VISUALIZING LAW - A NORM-GRAPH VISUALIZATION APPROACH BASED ON SEMANTIC LEGAL DATA

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ABSTRACT
Laws or in general legal documents regulate a wide range of our daily life and also define the borders of business models and commercial services. However, legal text and laws are almost hard to understand. From other domains it is already known that visualizations can help understanding complex aspects easier. In fact, in this paper we introduce a new approach to visualize legal texts in a Norm-graph visualization. In the developed Norm-graph visualization it is possible to show major aspects of laws and make it easier for users to understand it. The Norm-graph is based on semantic legal data, a so called Legal-Concept-Ontology.

Keywords: Norm-graph, Law Visualization, Decision Support Systems, Policy Modeling, E-Government, Information Visualization, Semantic Data

1. INTRODUCTION

Innovative enterprises, in particular in the ICT domain, regularly deal with innovations where no experiences in form of best practices could be used as reference. Well known examples are UberPop, autonomous driving systems in cars or services for smart (energy) meters, who have in particular in Europe hard challenges in perspective of the legal situation. Starting a new business model or service is always a challenging situation due to uncertainty about the market potentials, but it can become an extreme risk if also the legal situation is still unclear. In particular the data privacy in Europe is one point that was and is a quite complex situation, due to high barriers on what agreements and terms the user needs to accept or what is prohibited in general (Raabe et al. 2013). The problem of new small and medium size enterprises is the miss of legal experts, and even if they have lawyers, it is often difficult for them due to lag of technical experience. In fact, a number of services start without clarity about the legal validity.

As known from many other domains, visualizations can help to understand complex context much better and identify errors, problems or critical aspects. It seems logic that even for laws visualizations could help to understand the context much better and easier either for legal experts such as lawyers or casual users, similar to the other public affairs in policy modeling or e-government (Burkhardt et al. 2013, Nazemi et al. 2014). But, it still would help, if the complexity of laws could be simplified with “graphical sentences” that clearly could outline what each term has for definition or how it intended to use by law.

In this paper we introduce a new approach to visualize laws in a so named Norm-graph in an easy and commonly understandable manner, to support legal experts as well as casual users in understanding laws. As a major purpose we aim to support users in developing business models or services so that these could be validated against the law to ensure validity.

2. RELATED WORKS

Visualizations are rarely represented in the legal domain (Kleinhietpaß 2005), although visualization techniques offer a high potential for the easy understanding of complex issues. Schematic representations of references between legal texts, facts or relationships between different legal norms are everyday use cases. Nevertheless, there are some examples that demonstrate the potential of visualizations for the legal domain. For example, Röhl et al. (1995) uses the radiance of fundamental rights with the distinction between the conceptual kernel and the term court (Röhl 1995, p.26) to visualize legal knowledge. They also use a pyramid of terms to convey legal methods (Röhl 1995, p.51). These didactic representations of legal knowledge serve to impart legal knowledge and can be found in textbooks on methodology. However, these representations are designed for lawyers and legal experts, but not the end user who needs legal support or a legal expert of legal norms. In addition, these representations are static and not driven by ICT. The use of ICT in the legal domain is still a relatively young discipline. Nevertheless, there are already a few approaches that integrate the potential of visualizations in interactive applications. The following sections introduce some of these systems to give an overview of today's visualization approaches in the legal domain.

Most systems focus on managing legal cases, such as the case navigator (Fallnavigator 2013) by Faktor Logik, which is a computer-aided case processing system. The innovative approach supports the application of legal norms, contractual conditions and work instructions that are loaded as an ontology-formalized knowledge base. After a regulation (legal norm) has been loaded, the legal texts are presented in a structured way. In contrast to the previously presented approaches, the case navigator also allows a visual description of the facts in a graph-based visualization.

Beside the strong visualization-driven approaches, there are also ICT solutions that include basic visualization metaphors. One representative is the Legal Information Retrieval and Focused Semantic Search (LIRFSS). The main focus of Legal Information Retrieval (Gaur 2011) focuses on finding information in legal sources. These include ordinances, legal texts and historical sources such as judgment databases and precedents. The system takes account of various metadata such as date, place of action and IPC (Indian Panel Code). The downside is that the approach only integrates rudimentary visualization techniques to visualize and present the results obtained for a better overview.

Another approach in Legal Information Retrieval is Parallel Tag Clouds (Collins et al. 2011). The aim of this visualization technique is to present court decisions facetted and thus to graphically communicate a comparison between different courts. For this purpose, Parallel Tag Clouds uses the faceting approach in which the set of documents (judgments) is grouped according to a given facet (category). Each facet then extracts a set of keywords that are displayed vertically in a column. The keywords are sorted alphabetically by column and the font size is adjusted to the relevance values identified by the analysis. By combining the same keywords between the search results, this approach allows comparison of different courts and allows conclusions about the topics and judgments dealt with there. For a selection of key terms, a second view shows the corresponding documents and the relevance of the key terms in the respective documents. Thus, in addition to the overview of the judgments, the lawyer also has the opportunity to verify hypotheses based on the textual sources found.

Another approach that goes beyond the mere search for information in the legal domain is a demonstrator for visualizing legal rules on tungsten (Seth 2007). In an interactive graph representation of logical rules are visualized which connect a legal norm based on different legal arguments. In this way it is possible to visualize a fact to judge a legal consequence. The approach demonstrates in a flexible way how visualizations in the legal domain can be used to establish relationships between legal norms and facts. Although the demonstrator is a first example of automated legal education using visualizations, even if the system is still rudimentary.

Another example of Legal Information Retrieval is LexisNexis (LexisNexis 2013). The company specializes in information search for lawyers and legal experts and offers various solutions for identifying relevant information. The company offers several platforms for the search of legal facts. Among other things, the solutions enable search in case databases. The search results are usually presented in textual form, but rudimentary approaches to visualization are also integrated.

3. DATA PREPROCESSING

On the basis of raw texts of existing laws, it is actually not possible to generate effective law visualizations on the fly. For that reason, it is essential to preprocess the data for the final visualization purpose. In our use case we use supervised methods to manually generate the data basis, but for the wide use it is definitely recommended to enhance the approach by the use of semi- or non-supervised methods. As data fundament, we aim to generate a Legal-Concept-Ontology, where all law elements are represented in a semantic schema.

The process of legal modeling includes the systematic transformation of legal texts into a formal ontological description language, which can be processed by a machine. This process is divided into the following sub-steps (the steps are described in more detail in the following sections too):

- Normalization of legal texts: The normalization corresponds to an editorial adaptation of the legal texts. Implicit references within a legal clause are explicitly mapped to ensure correctness for the formalization.
- Legislative modeling (conceptual level): Starting from the normalized legal textual text, legal concepts that need to be modeled are identified, annotated and formalized as classes or relations in legal conceptual ontology.
- Legal sentence modeling (symbolic level): The legal terms formalized in Legal-Conceptual-Ontology (LCO) form the vocabulary for machine-processable definitions of legal sentences. For this process step, the identified legal terms for the extraction of a complete header are logically linked.

In addition to the formal depiction of legal concepts and legal principles, another task for the lawyer is the enrichment of the legal knowledge base with additional materials. In this step, for example, the modeled legal terms are supplemented with references to definitions, which are interactively integrated into the development environment for the client in order to provide a more detailed insight into the applicable legal situation.

3.1. Normalization and Selection of Legal Terms

In the first step of legal notion modeling, the legal texts are editorially adapted to explicitly represent implicit relationships within a legal sentence. This normalization modeling of legal norms is a necessary step in the legal methodology to ensure the correctness of the formalization. For the support of the modeling lawyer, the original legal text is displayed as a modeling object (see Figure 1, left box). In this opinion, the lawyer can make an editorial adaptation of the legal text and insert further characteristics that are necessary for the modeling.

After the resolution of all implicit references in the legal text, the view for legal texts allows the selection of candidates in need of modeling for the following modeling of legal terms. This step may be supported by the use of automatic pre-processing methods from the NLP area for transparency. Since the automatic identification of legal terms requiring modeling is a non-trivial NLP and information extraction challenge,

the annotation of the legal terms in the normalized legal text in the first version is done manually in order to avoid possible errors of automatic recognition.
For the annotation of legal terms requiring modeling, the view for legal texts provides appropriate tools with which the lawyer can mark the candidates intuitively by drag and drop. The selected terms are then displayed in an overview (see Figure 1, right box). In this presentation, the lawyer can see whether a legal concept to be modeled already exists on a symbolic or conceptual level. Furthermore, this view is used for the selection of legal terms and the selection in the other views.

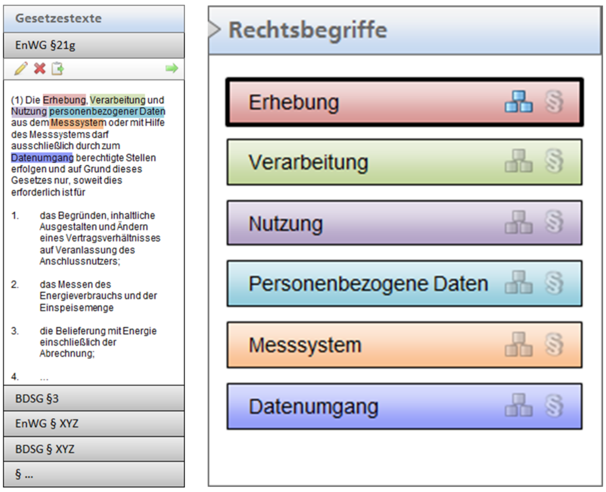

Figure 1. Selection and Normalization of Legal Terms (on the basis of the German Law EnWG §21g – more explanation in Raabe et al. (2015))

3.2. Modeling of Legal Terms (conceptual level)

On the basis of the identified legal concepts, the next step in legal concept modeling is to formalize the identified concepts as classes and relations in the Legal-Concept-Ontology.
This modeling at the conceptual level consists of two sub-steps: (1) creating and editing the classes and the taxonomy and (2) editing the class relations (see (Raabe et al. 2012). These tasks correspond to editing the schema-level ontology. The schema of an ontology can be derived as a tree structure over the *subclassof* relation. Thus, a tree visualization for display and editing by the lawyer is best suited to represent the taxonomy of the concepts and to make it navigable by the user. With the help of Expand/Collapse interactions, this approach enables the collapse and collapse of subtrees and thus also for large trees a clear layout (Figure 2). The hierarchy consists of the concepts of basic ontology (Dolce) and general conceptual ontology, which are color coded for differentiation. For the modeling of the identified legal concepts, drag and drop interactions are used which allow the modeling lawyer to classify legal terms into ontology. In addition to creating the inheritance hierarchy in the Legal-Concept-Ontology (LCO), the visualization also allows the creation of relations within the visualization.

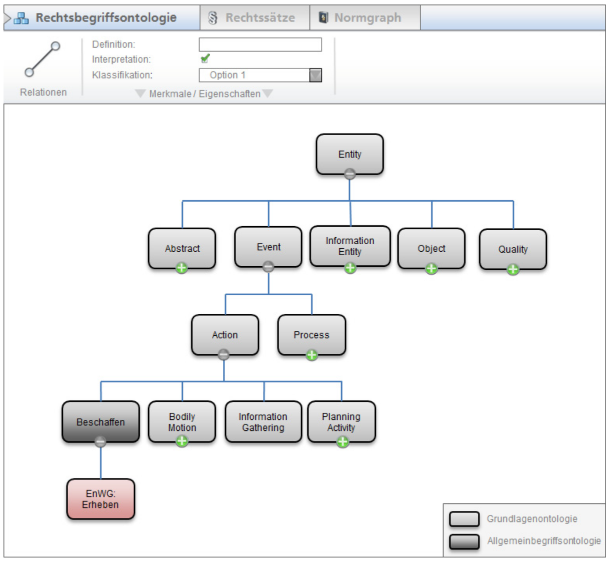

Figure 2. Modeling of Legal Terms

3.3. Definition Support

The interpretation aid provides the modeling lawyers with additional materials to assist in the interpretation. In the process, different materials are integrated into the development environment for the individual legal terms, which facilitates the interpretation and provides textual, systematic, historical and teleological support on the argumentative levels (Figure 3, top tab names). The interpretation aid also serves as a tool for creating a lexicon and allows the lawyer to annotate legal terms with additional materials such as word definitions from a lexicon (Figure 3, text area).
In detail, in the definition support at the following levels, materials are provided to assist the lawyer in interpretation:

- Wording Argument: Provides materials for interpretation at the word-level. For example, dictionaries or dictionaries are conceivable.
- Systematic Argument: For the systematic level, the definition support provides, for example, keyword searches in legal texts.
- Historical Argument: Supports the lawyer in the definition of a legal term on a historical level. For example, search functions for historical examples and accompanying lessons are included.
- Teleological Argument: Provides materials to assist the modeling lawyer in defining at the teleological level. Here, the change of language is in the foreground.

Until this stage, only the general legal aspects where defined on a conceptual level, but no law or sentence/paragraph is modelled. This major 2nd stage is done in the next sections.

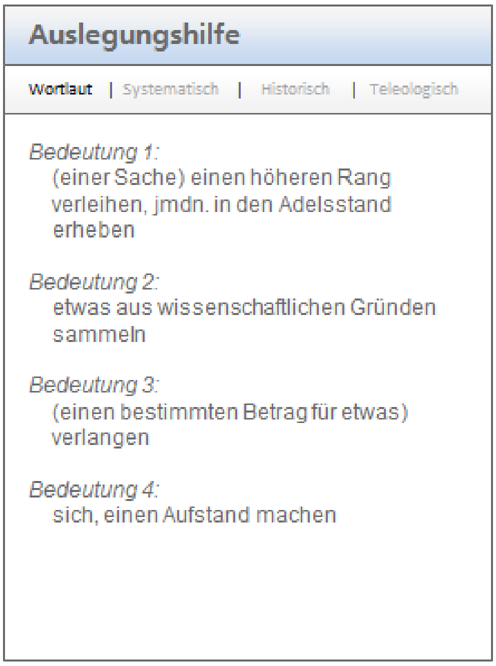

Figure 3. Definition support for the modeling of Legal Terms

3.4. Modeling of Laws (symbolic level)

The right editor provides visual methods used to map legal norms into logical rules. The legal concepts previously stored in legal ontology form the vocabulary for the representation of legal norms on a symbolic level. Therefore, we use an adapted form of the semantic-editing approach that originally was designed for non-ontology experts (Burkhardt et al. 2010).
The editor (Figure 4) makes it possible to link the symbols with different operators (AND, OR, XOR, NOT, ->, etc.). The mapping of the rules to the elements of the previously modeled LCO is implicitly done by the inserted symbols in the rule which all correspond to a concept or a class from the LCO.

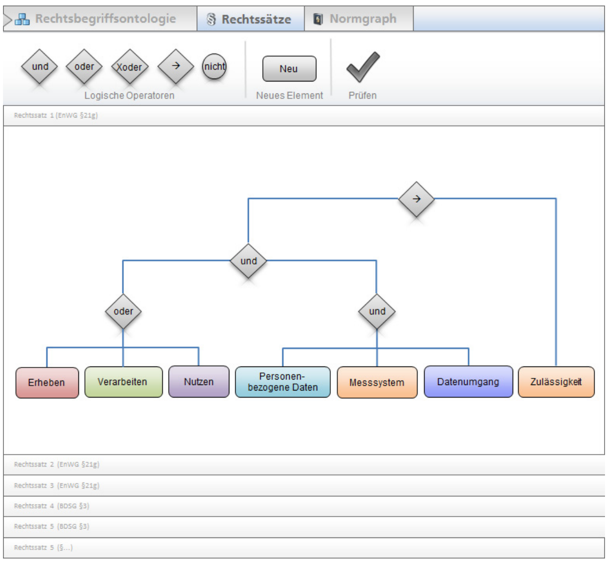

Figure 4. Editor Laws for mapping Legal Norms to Logical Rules

It is to mention that the definition scheme looks similar to a decision tree, but it is not. The expression tells only what legal artefacts in what combination are lawful. There is no opposite expression available, what is a common definition of a decision tree.

3.5. The Lawyer Development Environment

The lawyer development environment consists of four areas (Figure 5) that provide tools to formalize legal concepts and the modeling process; and help lawyers to map legal knowledge. The individual components are in turn divided into further tools which cover specific subtasks of the formalization: (1) *View of Legal Texts and Candidate Selection*: In the view for legal texts, the legal texts to be edited are displayed, and corresponding tools for the selection of models of legal subjects in need of a model and normalization tools are integrated. (2) *Overview of Legal Terms and Candidates*: The selected candidates and already modeled terms of a selected legal text are presented in the overview of legal terms. (3) *Definition Support*: For a more precise interpretation of legal concepts, the interpretation aid provides further additional material to support the definition of legal concepts and integrates further tools for the annotation of legal terms with third-party materials (such as lexicon entries, cross-references, etc.). (4) *Modeling Area*: The modeling area contains the following visual tools for the formalization of the selected legal candidates: (4.1) *Visualization of Legal Conceptual Ontology*: The visualization component on legal conceptual ontology represents basic ontology and general conceptual ontology and provides tools for the formalization of legal concepts on the conceptual level. (4.2) *Legal Editor*: Provides a visual environment for logical linking of legal sentences. Based on a logic language, this view allows formalization on a symbolic level. (4.3) *Representation Norm-graph*: The Norm-graph represents the result of the modeling and is used in the development environment lawyer for testing and validation purposes.

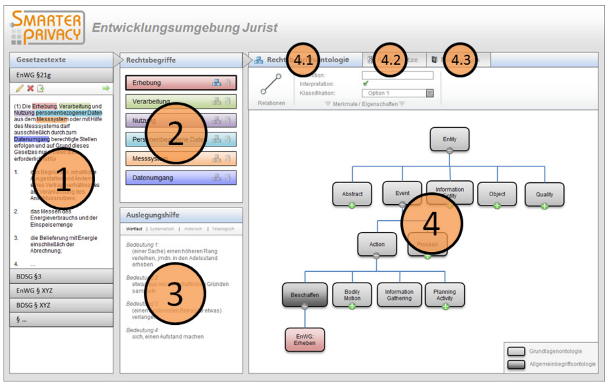

Figure 5. The Lawyer Development Environment

4. NORM-GRAPH TO VISUALIZE LAWS

In following sections, we explain how the Norm-graph is generated.

4.1. Data Principles and Structure

The fundament for the Norm-graph visualization is the generated LCO as described in section 3. In the LCO all terms are defined as sketched in Figure 6.

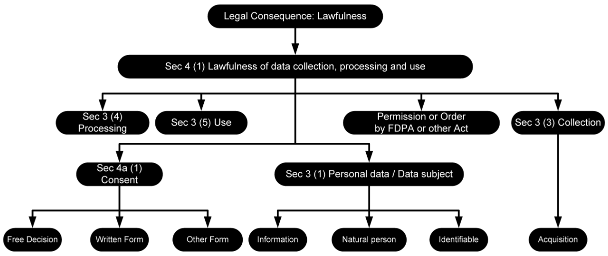

Figure 6. Norm-graph for the legal consequence of "Lawfulness" in the Sec. 4 (1) FDPA. (Oberle et al. 2012)

Next to the structure of the semantic data, also the data provision is important. We use a SPARQL server that enables us to retrieve the required elements with predefined queries. In general, this will also work with alternative technologies, but due to the flexibility of requesting a fine structured data-source, it is easier by using SPARQL.

4.2. Norm-graph Template

To outline better how the Norm-graph is generated, it is important to understand the principle structure that is something like a template. On this basis any kind of norm can be visualized.

As already described in section 3.4, a concrete norm or law consist of a number of constraints that connected with different operators (AND, OR, XOR, NOT, etc.). It is to indicate that there is also a logical structure (see Figure 7) of how certain aspects correspond to each other, such as objects like 'personal data' or actions like 'processing of'.

Followed on a number of connected constraints there is always a clear consecution (indicated with '->'). This consecution indicates if something is valid, in particular if a certain action is allowed or prohibited.

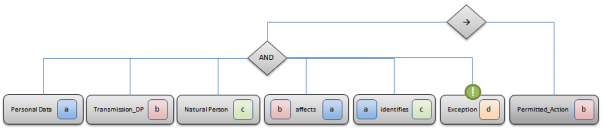

Figure 7. Template for a single Norm on the basis of the underlaying semantic structure

An example, how to request the concrete elements for a Norm-graph, on the basis of the sketched schema in Figure 7, is shown in Table 1.

Table 1. Semantic Query to retrieve the Norm-graph components from the LCO

```
[ Paragraph_21g Abs._1:
(?a rdf:type http://localhost/example_rbo.owl#Personal_Data)
(?b rdf:type http://localhost/example_rbo.owl#Transmission_DP)
(?c rdf:type http://localhost/example_rbo.owl#Natural_Person)
(?b http://localhost/example_abo.owl#affects ?a)
(?a http://localhost/example_rbo.owl#identifies ?c)
noValue(?d rdf:type http://localhost/example_rbo.owl#Exception)
->
(?b rdf:type http://localhost/example_rbo.owl#Permitted_Action) ]
```

4.3. Concept for Norm-graph and Data Cockpit

The Norm-graph represents the central navigation component of the surface lawyer and the subsumption in the narrower sense. The norm-graph visualizes a section of the complete premise of the modeled legal concepts (see section 3.2), the legal sentences (see section 3.4) and the entered facts during subsumption in the narrower sense meaning is presented graphically and thus represents the applicable legal norms (Figure 8). The root is always a legal consequence (e.g. admissibility). In the following nodes, the graph contains further legal norms that are marked as rules. The factual characteristics follow in a further level in the graph which shows which legal terms are involved in the facts. Thus, the client can see which "parts" of a legal norm apply to the facts. In addition, the assignment of factual instances to legal concepts is shown in a further level.

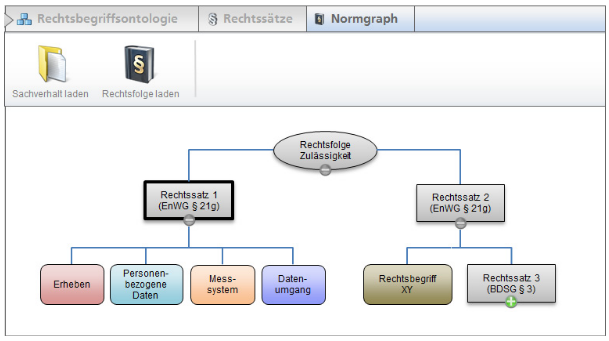

Figure 8. Norm-graph Mockup

In addition to the standard graph, further information is displayed in the client interface which further clarifies the legal situation on the facts and contributes to clarifying the legal basis. Figure 9 shows the data cockpit for the client when selecting an attribute (legal term).

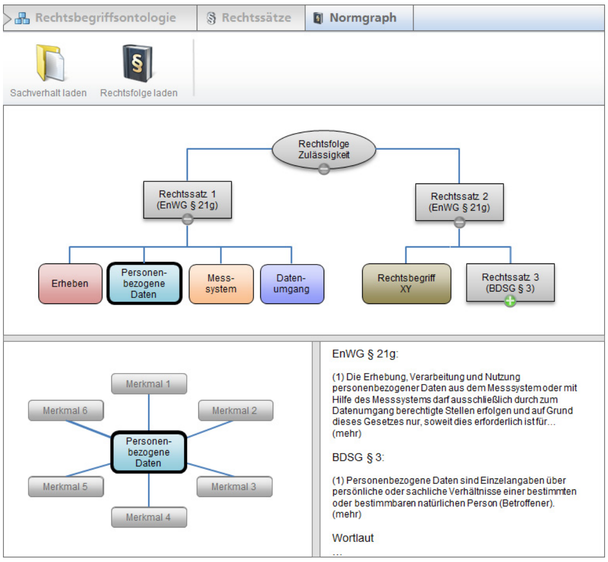

Figure 9. Data Cockpit Mockup including the Norm-graph

As data cockpit we orient on the so-called visualization cockpit as defined by Nazemi et al. (2010). In addition to the standard graph, the characteristics of the selected constituent element are also displayed in a graph visualization (bottom left) and the legal texts in which the constituent element occurs (bottom right). When selecting a legal clause, the logical structure is also displayed in a legal sentence visualization. In the norm graphs presented so far, a completely transferred state of affairs and thus a dynamic norm graph have been assumed.

4.4. Norm-graph to visualize Legal Text

The Norm-graph shows the major aspect of a law in one line (Figure 10, top line) with the consecution at the end – this is different to original concept but was necessary for the following interaction ability where further explanations are shown below. The show aspects in the top line is different to the text of laws, where now only the major aspects as annotated before (see section 3.1) are considered, but even on this level the message is easy to understand when read by humans.

Since a number of aspects are not defined in a single paragraph and sometimes references to terms from other statutes, the major advantage is the interactivity.

Through clicking on a concrete aspect, it shows underneath where an aspect is further explained, defined or where is derived from.

Since some referenced paragraphs or term definitions are representing an own norm, a second line is opened (Figure 10, second line). Based on this recursive approach, the user is able to elaborate the full bunch of underlaying laws to understand e.g. what "personal data" are and how they are defined. This simple overview about legal aspects and how each single aspect and term resolves to all kind of law sources enablers a fast and clear understanding.

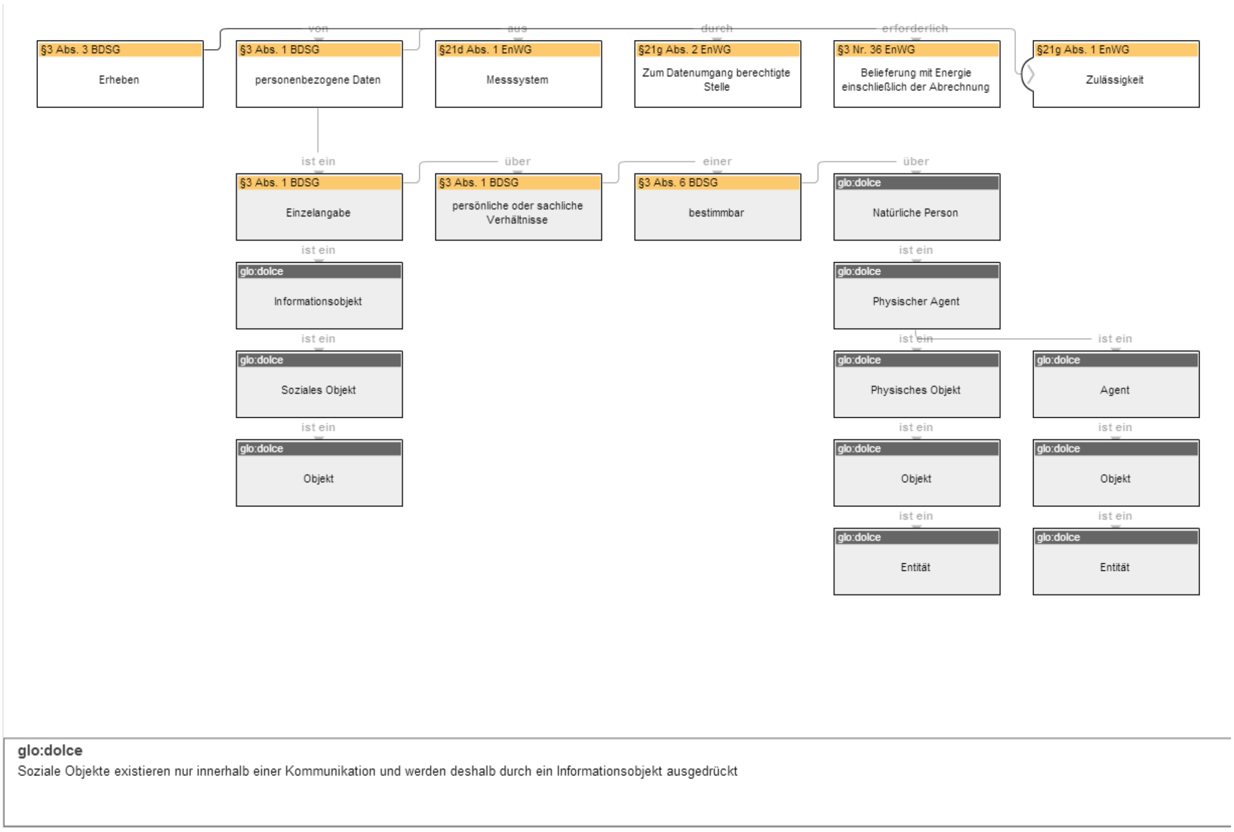

Figure 10. The final Norm-graph visualization

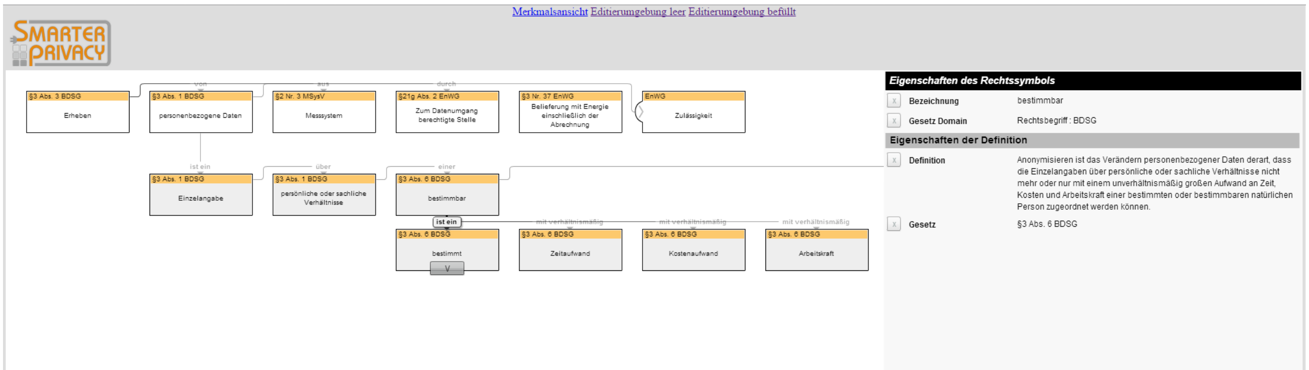

Figure 11. The Legal Data Cockpit

4.5. Law Data Cockpit for Legal Experts

The main goal was to create a data cockpit for legal experts that helps them to check business models or planned services against existing laws, in particular if they are conform with them. In a first round we prepared therefore a scenario toward the privacy of personal data in the field of the German Energy Industry Act (more information in Raabe et al. (2015)) and new services that needs to cover the regulations that are explained in it. The intention is that legal experts can validate business models and service purposes against the German Energy Industry Act (more information in Raabe et al. (2015)) to identify complications early (Figure 11).

The challenge of lawyers in checking validity of business model requires a complete understanding of the corresponding laws as well as how certain terms are defined. This connection to other laws, law books or legal (term) definitions can become quite complex that our visualization can easily show in one overview, and therewith decreases the efforts that needs to be investigated. An example could be, what are “personal data”, e.g. is the title (such as Dr./PhD.) also part of personal data? A full tree that shows, how this term can be derived on the basis on laws, legal books on legal definitions is a helpful lawyer support that makes finally the decision making much easier.

We used a generic approach that can be easily applied also on other domains and scenarios of legal aspect. The major requirement for this purpose is the data preprocessing as explained in section 3.

5. USE-CASE: A SEMI-AUTOMATED INTERPRETATION SUPPORT

The Norm-graph visualization is one of the major results to provide a simplified access to law data and support decisions toward legal conformity. However, the original intention is going a step ahead, where even the interpretation of legal issues should be supported via reasoning for enterprise services (Oberle 2014, Burkhardt et al. 2017).

Figure 12 shows a norm graph with markings that emerged as a result of the subsumption algorithm. In this example, the question of the admissibility of the facts was asked and the corresponding standard chains identified. By marking the user recognizes which parts could not be detected automatically during subsumtion. The red marked branches show the way to the criteria for a user interaction. In this example, the individual details of the personal data and the supply of energy could not be resolved. These elements are marked in red. With the selection by the user, these conflicts can be resolved. For this purpose, further graphical tools are provided, as the case may be, in order to facilitate the user's interpretation or the assignment of the instances from the situation to the unrecognized factual features of the LCO. So far, the following cases have been identified which are successively integrated into the surface: (1) layout at the schema level - teleological reduction (e.g. personal data), (2) interpretation of a relation (e.g. necessity, mean & purpose) and (3) schema interpretation - teleological extension (e.g. elevation).

After the interpretation in the strict sense and after all elements of the Norm-graph could be assigned to instances of the facts, the Norm-graph indicates the fulfillment of the norm. The standard fulfillment is indicated in the standard graph by further markings. By unfolding further subtrees and the view of additional materials, this concept allows the graphically interactive navigation and exploration of the applicable law to the inputted fact.

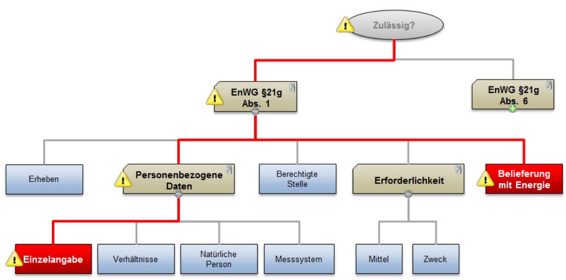

Figure 12. Concept for a Norm-graph that supports interpretation

6. DISCUSSION

Due to the strong collaboration with the target users as well as legal experts, we got constructive feedback and even positive feedback in perspective of productivity and added value. However, a major challenge is the empirical evaluation of this approach. We actually deal with a number of challenges. First the target group is very special and even there, lawyers are most often specialized, so the setup of an evaluation scenario is difficult – in particular to acquire a significant number of participants. The second challenge is the lack of similar visualizations, which would be necessary to perform a comparative evaluation. The third challenge is how to come to a general statement to the benefits of this kind of visualization algorithm. Since an evaluation can only cover a specific scenario, it is unclear how with that a general statement regarding the efficiency or effectiveness could be derived.

Next to the evaluation, there is also a challenge of how to preprocess data (semi-)automatically. Indeed, LDA algorithm are in general appropriate for this purpose, but it is to mention, that legal texts are very special than e.g. text from normal documents such as reports. In fact, the annotation is almost impossible to process that step completely automatically. Furthermore, legal books contain big amounts of contents that needs to be considered and additionally there are regularly changes that needs to be considered too. There is still further investigation required how to handle these data preprocessing stage almost autonomously.

7. CONCLUSION

The paper describes a new approach how to visualize laws graphically in a Norm-graph. The major benefit is that the complexity of norms and their legal aspects could be decreased so that also normal users can easily understand it and see all the relating facts. The major purpose is to finally support users in finding critical aspects, in perspective of existing laws, for new planned business models or services. The approach was practically implemented and tested on the basis of laws toward the German Energy Industry Act. The result received positive feedbacks from lawyers and legal experts.

ACKNOWLEDGMENTS

This work has been carried out within the Research Group on Human-Computer Interaction and Visual Analytics (https://vis.h-da.de). The presentation of the work was partially funded by the Research Center for Applied Informatics (FZAI) of the Darmstadt University of Applied Sciences.

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