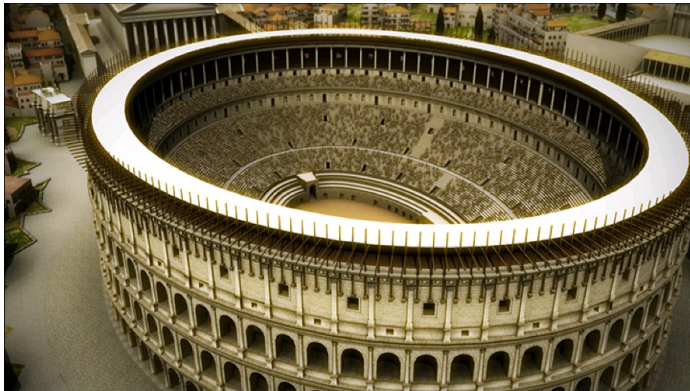
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What is a model?



$$\begin{aligned}
 h(x, y, z) &= |I_0|^2 + 2|I_1|^2 + |I_2|^2 \\
 I_0(x, y, z) &= \int_0^\alpha B_0(\theta, x, y, z) \left(t_s^{(1)} t_s^{(2)} + t_p^{(1)} t_p^{(2)} \frac{1}{n_s} \sqrt{n_s^2 - n_i^2 \sin^2 \theta} \right) d\theta \\
 I_1(x, y, z) &= \int_0^\alpha B_1(\theta, x, y, z) \left(t_p^{(1)} t_p^{(2)} \frac{n_i}{n_s} \sin \theta \right) d\theta \\
 I_2(x, y, z) &= \int_0^\alpha B_2(\theta, x, y, z) \left(t_s^{(1)} t_s^{(2)} + t_p^{(1)} t_p^{(2)} \frac{1}{n_s} \sqrt{n_s^2 - n_i^2 \sin^2 \theta} \right) d\theta \\
 B_m(\theta, x, y, z) &= \sqrt{\cos \theta} \sin \theta J_m(k \sqrt{x^2 + y^2} n_i \sin \theta) e^{jW(\theta)} \\
 W(\theta) &= k \left\{ t_s \sqrt{n_s^2 - n_i^2 \sin^2 \theta} + t_i \sqrt{n_i^2 - n_i^2 \sin^2 \theta} - t_i^* \sqrt{n_i^{*2} - n_i^2 \sin^2 \theta} + \right. \\
 &\quad \left. + t_g \sqrt{n_g^2 - n_i^2 \sin^2 \theta} - t_g^* \sqrt{n_g^{*2} - n_i^2 \sin^2 \theta} \right\}
 \end{aligned}$$

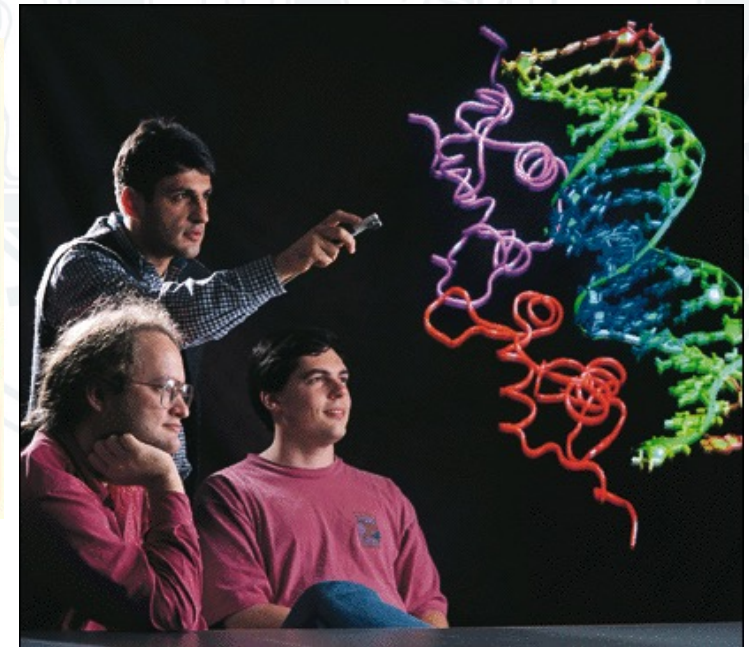
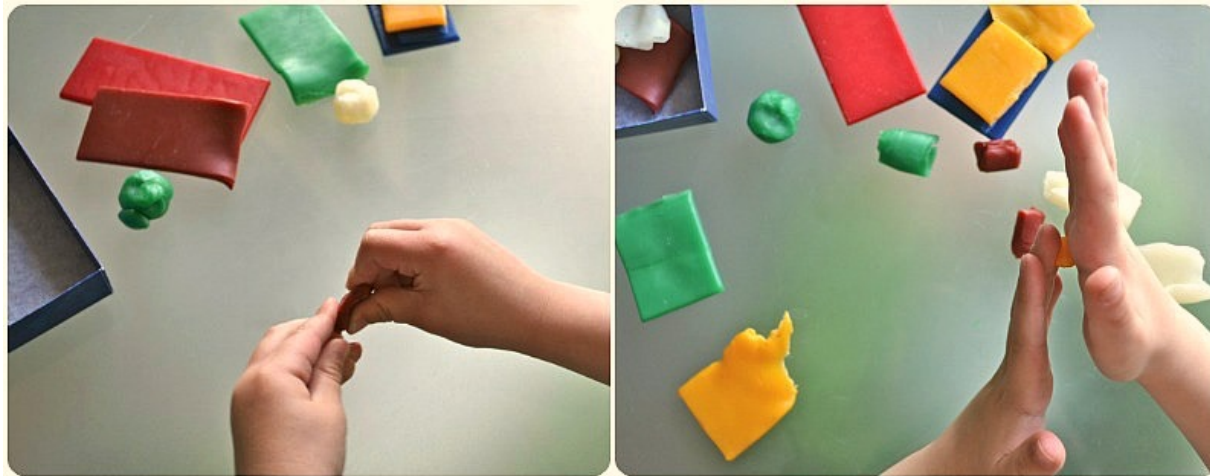
This distinction is the core of this paper

- 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?



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

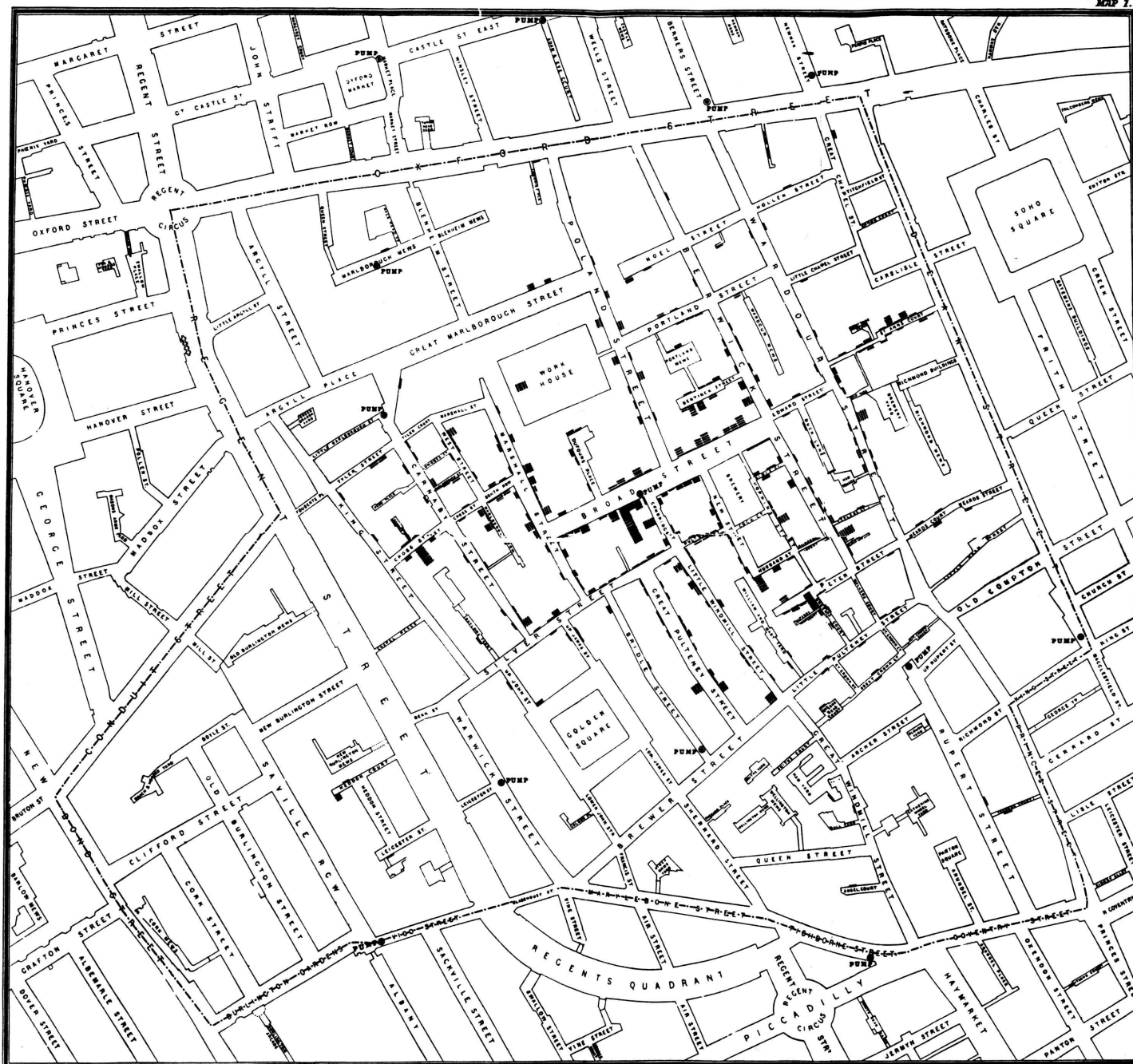


Modelling in the sciences

- 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
 - ...



Analysis and understanding



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

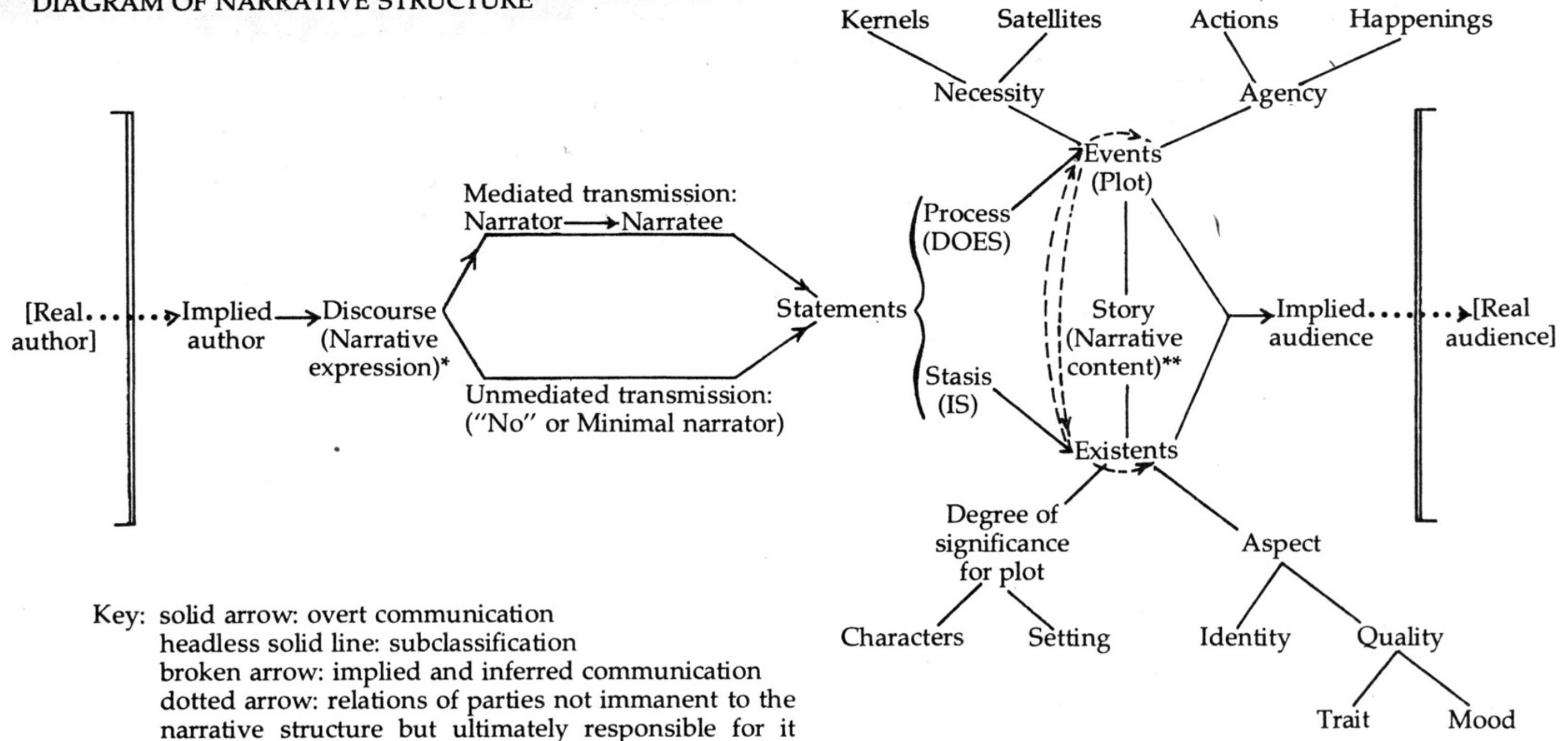
- Victory
- Liquidation
- Return
- Pursuit
- Rescue
- Unrecognized Arrival
- Unfounded Claims
- Difficult Task
- Solution
- Recognition
- Exposure
- Transfiguration
- Punishment
- Wedding

Propp, Vladimir. *Morphology of the Folktale*. Bloomington, 1958. Orig: Морфология сказки.



Narratological models: Chatman

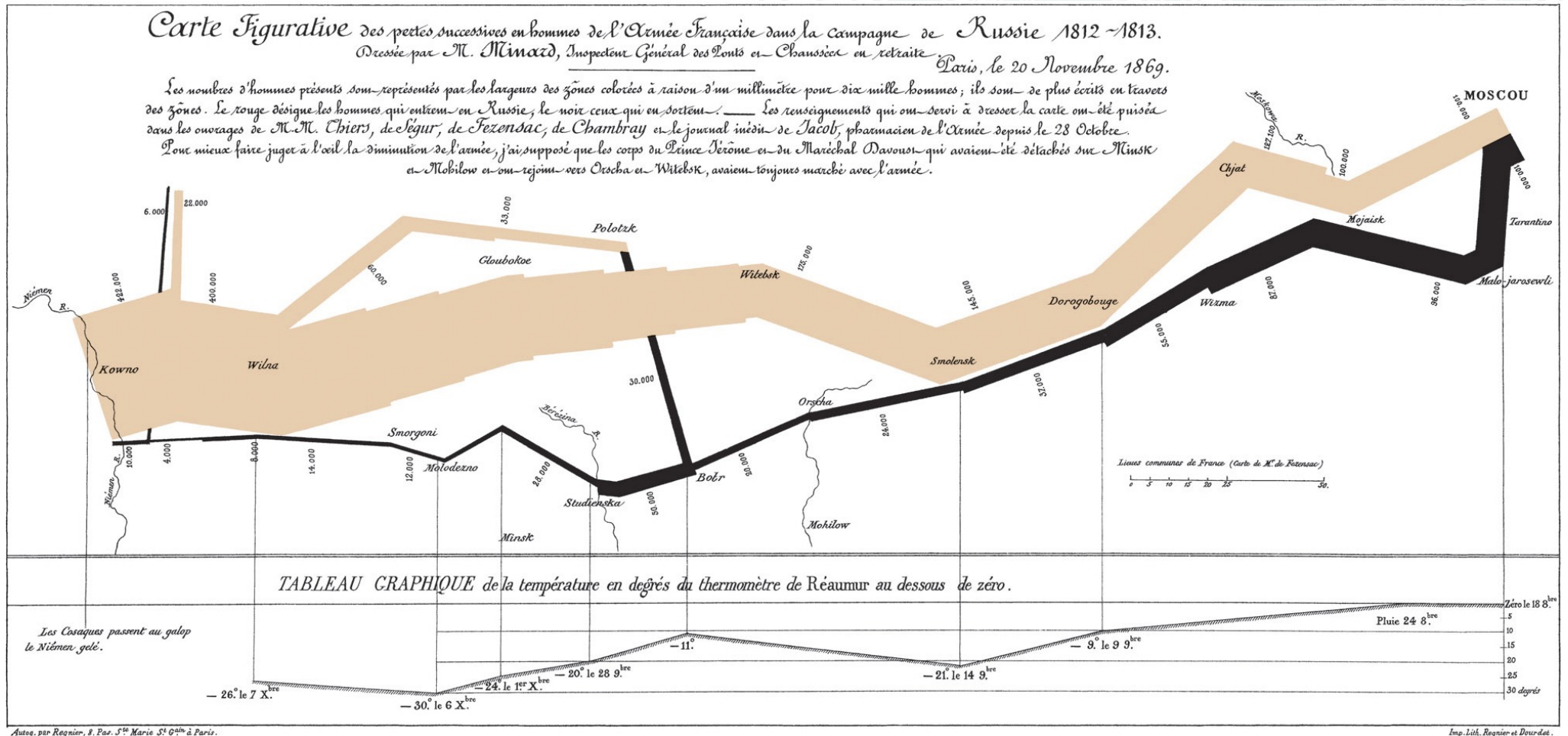
DIAGRAM OF NARRATIVE STRUCTURE



*This is the form of narrative expression; its *substance* or manifestation appears in various media (verbal: fiction, history; visual: paintings, comic strips; audio-visual: cinema, etc.).

**This is the form of the content not its substance.

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>

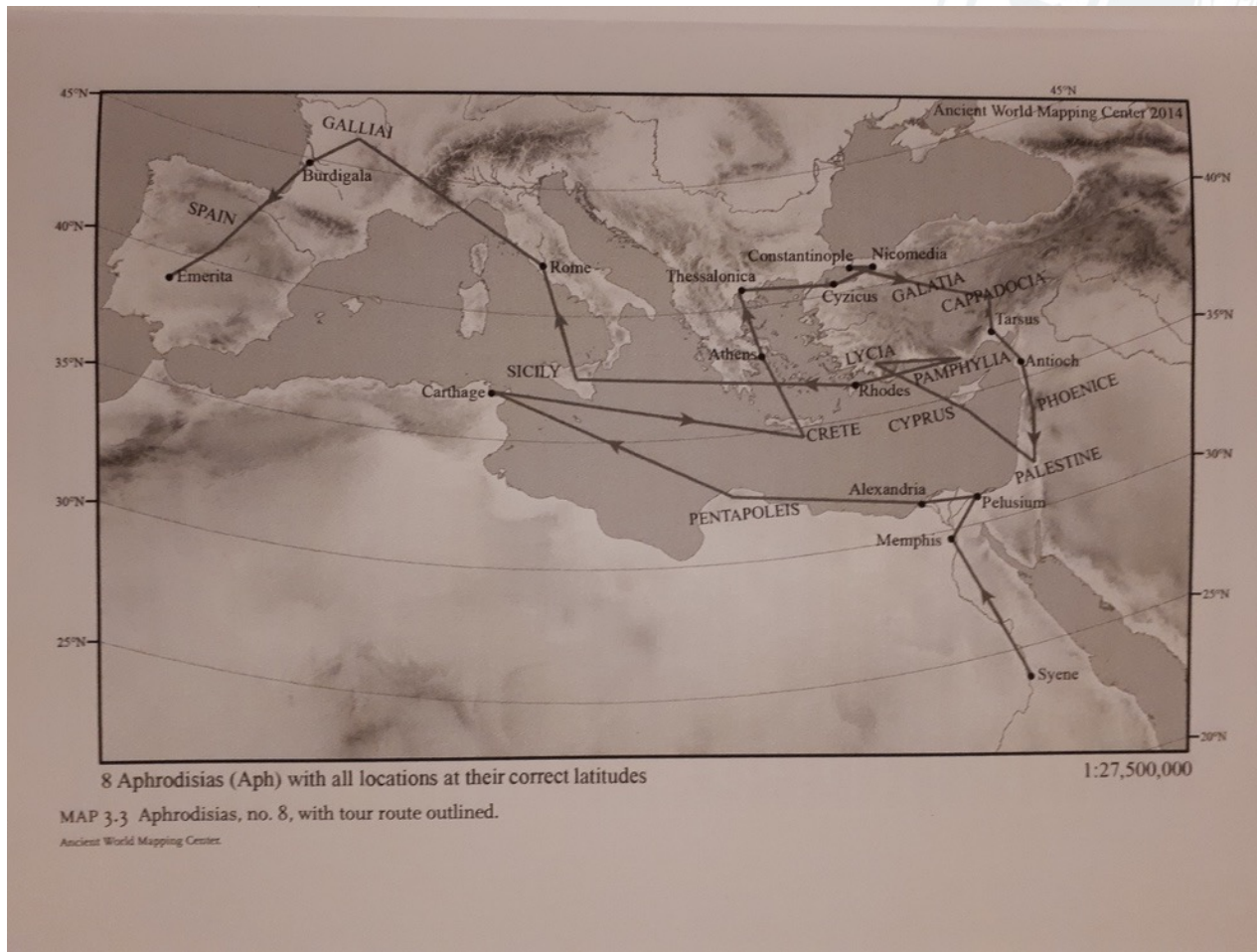
Modelling in Digital Humanities

- 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

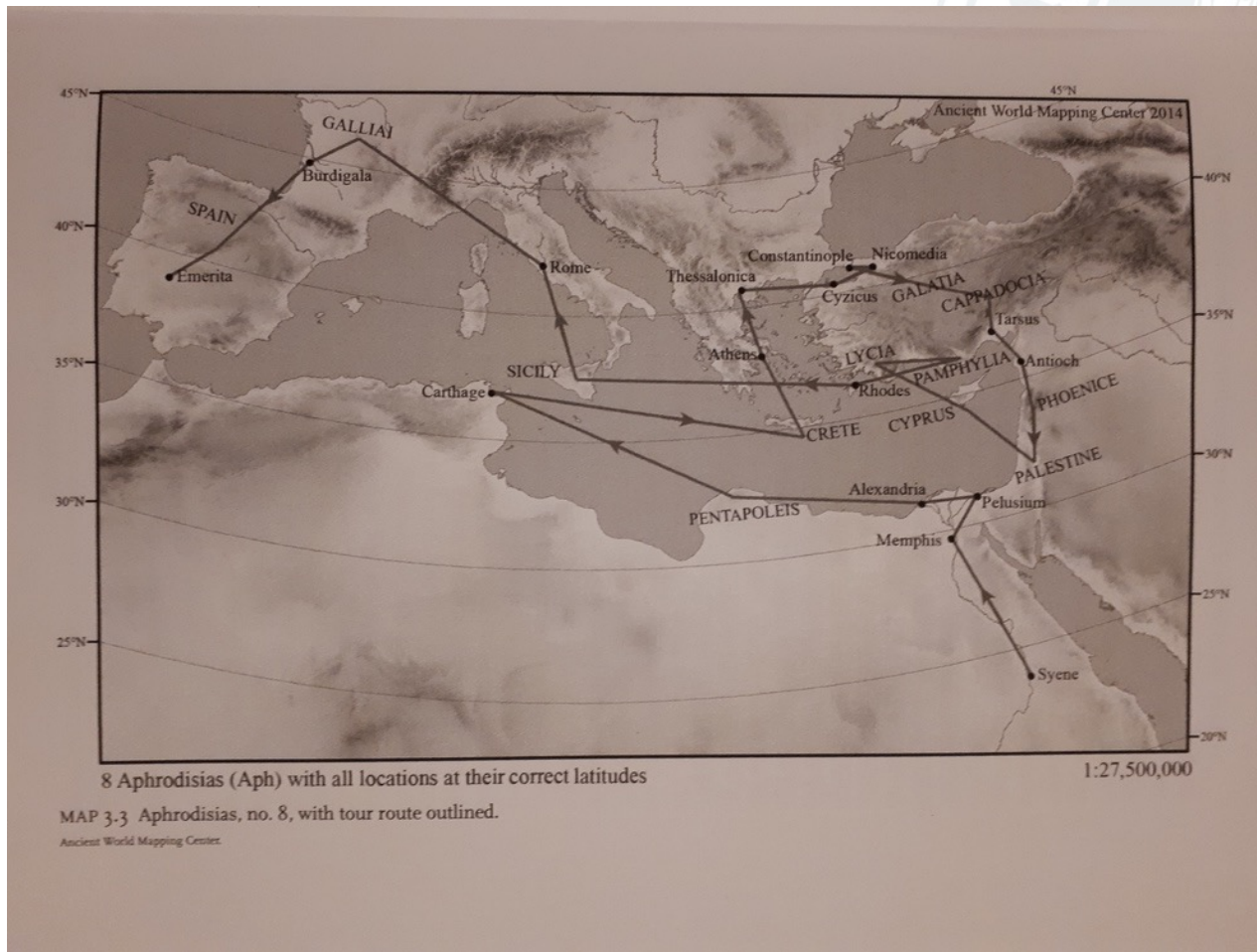


Talbert, R. J. A. (2017).
Roman Portable Sundials: The Empire in your Hand. Oxford,
Oxford University Press: 135.



Maps as models

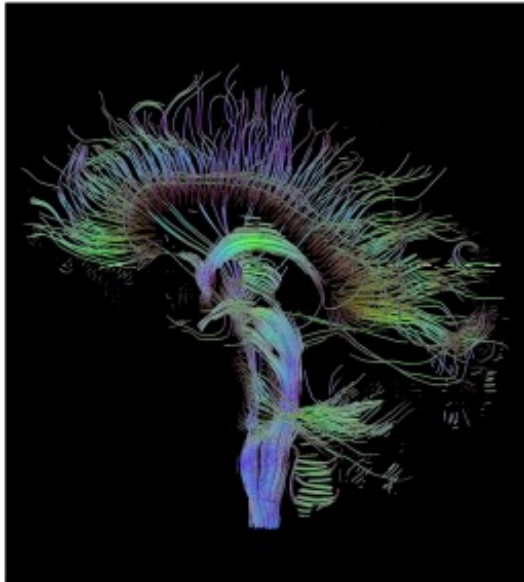
Modelling an interpretation of a listing of place names



Talbert, R. J. A. (2017).
Roman Portable Sundials: The Empire in your Hand. Oxford,
Oxford University Press: 135.

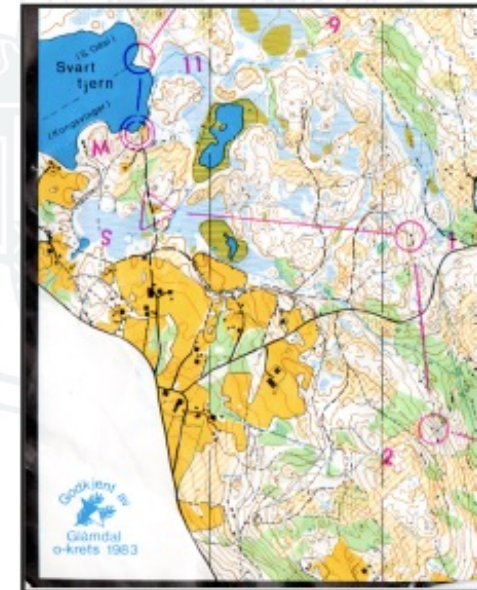


Signal transfer

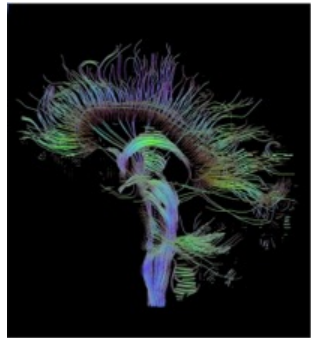


File from the Wikimedia Commons:
<http://en.wikipedia.org/wiki/File:DTI-sagittal-fibers.jpg>

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.

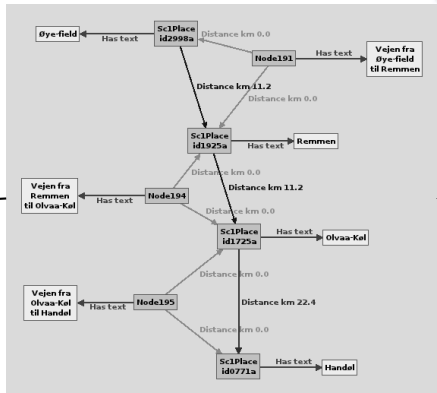
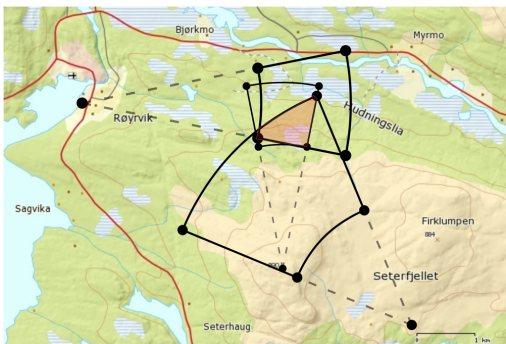
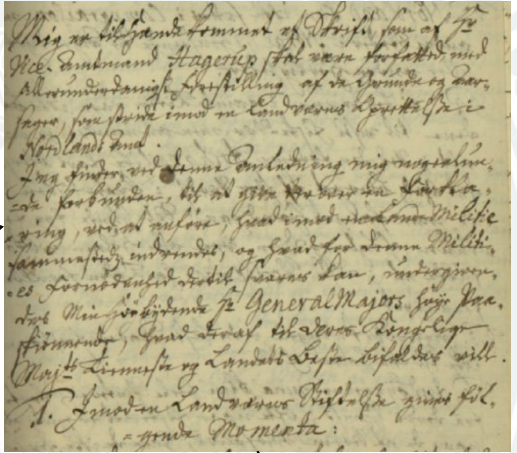


Signal transfer



Witness statement

Scribe's understanding



```

<p>heeder
<name type="person">
Anders Henningsen
Miøsdal
</name> Er Fød paa
denne gaard
<name type="place">
Stuedahlen
</name> ,... </p>
    
```



But...

PEER [...] (listens)

What's that sound of childish grieving?

Grief, but halfway to a song. —

Underfoot there's threadballs weaving — ! (lashes out)

Give me room, now! Get along!

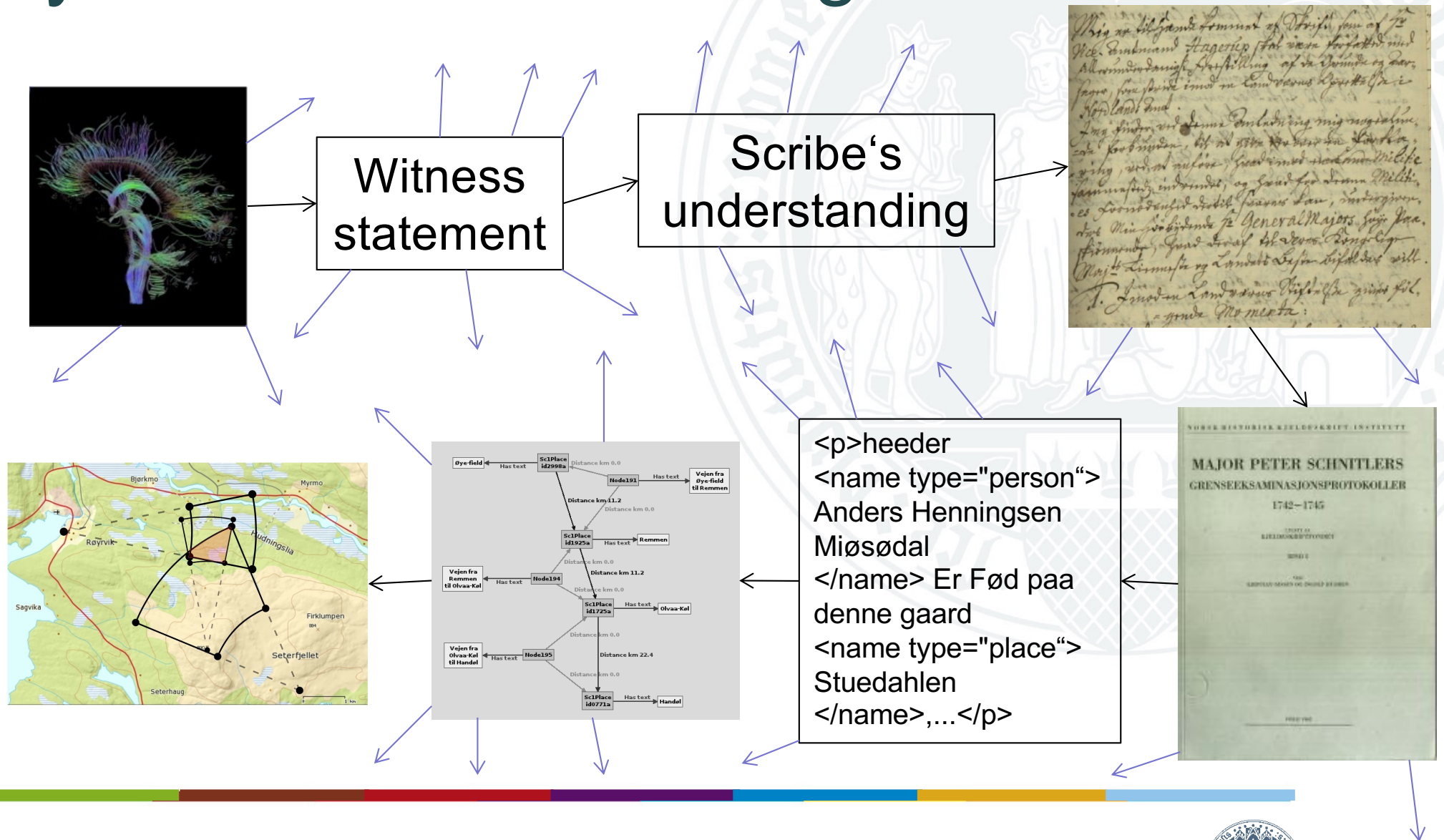
THREADBALLS (on the ground) We are thoughts;
you should have thought us; —

Henrik Ibsen: Peer Gynt : A Dramatic Poem, Act 5. Transl. John Northam. Ibsen.net, 2007.

http://ibsen.nb.no/asset/114049/1/114049_1.pdf

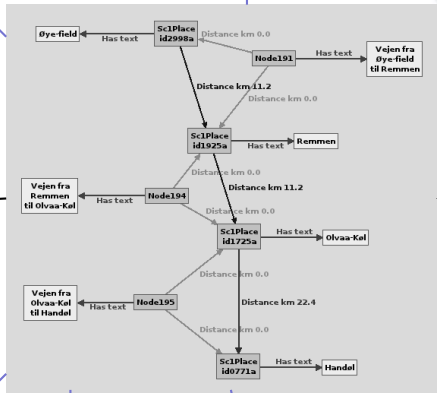
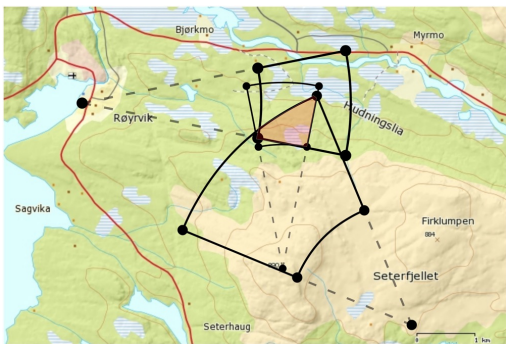
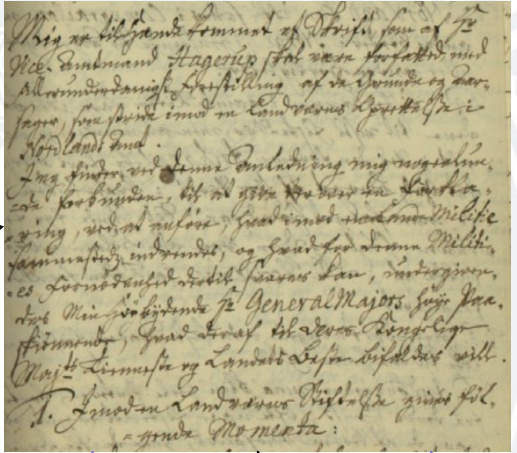


you should have thought us



Witness statement

Scribe's understanding



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<name type="person">  
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Miøsdal  
</name> Er Fød paa  
denne gaard  
<name type="place">  
Stuedahlen  
</name>, ... </p>
```



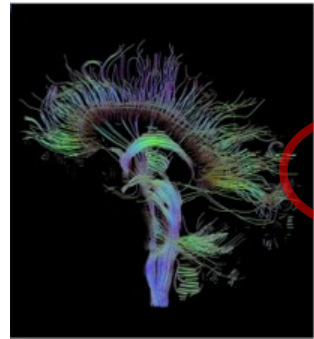
Something is missing

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

A large (infinte?) number of models were never created.



You should

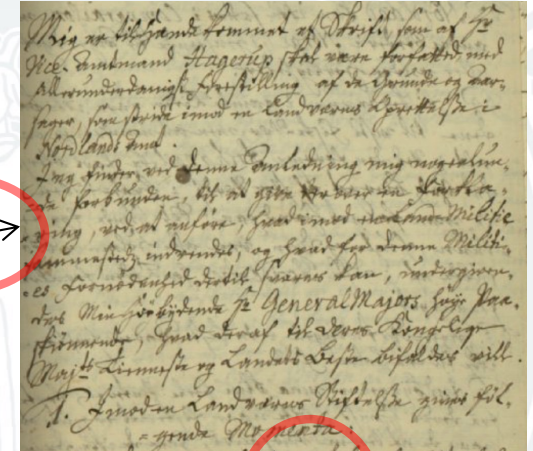


Witness

Witness statement

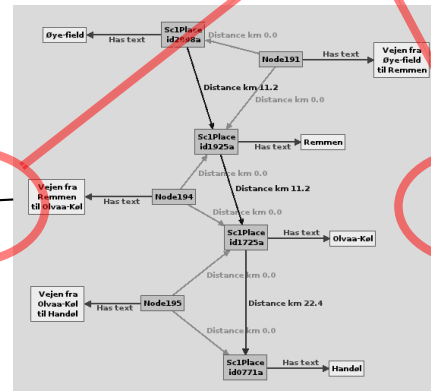
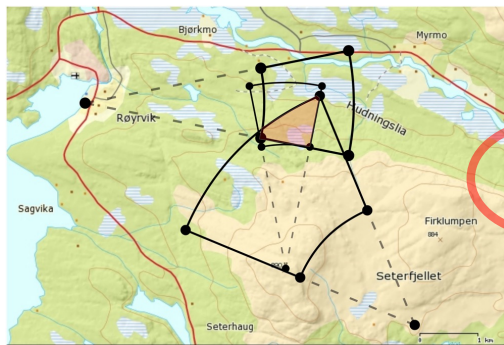
Scribe

Scribe's understanding

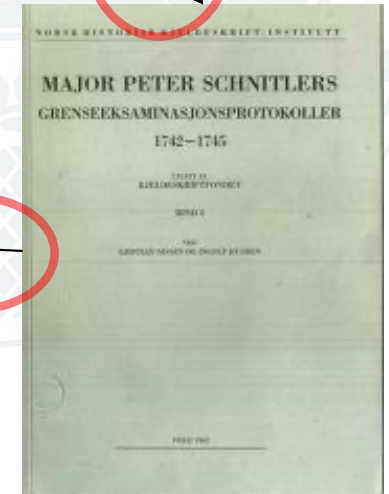


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Publisher



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<p>heeder  
<name type="person">  
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denne gaard  
<name type="place">  
Stuedahlen  
</name>, ... </p>
```



Universität zu Köln

Digital Humanities – Historisch-Kulturwissenschaftliche Informationsverarbeitung

Prof. Dr. 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)



Model

Theoretical aspects
model for

Empirical aspects
model of

Mediation

Abstraction

Abstract

Concrete



modelling goal



model source

Targets



ANSI 1975

Three perspectives on data modelling

Abstract

Concrete

Model

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

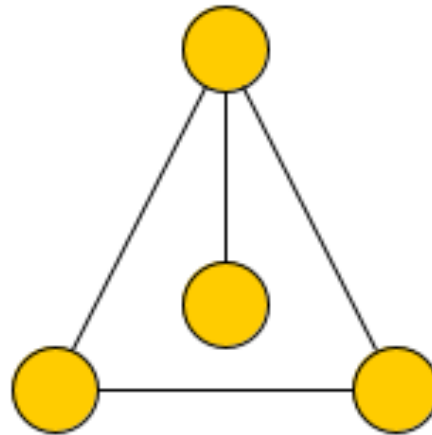
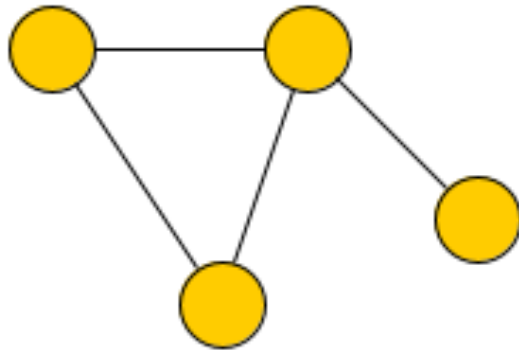
partitions, CPUs, tablespaces, ...



Abstract and concrete

"The abstract graph"

(a problem of representation)



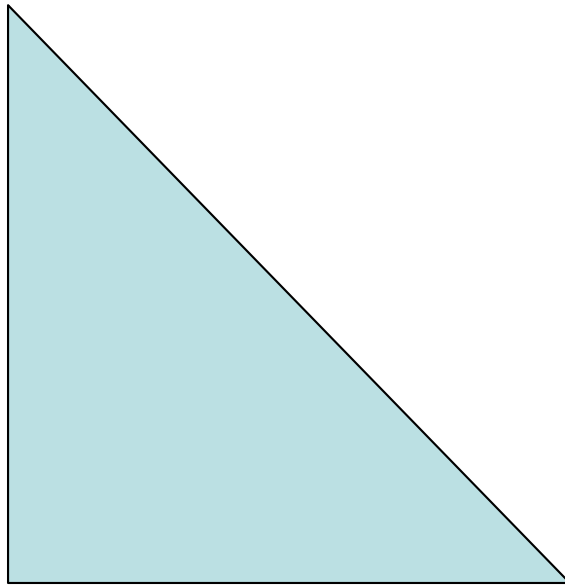
0	1	0	1
1	0	1	1
0	1	0	0
1	1	0	0

Abstract

Concrete



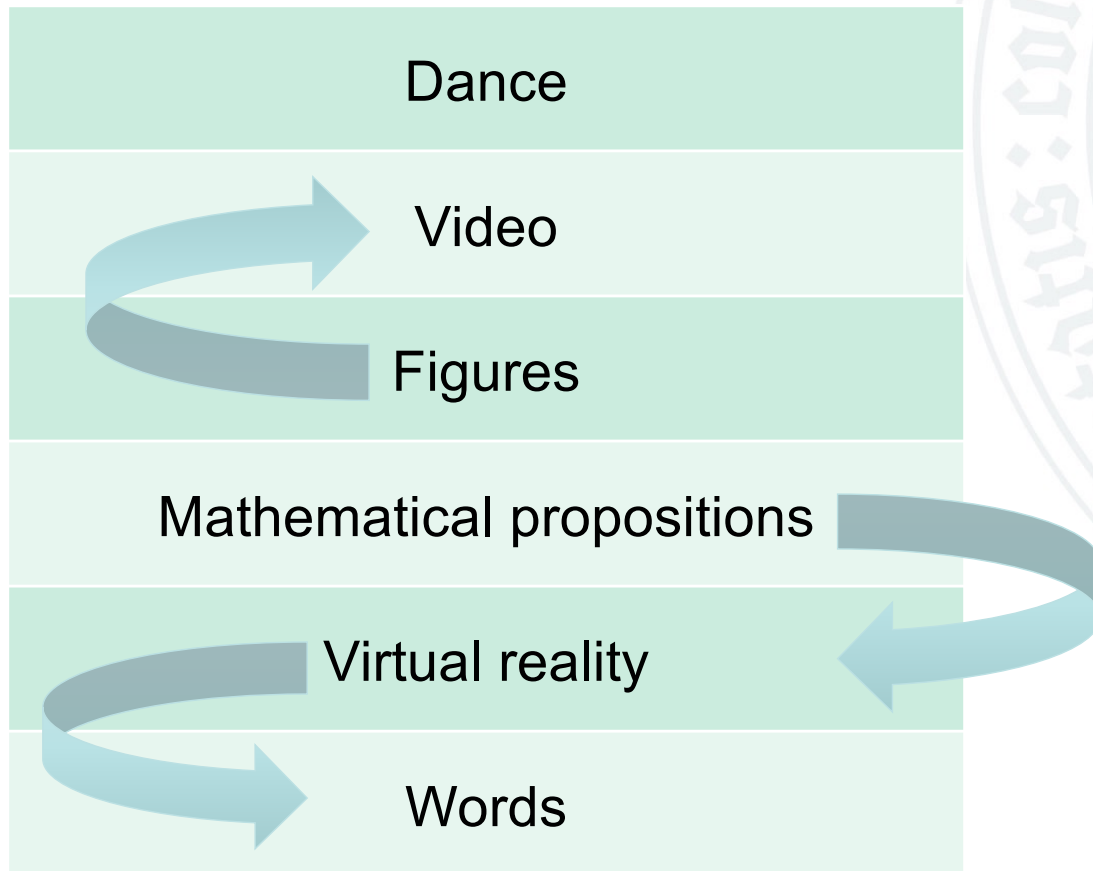
The concrete need for the abstract



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



What is a model?



There is no general hierarchy

no “more” or “better” type of model at the top

There may still be relationships

a model based on another abstraction/operationalisation of

