Ontologies in the legal domain

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Chapter 12
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12.1 Introduction

Ontologies are conceptual models of a specific domain. This use of the term 'ontology' in the context of computer science and artificial intelligence differs from the use of the term in a philosophical context (cf. Mommers et al. 1997). Gruber (1993) defines an ontology as a specification of a conceptualisation, and, more specifically, as a description of concepts and relations that exist for an individual or a community of individuals. A conceptualisation is a representation of the world that is both simplified and abstract (ibid.). In artificial intelligence, ontologies are primarily meant to provide a basic framework for knowledge representation: the entities and relations distinguished in an ontology provide a user with the means to represent knowledge in the domain that the ontology covers. Ontologies were considered to be able to establish the missing link between legal theory and AI & law by Valente and Breuker (1994).

The rise of ontologies in the domain of artificial intelligence and law (AI & law) can be seen as both the almost inevitable consequence of developments in computer science and artificial intelligence in general, and as a recognition of the necessity of building maintainable, scalable models that do justice to the structure of legal domains. An inherent problem for legal ontologies, however, is that legal systems that underlie such ontologies vary according to time and place. The general concepts and relations of a top-level ontology can rarely accommodate all the peculiarities of legal systems. In order to address the specific problems bound to appear in legal ontology building, this chapter provides an (incomplete) overview of ontologies built in the past decades of AI & law research.

Not all the ontologies discussed were named as such by their creators. We assume that any model – regardless of its name – that makes implicit or explicit claims regarding the existence of entity types and relation types amounts to an ontology.

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This chapter also critically assesses the claims of ontologies, it provides an overview of the tasks attributed to legal ontologies, and it summarizes developments expected in the near future. For a different overview of legal ontologies and their applications, please refer to Breuker and Winkels (2003), focusing mainly on a specific set of projects, but still indicative for the field.

This paper sets out by discussing legal ontologies, classifying them through a classic distinction between semantics, epistemology and ontology (Section 12.2). It subsequently discusses the applications of ontologies in the legal domain (Section 12.3). Then, it continues to explore future opportunities of the application of ontologies in legal domains (Section 12.4). Finally, it provides conclusions. However, we first elaborate on principled problems in building legal ontologies, arising from the nature of legal domains.

The legal domain is – as many other domains – dominated by the use of natural language. Although legal language use often has a particularly formal nature, and contains a lot of jargon, it is still natural language – not the formal kind of language we find in programming languages or logics. This means that there is neither a formal syntax nor a formal semantics for legal language. Any attempt to represent parts of a legal domain will encounter this lack of formal syntax and semantics, as representation languages require – at least – a formal syntax in order to be usable for automated reasoning, and a formal semantics in order to disambiguate meaning. The mapping from natural language – by far the important representation language for legal knowledge – towards (semi-)formal languages introduces so many principled and practical problems that one could wonder if building formal representation frameworks actually is a sensible thing to do.

Principled problems are, first, the nature of natural language meaning in general. The revolution that the later Wittgenstein (1953) started in philosophy of language was the denial of being able to fix natural language meaning in terms of necessary and sufficient conditions. This revolution has been translated to the legal domain by, among others, Hart (1961), by introducing the notion of open texture concepts (cf. also Bix 1991). Modeling a domain almost necessarily assumes a low degree of change if the representation is required to give a correct picture of that domain. Any changes in the domain have to be modeled to keep the representation up to date. As legal concepts change through time (they are either replaced by new concepts, or their meaning or interpretation changes through judicial decisions), their place in the ontology should change as well.

Second, modeling a domain assumes that a domain *can* be represented. However, many branches of legal theory actually concern those acts that 'mould' the law: judicial reasoning for instance, making new 'things' (decisions) on the basis of incomplete information about facts and rules that are not conclusive. Although there is discussion on the matter whether this problem concerns only hard cases (cf. Hage et al. 1993, Leenes 1998) – and consequentially, how to establish whether a case is actually a hard case – the problem will probably always apply to simple cases to a certain degree.

Third, representing a legal domain often includes representation of relevant parts of the 'real world'. Therefore, legal ontologies generally contain a mix of legal concepts and real-world concepts. There are major differences in the accommodation of the legal and the legally relevant types in legal ontologies. For instance, McCarty's (1989) Language of Legal Discourse (see below) contains largely legally relevant concepts. Van Kralingen's (1995) frame-based ontology of law (see below) contains mostly legal concepts. Mommers' (2002) knowledge-based ontology of law makes an explicit distinction between the two types.

Elaborating a bit further on natural language meaning – the first principled problem stated above – meaning is a subject of major importance to modelling in the law, as so many legal issues arise from the meaning and interpretation of natural language terms and sentences. In this respect, some logico-philosophical history is necessary. Frege (cf. Frege 1892) developed a theory of meaning that distinguishes between two components of meaning: sense (Sinn) and reference (Bedeutung). The sense of an expression consists of the conditions under which it obtains: if we call an unmarried man a bachelor, then the concept 'bachelor' has as conditions: being a man and being unmarried.

The presence of each of these conditions is necessary, and the presence of both of these conditions is sufficient for a person to be a bachelor. The reference of an expression consists of the set of all objects that fulfil the conditions that are part of its sense: 'bachelor' refers to all unmarried men. The sense of an expression determines its reference, and two expressions with the same sense have the same reference. Meaning may change, i.e., for instance, the conditions that determine the sense of a concept may change through time. This is sometimes referred to as the 'open texture' of a concept.

The open-texture nature of legal concepts can be more precisely defined as the possibility that elements of the definition of some concept may change, may be left out, or may be added at some point in time, from which point in time the new set of elements will constitute the definition of that concept. In other words: the sense of an open texture concept changes through time. The concept of open texture is not a purely legal phenomenon. It was introduced by Waismann (1952, p. 120), who distinguishes between open texture and vagueness of empirical concepts. If we consider vagueness to be the unclear (or missing) demarcation lines of application of a concept, then open texture can be defined as the *possibility* of vagueness. Vagueness may apply to both the intension (sense) of a concept, in which case there is no (clear) set of necessary and sufficient application conditions for the concept, and to the extension (reference) of a concept, in which case we cannot (completely) determine the set of objects the concept refers to.

The view of meaning as use, introduced by Wittgenstein (cf. Wittgenstein 1953), always is subject to the danger of becoming a slogan rather than a serious idea. It has to be more strictly defined (or rather, explained by examples, as Wittgenstein did) to make sense, because otherwise, it raises questions such as: whose use constitutes meaning? and: what kinds of use constitute meaning? Putnam (1975, p. 145) has an approach that may clarify the 'use' aspect of meaning:

> [E]veryone to whom gold is important for any reason has to acquire the word 'gold'; but he does not have to acquire the method of recognizing if something is or is not gold. He can rely on a special subclass of speakers. The features that are generally thought to be present in connection with a general name – necessary and sufficient conditions for membership in the extension, ways of recognizing if something is in the extension ('criteria'), etc. – are all present in the linguistic community considered as a collective body; but that collective body divides the 'labor' of knowing and employing these various parts of the 'meaning' of 'gold.

The question whose use constitutes meaning becomes acute when only a small part of the community is able to determine whether some substance is really gold. Is only their use of the term 'gold' relevant? The majority of people, who do not distinguish gold from many other substances that look like gold, use the term 'gold' in a way that makes it impossible to determine its reference. Should we then exclude reference from our understanding of meaning?

Any definition of meaning that is related to use yields such problems. In the determination of the meaning of 'meaning' we can employ the approaches to the concept itself. For an intensional approach, this would mean that we can define the meaning of 'meaning' in terms of necessary and sufficient conditions. As 'meaning' itself is an open-textured concept, we need to consider the possibility of changes in this set of necessary and sufficient conditions. Meaning regarded as use also enables us to integrate open-texturedness into the concept of meaning. Because the use of the concept of meaning varies through time and through communities, we should incorporate use in its definition. The meaning of 'meaning' thus becomes dependent on the actual occurrence of the concept in natural language use, or, more specifically, in the legal domain, or even in the domain of the employment of legal information systems. The concept of meaning forms the core of legal ontologies: any ontology that does not take into account the peculiarities of legal meaning – the meandering of legal meaning between fixed criteria ensuring legal certainty and open texture enabling proper responses to unforeseen situations and unfair consequences – will render itself useless in little time.

12.2 A Selection of Legal Ontologies

Despite the name 'ontology', legal ontologies are actually quite different in their approach to legal domains. For clarification purposes, I distinguish between three different approaches. Semantically oriented approaches focus on the semantic interpretation of a representation of elements and relations in a certain domain. Epistemically oriented approaches focus on the (acquisition of) knowledge in a domain. Ontologically oriented approaches stress the entities and relations that constitute a domain. It goes without saying that these approaches tend to overlap to a certain extent with respect to their semantic, epistemic and ontological claims. Still, the distinction helps to classify ontologies on the basis of their assumed relation to reality: through the relation between language and reality (semantics), between knowledge and reality (epistemology) or through claims regarding existence (ontology). What the examples below have in common, is that they are based on a

top–down approach, starting from very abstract concepts, and trying to apply these on concrete domains. There is one notable exception to this: the LOIS WordNet, which can be considered as a (lexical) ontology, was partly built from the viewpoint of individual legal concepts. The bottom–up approach, however, seems promising, and is further discussed in Section 12.4.

12.2.1 Semantically Oriented Theories

Many logical languages used in AI & law tend to make ontological assumptions if their syntax and semantics are deemed to be representative of certain legal classes. Deontic logics that distinguish between different types of norms make such underlying assumptions as well – unless any relation between the logic and the 'real world' is denied. An example of a semantically oriented theory is McCarty's Language of Legal Discourse. It is both a semantic and an ontological framework. The categories that McCarty distinguishes in one of his articles about LLD are space, time, mass, action, permission, obligation, causation, purpose, intention, knowledge, belief (McCarty 1989, p. 180). These categories give a clear indication of the common-sense character McCarty ascribes to the legal domain: there is little attention for its typically legal characteristics.

A different, less formal (in terms of lacking a formal semantics) approach is found in applications of WordNet in the legal domain. WordNet is a framework of relations between concepts. In WordNet, concepts are represented by a set of synonyms (synset) with an accompanying explanation of its meaning. These synsets are linked to each other by a fixed set of relations that are part of the WordNet framework (Fellbaum 1998). These include causality and specificity. JurWordNet is an extension of a generic Italian WordNet that contains legal terms and their meanings, linked up to the generic WordNet (cf. Gangemi et al. 2003). The LOIS WordNet is a legal WordNet for six European languages that is partly based on JurWordNet and contains around 5,000 legal concepts per language (cf. Dini et al. 20055). These WordNets enable, for instance, linking layman's search terms with the legal professional's language, thereby enabling search actions in legal documents without the need to know legal terminology beforehand. As WordNet is such a widespread semantic framework, it enables linking up legal WordNets to the generic ontologies that have been modelled in WordNet.

12.2.2 Epistemically Oriented Theories

Epistemically oriented theories contain claims on knowledge of the legal domain. As the law is generally regarded – at least partly – a human-constructed phenomenon, it makes sense to approach it from the viewpoint of knowledge: it consists largely of agreements between people; it is not tangible, and thus, it resides 'in the head' for the better part. A clear example of an epistemically oriented theory is Valente's (1995) 'functional ontology'. It models an ontology of law from

the perspectives of both information science, following the definition of 'ontology' given by Gruber, and of legal theory, following such legal theorists as Kelsen and Hart. The functional ontology distinguishes between six different basic types of knowledge: normative knowledge, meta-legal knowledge, world knowledge, responsibility knowledge, reactive knowledge, and creative knowledge.

Normative knowledge is regarded the most obvious kind of legal knowledge. It consists of the elements of the legal domain prescribing the behaviour of the people constituting a society, and a description of the way social reality should look. Meta-legal knowledge consists of the entities not directly regulating behaviour. These entities are empowering and derogating norms, and norms regulating the mutual relations among primary norms. World knowledge consists of elements telling us what the world looks like. Responsibility knowledge consists of the knowledge that links normative knowledge to reactive knowledge: in case some agent causes a certain event, responsibility knowledge helps to establish the extent to which the agent can be held responsible for what he did. Reactive knowledge consists of the sanctions imposed if an agent breaches a norm and is held responsible for that. Creative knowledge, finally, consists of information about newly created institutions and other entities that arise from the application of the law.

12.2.3 Ontologically Oriented Theories

Ontologically oriented theories make claims about reality. Such a theory will, for instance, make a claim about the existence of individual norms. Ontologically oriented theories will be the most 'ontological' from a philosophical viewpoint: they make implicit or explicit claims about existence.

An early ontologically oriented theory was that of Van Kralingen 'frame based ontology' (1995). He distinguishes between three main types of entities: acts, norms and concepts. For representation purposes, each of these entity types is represented by a so-called frame, each containing a number of slots filled with characteristics of a specific occurrence of the entity. An act frame consists of fourteen elements: an act identifier, promulgation, scope, agent, act type, means, manner, temporal aspects, spatial aspects, circumstances, cause, aim, intentionality, and final state. The slots of a norm frame are a norm identifier, promulgation, scope, conditions of application, subject, legal modality, and an act identifier. The third type of frame, concept frames, consists of a concept, concept type, priority, promulgation, scope, conditions, and instances. Concept types distinguished are definitions, deeming provisions, factors or meta-concepts.

Verheij and Hage (1997) developed a model consisting of three main elements: states-of-affairs, events, and rules. States-of-affairs are (possible or real) situations that can be described by descriptive sentences. Events bring about changes in the current states-of-affairs. Rules express direct relations among states-of-affairs. Thus, there are two different relations among states-of-affairs: either the transition from

one state-of-affairs into another is *caused* by an event, or the transition from one state-of-affairs into another is the result of the application of a rule, which makes the former *constitute* the latter. The model is inspired by institutional theories of law. By accommodating the temporal aspects of relations between states-of-affairs and events, the supervenience relation between states-of-affairs, and the different modalities of states-of-affairs, the authors introduce a very abstract approach towards modelling legal phenomena.

LRI-Core, developed by, among others, Breuker and Winkels (2003) is a core ontology specifically aimed at the legal domain, but with a clear connection to the physical world. The main entity classes distinguished in the physical world are objects (e.g., documents) and processes (e.g., actions). Mental objects and processes often relate to the physical world. Social organization is attained by imposing roles on agents, partly regulated by (legal) norms. It has been used as top-ontology in several practice-related projects, such as the CLIME project (Winkels et al. 1998), in which a question–answerring system was based on an ontology-oriented representation of a certain domain.

12.2.4 Mixed Approaches

Mommers' (2002) 'knowledge-based ontology of law' focuses merely on the ambiguous perspective that one can have on legal domains. By distinguishing between ontological status layers and empistemic roles, he accommodates both the epistemic and the ontological viewpoint in a single ontology. Although the author includes some semantically oriented categories (sentences, statements) in his ontology, the main focus is on accommodating views on the existence of legal systems and their constituents, and knowledge of the law. Ontological status layers are efficacy (the degree to which a law has the intended effect), validity (has a law been issued by the proper authorities in a proper way) and recognition (has a law been recognized as a law by its addressee). They each reflect, for instance, a view on the existence of legal rules. An epistemic role is a role that an entity (a belief, a statement) can take in the acquisition or justification of knowledge. Epistemic roles include reasons, defeaters ('arguments' that attack a reason or a relation between a reason and a conclusion) and knowledge. By including such epistemic roles, there is also a clear place for legal argumentation in the ontology.

12.3 Applications of Legal Ontologies

Applications of legal ontologies range from information systems to knowledge-based systems. The more 'intelligence' is requested from a system, the more detailed knowledge representation the ontology should support. Examples of applications of legal ontologies are:

(a) Information retrieval. By encoding knowledge about the meaning of concepts and the relations among them, it becomes possible to empower users of information retrieval systems. A seminal version of an ontology, a *thesaurus*, can encode relations between terms and concepts, for instance hierarchical relations. Information about less and more specific concepts can help the user to find information relevant to his query. Examples of relevant publications and projects are Matthijssen (1999), who introduces an interface between the lay user and a legal database, LOIS (which stands for 'Lexical Ontologies for legal Information Sharing', cf. Dini et al. 2005) and BEST (which stands for 'Batna Establishment using Semantic web Technology', cf. Van Laarschot et al. 2005).
(b) Translation of legal documents. Making explicit the meaning of legal terms can help in (manually!) translating legal documents from one language into another one. A framework for this specific purpose has been developed by Termorshuizen-Arts (2003). Although her work was not done from the perspective of artificial intelligence & law, it is certainly relevant to that discipline.
(c) Automated classification and summarizing. Parallel to information retrieval, automated classification is meant to facilitate finding documents. Ontologies, combined with statistic techniques and natural language processing techniques, can support classification techniques as well. The same goes for making summaries of documents automatically (cf. Moens et al. 1997, Moens 2004).
(d) Question answering. Automatic question answering requires thorough representation of knowledge in order to let a system 'understand' both a question and the sources of knowledge on which to base automatic answering. Cf., e.g., the CLIME project. CLIME stands for 'Computerised Legal Information Management and Explanation', cf. Winkels et al. (1998).
(e) Decision support and decision making. Legal (procedural) regulations often contain decision structures that allow making certain decisions or qualifications. Although such structures can be modelled in relatively simple decision trees, such decision trees still require user intervention on making a choice in each step. An ontology can be used to encode not only the decision steps, but also the contents of the decision rules. Advantages of using an ontology in such a case are supposed to include consistency of the modeling activity result and the re-usability of the underlying ontology for other modeling activities. Although the models underlying case-based systems are seldom called 'ontologies', they can be regarded as such. The model underlying a sentencing system described in Oskamp (1998) is just one example of this. It contains a model with two main constituents: facts and factors. Factors are subjective qualifications of (sets of) objective facts. By the nature of these entities, they constitute an 'ontology' of the arguments underlying sentencing decisions.
(f) Agent technology. Although still largely a theoretical exercise, agents are assumed to allow for intelligent autonomous communication between different computer systems. For such communication, the modelling of rules governing that communication is necessary. As in the case of decision support and decision making, such modelling can be supported by an underlying ontology. Potential

practical applications of agents in the legal domain are automated dispute resolution by negotiation and the controlled exchange of sensitive data, for instance in electronic legal dossiers

Of these different applications of ontologies, information retrieval still remains the most widely found application of ontologies – especially if we count those frameworks that are regularly not *called* ontologies, such as thesauri. In this respect, the legal domain does not really differ from many other domains.

12.4 New Developments

Large-scale information systems and knowledge-based systems have stimulated the development of ontologies in recent years. Unlike the earlier top–down approach towards ontology construction seen in the discussions in Section 12.2, a bottom–up approach towards the generation of ontologies has gained attention, by following the structure of legal sources themselves. The result of generating such a model can be coined a 'bottom–up ontology'. The development of interactive internet applications has triggered the generation of 'folksonomies': classification schemes that are the result of the joint participation of many users. This development will play a growing role in the legal domain. For instance, Wikipedia (the internet encyclopaedia; cf. www.wikipedia.org) currently contains many legal entries, and the references between these entries indicate a structure. The same will be seen for Jurispedia – a legal variant of Wikipedia.

How the process of bottom–up construction of ontologies can be best facilitated, is largely unknown. Most platforms that could support such construction are still in their infancy – policies for the proper use of on-line collaborative environments (such as wikis, enabling the joint production of texts) are subject of trial and error in their actual use. Use of such platforms in the legal domain is still quite rare, so little is known about suitable policies for collaboration among lawyers. Still, this bottom–up approach could be very promising as it involves domain specialists to a much higher degree, putting more specialist knowledge into legal ontologies.

As a response to top–down, legal-theoretically oriented ontology building, more pragmatic and positivist approaches have been developed. From the viewpoint that general classification schemes will always be largely normative in nature, the awareness arose that the most important basis for ontologies can be found in formal sources of law: in legislation, case law etc. This insight was used in the LOIS project, in which roughly half of the multi-lingual WordNet is constituted by concepts directly derived from definitions in European directives (cf. Dini et al. 2005, Mommers and Voermans 2005). A similar approach was suggested in Després and Szulman (2005).

Folksonomies are classification schemes developed on the basis of user interaction. They have become widely known through services such as FlickR.com, that enable users to classify, for example, their own photos with self-selected 'labels'. A more or less coherent system or taxonomy of labels can thus come into existence.

The opportunities offered by folksonomies are especially interesting with respect to information retrieval. Current legal information systems are often either based on full-text retrieval, statistic-based retrieval, or thesaurus-based retrieval. Full-text retrieval does not offer meaningful connections with synonyms or related terms. Statistics-based information retrieval generally provides only access to documents with 'associated' terms, which makes these less reliable than search engines based on thesauri or ontologies, the latter providing more rigid connections between concepts.

Thesaurus-based retrieval is based on a pre-built thesaurus, which includes the views of the builders on the legal domains included. This view can clash with the users' expectations of synonymy and related terms. It would be interesting to see the type of user-initiated classification schemes applied in legal information retrieval. Little work has been done on this matter in the legal domain. A somewhat related attempt to model user interaction in the quality assessment of legal documents and legal institutions is found in Mommers (2003) and (2005). A collaborative approach of legal knowledge dissemination is found in Hoorn (2005). A more complex collaborative approach would allow for establishing, for instance, WordNet relations between different items.

12.5 Conclusion

Although a considerable number of legal ontologies has been developed in the past two decades, there are still few large-scale applications. Apart from an apparent lack of dissemination activities by the AI & Law community in the legal domain, this could be attributed to the gap between the state-of-the-art in AI & Law and the situation in legal publishing, one of the main (potential) users of legal ontologies. It seems that the more profound type of modeling in legal ontologies is still too advanced for legal information retrieval, in which traditional taxonomies, thesauri and keyword lists are still prevalent. Additionally, an important cause for a lack of 'deep' modeling can be found in the enormous effort that has to be made for it.

Also, there is a tendency in AI & Law to build generic models that do not really fit in with large parts of the legal domain, which in itself is very complex and diverse, and thereby very hard to classify. A bottom–up approach is seldom found, which is a pity, because it could yield very interesting insights in the nature of legal concepts: how they can be defined, how they relate to common-sense concepts (if they do), and what legal relations there are among legal concepts. The most important development in this respect comes, in my opinion, from outside AI & law. Folksonomies and on-line collaborative environments create great opportunities in distributing the modelling effort needed for large-scale ontology-based legal information systems among many persons. All kinds of incentives (for instance, reputational rewards) could be used in order to unleash the massive knowledge present in the population of lawyers in order to build semantic networks.

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