

IURISERVICE DEVELOPMENT

II

ONTOLOGY

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Abstract In the legal domain, ontologies enjoy quite some reputation as a way to model normative knowledge about laws and jurisprudence. While there is a multitude of ontological models to represent theoretical legal knowledge, no previous attempt to construct ontologies based on professional knowledge exists, capturing judicial expertise. We define the epistemological and ontological levels as separate issues.

This paper shows the preliminary ontology development for the second version of the prototype *Iuriservice*, a web based intelligent FAQ for judicial use containing a repository of professional judicial knowledge, within the IST project SEKT. The iFAQ system will focus on such knowledge and will base on OPLK —Ontology of Professional Legal Knowledge— developed by Universitat Autònoma de Barcelona. LPK refers to the core of professional work that contains the experience of the daily treatment of cases and is unevenly distributed within individuals as a result of their professional and personal experiences.

Judges had a strong and thorough education and became experts in their domain, but they still often seek the help of senior judges or tutors to solve on-duty problems. The knowledge acquisition process has been based on an ethnographic process designed by the UAB team and the Spanish School of the Judiciary within the national SEC project, to efficiently obtain useful and representative information from questionnaire-based interviews. Nearly 800 competency questions have been extracted from these interviews and the ontology is being modelled from the selection of relevant terms. Once the terms are identified, the relevant relations between those terms need also to be identified, following a *middle-out strategy*.

Regarding ontology modelling issues, some other changes have been introduced into *Iuriservice prototype II*. First, several KAON applications, such as the ontology editor Oi-Modeler, have been used in order to model and visualize the domain ontology. Second, we have used two different software applications to analyze the competency questions and extract relevant concepts: TextToOnto and ALCESTE. And finally, we have also followed the DILIGENT argumentation methodology to control and trace the discussion of each of the arguments used in favor or against the introduction of a concept *X* as part of the domain ontology.

This paper presents the preliminary Ontology of Professional Judicial Knowledge that has been extracted manually from the selection of relevant terms from nearly 200 competency questions and affirms that the modeling of this professional judicial knowledge demands the description of this knowledge as it is perceived by the judge and the abandonment of dogmatic legal categorizations.

Keywords: judiciary, ontology, legal ontology, professional knowledge, knowledge acquisition, middle-out strategy.

Introduction

Iuriservice prototype II development will provide judges with access to frequently asked questions (FAQ) through a natural language inter-

face. The system will respond with a list of question-answer pairs that offer solutions to the problem faced by the judge and a set of related and relevant case rulings. Ontologies are being used to provide a more accurate search than the basic keyword search.

When a knowledge management system has to be able to adapt to user requirements and provide them with an efficient support in a fast and reliable way, the accuracy and the validity of the knowledge repository is critical. For this reason, two national surveys have been conducted as a primary source of data regarding both the context of use and the contents of the questions to which the system provides answers.¹ These surveys have offered interesting and important data to elaborate the user's profile and obtain competency questions from which the ontology has been extracted.

There are three aspects of the professional profile of judges most relevant to our project. The first one involves the frequency with which the new judge talks about the cases he is dealing with. Only 4.71% of the judges interviewed stated that they never exchange information concerning their cases with others, usually peers. Secondly, judges offer an interesting answer to the question of "which would you like to find if judges were given a web service system?". The majority of them proposed a site where doubts regarding professional cases could be put in common and discussed. Finally, the surveys allowed us to identify three main areas which presented some difficulties to new judges: (i) the organization and management of judicial staff (clerks working in judicial units); (ii) the interpretation and implementation of new procedural statutes (e.g. *Ley de Enjuiciamiento Civil*); (iii) the "on-duty" period (or the *guardia*, that is, the week in which the entire court is on duty tackling the preliminary investigations of the criminal cases that keep entering the system).

The competency questions obtained from the judges are analyzed using two different software applications TextToOnto² and ALCESTE,³ in order to extract relevant terms and identify knowledge domains, respectively. Finally, we follow the Distributed, Loosely-controlled and evolving Engineering of oNTologies (DILIGENT) methodology during the ontology engineering process [28]. The visualization of the arguments takes place on a wiki-based environment which allows them to be traced (Fig. 1).

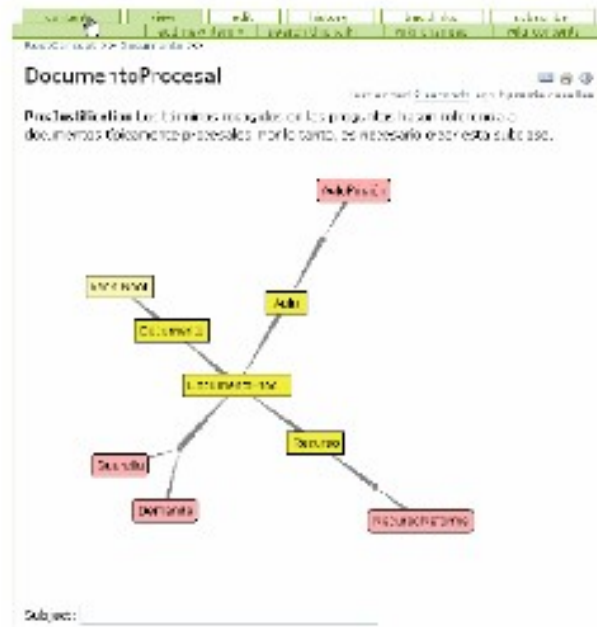


Figure 1. Screenshot of the ontology of professional judicial knowledge (OPJK) in a wiki discussion page.

1. Modeling legal knowledge: Legal ontologies

Legal ontologies have played a part in the process to help structure legal knowledge and create knowledge management tools. Many legal ontologies have been built so far.⁴

They differ from other types of domain ontologies in two special features. The first one is the bulk of common sense notions that are carried out within the legal domain. Legal statutes, legal judgments or jurisprudence are written both in natural and in a more technical language. But practically all the common sense notions and connections among them that people use in their everyday life are embodied in the legal domain.

The second special feature has to do with the fact that the strategy of ontology building must take into account the particular model of law that has been chosen. This occurs in a middle-out level that it is possible to skip in other ontologies based in a more contextual or physical environment.

When the task to be done involves a whole process it is possible to figure out the ontology following some descriptions of cognitive models

that can be used as templates to build the basic ontological concepts and their relationships. In this case only two levels are really needed: the domain conceptual level and the upper ontological level.

For instance, recent conceptual work shows in which way a plant oil battery [11] and a smart home environment can be plotted into cognitive maps using these twofold ontological levels.

However, in the legal field, the modeling process usually requires an intermediate theoretical level in which several concepts are implicit or explicitly related to a set of decisions about the nature of law, the kind of language used to represent legal knowledge, and the specific legal structure covered by the ontology. There is an *interpretative* level that is commonly linked to general theories of law. This intermediate level is a well-known layer between the upper-top and the domain-specific ontologies, especially in the so-called “practical ontologies”.⁵

Perhaps the most striking feature lies in the fact that in most of the legal ontologies constructed so far, the intermediate layer is explicitly occupied by high conceptual constructs suggested by general theories of law instead of a more flexible knowledge provided or induced from empirical or cognitive findings. Therefore, the link between epistemology and ontology is filled up with some intuitive or philosophical assumptions about the nature and function of law.

General theories of law seek to map into a single coherent body the most general concepts aiming to represent legal knowledge. In this way, several formulations have been approached. Law conceived (i) as a set of related static and dynamic norms, (ii) as a set of interrelated rights and duties, (iii) as a set of institutional rules and facts, or (iv) as a set of states of affairs, events and rules, has been the source of inspiration for legal ontology building.⁶

This is not necessarily a critical issue. There is a free space for epistemological assumptions in ontology building and, besides this, each ontology might be constructed having in mind specific goal-ended plans. But it seems to us that the lack of empirical knowledge in legal ontology engineering may broaden the gap between users’ needs and expected solutions, as already noticed in the literature [27].

The interpretative middle level in which all fundamental concepts are defined is usually known as a *Legal-Core Ontology*. Breuker and Winkels [3] have recently distinguished between legal ontologies originally based on normative knowledge (legal theory) and legal ontologies —or “with an ontological flavour” — in which modalities play the role of knowledge categories. This would be the case for McCarty’s LDD or for deontic logic formulations applied to the legal domain (rethinking the hohfeldian conceptions⁷ or based on modal linguistic functions: obligatory, forbid-

den, permitted. . .). However, in both cases, the fundamental concepts are epistemologically set within a Legal-Core Ontology, that is to say, an ontological representation of basic legal knowledge, in which the theoretical representation of abstract rights and duties count much more than the practical aim of a hypothetical user. Legal reasoning prevails over practical purposes.

The perspective followed in the construction of the ontology for *Iuris-ervice* is based on the need to capture and model the professional knowledge contained in the questions.

2. Capturing and modeling Professional Knowledge

Professional knowledge (PK) as encoding a specific kind of knowledge related to particular tasks, symbolisms and activities has been described many times in the Law & Society literature [1].

Professional knowledge has been defined as possessed by professionals, which enables them to perform their work with quality [16]. Professional knowledge then includes: (i) propositional knowledge (knowing that); (ii) procedural knowledge (knowing how); (iii) personal knowledge (intuitive, pre-propositional); (iv) principles related to morals or some kind of deontological code. Such knowledge is not just represented mentally in the form of statements and rules, but also includes images, metaphors and attitudes to produce successful outcomes [9].

It is generally distinguished a *knowledge base* which is being developed through practice and *experiential learning*. But do notice that globalization produces pervasive and unexpected paradoxes [15]. Moreover, in the legal field, there is a growing gap between the institutionalized professions closer to the state (judges, prosecutors) and those operating within the legal markets.

We could say that a counsel shares with the judge, the prosecutor or other court staff only a portion of the legal knowledge (very likely the legal language and the most general acquaintance of statutes and previous judgments). But there is another kind of legal knowledge, the one having to do with personal behavior, practical rules, corporate beliefs, effect reckoning and perspective on similar cases, which remain implicit and tacit within the relation among judges, prosecutors, attorneys and lawyers.⁸

Legal ontologies have been built up with several purposes: (i) creation of regulatory metadata and content standardization (e.g. LegalXML/LeXML/MetaLEX, ADR/ODR-XML, etc.) (ii) information extraction from legal documents; (iii) regulatory compliance; (iv) statute-

content harmonization; (v) modelling of legal reasoning; (vi) support to decision making. Although the legal domain remains very sensitive to the features of regional or national statutes and regulations, some of the Legal-Core Ontologies (LCO) are intended to share a common kernel of legal notions. Therefore, LCO remain in the domain of a general knowledge shared by legal theorists, national or international jurists and comparative lawyers.

Our data indicate that there is a kind of specific legal knowledge, which belongs properly to the expert domain and that is not being captured by the current Legal Core Ontologies.

Judges are experts; they take for granted the acquaintance with statutes, textbooks or former legal decisions. What is at stake here is a different kind of legal knowledge, a *professional legal knowledge* (PLK) [4] [5] [6]. What judges really seek are some clues, some hints or well-grounded practical guidelines that refer to the problem they have before them when they put the question or start the query.

In this regard, the design of legal ontologies requires not only to represent the legal, normative language of written documents (decisions, judgments, rulings, partitions. . .) but also those chunks of professional knowledge from the daily practice at courts.

From this point of view, professional knowledge of a legal topic (such as e.g. gender violence, medical issues, police behavior. . .) involves a particular knowledge of: (i) statutes, codes, and legal rules; (ii) professional training; (iii) legal procedures; (iv) public policies; (v) everyday routinely cases; (vi) practical situations; (vii) people's most common reactions to previous decisions on similar subjects.

We may point out several properties of *Professional Legal Knowledge* (PLK). PLK is: (i) shared among members of a professional group (e.g. judges, attorneys, prosecutors. . .); (ii) learned and conveyed formally or most often informally in specific settings (e.g. the Judicial School, professional associations –the Bar, the Judiciary. . .-); (iii) expressible through a mixture of natural and technical language (legalese, legal slang); (iv) non-equally distributed among the professional group; (v) non-homogeneous (elaborated on individual bases); (vi) generally comprehensible by the members of the profession (there is a sort of implicit identification principle).

One of the main features of PLK is that it is context-sensitive, anchored in courses of action or practical ways of behaving. In this sense, it implies: (i) the ability to discriminate among related but different situations (e.g. when is it really needed or required to issue an injunction of protection to prevent a woman of being injured or murdered by her husband?); (ii) the practical attitude or disposition to rule, judge

or make a decision; (iii) the ability to relate new and past experiences of cases; (iv) the ability to share and discuss these experiences with the peer group.

Professional Judicial Knowledge

Especially in the judicial field PLK presents two additional features: (i) the attunement process produced in the everyday decision making with previous “organizational memory” of senior peers (institutional process); (ii) the need to ground each new ruling on past jurisprudential decisions (legitimacy process). The first process is almost completely tacit, but the second is totally explicit in the judicial ruling: there is a substantial part for it within the written ruling named *fundamentos de derecho* [legal grounds]. To accomplish the ruling task it is required to carry out this two parallel information processes.

In order to build OPLK, we believe that we have to take into account the kind of *situated knowledge* that judges put into practice when they store, retrieve and use PLK to make their most common decisions. We use “situated knowledge” in a similar way in which W.J. Clancey [12] talks about “situated cognition”: the concrete use of knowledge which is partially shared and unequally distributed through a certain “community of practice” who is able to use and reuse this same knowledge while transforming it.⁹

The main idea is that PLK is always *situated* in a particular context in which the judge or the lawyer needs to complete the information they possess about a particular case or problem to trigger or put into practice the basic knowledge that they already have. In this sense, they do not need to be provided with a complete legal reasoning, but only with some reliable information that they may use as a comparative parameter. They seek “another opinion”, an external interlocutor to follow the full reasoning process that they build up any time they have to make a new decision. This is the reason why they discuss the case with their peers: not really to be helped in the decision making but to double check the decision they are going to make.

Other related concepts close to “situated knowledge” are the ideas of “situated communities” [20], “situated meaning” [14], “organizational memory” [36] and “corporate ontologies” [32, 24].

Legal reflection is eventually almost an automatic process in which lawyers or judges are involved without being fully aware of the devices they are using. But our data analysis makes clear that this is a *collective and interactive process*, even if it is usually performed on individual bases and remains tacit.

Building ontologies means entering a process in which this tacit knowledge is made conceptually explicit in a formal machine-readable language. But, because of its own nature, this is not made without some tensions.

On the one hand, for all practical purposes there is no such thing as absolute *meaning*: everything must ultimately be the result of agreements among human agents such as ontology engineers, domain experts and users [19]. On the other hand, in ontology knowledge modeling a concept is neither a class nor a set: the concepts which represent the meaning of the terms are structured into binary trees based on couples of opposite differences [32].

Capturing Professional Judicial Knowledge

Previous work has shown that ontology modeling methodology makes an extended use of many underlying assumptions about the user, about the task and about the domain [35]. Following CommonKADS, Visser's methodology for Legal Knowledge-Based Systems (LKBS) divides the design process into four separate phases: (i) an analysis phase, (ii) a conceptual modeling phase, (iii) a formal modeling phase, and (iv) and implementation phase [34].

We think that there is a previous phase, concerning the social knowledge acquisition. Capturing professional knowledge is a time consuming and often painstaking process implying different types of social techniques (usually surveys, interviews, participant observation, focus groups and expert panels). This means inferring social knowledge from protocols. The way in which this set of tasks is performed usually influences the ontological modeling. This problem deserves a separate reflection on what we will call "pragmatic integrated cycle" (from knowledge acquisition and ontology construction to the users' validation plan). We will just point it out in this paper, without going further.

3. OPJK Development

Ontologies of Professional Legal Knowledge would model the situated knowledge of professionals at work. In our particular case we have before us a particular subset of Professional Legal Knowledge belonging specifically to the judicial field. Therefore, we will term the conceptual specification of knowledge contained in our empirical data Ontology of Judicial Professional Knowledge (OJPK). Modeling this professional judicial knowledge demands the description of this knowledge as it is perceived by the judge and the attunement of dogmatic legal categorizations. The way in which judges produce a different kind of knowledge

through dogmatic legal categorizations it is not clear yet. But the assumption that their reasoning process follows some specific dogmatic patterns is not required.

To model this ontology, first, we have had to acquire the judicial professional knowledge as it can be collected and reconstructed from regular data. The work on the ethnographic field offered us a set of protocols (literal transcriptions of the interviews, the completed questionnaires and the extracted questions) containing this knowledge.¹⁰

Once the knowledge is obtained, the construction of the ontology is based on the term and relation extraction from the questions regarding judicial practical problems posed by the judges during their interviews. Due to the fact that at that time semi-automatic extraction software for Spanish was not available, the extraction is performed manually; nevertheless, tools such as TextToOnto and ALCESTE were used to support manual term extraction. Finally, in order to model the ontology, decisions are taken following the DILIGENT argumentation model.

Question-based discussion

The method used to build up the ontology has focused on the discussion within the UAB legal experts team over the terms which appear on the competency questions. This method has several phases. First, it basically consists in selecting (underlying) all the nouns (*usually* concepts) and adjectives (*usually* properties) contained in the competency questions. Below, there is an example of selected terms (in bold) in some competency questions.

Once the terms had been identified, the team discussed the need to represent them within the ontology and their place within the taxonomy. And accordingly, we followed the *middle-out strategy* [18]. With this strategy, the core of basic terms is identified first and then they are specified and generalized if necessary. However, difficulties in reaching consensual decisions and the lack of traceable lines of argumentation were slowing down the construction of the ontology. For that reason, the introduction of the Distributed, Loosely-controlled and evolving Engineering of oNTologies (DILIGENT), provided by the AIFB research team, offered a reliable basis for a controlled discussion of the arguments in favor and against modeling decision. The introduction of DILIGENT proved the need to rely on guidelines for the decision-making process within ontology design. The use of DILIGENT speeded up the modeling process, as decisions were more easily reached and more concepts were agreed upon.

Ontology of Professional Judicial Knowledge (OPJK)

The Ontology of Professional Judicial Knowledge has been extracted from the selection of relevant terms from nearly 200 competency questions. Currently, we are discussing the remaining 600 questions, while integrating this ontology into PROTON (Proto Ontology),¹¹ as part of the necessary integration of the SEKT Project technology.

This integration implies that the Ontology for Professional Judicial Knowledge should include the System Module and Top Module from PROTON. The System Module includes *Entity*, *EntitySource*, *LexicalResource*, *Alias*, *SystemPrimitive*, *TransitiveOver* and the Top Module includes *Abstract*, *Agent*, *ContactInformation*, *Document*, *Event*, *Group*, *Happening*, *InformationResource*, *JobPosition*, *Language*, *Location*, *Number*, *Object*, *Organization*, *Person*, *Role*, *Situation*, *Statement*, *Topic*, *TimeInterval*, and their correspondent relations.

Figure 2 shows the main OPJK classes integrated into PROTON.

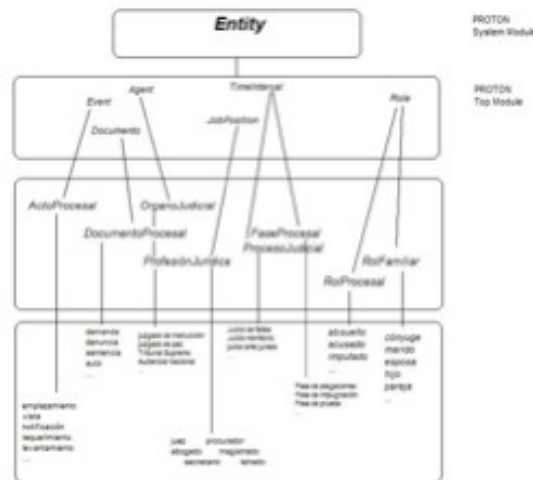


Figure 2. Preliminary structure of OPJK. Domain, Core and Upper layers.

4. Conclusions

This paper has described the OPJK —Ontology of Professional Judicial Knowledge— developed by UAB. Professional Judicial Knowledge refers to the core of professional work that contains the experience of the daily treatment of cases and is unevenly distributed within individuals

as a result of their professional and personal experiences. For that, it is necessary to capture the expert knowledge.

This ontology is still under development; first, there are still more than 500 competency questions to be analyzed. Second, the ontology, once integrated into the *Iuriservice II* prototype, will be tested for its efficiency in relation to the FAQ retrieval system. That will surely lead to an in-depth refinement process. Third, the competency questions will be analyzed with Text2Onto, when as a result of the work done within the SEKT Project, the Spanish components are integrated.

OPJK modeling affirms that the modeling of professional judicial knowledge demands the description of this knowledge as it is perceived by the judge and the attunement of dogmatic legal categorizations.

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SEC2001-2581-C02-01 and EU-IST (IP) IST-2003-506826 SEKT. Another version of the same work will be presented at the Workshop “Legal Ontologies and Artificial Intelligence”, LOAIT, Bologna, June 6th 2005, ICAIL-’05. A more developed version of the *Iuriservice II* ontology can be found at ICAIL-’05 Proceedings, “*Iuriservice II: Ontology development and Architectural design*”.

Notes

1. For more information regarding the surveys and the prototypes see [2] and [10]. The first prototype was developed from the data obtained during the first survey and the current prototype is being developed from the second ethnographic field work.

2. TextToOnto is a tool embedded in the Oi-Modeler platform which supports the semi-automatic creation of ontologies by applying text mining algorithms. Although TextToOnto will not be further developed, the Spanish GATE components, result of the SEKT Project work, will be implemented into Text2Onto in a near future, <http://ontoware.org/projects/text2onto/>.

3. ALCESTE is a software used to perform automatic analysis of textual data, developed by Max Reinert [30, 31] at the Centre Nationale de la Recherche Scientifique (CNRS). ALCESTE classifies different subsets of a given textual corpus based on a hierarchical descending clustering algorithm. Successive dichotomies are carried out along the first axis of a factor analysis. Therefore, for a relative semantically homogeneous corpus, the program seeks the list of most characteristic words assembling subsets of “lexical worlds” according to a chi2 metric. This has proved to be useful to flesh out the conceptual structure of the judicial competency questions.

4. See especially [33] for an insightful summary of the state of the art.

5. “An *interpretation* is the mapping (semantics) from one application instance (conceptual schema) syntactically described in some language into the ontology base, which is assumed to contain conceptualizations of all relevant elementary facts. (...). The interpretation layer constitutes an intermediate level of abstraction through which ontology-based applications map their syntactical specification into an implementation of an ontology ‘semantics’.” [19].

6. McCarty [23] has formalized Hohfelds' legal fundamental conceptions (1919) to model property rights using deontic logic. have modeled a formal theory of law stemming from the causal or ruled link between events and state of affairs. Gangemi et al. [17] have conceptually represented the law implementation or application process as a relationship between legal normative descriptions and cases. Boella and van der Torre [8] have constructed a normative multiagent system based on regulative and constitutive norms.

7. See the A-Hohfeld Language [21] and the extended LEGAL RELATIONS Language [22].

8. Cfr. [7, Intr.].

9. “*Situated cognition* is an approach for understanding cognition that seeks to relate social, neural, and psychological views. From the social perspective, situated cognition provides insights about *the content of knowledge*, namely how people conceive of what they are doing in terms of their contribution to a community of practice and how this affects their attention and priorities over time. From the neural perspective, situated cognition provides insights about *the physical structure of knowledge*, namely how perception, conception and motor action are related through a self organizing coordination process with a memory. From a psychological perspective, situated cognition provides insights about *how behaviour is improvised* by resequencing and recomposing previous behaviours.” [12] See also [25], [26], and [13].

10. For more information regarding the protocols and its analysis consult [10].

11. <http://proton.semanticweb.org/>

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