Demonstration of a Customizable Representation Model for Graph-Based Visualizations of Ontologies – GizMO

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Abstract. Visualizations can facilitate the development, exploration, communication, and sense-making of ontologies. Suitable visualizations, however, are highly dependent on individual use cases and targeted user groups. In this demo, we present a methodology that enables customizable definitions for ontology visualizations. We showcase its applicability by introducing GizMO, a representation model for graph-based visualizations in the form of node-link diagrams. Additionally, we present two applications that operate on the GizMO representation model and enable individual customizations for ontology visualizations.

Keywords: Ontology visualization, annotation ontology, customization, visual representation, visualization framework, visual notation.

1 Introduction

Numerous approaches for the visualization of ontologies are available, and new ones are being developed every year. The applied methods range from indented trees and chord diagrams to treemaps and Euler diagrams. Most methods and tools visualize the content of ontologies using two-dimensional graph-based representations in the form of node-link diagrams [1].

The challenge with most approaches, however, is grounded in their design. On the one hand, visualization methods are created with a particular definition for the representation model. On the other hand, users perceive the provided visualization and build a mental model for the interpretation of the content [2]. Ideally, the visual representation model corresponds to the user's mental model. However, these match typically *only* in some aspects and diverge from the user's expectations and previous experiences in others.

This demo paper introduces our methodology to enrich ontologies with definitions for their visual representation. Furthermore, we present GizMO, a realization of the methodology for graph-based visualizations in the form of node-link diagrams. The practical use of the methodology and GizMO is shown using two applications that indicate the variety of achievable ontology visualizations.

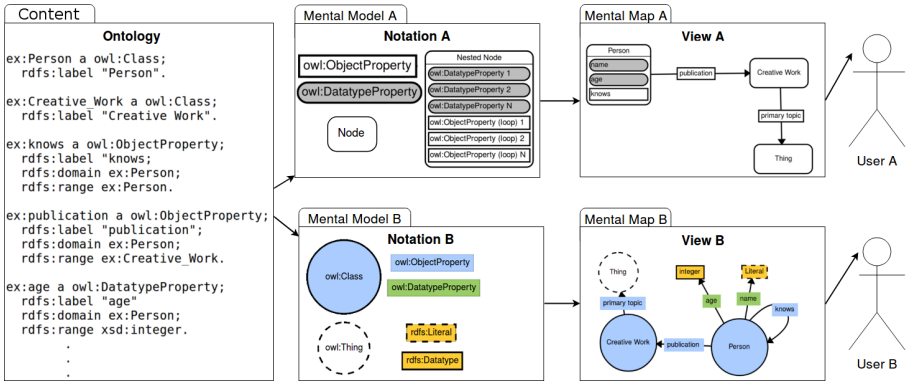

Fig. 1. Distinguishing between the content ontology, notations, and views: Notations address how ontology constructs are generally depicted. Views store information for the individual elements of the content ontology (e.g. their spatial position and visibility).

2 Methodology

Visualizations provide an abstraction of the information contained in an ontology. Our methodology separates this abstraction into two information layers:

1) **Notations** reflect the users *mental model* and address the global description of visual representations for OWL constructs. 2) **Views** reflect the user's *mental map* and address the local information for elements of the ontology that is visualized (the **content ontology**). As illustrated in Figure 1, different users have different mental models and mental maps while studying the same ontology.

Our methodology creates visual representation models for ontologies using the annotating mechanisms of OWL. Inspired by the Web Annotation Data Model [3], targeting properties link visual descriptions to general OWL constructs and individual elements of the content ontology. The utilization of the linking mechanisms ensures the originality of all elements and increases the flexibility of the methodology.

The methodology allows to modify and exchange visual representations in order to coincide with the user's mental model and mental map:

Notations – Notations provide the customizable definition of visual representations for OWL constructs. A visual description for a single OWL construct is organized in an instance of type `owl:NamedIndividual`. This instance links the asserted visual properties to the OWL construct. A notation is a collection of such instances and is independent of the specific content ontology.

Views – While notations describe the visual representations of the OWL constructs, views are designed to enrich the individual elements of the content ontology with additional information, such as their spatial position, visibility status, and optional customizations.

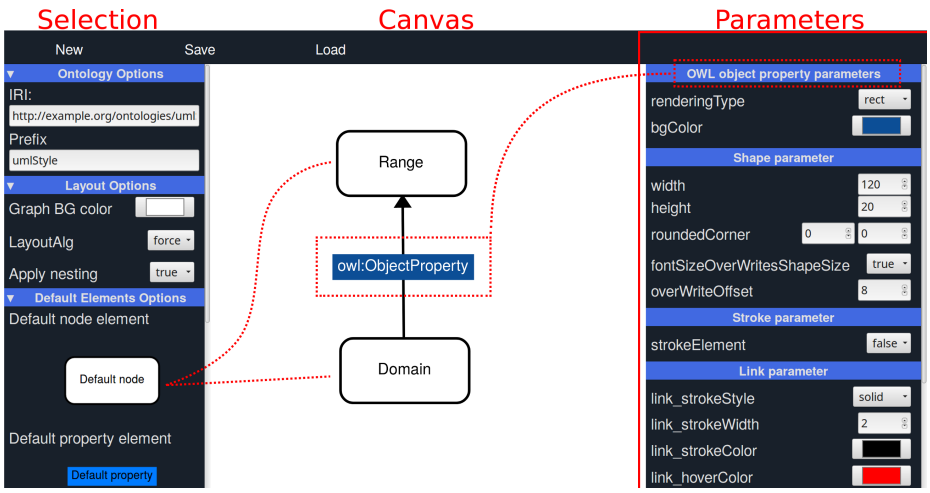

Fig. 2. The GizMO notation editor allows to design notations in a WYSIWYG manner. The user can select OWL constructs (left sidebar) and modify their visualization parameters (right sidebar). The visual adjustments are previewed in the canvas.

3 GizMO

GizMO is a realization of the methodology. Accordingly, visual representations are defined as OWL ontologies in order to foster their utilization, interoperability, flexibility, and reusability. A GizMO core ontology provides a collection of annotation properties that are used in our representation model. Instantiations of annotation properties are grouped in annotation objects (`owl:NamedIndividuals`). These annotation objects help to structure and separate different parts of the representation model, such as the general visualization of OWL constructs and the spatial positions of the individual elements of the content ontology. Other annotation objects provide meta information for notations and views (e.g., the background color or the zoom factor). Content ontologies are enriched with notations and views using `owl:imports` statements, enabling the flexible exchange and reusability of visual notations.

4 Demonstration

In the demonstration, we will introduce the methodology and showcase two applications[4] operating on the GizMO representation model. The GizMO notation editor minimizes the textual crafting of GizMO notation ontologies, by enabling the creation of notations in a WYSIWYG manner (cf. Figure 2).

The GizMO visualization framework generates the ontology visualizations using the GizMO representation model. Additionally, it provides means to create

[4] GizMO landing page with video and tool demos: https://gizmo-vis.github.io/gizmo/

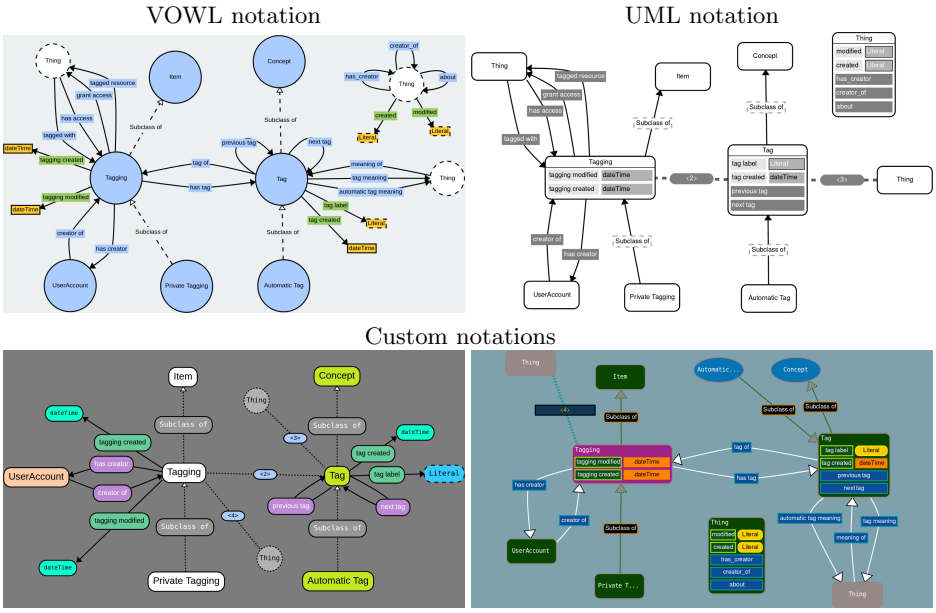

Fig. 3. Examples created with GizMO, realizing VOWL, UML, and custom notations.

multiple views for the same ontology. A short video on the GizMO landing page demonstrates the exchange of notations and views for a simple ontology.

While the current conceptualization of GizMO supports only a subset of OWL constructs and visual mappings, Figure 3 indicates the large variety of representations that can already be achieved on that basis.

At ISWC, we will provide a hands-on experience of the methodology and GizMO: Users will be enabled to create custom notations using the GizMO notation editor and visualize small ontologies with their own visual representations using the GizMO visualization framework. Additionally, we will show how the content ontology and its visual representation can be saved as a single ontology file. We will direct the audience to the GizMO landing page and web applications, allowing for independent testing. Finally, we hope that discussions with Semantic Web experts at the conference will allow us to identify further requirements, needs and features for the methodology and its implementation in GizMO.

References

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