

Modelling in Digital Humanities: Signs in Context

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Modelling is a creative process to gain new knowledge about material and immaterial objects by generating representations of them. It is widely understood and used as a heuristic strategy in the sciences (Frigg and Hartmann 2012, Mahr 2009) as well as in digital humanities (DH) research where it is considered a core practice (McCarty 2005, 20–72). In the last two decades there has been a significant development of theory that complements the practice based tradition of the field (e.g. *ibid*, Buzzetti 2002; Jannidis and Flanders 2012). In this paper we aim at enriching the current theoretical understanding by contextualising our practices within a semiotic conceptualisation of modelling. Ultimately, this is an attempt to address the following questions:

- How is knowledge and interpretation of and around historical documents distilled into and read out of digital models?
- In what way and to what degree does the development of these digital models amplify and replicate existing assumptions and scholarly approaches around the source objects?

We believe that Kralemann and Lattmann's (2013) semiotic model of modelling complemented by Elleström's (2013) theories on iconicity is a useful tool to inform our perspectives on these questions. A semiotic approach enables us to contextualise DH modelling in a scholarly framework well suited to humanistic enquiries, forcing us to investigate how models function as signs within specific contexts of production and use. We will first present Kralemann and Lattmann's model briefly, then contextualise it within source based modelling practices in DH,¹ and then propose some conclusions.

Semiotic framework

Kralemann and Lattmann (*ibid.*, 3399–3400) claim that models should be understood in the semiotic theory put forward by Peirce, with three main classes of signs: symbols, icons and indexes. They claim that models are icons because the dominant relation with the original objects they represent is one of similarity.² Different shades of iconic similarity between sign and object as theorized by Pierce correspond to three kinds of models in Kralemann and Lattmann:³

¹ By source based modelling we mean the creation and use of models representing some kind of historical sources and cultural artefacts, such as documents and manuscript pages together with any of their relevant components and their structure.

² We will not dwell on the complexities around the cognitive concept of similarity in this paper.

³ The distinction between the three types of icons is not meant to be clear-cut. We follow Elleström (2013) in seeing these types as grades of a continuum rather than separate categories.

- **image-like** models, for example photographs where single qualities such as forms and shapes are seen as similar to the original objects
- **relational** or **structural** models, that is, diagrams where the 'interdependence between the structure of the sign and the structure of the object' (ibid., 3408) enables the modeller to make inferences about the original by manipulating its model
- **metaphor-like** models which represent attributes of the original by a specific quality of their own not recognised by convention or habit

Models do not act as signs in virtue of themselves. What establishes the model as a sign is the interpretative act of a subject, whether as creator or reader. The practical act of modelling connects the model to its interpretation, that is, to its specific semantic content in a given social and institutional context (ibid., 3402–3). The modeller's judgement depends on his or her presuppositions connected to 'theory, language or cultural practice' (ibid., 3417). It is evident that Kralemann and Lattmann reiterate the concept of models as middle ground between theory and objects.⁴ The relationship of iconicity between the model and the object being modelled is partly externally determined (it relies on the similarity between the model and the object) and partly internal (it depends on theory, conventions, prior knowledge). Based on this duality they stress, on the one hand, the subjectively determined dependency of models on prior knowledge and theory and, on the other, their independence from these in light of the specific conditions of the objects being modelled.

Modelling in digital humanities

In this paper we take previous research (Ciula and Eide 2014; Marras and Ciula 2014) one step further by mapping Kralemann and Lattmann's trichotomy of models as icons to digital modelling exercises in historical research. The prototypical cases we chose are a starting point to investigate how such models relate to the cultural objects they represent.

⁴ Past research concerned with the experimental or techno-sciences recognise models including computational models as mediators between theory and objects of analysis (e.g. Winsberg 2003; Morrison 2009). This is in line with sign-vehicles functioning as mediators between denotational and connotational qualities, between thing and meaning (MacEachren 2004, 246).

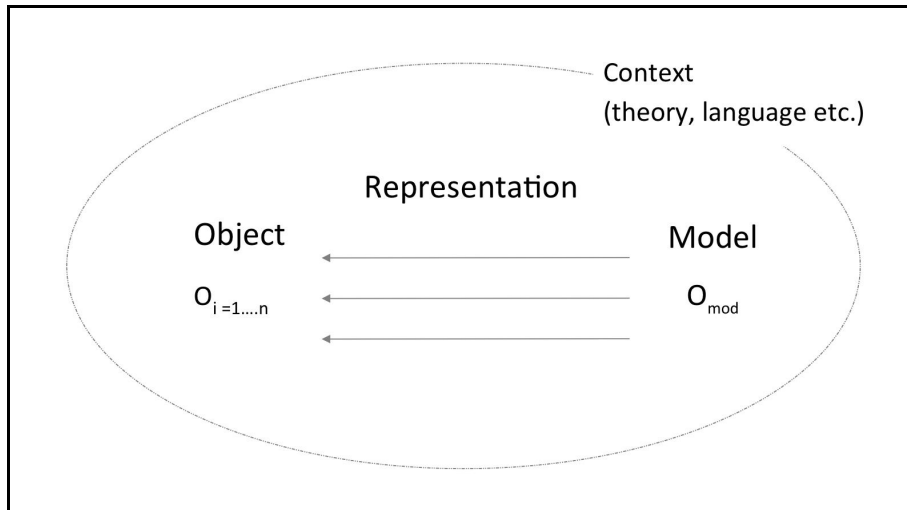


Figure 1. Models representing objects in context.

If we accept Kralemann and Lattmann's argument it follows that by modelling we link models to qualities and relationships already existing in the objects being modelled. Such linking is based on choices which are made for a certain end informing and motivating the act of modelling. Models are created in actual scholarly situations of production and use and cannot be seen as decontextualised operations. A model is partially arbitrary in that the same inferences drawn by manipulating one model could have been reached in other ways, for instance using a different model.

In this framework, models operate as sign functions. To understand their epistemic role, we need to look at both how they come to be (context) and how the similarity relation with the object is realised. By analysing the association of syntactic attributes of the source object with the attributes of the model we focus indeed on the contextual elements. However, these need to be complemented with the analysis of the specific sign-function in which production and use of models is enacted, as indicated in figure 1. Three examples will be used to analyse the three types of sign-functions in a DH context:

- **Image-like models.** We will use an example from digital palaeography research (Ciula 2005; 2009), where the abstract model letter acts as an image-like model of the samples it was algorithmically generated from. What we can learn about the objects of analysis (the medieval handwritten letterforms) depends on the features being selected in the modelling process. However, the inferential power of the model is mainly based on a strong sensorial similarity between model and object.

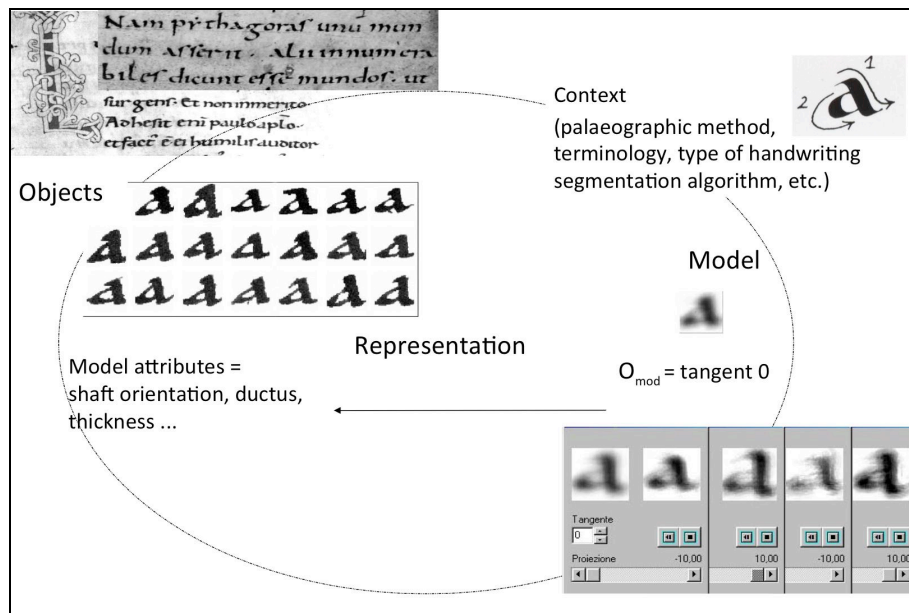


Figure 2. Image-like model. Morphological features of segmented letter forms are modelled into an average morphing letter. Inferences on the manuscript handwriting are based on the analysis of the morphing letter-models in virtue of a 'sensuous resemblance'.

- **Relational models.** As an example we will use models of landscapes described in historical sources (Eide 2013). The inferential power of the model relies on the common relational structure between object and model. What new we can know about the object of analysis very much depends on the correspondence between the structuring of the textual expressions in the modelling process and the structure of the map model.

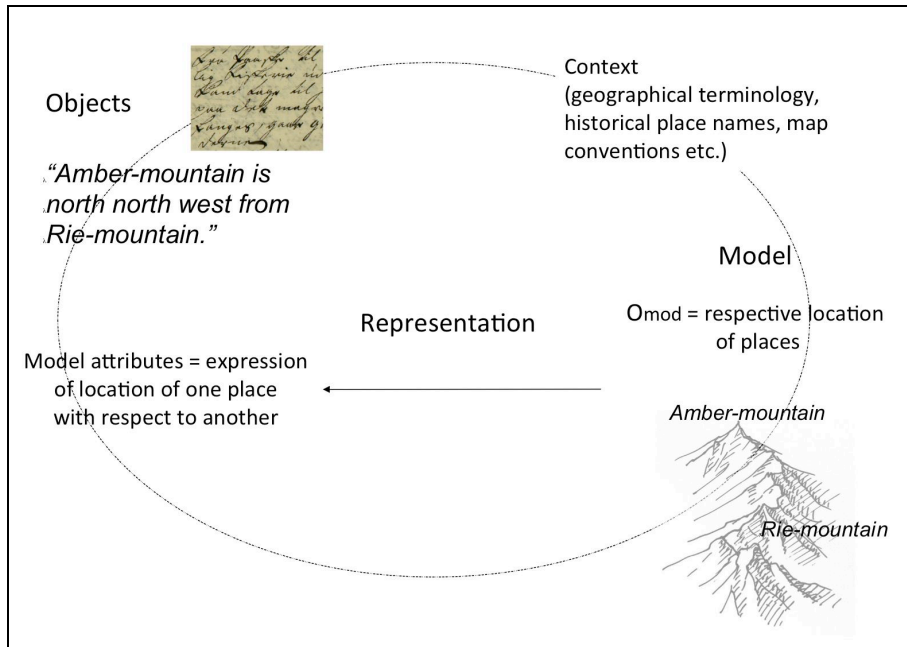


Figure 3. Relational model. Relational textual expressions are modelled into geometrical relations. Inferences on space as expressed in the text are drawn in virtue of the corresponding spatial structure in the map.

- **Metaphor-like models.**⁵ We will use the example of network models used to capture information about references to persons in historical sources. These do not only tie specific textual passages to real world historical entities, they also form parts of networks of co-references (Eide 2009). The association of a fishing tool (the net) to describe relationships between people is metaphorical. The inferential power of the model leverages on a deep cognitive similarity between the model and the object. It can generate unexpected connections between the objects it represents which exist 'only' metaphorically in a network.

⁵ In Kraleman and Lattman these models are claimed to be based on semiotic similarity, but this appears categorically misleading to us so we privilege the concept of metaphor taken from Peirce.

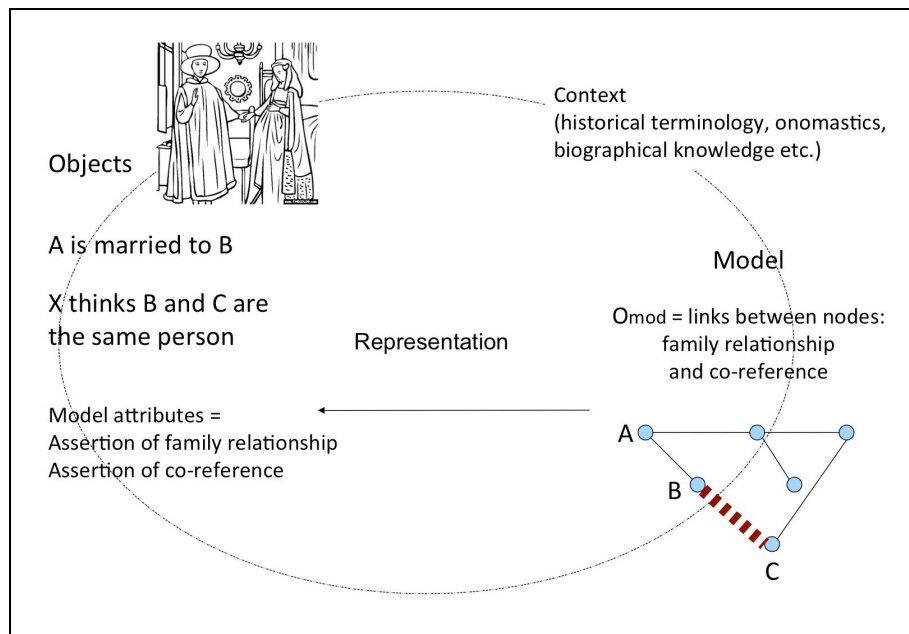


Figure 4. Metaphor-like models. Person names and their relationships as referred to by a document are modelled respectively into entities (nodes) and into properties connecting them (links). Assertions of co-reference are also modelled into properties connecting entities. Thus the net is now used to model social relations as well as assertions about people.

Common for all three types of models is the inferential power operating at the interplay between their 'intrinsic structure' and their 'extrinsic mapping' (Kralemann and Lattmann 2013, 3409). Indeed, the features being selected in the modelling process are influenced by contextual elements of different kinds, including hypothesis, scholarly methods and conventions, sample selection, and the technologies being used. However, the epistemic power of the model relies more on extrinsic aspects (sensorial similarity) and less on intrinsic aspects in image-like models; while it depends very much on intrinsic aspects (cognitive similarity) and less so on extrinsic aspects in the case of metaphor-like models (Elleström 2013).

Conclusions

In the paper we will focus on some aspects highlighted in Kralemann and Lattmann's theory with respect to the role of *context* in modelling acts and the nature of *representational relation* between objects and models through practical examples. We believe that these two foci are where modelling practices in DH meet with this semiotic framework in productive ways.

We will address the questions outlined in the introduction by contextualising this framework with specific examples of image-like, relational and metaphor-like modelling with respect to source based digital humanities. Prior knowledge is a *sine qua non* to create models in the first place and to use them as interpretative tools with respect to the objects they are signs of (Ciula and Eide 2014). The relationships between modelling processes and interpretative outcomes are

neither mechanical nor directly causal; however, the type of similarity on which modelling relies shapes the interpretative affordances of those 'anchor' models. Modelling processes bring about investments and burdens with respect to our knowledge of the objects we model. In particular, models as signs relate to the interpretation of those objects in different ways, from the immediacy of visual similarity on the image end of the iconic continuum to the deep cognitive similarity on the metaphorical end.

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