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Visualization as a *Tertium Comparationis* within Multilingual Communities

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Abstract. Legal data science, as part of legal informatics, serves as the integrative model of computer-supported representation and analysis techniques. Structural visualization deals with diagrams and represents the semantics of law. We aim at applications for visual navigation in legal documentation systems. We propose the visualization of meaning as a *tertium comparationis* (the third part of the comparison) to act in the EU as a common element for all 24 linguistic versions. We see two discourse patterns. The use of English shows the top-down pattern. The use of other languages, e.g. German, shows the bottom-up pattern. Another concept, *tertium communicationis*, denotes the communication intermediary between two agents who speak languages A and B, respectively. We see the intermediary's conversion "from *tertium communicationis* through *tertium translationis* to *tertium comparationis*." In the end we attempt to approach an ontology of legal relations. Therefore we classify legal relations according to Is–Ought combinations.

Keywords: data science, legal informatics, legal meaning, legal visualization, knowledge visualization, visual navigation

1. Introduction

This paper concerns visualization in the representation of law. We further tackle an approach that is called Structural Legal Visualization, SLV (Čyras et al., 2015a). Hence, we explore SLV in the context of legal data science (Schweighofer, 2015), where the visualization view in the representation of law is distinguished (Fig. 1). In SLV, diagrams are employed to represent legal meanings, in other words, to represent the semantics of law for the human user.

The intended results concern visual navigation in information space, namely, information systems, which represent the law (henceforth: legal information systems). Such navigation can be compared with navigating a map (see e.g. GoogleMaps). The intended applications concern the already high, but not well recognized potential of visualization in representing the deep structure of legal systems.

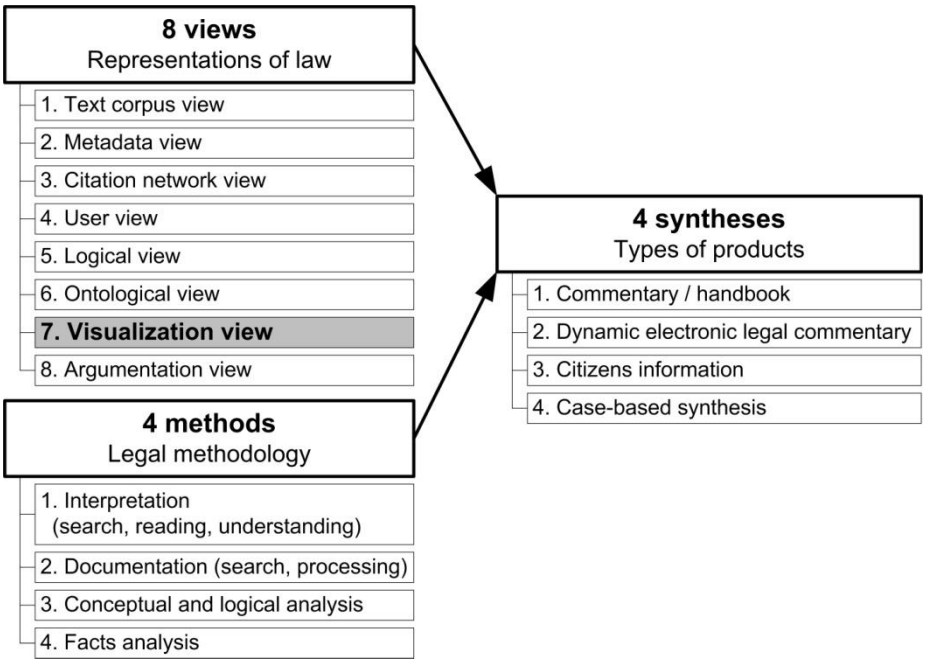

Fig. 1. Schweighofer's 8 views/4 methods/4 syntheses approach to legal data science.

The achievements of research in AI and Law are not well recognized in computer science departments and law schools. Even in the "knowledge and network" society, legal work has not changed much at all. Under the open-textured concept of legal dogmatics, methods of handcraft and art are mostly used to disguise a discipline, with insufficient account being taken of legal theory and modern technologies. An example can be seen in the use of legal information systems. Practical training is now standard, but scientific reflection is still insufficient.

Legal informatics has developed new methods for the representation, analysis and synthesis of legal materials. These analytical tools were structured as legal data science (Schweighofer, 2015). Schweighofer's model of 8 views, 4 methods and 4 syntheses describes the eight different representations of a legal system, four computer-supported methods of analysis, which lead to a synthesis, a consolidated and structured analysis of a legal domain, either 1) a commentary, an electronic legal handbook, or 2) a dynamic electronic legal commentary (Schweighofer, 2011), or 3) a representation for citizens, or 4) a case-based synthesis (Fig. 1). The eight views (or representations of law) are: 1) text (multimedia) corpus, 2) metadata view, 3) citation network view, 4) user view, 5) logical view, 6) ontological view, 7) visualization view, and 8) argumentation view. The four methods are: 1) interpretation (search, reading and understanding), 2) documentation (search and processing), 3) structural (conceptual and logical) analysis, and 4) fact analysis. A more detailed description can be found in Section 3.

This paper is about visualization as *tertium comparationis* in legal informatics and in multilingual scientific communities. *Tertium comparationis* (Latin – the third [part] of the comparison) is the quality that two things that are being compared have in common.

"The third of comparison denotes a point of commonality without which no comparison seems possible" (Weber, 2014, p. 155), see Fig. 2.

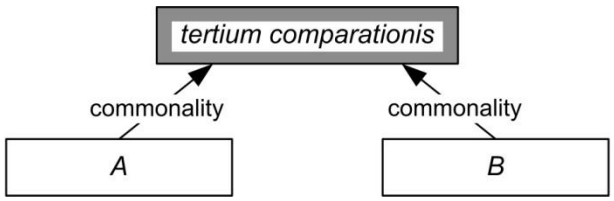

Fig. 2. An indirect relation between *A* and *B* through *tertium comparationis*, the common property.

Visualizing legal meaning differs from representing it as text, because its greater and easier expressiveness makes it capable of capturing structural relations between documents, legal concepts or events. Visualizations of timelines, events and concepts are commonly used, but only hint at the great potential of visualization. Results from legal theory research, in particular, *tertium comparationis*, are not well known, but are highly relevant. Relations between two entities can be manifold and are often insufficiently expressed in legal language. Visualization as *tertium comparationis* represents these relations, but also constitutes an intermediate step towards a formal and machine-usable representation. There is a big variety of relationships in law such as weak/strong, direct/indirect, presumed/legally established, etc.

The remainder of this contribution is structured as follows. Section 2 introduces structural legal visualization as our method in legal informatics. Section 3 describes the 8 views/4 methods/4 syntheses approach, which is proposed by Schweighofer (2015), as a related work. Section 4 first observes visualization as *tertium comparationis* then top-down and bottom-up communication. Section 5 tackles the kinds of legal relations towards an ontology of relations. Section 6 draws conclusions.

2. Related work and Structural Legal Visualization

Legal visualization means the use of graphics, pictures and videos for the visual representation of the law (Brunschwig, 2014). Graphical notations are also a strong support for a formalized view of the law. The key features are represented by images or graphics, even in cases in which the necessary level of abstraction for formalization is not yet reached. Legal visualization deals with graphical representations, in particular, with the visualization of the abstraction of the law (Lachmayer, 2002). Visualization as a method tries to describe and find implicit relations between various rules, concepts and documents. The complexity of legally relevant events, actions and documents is structured and put into a proper timeline that is sufficiently clear for laypeople in such situations. Text and picture accord to two levels, abstract and concrete. An overview of legal visualization can be found in Röhl and Ulbrich (2007).

The lack of pictures in jurisprudence becomes a learning obstacle (Röhl and Ulbrich, 2007, pp. 15–17). A starting position is "Law is text", and therefore law is always textual for jurists. Hence, there are reasons for jurists' reluctance to visualize. Pictures can have drawbacks, such as redundancy, a low level of abstraction, trivialization, and emotions (ibid., pp. 18–25, 100–102). However, the use of logical pictures (*logische Bilder*) can

bring advantages. Metaphors and symbols can be employed to represent norms, and thus pictorial two-dimensional representations emerge (ibid., pp. 42–62). Communicating the meaning of law to the human user is of primary importance in legal education. The visual structure is a diagram, which represents the meaning. Diagrams serve well as visualizations of legal norms (*Rechtsnormbilder*, ibid., pp. 109–111). Besides pictorial visualizations, logical diagrammatical visualizations such as argumentation graphs, storytelling, and legal workflow, including info-graphics, are widely used to represent legal content.

Structural legal visualization (SLV) is about the visualization of statutory law rather than facts. It is intended for human consumption and enables the user to comprehend the meaning of legal terms. SLV is diagrammatical, relation-centered, model-based and is related to visualizing legal ontologies (cf. Guarino et al., 2009; Oberle et al., 2012). The presentation of legal institutions is at stake.

SLV stems from Friedrich Lachmayer's imagination of visualizing insights, ideas and texts, primarily in the domain of law; see examples on the web.[1] Visualizing statutory law was addressed right at the beginning of legal informatics (Lachmayer, 1976). For decades, SLV was used in practice as slide presentations at numerous conferences and lectures, where each slide served as a separate view. Among other things, we visualized Hans Kelsen's Pure Theory of Law and Hajime Yoshino's Logical Jurisprudence (Yoshino, 2011; Čyras and Lachmayer, 2012). Besides legal education, SLV is also aimed at eGovernment applications such as the Austrian FinanzOnline,[2] RIS,[3] which publishes cases and supports ex-post analysis, the citizens' information system Europe Direct[4] or HELP.gv.at,[5] which states the applicable law for various situations and supports ex-ante analysis, or e-Codex.[6] Citizens' information systems use the Internet to spread easily understandable public information. Figures in this article are also examples of SLV visuals.

Examples of SLV are slides, the diagrammatical visualizations of legal institutions, at *http://jusletter-it.weblaw.ch/visualisierung/chinese.html*. They contain letterings that are translated from German to Chinese via English. Each lettering consists of one, two or three words and thus names the legal concept (legal institution) such as contract, unauthorized recording, communication secret, abuse, etc.

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[1] *http://jusletter-it.weblaw.ch/visualisierung.html* and *http://www.legalvisualization.com*.

[2] FinanzOnline provides a one-click link to the Austrian tax administration; see *https://finanzonline.bmf.gv.at/*.

[3] The Legal Information System of the Republic of Austria; *http://www.ris.bka.gv.at/*.

[4] *http://europa.eu/europedirect/index_en.htm*.

[5] *HELP.gv.at* – a government agency help site on the Internet, which offers necessary information for living and working in Austria; see *https://www.help.gv.at/Portal.Node/hlpd/public/en*.

[6] The e-Codex project "e-Justice Communication via Online Data Exchange" (*http://www.e-codex.eu*) supports transnational procedures between EU member states. For example, suppose Small Claim Procedure online forms, to input data such as plaintiff, defendant, claim, etc. (Francesconi, 2012).

These examples demonstrate how text and visualization are linked up to produce a comprehensible view (*Anschauung*, see Walser Kessel et al., 2016). We demonstrate that it is not enough to take into account German–English translation of words. It is also important to take into account the difference in legal terms in different legal systems. (Continental law prevails in Continental Europe and the common law prevails in the UK and the USA.) Therefore the translation into Chinese has to take into account the legal system and the doctrine in China. In letterings, the rules of grammar do not prevail. Therefore, in translation, the syntactic structure of the letterings can be neglected. The cultural contexts of the languages are different and have an effect on visualization.

Legal norm. A legal institution is comprised of several norms. The notion of legal norm is not as simple as it may appear from the first impression of the meaning in natural language. Legal texts are not made of norms but of structural arrangement units such as parts, sections, paragraphs, sentences, etc. Moreover, legal norm is not a primary elementary notion of law. Legal documents as a form of legal information do not know the notion of norm. Legal documents reproduce the structural arrangement units of legal texts and contain their own document units, for example, in XML. Legal dogmatics holds that legal norm is a mental product. It extracts, reconstructs and formulates the contents, i.e., the legal meaning of a legal norm. A norm is obtained by interpreting legal text. A paragraph of a document can contain several norms of behaviour or a norm can continue through several paragraphs, part here part there. As a basic principle, legal norms are formulated in a natural language. A simple form is: "if *SF* then *LC*," which reads "when a state of affairs (*SF*) is given, then the legal consequence (*LC*) applies," *SF→LC*.

The structural analysis consists in the rewriting of rules as logical statements or conceptual structures. In both cases, paper and electronic representations can be used (see e.g. Sergot et al., 1986; Oberle et al., 2012). Without appropriate and fine-tuned conceptual structures and rule frames, such as decision trees, the application of rules remains cumbersome and time-consuming. For any well-defined process, this analysis is indispensable for automation or semi-automation. Further, (semi-)automated linguistic methods can be very helpful.

SLV variations. Structural legal visualization can be divided into the following two major variations (i.e. build-ups of the resulting views): dynamic SLV and static SLV (Čyras et al., 2015). In dynamic SLV, a dynamic object is viewed; the object changes. Views in dynamic SLV can be compared with film frames. The change of a structure (system) is a challenge for legal informatics. Consider the European law and decision making between the European Parliament, the European Commission and the Council of the European Union. The processes are complex and difficult to comprehend. However, they can be explained step by step. A novice can start from an overview.[7] Each phase is viewed differently and comprises branches. Modeling these procedures involves processes and their traces.

In static SLV, a static object is viewed; the object does not change over time. Static SLV produces a series of views by highlighting individual items sequentially. The entire

[7] See e.g. *http://www.plan-eu.org/content//uploads/2013/05/How-laws-are-made.jpg*.

object is too complicated and hiding details is an essential feature. Fig. 3 shows a picture that can be analyzed in depth using three different focuses.

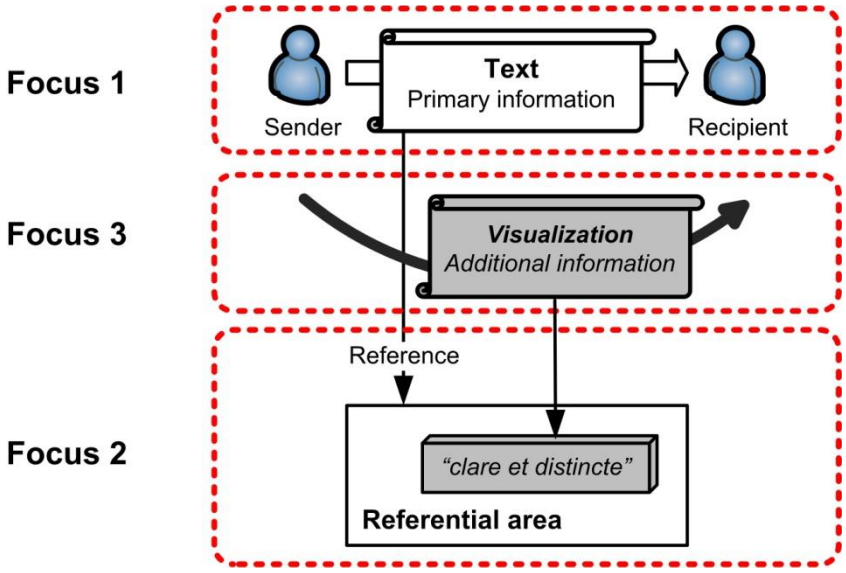

Fig. 3. A sample of three focuses in an alternate focuses SLV. A text is communicated from a sender to a recipient. A visualization refers to clear and distinct knowledge that contributes to understanding.

Image generation. Slide tools such as PowerPoint have very limited interaction capabilities and no camera; therefore only slide functions can be applied for animation. The camera concept is commonly employed in three-dimensional engines and can be applied in more elaborated visual navigation.

SLV is about the generation (synthesis) of diagrams. Images can be represented by data and algorithms. The sequence of images depends on the user's goals. The users may have different capabilities (laymen and professionals). A problem here is presenting explicitly a huge structure of legal terms. Pictures are merely reproduced in a simple slide preparation tool; however, pictures are generated in advanced tools such as computer aided design (CAD) systems or geographic information systems (GIS). There are interactive systems which allow the user to navigate and to choose a visualization sequence according to her needs. For instance, in GoogleMaps, the user can first overview a broad region and then zoom in and move to details, where images are generated from a GIS database.

SLV is intended for navigation in a state space, where visualizing concepts lead first to scenarios and next to processes. The trace of a navigation process is a series of displayed views. Here the event-recording symbols are graphical ones.

Different pathways through the informational space have to be considered in eGovernment Help applications, in which ordinary citizens seek advice depending on a situation and a phase. A user navigates the system and obtains a sequence of information chunks. Modeling the user's degree of interest and information layers is a requirement.

SLV increases the ability to comprehend the information space, which is the law. The purpose of cognition in SLV outweighs perception. Cognitive skills are more important in SLV than perceptual ones as in the case of information visualization. SLV focuses on cognitive tasks and not on search and target acquisition tasks as in information visualization.

Scenarios. We think that scenario-centered visualized narratives can be used in the development not only of technical systems, but also of socio-technical ones. "Scenarios are a powerful antidote to the complexity of systems and analysis." (Alexander, 2004, p. 3) A scenario is a narrative of foreseeable interactions of user roles (actors) and the technical system. A narrative is a time-threaded sequence of actions. "[S]cenarios are basically holistic… [T]he scenario is in essence, a single thing that conveys a human meaning." (ibid., pp. 4, 9).

Evaluation of SLV. The subject to be evaluated in the SLV approach is the recipient's comprehension of the communicated legal contents. The recipient can miss implicit relations that are inherent in the legal domain. Explicit representation of relations contributes to understanding the domain. The better SLV visuals are in the navigation, the better the recipient comprehends the contents.

3. The 8 views/4 methods/4 syntheses approach

Legal visualization appears in the context of legal informatics that comprises the topics of legal document systems, navigation and information retrieval. In the legal data science model of Schweighofer (2015), the four views of Lu and Conrad (2012, 2013) are extended by the addition of four other views, four methods and four syntheses (Fig. 1). The basis is the textual representation, the text corpus, which consists of primary sources (e.g., statutes, regulations, court cases and administrative decisions), and secondary sources (e.g., descriptive and analytical legal publications). Lu and Conrad call this textual set of evidence the document view of the world. Secondly, the annotation view consists of legal documentation (bibliographical data, topical classifications, thesaurus descriptions and expert annotations, e.g., Westlaw's headnotes[8]), which relies on a legal taxonomy. Thirdly, using long-standing experience in cross-references, the multiplicity of both out-bound (cited) sources and in-bound (citing) sources can also be exploited as the citation network view. Advanced citation does not stop with the document, but goes to the granularity of these citations at a document segmentation level (e.g., articles, sections, lists, etc.). Such citations can be weighted by citation frequency. Fourthly, a modern search engine can aggregate user behavior. Respecting data protection, and thus, disregarding individual behavior, the accumulated evidence represents the numbers of views, prints, citation checks, etc. for a document.

Lu and Conrad's list is extended by the addition of the logical view, the ontological view, visualization and the argumentation view. Logical representation describes the legal system as a set of first order logic statements, structured in time layers (one per day) and quantifiers identifying the (possible) persons concerned. It is strongly linked to

[8] West's Key Number System: http://info.legalsolutions.thomsonreuters.com/pdf/wln2/L-374484.pdf.

logic programming (cf. Sergot et al., 1986). The main advantage of logical representations lies in the potential for the automation or semi-automation of case handling. Using intelligent forms or digital pictures for the descriptions of facts, the logic program can automatically apply rules for a given date and particular persons. Ontological representations are machine-usable conceptualizations of the domain. In law, ontologies describe both the legal conceptualization and the factual conceptualization, i.e., a legal ontology and a world ontology (e.g., a "common sense" ontology such as Cyc[9]) are relevant. Ontologies enhance legal analysis with machine-usable concepts and their relations (Schweighofer, 2011). However, in practice, few applications exist. Legal ontologies require a deep analysis of the legal domain that can be conducted by the legal expert.

Legal search. Legal methods start with reading, finding, understanding and interpreting the law. For this manual process, books are sufficient, but a legal information system provides a much better and more efficient knowledge platform. This consists in collecting all relevant sources, adding metadata and making the documents available on the Internet (see e.g. Francesconi 2015).

The search engine is the main methodological add-on of legal informatics in the interpretation of the law. Modern search techniques are indispensable for finding the only appropriate document in a collection of millions of documents. Search is based on an understanding of legal vocabulary, combined with metadata. The popularity of search engines means that legal searches are too often made easy, rather than powerful. New approaches try to include elements of semantic searching, following Google search techniques. Legal search is an important IT support in the interpretation process, because it finds and analyzes relevant documents. A developing area that is becoming more important can be seen in the ranking of legal documents.

Synthesis. The synthesis changes dramatically in the "knowledge and network" society because of the much more powerful views and methods. It is no longer only text that has to be interpreted and analyzed. All eight views have to be taken into account, as well as the four analysis methods. There are various methods of product synthesis. Here, four main methods are singled out: manual commentary, Dynamic Electronic Legal Commentary (DynELC), citizens' information systems and case-based synthesis. The manual legal commentary is a representation of a legal system's knowledge that offers a particular area of law for comprehensive understanding in a systematic way. The concept of the automatic generation of these data in a more formal way already exists with DynELC (Schweighofer, 2011). Metadata for the text corpus are generated (semi-) automatically and added in a machine-usable way. This process comprises document categorization, semi-automatic generation of thesaurus descriptors, automatic generation of hypertext links and automatic generation of temporal relations.

[9] *http://www.cyc.com/documentation/natural-language-processing-in-cyc/*, *https://en.wikipedia.org/wiki/Cyc*.

4. Communication patterns

Visualization as *tertium comparationis.* *Tertium comparationis*, a basis of comparison, describes the quality that two things that are being compared have in common. An example of *tertium comparationis* is the number. Suppose four apples are being brought into relation with four pears. This is about the number, in this case about the number four, which occurs as *tertium comparationis*. It does not compare apples with pears but compares four elements with four other elements. A comparison can be performed through other common qualities such as "fruitiness".

In the legal domain, the concept of comparison can be interpreted broadly, see Section 5. In computer science, the interpretation is narrower and the notions of matching, substitution, and *is-a* relationship are employed. For instance, the rule, "All humans are mortal," $\forall x\ human(x) \rightarrow mortal(x)$, and the fact "Socrates is a human," *human*(*Socrates*), in other words, *is-a*(*Socrates*, *human*), entails the conclusion "Socrates is mortal," *mortal*(*Socrates*). Here the constant *Socrates* matches *human*. The substitution is [*Socrates*/*x*]. However, the god Zeus does not match *human* and there is no inference that "Zeus is mortal." Hence here we follow the conceptualization of the *is-a* relationship: "the *tertium comparationis* may be related to *comparata* as a whole is to its parts, a substance to its accidents, an idea to its instances, or a generic concept to its subsumed concepts, and so on" (Weber, 2014, p. 155).

On the one hand, there are formal notations that go beyond the textual ones; on the other hand, there are visual representations that also occur in competition with the text. In turn, two different types of visualizations can be distinguished: first, visualizations formed according to strict formal rules; and second, more intuitive pictures that can describe situations better.

There are also quite different approaches to visualization – through semiotics (Fig. 3), for instance. The classical philosophy of law, however, as approximately represented by Arthur Kaufmann (Lachmayer, 2005), has provided a methodological introduction to visualization with the thought pattern of *tertium comparationis*. In the European Union with its many official languages, in particular, visualization, which appears as a *tertium*, can form a mental bridge between the different languages.

4.1. *Tertium communicationis* – the third in communication

Tertium communicationis is not a word play: we are introducing a new term to denote the third part of communication. The subject matter of this abstract concept is, however, simple. A relation between two elements can be either direct or indirect (i.e. via a third, see Fig. 4 a). A communication between two monads can be either direct or indirect. This theoretical basic concept comes from Leibniz: monads are uninteracting and each reflect the entire universe in a pre-established harmony.[10] In this way, for instance, the

[10] Leibniz's place in the history of the philosophy of mind is best secured by his pre-established harmony, that is, roughly, by the thesis that there is no mind-body interaction strictly speaking, but only a non-causal relationship of harmony, parallelism, or

Internet is a *tertium communicationis* for two-computer communication and the Telecom – for phone communication (Fig. 4 b).

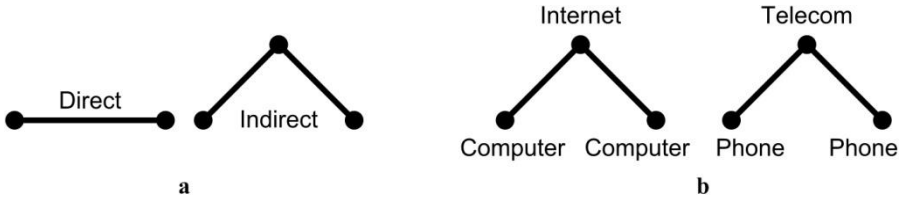

Fig. 4. a) Direct relation and indirect relation. b) Samples of indirect communication: via a third.

We use *tertium communicationi*s as a conceptual definition of something that improves communication between human beings or machines (Fig. 5). This communication need not be visual. Text is not just verbal and in the end a textual document has a layout, its graphic structure. The question "Which formats contribute to better communication?" depends on various factors, such as the document type and the communication task, and is worth a separate study. Intermediate formats have their syntax and semantics.

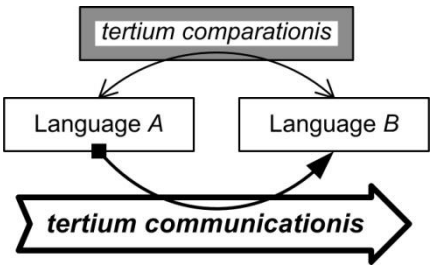

Fig. 5. *Tertium communicationis* as an intermediate format.

Converting a *tertium comparationis* into a *tertium communicationis* can make an indirect relation more dynamic and personal. This conversion leads further, to *tertium identificationis* and *tertium socialisationis*. The latter can be foreseen in requirements engineering for an information system, which serves as a *tertium*.

Suppose a translation from language *A* to language *B* is being performed. Besides visualization, other intermediate formats can be employed in translation. An intermediate language can serve as a *tertium translationis* (Fig. 6).

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correspondence between mind and body. See the article by M. Kulstad and L. Carlin at *http://plato.stanford.edu/entries/leibniz-mind/*.

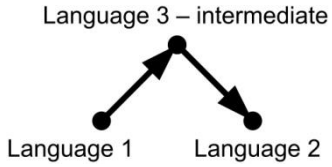

Fig. 6. *Tertium translationis* as an intermediate language.

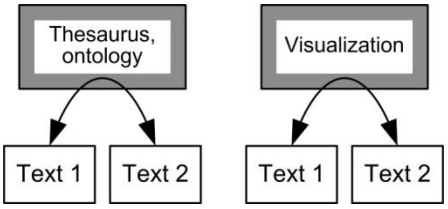

Fig. 7. Two kinds of *tertium comparationis*.

In natural language translation, for instance from Mandarin to German, the use of English as an intermediate can also make strong sense, especially in a scientific discourse. Similarly, a translation from Portugal into Lithuanian through English can also make sense.

4.2. Communication top-down and bottom-up and translation

Our own model on multilingual legal systems takes into account that only English is now the reference language for translations, and the equal treatment of all languages is disregarded in practice. We see two communication patterns in multilingual discourses: *top-down* communication and *bottom-up* communication. Different languages can be used in scientific discourse. Therefore, two situations arise regarding the discourse language. On the one hand, English, a global language, can be used. (Other standards such as Latin could also be used, and thus the role of *lingua franca* emerges.) This is the *top-down* pattern. On the other hand, other (working) languages, such as German or French, can also be used. This is the *bottom-up* pattern. Native languages allow a scientist to unfold his ideas more naturally, and the discourse becomes more creative and productive. Hence, the bottom-up approach is also more meaningful than the top-down one.

Translation problem. The use of different languages brings translation problems. Therefore, dictionaries and translation machines, such as IATE (formerly Eurodicautom) emerge.[11] Currently, ontology-based approaches for document accessibility and semi-automatic extraction from legal texts are addressed in various projects (see e.g. Yoshida et al., 2013; Francesconi, 2015); one of the first extensive works in the legal area was the book by Schweighofer (1999). A related work is also the Grammatical Framework[12] that provides abstract syntax trees as an intermediate format.

Visualization supplements translation. It is quite possible to go a long way around from one language into another language by going via a third language, the *tertium translationis*. Examples of this bridge language being visualization can be found in books for visualized learning, where illustrations complement word translation; for

[11] Eurodicautom, created in 1975, was the pioneering terminology database of the European Commission. In 2007 Eurodicautom was replaced by Inter-Active Terminology for Europe (IATE), the inter-institutional terminology database of the European Union (`http://iate.europa.eu`).

[12] `http://www.grammaticalframework.org/`.

instance, from the English ‘table’ to the German ‘der Tisch’ (Fig. 8). In this way, visualization supplements translation and brings an additional syntactic dimension to natural languages. Vividness is increased in the course of translation, so speakers obtain additional contemplation capabilities, and their discourse becomes more efficient. The more often use of visual dictionaries, in particular for languages like Japanese or Mandarin, is evident. Thus, visualization is shown to be important beyond legal informatics.

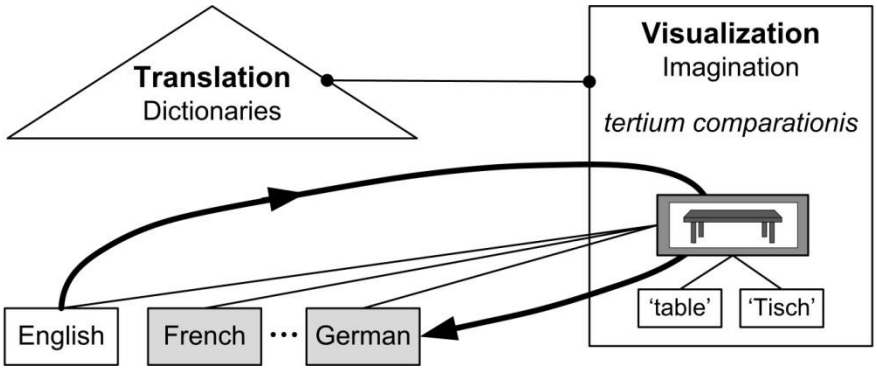

Fig. 8. Translation with visualization.

Lettering. A special situation occurs with worded visualizations. So far as the pictures are involved, no translation is required, since the pictures can be more or less “read” in all languages. If a visualization is to be offered in another language, the wording must be replaced. Here, the *tertium comparationis* consists either in a text system or in the visual elements themselves, because they have a common reference to the different language versions.

Wording brings semantics to visualization and may have various forms, such as figure captions, explanations, footnotes, labels, inscriptions, etc. A picture without a description is simply a graphic structure and can be viewed as mere visual chaos without semantics; it is therefore not acceptable in a discourse. The description could be in English and in other languages. Thus, the top-down and the bottom-up approaches can also be used in wording.

Transformation. To sum up, we are dealing with two kinds of *tertium comparationis*: thesauri/ontologies and visualizations (Fig. 7). Visualization in the role of *tertium comparationis* is the outcome of the following metamorphosis: from *tertium communicationis* through *tertium translationis* to *tertium comparationis*. In other words, the conversion of the roles of *tertium* is as follows: *tertium communicationis* changes into *tertium translationis* then into *tertium comparationis*. This transformation is aimed at applications in document space navigation.

4.3. Two directions: from natural language to professional juristic language and vice versa

In the projects that produce legal visualizations, we single out two directions for the development of ideas: first, from the natural language to a professional language (legal

language) and then to a formal technical language (Fig. 9 a), and, second, vice versa, from a professional legal language to the natural language (Fig. 9 b). Laypeople speak the natural language and jurists speak their professional language(s). Terms in a professional language may have specific metaphorical meanings, which are not intended in a natural language.

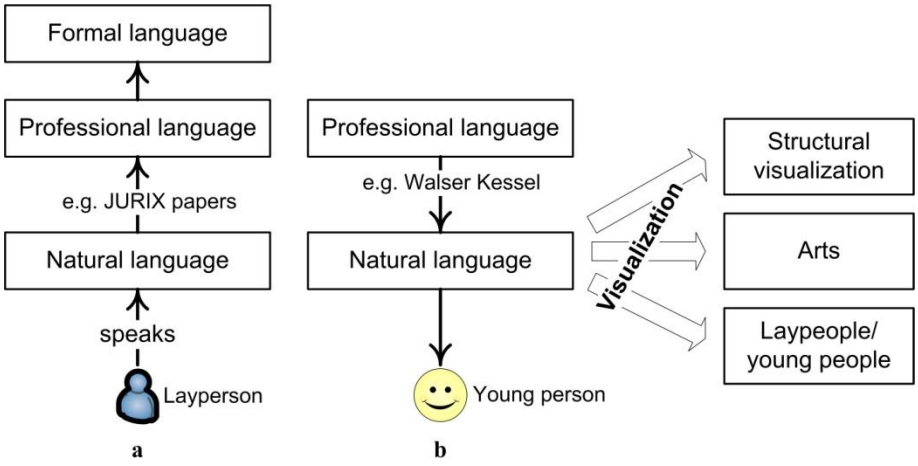

Fig. 9. Two directions: a) from a natural language to a professional language, and b) vice versa.

A further step in the first direction (Fig. 9 a) up from the formal technical language is computer implementation. In this way the so-called legal machines are produced, for instance traffic lights, automatic barriers and information systems, which have legal effects, e.g. for tax management.

The first direction can be observed, e.g. in Francesconi (2012). The second direction is demonstrated in Walser Kessel's (2011) informative book about law for young people.

We point to three kinds of legal visualization:

1. Structural visualization; see, e.g., Lachmayer's PowerPoint presentations, *http://jusletter-it.weblaw.ch/visualisierung/*
2. Arts. Examples are novels and films about legal matters and also pictures and statues of Themis, etc.
3. Explaining law to laypeople or young people.

A topic to explore is the transformation of syntax when a diagram is produced from a text. For example, the text layout and font have to be changed to communicate legal content for young people.

4.4. From text to visualization and to model

There are two ways to move from a text in one language to a text in another language. One way is via visualization, as we have discussed above. This path is shown in Fig. 5 and also Fig. 10 as the *tertium comparationis 1* arch. However, there is another way – via the model level (Fill, 2014a, 2014b). This way is shown in Fig. 10 as the *tertium comparationis 2* arch, and uses a model of the text, an ontology or a higher-level model.

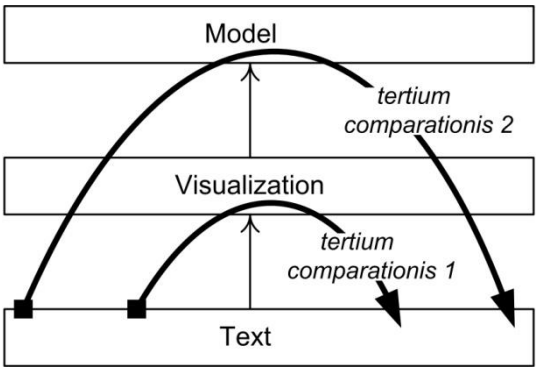

Fig. 10. Two ways of producing *tertium comparationis*: via a visualization and via a model.

4.5. Text–visualization correspondence

We see a correspondence between the textual world and the world of visualization. This correspondence is shown in Fig. 11, where the traditional model-driven development infrastructure, which is addressed by Atkinson and Kühne (2003), is taken into account.

We now explain the correspondence. Let us start from the world of textuality (Fig. 11). Metadata descriptors are extracted from texts. Next, thesauri appear beyond texts and metadata. Then, beyond thesauri we place legal ontologies.

The visualization world is shown on the right in Fig. 11. Pictures, photos, and other visually sensed raw materials correspond to texts. Above them we place *structural visualization*, which denotes the graphical representation of the legal meanings of the texts. Above that we place *meta-visualization*, which addresses the methods of visualization and their components, cf. Moody (2009); Fill and Karagiannis (2013).

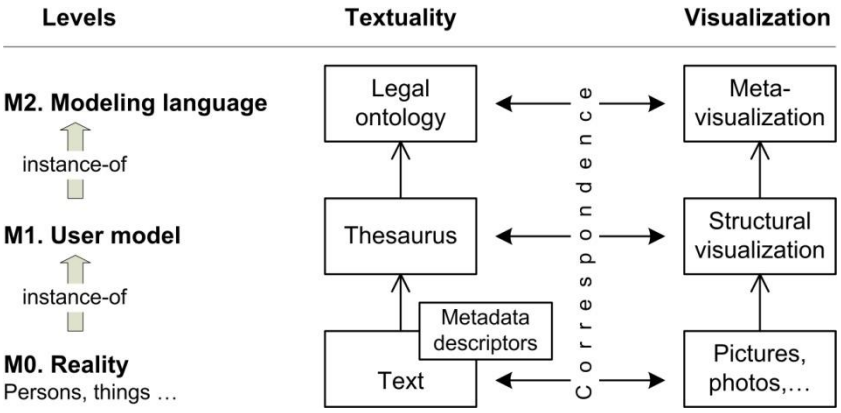

Fig. 11. Correspondence between textuality and visualization at different levels of abstraction.

4.6. Visual products as *tertium comparationis*

We can see different examples of visualizations that can serve as *tertium comparationis* products in law. A starting point is verbal metaphors. For instance, a pyramid represents the hierarchical structures of the branches of law or legal sources. Then comes a bridge (e.g., connecting the banks of law and technology), step working, etc. Here we can revert to the point of view that legal terms are also metaphors and have a specific meaning (Lakoff and Johnson, 2003).

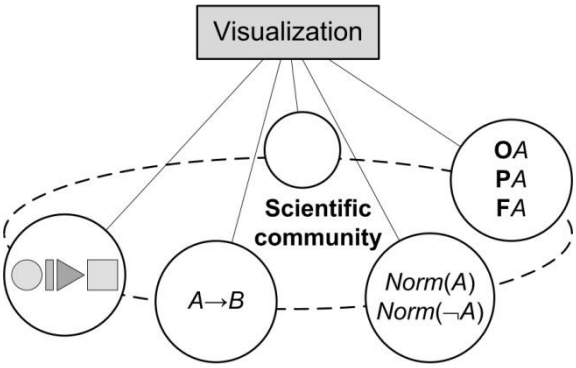

Fig. 12. A metaphor of different models for legal visualization.

As ideal visual models we would mention the globe, the solar system, the atom model that is composed of a nucleus made of protons and neutrons surrounded by a cloud of electrons, and molecule models such as H_2O. Here we stress that we are talking of pictorial models and not formal graphic models. There are different types of models, depending on the legal task, the domain of law, and the scientific community. For instance, a norm can be modeled as 1) a graph consisting of the addressee, the deontic modus, the action, and the subject, or 2) a rule "if *C* then *A*," $C \rightarrow A$ for short, or 3) a prescription to do *A*, *Norm*(*A*), or 4) a sentence in deontic logic, for instance, an obligation **O***A*, a permission **P***A*, or a prohibition **F***A*, etc. (Fig. 12).

5. Legal relations

Software engineers need to model relations while implementing legal machines. However, engineers may meet difficulties understanding the meanings of legal relations. In legal theory and legal philosophy, the concept of relation has certain nuances. The meaning of legal relations differs from the concepts of an extensional relational structure, an intensional relational structure, and an ontology in computer science (cf. Guarino et al., 2009), and from the concept of a (relational) structure in philosophy. Next, several complications on the way towards an ontology of relations are shown.

Legal scholar Arthur Kaufmann replaces ontologies of substances with ontologies of relations (Lachmayer, 2005). Legal relations are relations between different kinds of elements, for example, a) civil obligations between persons, *vinculum juris*, i.e. "bonds of law," b) relations between movable/fixed assets, and c) relations between the factual

and the normative (in German *Lebenssachverhalt und gesetzlicher Tatbestand*). It is not straightforward to model a legal relation as a mathematical relation. A relation R over the sets $X_1,\ldots X_n$ is defined as a subset of its Cartesian product, written $R \subset X_1 \times \ldots \times X_n$, and represented as a table.

5.1. Indirect relations and *tertium comparationis*

Indirect relations. *Tertium comparationis* is the case of a relation that does not lie directly between one element and another, but goes through a third. However, a course through *tertium comparationis* modifies the relation. With *tertium comparationis* one deals not with a direct relation between two elements, but, rather, with an indirect relation between them that is mediated over a third element. This indirect relation is a reflected relation and can also be characterized as a broken relation. A broken relation, a direct one, is replaced by two relations. For instance, a translation from Portugal into Lithuanian would be performed not directly, but through English. Another example is making two information systems interoperable. Interoperability requires a bridge between the systems.

Overcoming barriers with *tertium*. A reflected or broken *tertium comparationis* is able to make a connection through "walls" or other barriers. The situation is similar to a mirror, which allows one to survey areas that cannot be viewed directly. In this way, one can see not only the present, but also the past and the future. *Tertium comparationis* is a suitable technique to make connections in the unconscious, as they cannot be made directly.

Projecting a relation. Legal relations are generally not simple matters. In most cases a relation is not like a bridge between two banks because it is not even observable in the outside world. Often, relations are projected and a relation becomes the result of projecting. Hence, projection is the content of a thought act, a speech act, or a legal act.

Comparison. A comparison also concerns relations. Various elements can be compared and hence brought into a relation. If a relationship is projected, the elements that are connected in the relation are also projected. Hence, a) Is can be compared with Ought (i.e. sense, meaning, German *Sinn*), b) Ought with Is, and c) Ought with Ought.

Interpretation and comparison. A classical usage is a relation between the factual (*Lebenssachverhalt*) and the normative (*gesetzlicher Tatbestand, Normhypothese*). It is meaningful to examine this relation because it usually appears in judgments, i.e. legal acts. We hold that interpretation precedes comparison. The factual and the normative are compared not directly but through their meaning, which is projected onto the factual and the normative, respectively (Fig. 13). In legal language, it is not the case that a fact (which appears in the Is world) is compared directly with the content of a norm, but the interpreted fact is compared with the meaning of the norm (which appears in the Ought world). The interpretation (*Deutung*) is a prerequisite. The comparison compares the meaning-structure of the fact with the meaning-structure of the normative hypothesis. Legal terms serve as *tertium comparationis*.

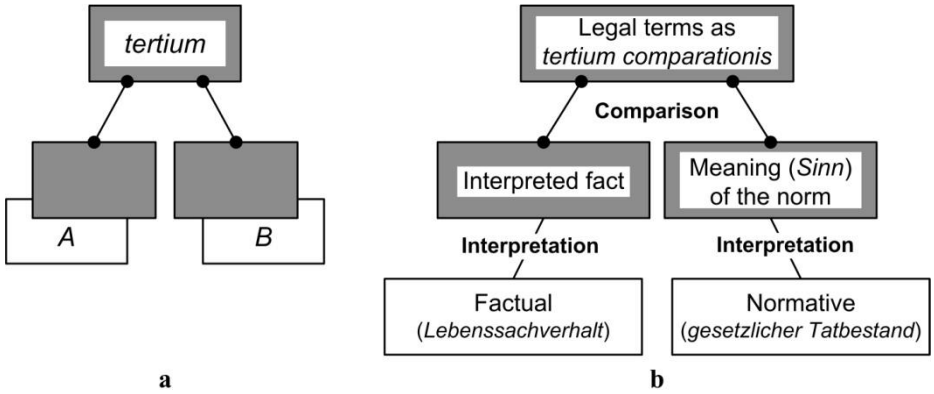

Fig. 13. An indirect relation between *A* and *B* through a common quality *tertium comparationis*: a) pattern and b) explanation.

Pretextual universals. A textual culture dominates in law and, therefore, there is little that is pretextual or non-verbal. However, there are also normative approaches that are centrally non-verbal. Examples are the simulated measurement units of the body, such as the radius or the cubit, the foot or the step. Hence, there are archetypes that are non-linguistic and have a social normative effect.

Subject-internal *tertium comparationis*. We spoke above about the abstract structural background that lies behind universal interpretation schemas such as language, types, and terms, and that thus lies behind supposed objectivity. However, another course can be followed to facilitate *tertium comparationis*, specifically through the subject. Universals can also be derived from the subject. There are *universalia in rem* that are internally in the subject (Fig. 14); they differ from *universalia ante rem* that are in the objective area before the subject and the thing.

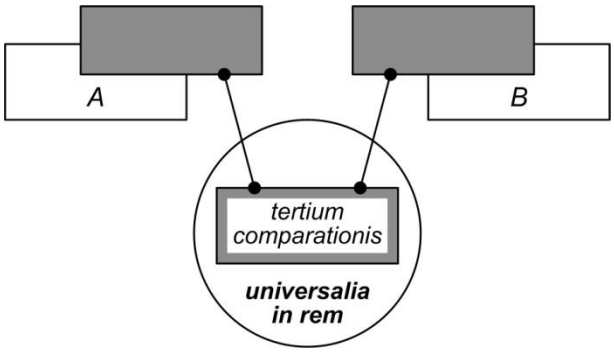

Fig. 14. An indirect relation between *A* and *B* following the course *universalia in rem*.

These universals can, but need not, be formulated verbally. Such indirect relationships can be produced in the subject for a preliminary understanding. Since we hold that language is a distinct human competence, the pre-verbal ability may be associated with the development stages before humans. A comparison is also possible, to

a certain extent, and thus a thought. The big advantage of language is less in the standardization in the projected meaning, but rather in the inter-subjectivity.

Two poles of *tertium comparationis*. There are thus two poles of *tertium comparationis* – namely, *universalia ante rem* that is assigned to the objective and *universalia post rem* that is attributed subjectively. Although you can find such comparison measures in different areas, they are still functionally lifted from the things whose conceptual link they make possible.

Relations and personality. Relations are assigned to the meaning level. There are many different types of relations, especially in the area of law. If a case is brought into a relation with a norm, the projecting onto the relation of correspondence is performed. However, it is different with complementary roles. Here there is something like a *vinculum juris* between people. The personal relation of the complementary roles of two or more persons is probably what Arthur Kaufmann had in mind when he developed his theory of the person.

Substance of *tertium comparationis*. The question "What is the substance of *tertium comparationis*?" is not trivial. A *tertium comparationis* such as the meter or the kilogram (of the International Bureau of Weights and Measures) can be assigned a concrete substance. However, the substance of *tertium comparationis* can be weakened; think, for example, of merely projected units of measurement. Here the substance is not as clear as in the case of concrete *universalia in rem* examples like the meter or a cardboard/computer model of a house that is built by an architect.

5.2. Towards an ontology of relations

Stressing the ontology of relations is a radical step that is interesting from a linguistic viewpoint. However, the practical consequence of this step has not been sufficiently considered. Is it in fact the case that only relations, and not the substances that are associated with them, are real? Through the elimination of the substances one falls into a bottomless abyss, and the relations alone are not able to slow down this fall. An attempt to visualize the ontology of relations is shown in Fig. 15. This ontology can be treated as a classification of relations, which are grouped according to 'Is'–'Is', 'Is'–'Ought' and 'Ought'–'Ought' combinations. The proposed concept of the ontology of relations is at a very abstract level, and does not conform entirely to the treatment of ontologies in computer science (cf. Guarino et al., 2009).

Arthur Kaufmann made a radical change to Aristotle's category. Relation is a category for Aristotle. Aristotle replaced one category by a different category. Like Arthur Kaufmann, Hans Kelsen stressed this relational character at least of subjective law, in which he defined the person as an embodiment of rights and obligations. For Kelsen this was possibly an attempt to reconsider the traditional concept of the person in its figure (*Gestalthaftigkeit*) and to suspend it dialectically, especially in order to understand it from his ideology-critical approach.

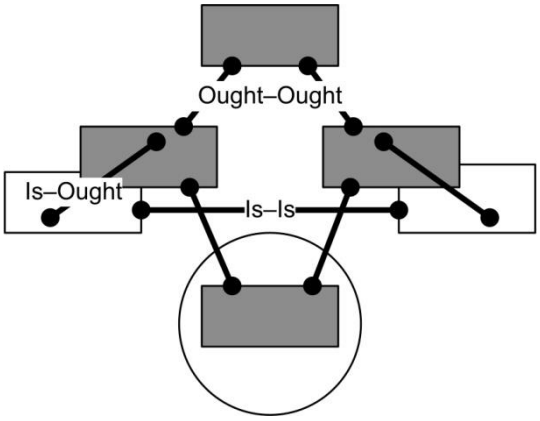

Fig. 15. Towards an ontology of relations.

6. Conclusions

Modern legal informatics theory developed legal data science for computer-supported representation and analysis techniques. Legal data science aims to create the eight views of the legal system. A major part of the analysis consists of structural visualization that deals with logical diagrams and represents the semantics of law.

An overall function of visualization is to reduce complexity. Depicting legal meanings is a problem. In SLV, the law (Ought, legal institutions) is in the forefront rather than facts (Is). SLV stresses a scenario rather than information display. Legal narratives with SLV are visual ones. Another point of SLV is the dynamic aspect, namely, user-centric navigation in the information space. For instance, laymen and professionals use different wordings and play different roles in informational processes. SLV can serve to show a bright-line distinction between legal terms, for instance in eGovernment applications explaining the law to citizens.

In this contribution, we focus on visualizations that can serve as *tertium comparationis*. In a multilingual scientific discourse we see two communication patterns: top-down and bottom-up. Next, we introduce the concept of *tertium communicationis*, which facilitates communication between human beings or machines. We aim to use *tertium communicationis* as a conceptual definition that improves communication. In the production of legal visualizations, we single out two directions for the development of ideas: 1) from the natural language to a professional language (legal language) and then to a formal technical language; and 2) vice versa. We see two ways of producing *tertium comparationis*: 1) via visualization and 2) via a model. Therefore, we show the correspondence between textuality and visualization at different levels of abstraction. The transformation pattern of the *tertium* is "from *tertium communicationis* through *tertium translationis* to *tertium comparationis*." Next, we provide a classification of legal relations based on 'Is'–'Ought' combinations. We conclude that the substance of *tertium comparationis* may not be trivial, as in the case of units of measurement.

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