BRIDGING PICTORIAL AND MODEL-BASED CREATION OF LEGAL VISUALIZATIONS: THE PICTMOD METHOD

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Abstract: *In the domain of legal visualization two directions for creating visualizations can be found. Traditionally, many authors used pictorial representations that are either based on drawings and/or on the free composition of pre-defined shapes. More recently, model-based visualizations emerged that are based on grammars, i.e. strict specifications for composing visualizations based on sets of pre-defined elements and relations. In this paper we present an approach to bridge these two directions by building upon concepts of meta modeling and the conceptualization of IT-based modeling methods. To validate the feasibility of the approach, it will be illustrated using a first prototypical implementation.*

1. Introduction and Motivation

The use of visual representations in the domain of law has been discussed in the past in various contexts. These include for example the provision of means for supporting the understanding of fundamental legal relationships (Brunschwig, 2011) and specific norms (Kahlig, 2011) or the support of actors in the legal domain, e.g. when establishing contracts (Haapio, 2012). In contrast to ancient printing methods for creating legal visualizations – e.g. as they can be found in the illustrations for the Sachsenspiegel – today's visualizations are primarily created using IT-based tools. Whereas many of these IT-based visualizations are created using commercial or open-source drawing tools such as Microsoft PowerPoint / Visio, Adobe Photoshop or Illustrator, Gimp, or Inkscape, more recently also model-based visualization tools have been used (Fill, 2011). The essential difference between drawing tools and modeling tools is that modeling tools revert to a modeling language or meta model, i.e. a set of pre-defined elements with distinct characteristics, explicitly defined relations, and a specific meaning, i.e. semantics, assigned to the elements and relations, which are used to compose the visualizations. Although this is more restrictive in terms of graphical expressivity – i.e. modeling tools do not allow using other than the pre-defined elements – the restriction to the elements of the modeling language also permits to specify algorithms that are based on the modeling language and facilitates the inter-subjective understanding of the visualizations based on the explicit definition of the modeling language. So far, these two approaches for creating legal visualizations have been treated separately. In the paper at hand we discuss an approach to bridge these creation approaches. We thereby revert to previous work in the area of semantic visualization (Fill, 2009) where similar thoughts have been made for the area of enterprise modeling and information visualization. The remainder of the paper is structured as follows: In chapter 2 we will briefly discuss some foundations for the approach and define in particular some terms that are required to describe the approach. The approach itself will be presented in chapter 3. Chapter 4 will discuss a first assessment of the feasibility of the approach.

The paper will be concluded with an outlook on the next steps for realizing the approach in chapter 5.

2. Foundations

In order to clarify some of the fundamental terms we will use in the following we will briefly discuss our definitions for modeling methods, modeling languages, and meta modeling as well as of model types, classes, relations, and attributes. Regarding the term 'modeling method' we refer to the framework proposed in (Karagiannis and Kühn, 2002). In this framework a modeling method consists of a modeling language, a modeling procedure for applying the language, and mechanisms and algorithms which are being applied to the models created with the language. 'Meta modeling' refers to the task of creating a modeling method, in contrast to 'modeling' which refers to the task of applying the modeling method by creating models by using the modeling language. More specifically, a modeling language consists of syntax, semantics, and a graphical notation. The syntax specifies the elements of the modeling language and the rules to create valid statements in the modeling language. The semantics assigns meaning to the elements and statements of the modeling language and the graphical notation specifies the visualization of the elements and statements. When defining the syntax of the modeling language, it is common to revert to pre-defined structures (meta meta models) that facilitate the later IT-based implementation. Examples for such structures are the constructs as used in object-oriented programming languages such as Java, C++ or C#, specialized mathematical formalisms such as FDMM (Fill et al., 2012) or proprietary meta modeling platform structures, e.g. as used in ADOxx (Fill and Karagiannis, 2013). For our purposes here we will use a pseudo-code like approach to define these structures, which is common in computer science to define implementation-independent specifications of software artefacts. Therefore we will use the following structures for the definition of modeling languages: 'model classes' and 'relationclasses' to define templates for elements and relations between these elements, 'attributes' to define properties of the classes and relationclasses, as well as 'model types' to define groupings of classes and relationclasses. The model types can then be instantiated to models, which means that the definitions set forth in the modeling language are used to create model-based visualizations.

3. PICTMOD: Bridging Pictorial and Model-based Legal Visualizations

For bridging the traditional creation of legal visualization using drawing tools and the model-based creation approaches, we propose an approach that is capable of dynamically integrating pictures from drawing tools into a modeling environment. In contrast to the distinct specification of individual modeling methods for particular types of legal visualizations, which would require at least a basic technical familiarity with the implementation of modeling methods on platforms such as Eclipse or ADOxx, the approach we outline in the following does not require any specialized technical knowledge. It rather focuses on facilitating the use of model-based visualizations and acts as a preliminary phase to the actual implementation of a specific modeling method for a legal visualization.

At the core of the approach stands a generic modeling method, which we will denote as the 'PICTMOD' method. PICTMOD provides one model type named "Visualization Model", a modelclass "Class" and a relationclass "Relation". The class and the relationclass both provide image attributes to assign arbitrary images. These images are then displayed for the corresponding instance of the modelclass and the relationclass. In addition to attributes for assigning a name and a label to the instances of the modelclass and relationclass, they also provide a string attribute "Class". This attribute can be used to indicate that instances belong to the same class by referring to a commonly defined name. These definitions are also given in the following code definition.

```
Modeltype 'Visualization Model' {
      Modelclass 'Class' {
            Attribute Name : string
            Attribute Class : string
            Attribute Graphic : image
      }
      Relationclass 'Relation' {
            Attribute Label : string
            Attribute Class : string
            Attribute Graphic : image
      }
}
```

Code Definition 1: Specification of the Visualization Model Modeltype

From a technical perspective, the PICTMOD method can thus be easily implemented on a meta modeling platform and provided to the creators of legal visualizations. This permits to create instances of the specified model type in a graphical environment. To supply the images for the 'Class' and 'Relation' instances on the fly, an interface from a drawing tool is required. Thereby the images are directly transferred to the instances in the model where they can be assigned using the aforementioned image attributes. These relationships are shown in the subsequent figure 1.

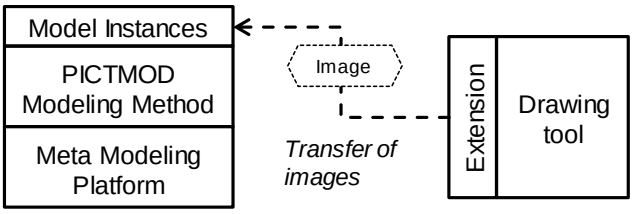

Figure 1: Conceptual Architecture for Realizing PICTMOD on a Meta Modeling Platform and a Drawing Tool

The procedure for using the PICTMOD method is set as follows: At first a user creates or re-uses existing images in the drawing tool. The user then identifies the parts of an image that should be used for defining a Class or Relation in the model instance. In the modeling environment the user creates instances of Class and Relation objects to define the model. In the next step, the image parts that were selected in the drawing tool are transferred to selected instances of the Class and Relation objects in the modeling environment. In this way certain parts of the original image become elements of the modeling language and are thus amenable to the processing by algorithms, e.g. to identify explicit relations to other elements. In addition, the user can specify class names of the thus specified model elements, thereby defining common groups of objects. By following this procedure the previously pictorial representations are transferred to modeling concepts.

4. Assessment of Feasibility

The concepts and relations in the legal visualization which were identified using the PICTMOD method can then be used as input for the specification of a distinct legal visualization modeling method. Such a modeling method may be derived directly from the Classes and Relations, whereby elements with common values in the 'Class' attribute may be represented as modelclasses respectively relationclasses in the new modeling method. However, the realization of such a modeling method requires technical knowledge, e.g. using an implementation language such as ALL (Fill and Karagiannis, 2013).

To evaluate the technical feasibility of the approach, a first implementation has been realized using the ADOxx meta modeling platform and Microsoft PowerPoint – see figure 2. With this implementation, parts of vector or pixel graphics in PowerPoint can be transferred to an

implementation of PICTMOD on ADOxx. The transfer is thereby realized using Macros in PowerPoint written in Visual Basic for Applications and Visual Basic/.NET 4.5.

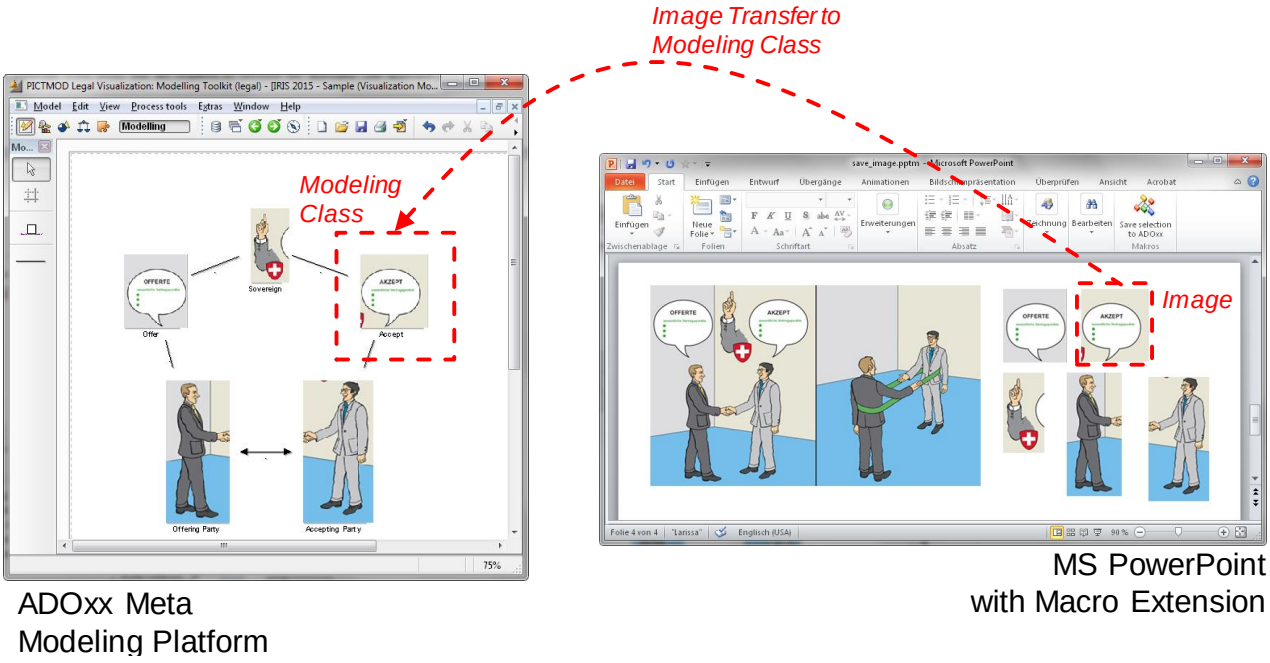

Figure 2: Prototypical Implementation of Approach Using ADOxx and MS PowerPoint, Picture Sources: (Brunschwig, 2011)

5. Conclusion

In conclusion the presented approach contributes to the easier creation of model-based legal visualizations. By using the PICTMOD method, users can create legal visualizations in a modeling environment, which can be taken as a starting point for developing specifically designed modeling methods for legal visualization. As next steps we plan to make the implementation publicly available on the OMiLAB.org website and apply it to a real use case in the domain of law.

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