

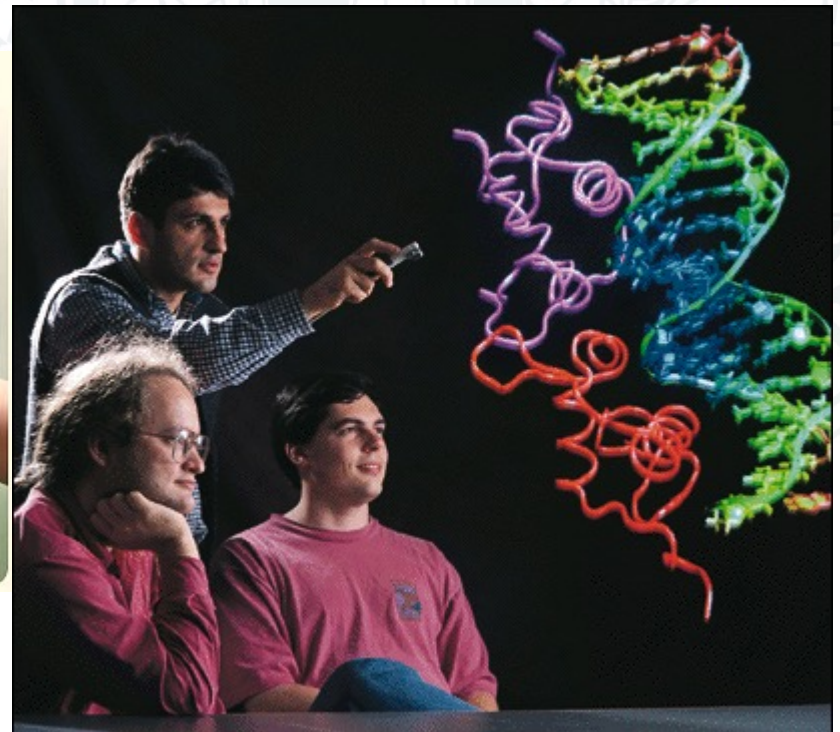
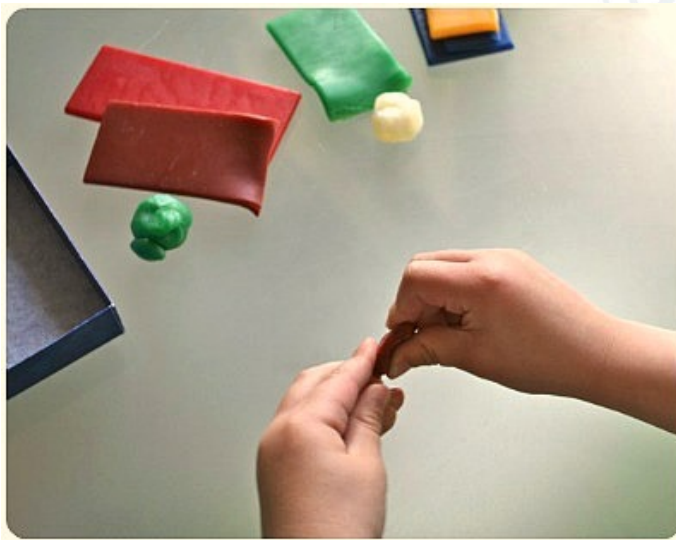
# Historisch- Kulturwissenschaftliche Informationsverarbeitung Woche 9

## Modellierung in den Wissenschaften



# 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

# Working definition of modelling

modelling =

(modeller+,  
model (mediaProduct+),  
target+)



# Digital Humanities and Numerical Mathematics

- Modelling
- Formalisation
- Operationalisation

*core areas of practice and research for many decades*



# History of the humanities

- Antiquity
  - Patterns and principles
  - Development of categories
  - Classification
  - Clusters
- Model based digitisation
  - what is evidence?
  - empirical research
  - experiments

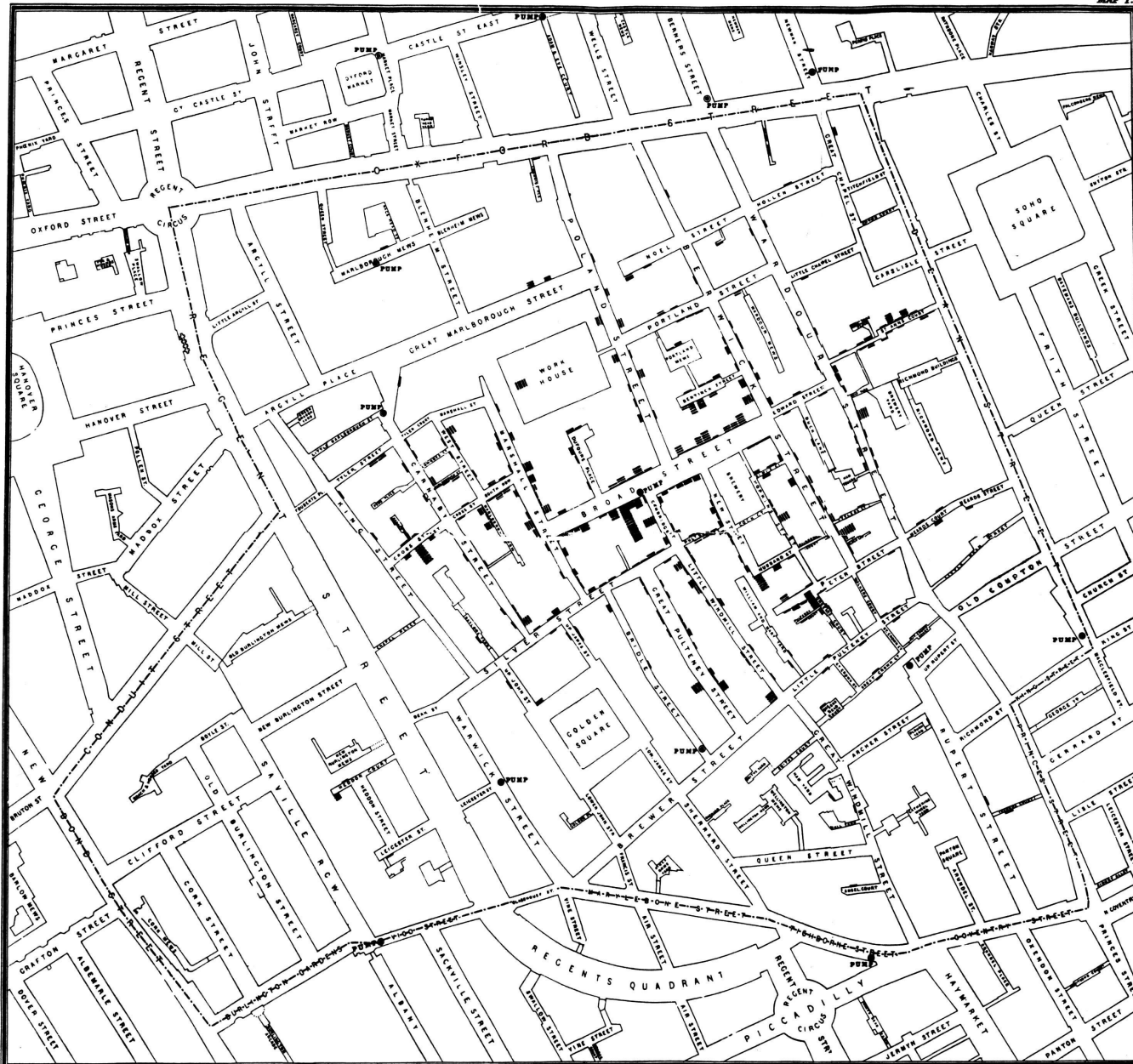


# History of the humanities

- Historical development
  - rise and fall
  - cyclical models
  - periodisation
- Architecture, geometry, cartography
  - cosmological models
  - Mappa Mundi
- Philology
  - stemmatology
  - concordances



# 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

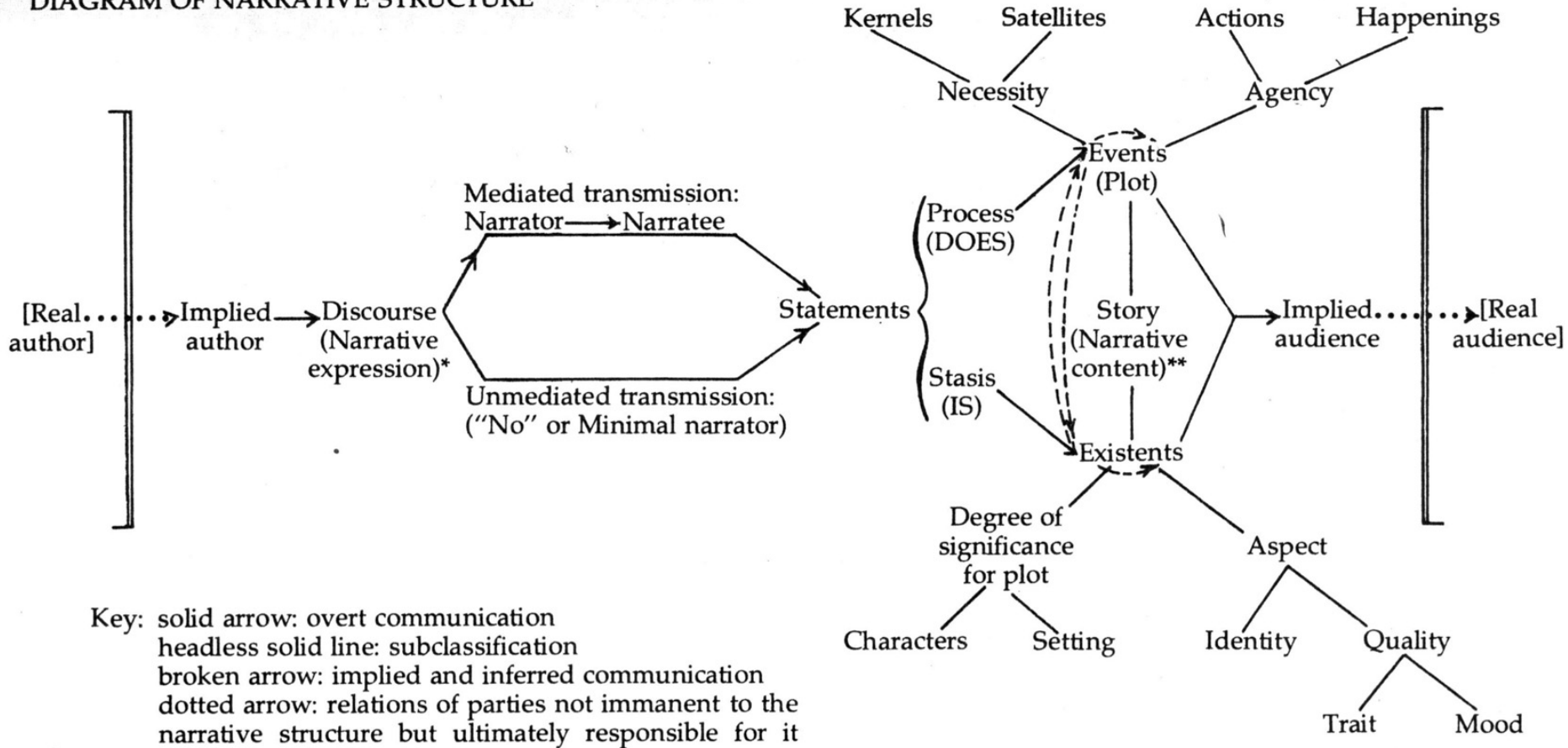
- Victory
- Liquidation
- Return
- Pursuit
- Rescue
- Unrecognized Arrival
- Unfounded Claims
- Difficult Task
- Solution
- Recognition
- Exposure
- Transfiguration
- Punishment
- Wedding

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.

Chatman, S. (1978). *Story and discourse: narrative structure in fiction and film*. Ithaca.



# Modelling and storytelling

*Carte Figurative* des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.  
Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui ont été en Russie, le noir ceux qui en sont sortis. Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Chiers, de Léguir, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre. Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davout, qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

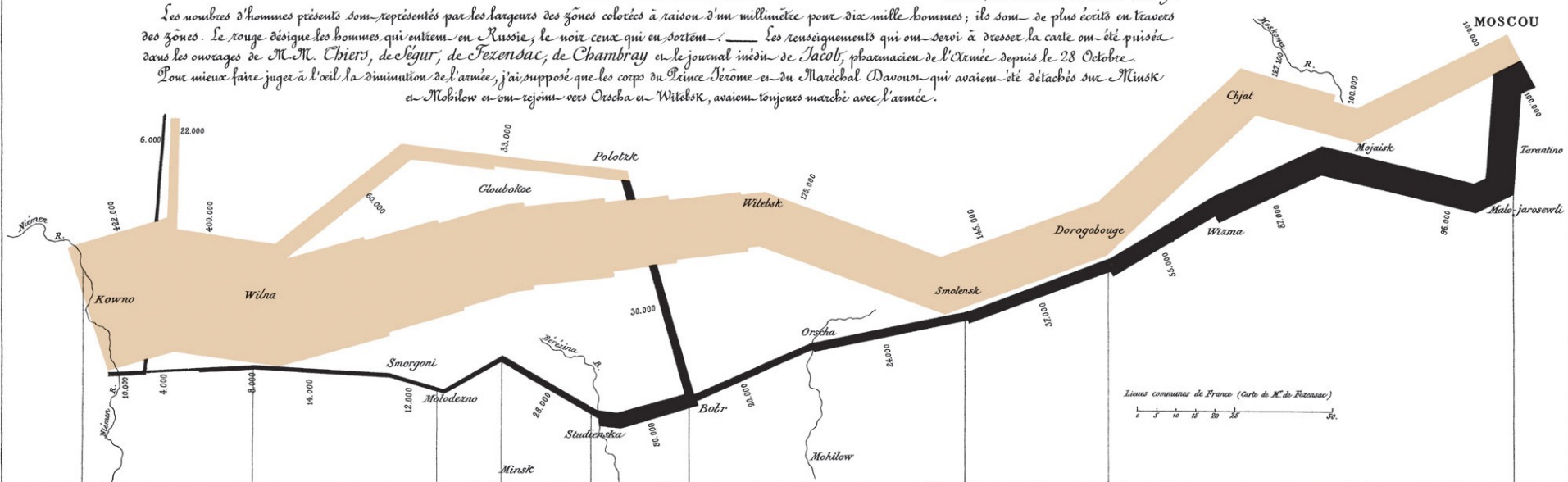
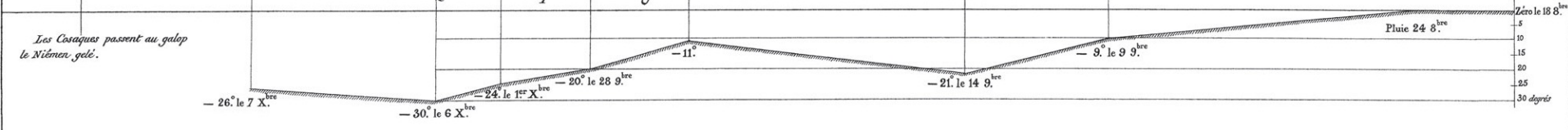


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.



Les Cosaques passent au galop le Niémen gelé.

Autog. par Regnier, 8, Par. S<sup>te</sup> Marie S<sup>t</sup> O<sup>u</sup> à Paris.

Imp. Lit. Regnier et Doucet.

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>

# Digital humanities

- Data modelling
- Databases and software
  - cultural heritage and museums
  - lexicographical production systems
  - scholarly editing
  - research databases
- Modelling as a process of coming to know
  - manipulation of media products
  - semiotics
  - operationalisation



# 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, not discussing mind models\*
- Models are dynamic
  - sometimes in form
    - can be modified
  - always in creation
  - always in use
- Thus: *modelling*

# 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)

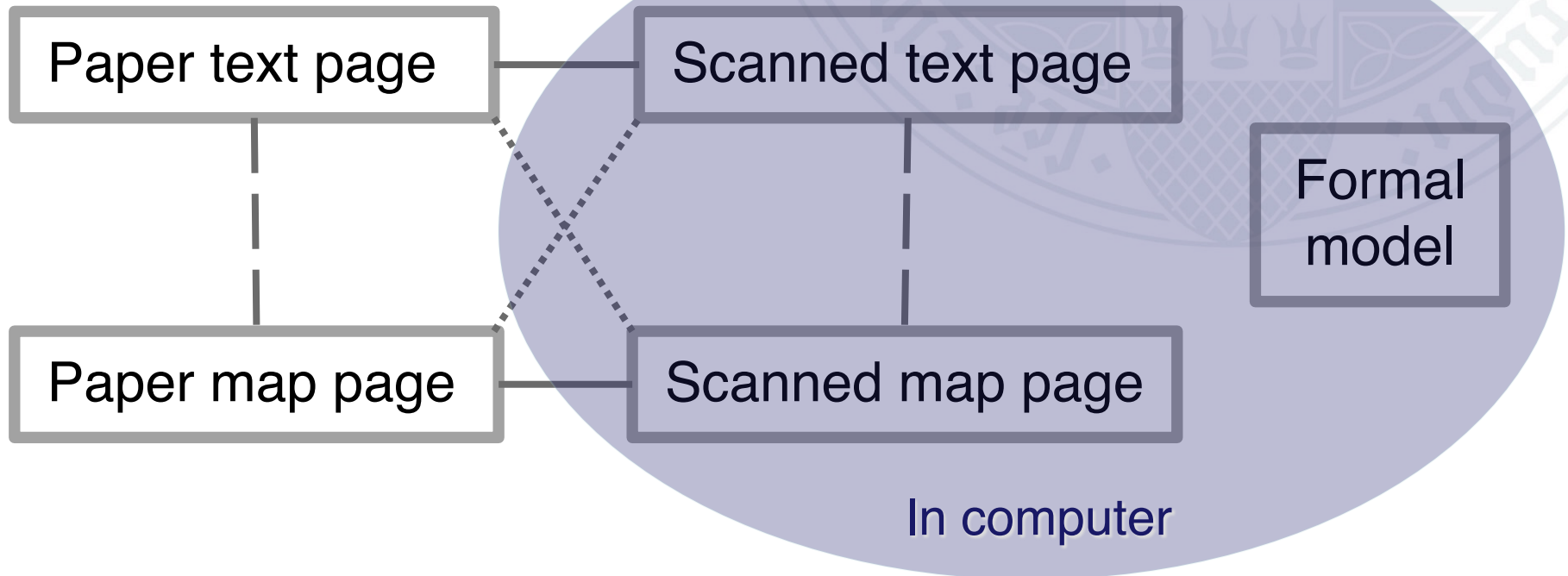


# Modelling in (digital) humanities

- Digital
  - formal
  - rule-based
  - structured
  - discrete
- Humanities
  - analogous
  - continuous
  - nuanced
  - hermeneutical
- Thick descriptions
- Practice-based
  - Bridge: operationalisation*
  - Make concepts of humanities enquiry
    - measurable
    - computable
- Cf. models as tools

# Critical stepwise formalisation

- Creating expressions in one medium based on a source in another medium
- The computer is not in itself rigorous



# Media transformations

- Intermedia studies
  - *study* media transformations
  - e.g., adaptation studies
- Transformative digital intermedia studies
  - *perform* media transformations
  - reasoning through external representations
  - understood better through intermedia theory





# 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
- Quite different forms
  - physical and fictional objects
  - set-theoretic structures
  - mathematical equations
  - ...



# 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’



# Numerical mathematics

- Mathematical formula
  - describes problems
  - natural science
  - engineering
- Mathematical models
  - only idealised processes
  - modelling errors
- Analysis of models
  - unique solution?
- Solving mathematical models



# Solving mathematical models

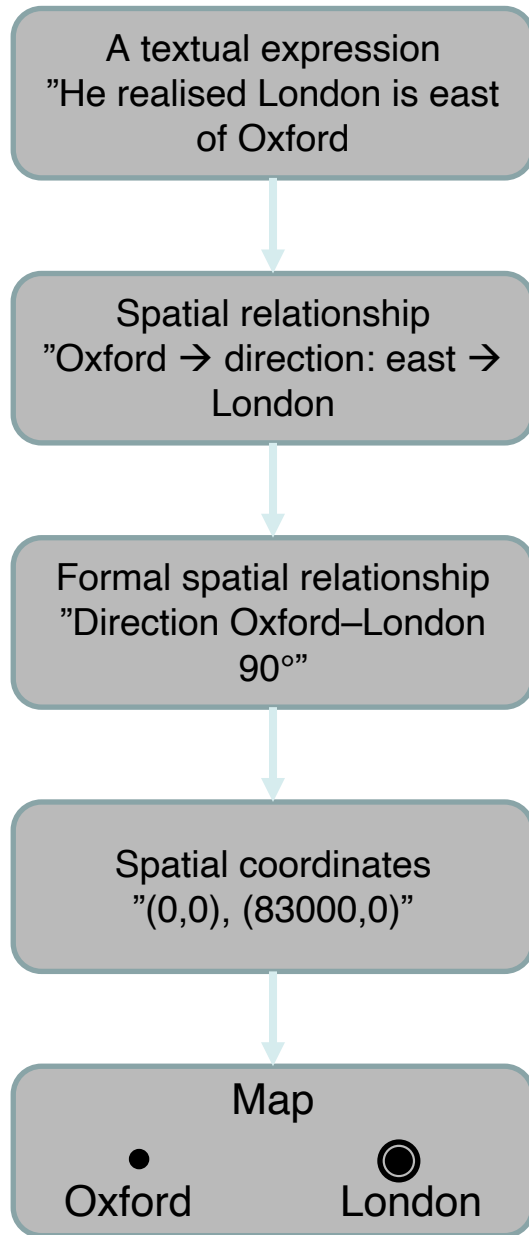
- Not possible analytically
  - too complex
- Numerical solutions
  - approximation
- Discrete numerical-mathematical problem
  - the numerical model
- Transfer mathematical (analytical) → numerical (discrete)
  - modelling error



# Numerical models: exact or solvable?

- Close connection mathematical—numerical model
- Must be computable
  - construction of algorithms
  - calculation on (super) computers
- Computer simulation
  - modelling error
- Results in large tables of numbers
  - visualisation
  - modelling error





Critical  
stepwise  
formalisation  
*and*  
Using numerical  
models

