Epistemology and ontology in core ontologies: FOLaw and LRI-Core, two core ontologies for law

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Abstract

For more than a decade constructing ontologies for legal domains, we, at the Leibniz Center for Law, felt really the need to develop a core ontology for law that would enable us to re-use the common denominator of the various legal domains. In this paper we present two core ontologies for law. The first one was the result of a PhD thesis by [Valente, 1995], called *FOLaw*. *FOLaw* specifies functional dependencies between types of knowledge involved in legal reasoning. Despite the fact that *FOLaw* was the starting point for a number of ontologies and legal reasoning systems in various (European) projects, it is rather an epistemological framework than a (core) ontology. We are not the only ones who easily confound epistemology with ontology. In the paper we present some examples and discuss whether this epistemological promiscuity in (core) ontology development is a serious problem. It is to some extent, as it limits the scope of re-use (if not leading to confusion). Therefore, we started about four years ago the development of a 'real' core-ontology for law based upon notions of common sense. The reason for a common-sense foundation is that domain independent concepts of law – the common denominator – are still tainted with a strong common-sense flavor. Moreover, domains of law refer to social activities which are generally governed by common-sense notions. This core ontology, called *LRI-Core*, consists of five major portions ('worlds'): physical, mental and abstract classes; roles and occurrences.

1 Introduction

At the Leibniz Center for Law, we have been developing a dozen ontologies for legal domains over a period of more than a decade. The use of these ontologies ranged from simple legal case 'understanding' [Winkels *et al.*, 2002] to information retrieval and annotation [Breuker *et al.*, 2000]. Most of these ontologies were part of (5) European projects in which tools were developed for legal knowledge management. To consolidate the insights acquired in modeling legal domain knowledge and to provide a conceptual framework for developing ontologies in new legal domains, we decided about 4 years ago to develop a core ontology for law that could be re-used in new projects and to be made publicly available. This ambition started already mid-90-ies with the work of [Valente, 1995] (see also [Valente *et al.*, 1999]). His "Functional Ontology for Law" (FOLaw) captured dependencies between the various types of knowledge in legal reasoning. It provided a useful and validated conceptual framework in the development of several applications [Winkels *et al.*, 2002, Muntjewerff & Breuker, 2001]. However, as will be explained in Section 2, *FOLaw* is not a 'pure' ontology, but rather an epistemological framework. It lacks the abstract, core concepts that make up law. Nevertheless, *FOLaw* has

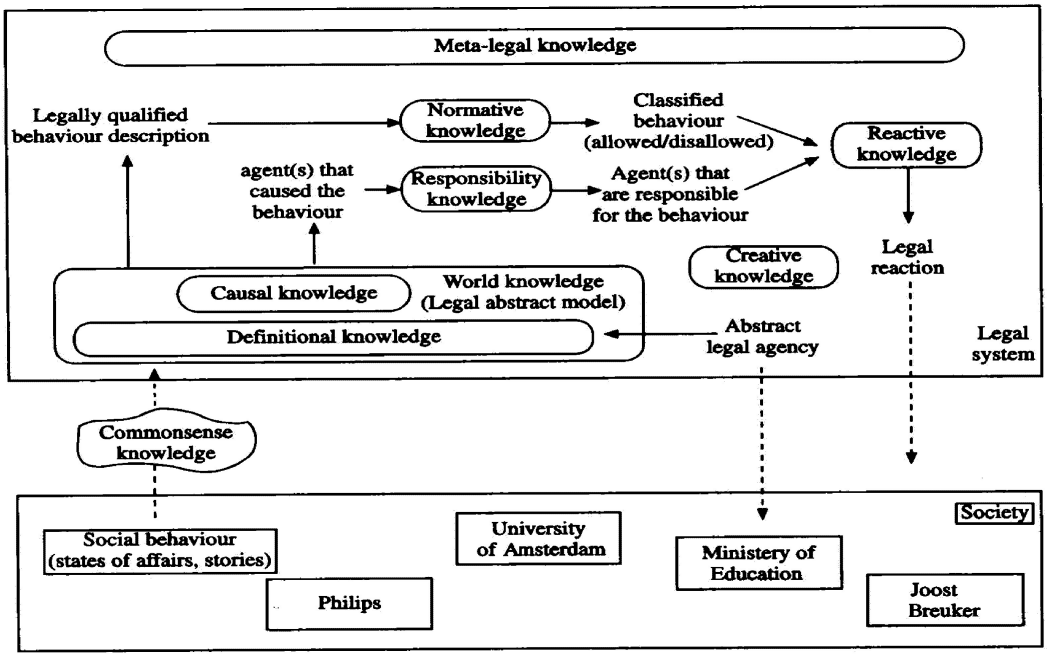

Figure 1: FOLaw: a functional ontology for law [Valente, 1995]

some strong commitments to types of knowledge involved in legal reasoning. As any legal source – legislation, contracts, precedence-law – reveals immediately: the majority of concepts in an individual source refers to specific domains of social activities. These domains are called '*world knowledge*' in *FOLaw*. World knowledge contains a very high proportion of common-sense concepts. Even if modern technology has created new legal domains with a specialized vocabulary (e.g. environmental law), the law is still intended to be accessible to "the people".

Besides these law-domain specific terms, all legal sources contain or assume a variety of concepts that may not be exclusive, but certainly typical for law. Law is in the first place concerned with the codification of norms. Codification means a rather strict documentation. Norms define legal positions, which are roles. Moreover, norms address people in their social roles. Besides concepts like role, document, and normative terms like right, obligation, permission etc., in applying law, notions about actions, causality and responsibility play a prominent role [Lehmann, 2003]. To capture the main structure of these concepts, we developed (and are still developing) a 'real' core ontology for law, called *LRI-Core.* A presentation of *LRI-Core* forms a major part of this paper (see Section 4)

2 FOLaw: what's in legal reasoning

We present here a summary of *FOLaw* for two reasons. The first one is that *FOLaw* provides a good insight into legal argumentation (reasoning). The second reason is that *FOLaw* is strictly speaking not an ontology, as will be argued at the end of this section.

FOLaw is a functional ontology. The roles that the legal system plays in society are taken as point of departure. *FOLaw* presents a legal-sociological view rather than a perspective from the law itself, as in most legal theoretical studies. There is a secondary notion of 'functional' involved: *FOLaw* identifies the dependencies between the types of knowledge, which indicate the roles that types of knowledge play in the reasoning. These two views on 'functional' are not independent. One may see the reasoning as to some extent simulating the social roles, in the same way as reasoning about

physical systems consists to a large extent of simulating physical processes.

We will give here a summary description of *FOLaw*. Figure 1 provides the comprehensive picture of dependencies of the various types of knowledge in legal reasoning. At the same time it also expresses the role of the legal system as controlling the actual social behavior of individuals and organizations in society. The following six types of knowledge are distinguished.

Normative Knowledge is the most typical category of legal knowledge, to such an extent that to many authors 'normative' and 'legal' are practically the same thing. The basic assumption is that norms express (un)desirable behavior and that therefore the typical deontic 'operators' P(ermission), O(bligation) and F(orbidden) can be 'decompiled' into a binary value. For details about the inference rules and their formalization we refer to [Valente *et al.*, 1999] and [Winkels & Haan, 1995]. Essentially this makes deontic reasoning tractable, where (standard) deontic logics suffer from intractability and counter-intuitive paradoxes.

Meta-legal Knowledge is knowledge needed to solve conflicts between individually applicable norms. Typical conflict resolution is provided by meta-legal rules that state for instance that the more specific rule should be applied rather than a more general one: *"lex specialis derogat legis generalis"* expresses this age old wisdom in law. Meta-legal knowledge is not only used for solving conflicts between norms. Another function is to specify which legal knowledge is *valid*.

World Knowledge By its very nature, law deals with behavior in the world. Therefore, it must contain some description of this behavior. For instance, in order to describe how the world should (ought to) be, norms must describe how things can be. World knowledge acts as an interface and filter between the legal system and the actual events that happen in some jurisdiction. Cases are usually described in common-sense terms and matched against the terms codified or established by law. Also the causal connections between these events have to be interpreted and are used (to some extent) to assess the legal responsibilities of the agents (legal persons) involved in the events.

Responsibility Knowledge has as a function to assign or to limit the responsibility of an agent over a given (disallowed) state of affairs — i.e. to (dis)establish a link between the violation of a norm and an agent which is to be considered responsible (accountable, guilty, liable) for this violation.

Reactive Knowledge specifies which reaction should be taken and how. Usually this reaction is a sanction, but in some situations it may be a 'reward' (e.g. being entitled for social security benefits).

Creative knowledge is somewhat isolated in *FOLaw* as it is not dependent on other types of knowledge. Creative knowledge should account for the fact that the legislator may create social institutions and legal persons 'by decree'.

We have used the framework of *FOLaw* as a lead for fundamental research, e.g. on responsibility [Lehmann, 2003], and as the basis for practical applications and architectures for legal reasoning (e.g., *ON-LINE* [Valente *et al.*, 1999]). It as used in the CLIME project [1] that was aimed at the construction of a legal information server. The try-out domain were international rules for safety and environmental care at sea, and the rules for ship classification (certification): in total about 15,000 different articles. This CLIME information server has two modes of operation. The first mode is typical information retrieval, where keywords (in phrases) are matched against terms in the rules. A large ontology (over 3,500 concepts) allows the elaboration of the keyword-terms by implied terms. The second, more expensive and experimental mode is in fact a question answering one. The CLIME system assesses

[1] CLIME was an European project (IST 25414, 1998-2001): see http://www.bmtech.co.uk/clime/index.html)

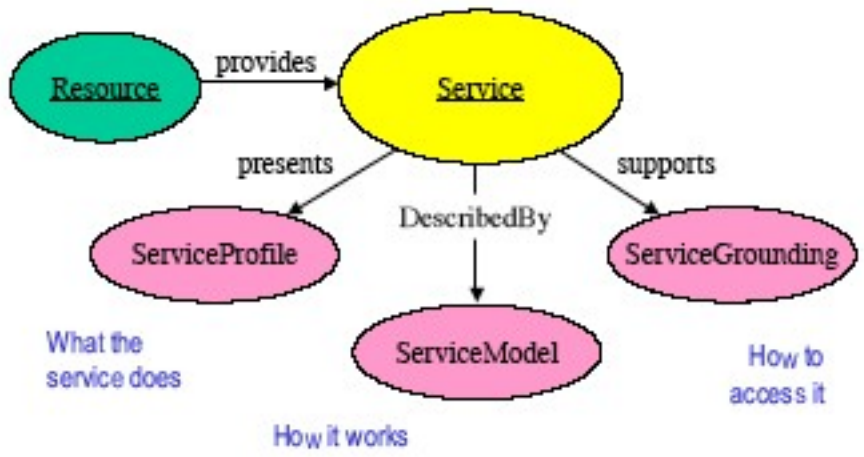

Figure 2: OWL-S: a core ontology for services (see www.daml.org/services)

whether a case, e.g. results of the inspection of a ship, or legal questions during the design of a ship, complies with the rules or not. The applicable (violated or 'potentially' violated) articles provide the justification and focus for the answer. An overview of CLIME and an evaluation of its results can be found in [Winkels *et al.*, 2002]. Other applications of the *FOLaw* framework (annex architecture) are reported in [Muntjewerff & Breuker, 2001] (PROSA, a training system for solving legal cases); in the KDE project [2] the ontologies of CLIME have been re-used [Jansweijer *et al.*, 2000].

These applications show that *FOLaw* can be effectively re-used but closer inspection shows that it is a reasoning structure that models the way legal cases are argued for, rather than an ontology. It is not difficult to see that the dependencies are analogous to the dependencies – input/output requirements – in a CommonKADS inference structure [Breuker & Van De Velde, 1994, Schreiber *et al.*, 2000]. [3] An inference structure is a representation of a problem solving method that specifies the problem decomposition and its dependencies. It abstracts from the control aspects of the method. In CommonKADS reasoning – a problem solving method – and the domain knowledge (ontology) are strictly separated follwing the insight of the beginning of the eighties that mixing-up the two not only makes intractable system architectures [Clancey, 1983], but also that both components are to be reused in totally different context: problem solving methods are specific for types of tasks, but independent of the domain [Breuker & Van De Velde, 1994]. [4] One may reuse the same method for troubleshooting cars, electronic circuitry and even errors in reasoning [deKoning *et al.*, 2000].

3 Epistemological promiscuity

A reasoning structure is an epistemological framework. Epistemology is concerned with the justification of knowledge and belief; in reasoning arguments are given why a conclusion is justified. It may

[2] KDE, for Knowledge worker Desktop Environment is a European IST project (IST 28678,1999-2001); see www.lri.jur.uva.nl/kde)

[3] In CommonKADS the dependencies (called 'dynamic roles') are input/output requirements for inferences. These roles and inferences are not explicit in Figure 1, but the so called 'static roles' which refer to (portions) of domain knowledge that are used in the inferences are well described.

[4] This is not completely true: the structure of domain knowledge may interact with potential problem solving methods: this is called the interaction hypothesis [Chandrasekaran, 1988]. Although this limits the reusability of problem solving methods, it does dispute the essentially different nature of problem solving methods and domain knowledge.

not be a coincidence that we have been tempted to have an epistemological view on law, as the practice of law is almost exclusively aimed at the justification of legal decisions. Studies in jurisprudence (legal theory) and legal philosophy are almost exclusively focussed on the role and justification of law, authority, argument, etc., but hardly with legal concepts (see e.g. [Breuker *et al.*, 2004]. In fact, it is hard to find exclusively legal concepts in the same way as one may easily find in other domains of professional practice such as medicine (see e.g. [Rector, 2002] or engineering, ([Borst *et al.*, 1997]). These disciplines have highly specialized terminologies. Of course, they also have their methodologies and typical kinds of problems to solve – in medecine diagnosis and the planning of treatments are the major kinds of tasks; in engineering design is the dominant task – but the basic expertise is in the construction of *explanations*, i.e. models that can be used as solutions. Finding or constructing a solution that matches the available data is here the focus. In law the solutions themselves are simple and highly constrained by legislation (c.f. 'reactive knowledge' above), but the core problem is in finding and balancing adversary argumentation. Therefore it is no surprise that one may find that many legal ontologies are mixtures of epistemological and ontological perspectives (e.g. [Mommers, 2002], [Lehmann, 2003], [Hage & Verheij, 1999], [Boella *et al.*, 2004]).

However, this kind of epistemological promiscuity in ontologies is not exclusive for legal ontologies. The feature that gives away an epistemological rather than an ontological perspective is the use of active verbs (e.g. 'supports', 'produces', etc.) that represent dependencies between pieces of knowledge instead of typical 'semantic' relations that define the *meaning* of concepts. These dependencies are usually drawn between clusters of concepts that have little semantic family relationships.

[The OWL Services Coalition, 2004] provides a good example of epistemology mixed with ontology in the OWL-S core ontology for (web) services. Its (re-)usefulness is undisputed, but it is not a pure ontology, despite the fact that it is written in OWL. A service is a task, and OWL-S represents a task structure rather than a semantic structure (see Figure 2).

Seeing that also well experienced researchers in ontologies and knowledge representation are not immune to epistemological promiscuity, we may ask the question whether it hurts to mix these up, in the same sense as e.g. the kind of confusions and errors spelled out in OntoClean [Guarino & Welty, 2003]. The confusion is between knowledge (ontology) and reasoning (justifying knowledge): both are intimately related. It is not only in the role, but also in the structure one may find important distinctions.

An ontology is in the first place a set of terminological definitions built around a taxonomic backbone, while a framework is a an assembly of concepts or types of knowledge that reflect recurrent patterns of use. It is similar to Minsky's notion of frame: a typical – and therefore reusable – way objects and processes co-occur. In the co-occurence objects and processes – rather entities and events – new relationships emerge. These relationships are not 'essential' and certainly not 'semantic'. The position of a solid object in space is accidental to an object, while its extension in space (size) is usually inherent to the object. The difference between a 'clean' ontology and a framework is best illustrated by concrete, physical objects. A simple exercise in ontology development may be the world of wines or furniture. Taxonomies of wines or furniture form the backbone of such an ontology. However, furniture may come in typical spatial arrangements. One may think of a framework for office furniture arrangements, where the desk takes a central role. However, desks are absent in the way we usually arrange our living rooms. A guide for a balanced distribution of wines to keep in a wine cellar is another example of a framework. Frameworks are generic models of typical, re-occuring combinations of objects and processes and have therefore a high re-use value. Only if the reasoning structure is contaminated with knowledge that is specific for a particular domain the re-use is unnecessarily limited. FOLaw and OWL-S do not mix: they are both 'clean' epistemological frameworks. Their only sin is that they are sold as ontologies. Who cares? Well, me sometimes, as I have found that not only reasoning structures but also plans, data-base schemas, designs, etc. are presented as ontologies. A powerful knowledge representation formalism as OWL allows one to specify these structures as well as 'clean' ontologies. As OWL is popularly known as a language for ontologies it almost follows that

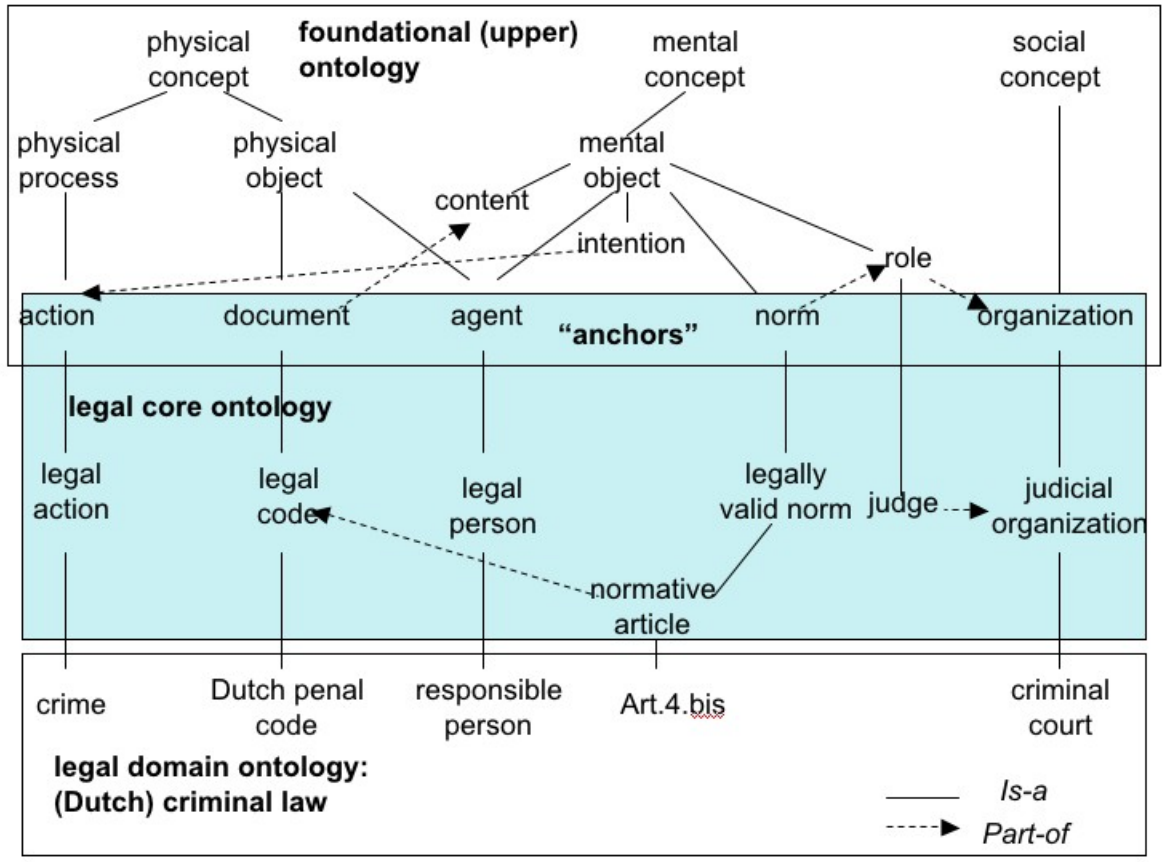

Figure 3: LRI-Core layers: foundational and legal core share 'anchors' (high level concepts typical for law)

anything represented in OWL is an ontology. A more serious problem is interoperability. As the terms used in these frameworks are not really defined but rather specified, it may be difficult to match or align terms from 'clear' ontologies with what the component stands for. Despite both may be written in OWL, the meaning of 'resource' in e.g. the OWL-S framework may not coincide with the meaning of 'resource' in an ontology describing a social organization.

To return to *FOLaw*: we have experienced also another limitation in the re-use of *FOLaw* for modeling legal domains than its focus on legal argumentation. *FOLaw* was also insufficiently specific to enable deep *use*. It turned out that the domain ontologies we developed in the various projects contained for almost ninety-nine percent terms that belonged to the category 'world knowledge', i.e. the world the legal domain is about, which means that *FOLaw* does not provide much help in acquiring an ontology for a legal domain. Therefore, at the end of the nineties we changed strategy. To cover concepts of law, we needed a core ontology that would include typical legal concepts, like norm, responsibility, person (agent), action, etc. As stated in Section 1 these concepts have still a strong common-sense flavor, even if legislation and legal practice have refined or sharpened these concepts. This made us decide to develop a core ontology of law, grounded in common-sense: *LRI-Core.*

Except for CYC [5], foundational ontologies are not common-sense ontologies. A good example is SUMO [6] [Pease & Niles, 2002] that contains mainly concepts from physical and abstract worlds. The definitions reflect rather 'revisionary' (modern) views of the physical world [Strawson, 1959], than common-sense ones as e.g. in naive physics [Hayes, 1985]. Even in DOLCE, that is based upon "human perception, cultural imprints and social conventions" [Massolo *et al.*, 2002, p.8], the

[5] www.cyc.com

[6] http://ontology.teknowledge.com/

common-sense perspective is not explicitly developed. Psychological evidence, in particularly from developmental and evolutionary studies, but also neurological data (brain damage) should play an important inspirational role in deciding . In [Breuker & Hoekstra, 2004] we present arguments why we think that a common sense foundational ontology should focus around (at least) the six major categories of that form the top-layer of *LRI-Core* (see also Figure 4). [7] They will be shortly described in the next sub-sections.

Of course, there are also other reasonons not to ground LRI-Core in already existing foundational ontologies besides the fact that they are not really reflecting common-sense. For arguments, we refer to [Breuker *et al.*, 2004]. They boil down to two issues. The first one is that these ontologies do not, or only in a rudimentary way cover the typical legal concepts we need: in particular social ones (role, communication, norm); the notion of intention and other mental concepts (motivation; reason, etc.). Also, the representation of concepts that have multiple views is lacking, such as the fact that a document may both mean a physical object but may also – context dependently – refer to its mental content (message). We may refer to the body or to the mind of an agent, but it is not right to represent an agent as either one. Agent is both a physical and a mental concept in the same sense as a car may be a means of transport, a commodity or a physical device. Note, that all three functions (meanings) may occur in the same domain. An ontology as a semantic repository should cater for all or most senses a term may take in some domain. In foundational ontologies we are not even able to limit the senses by some domain-limitation. Of course, this does not apply to really polysemous terms where clearly two distinct types of entities are meant, as in the word 'bank' that clearly deonotes two different concepts, despite etymological roots. The second reason that we developed our own ontology is as old as (meta-physical) philosophy: we do not agree with the ontologies proposed in a number of essential aspects. That may aspire in the description of LRI-Core below, but one may find more explicit arguments in [Breuker *et al.*, 2004]

4 LRI-Core: a core ontology for law

One may distinguish in law many concepts, but not many are typical for law. These typical concepts are usually specializations of common sense concepts. Therefore, *LRI-Core* contains two levels (see Figure 3). The most abstract level is a 'shallow', foundational ontology that covers concepts from physical, mental, and abstract worlds and roles (psycho-social world). Also a terminology is added to be able to talk about occurrences. The properties of the concepts of the foundational ontology are inherited by the core ontology via the *is-a* 'backbone', so – not surprisingly – a legal role has all properties of a role, etc. In this section we will focus on the design of this foundational layer, not only because it gives the basic ingredients for the law core, but also because most work has been invested in this layer. *LRI-Core* is still under development. [8]

In [Breuker *et al.*, 2004] we present arguments why we think that a common sense foundational ontology should focus around (at least) the five major categories of that form the top-layer of LRI-Core (see also Figure 4). The major line of argument is an evolutionary one. The primary conceptualizations come from moving and sensing life experiences with the **physical** world. The complexity of this causal world can be reduced by taking a 'teleological' stance with respect to life, in particular living organisms of the same species. A teleological or intentional stance implies that one assumes that agent-actions are motivated by goals. Teleological reasoning works 'backward, i.e. allows reasoning from end-states (goals) to current states: this is less complex than the branching in possible worlds in causal, forward reasoning. Living creatures seek the maintenance and reproduction of life. The

[7] LRI-Core is cast in OWL, using Proté.g.é.

[8] Most of this development occurred as part of e-COURT, a European 5th Framework IST(2000-28199) project (see www.intrasoft-intl.com/e-court) aimed at the development of information management tools for recordings of sessions of criminal courts in Europe.

discovery of one's own **mental** life, i.e. consciousness and self-awareness in humans and to some extent also in higher mammals has lead to the need to model mental processes and objects. Awareness not only enables us to control one's reasoning and emotions, but also to understand those of fellow creatures in order to plan social activities and to communicate. Self-awareness enables 'reification', i.e. metaphorization that makes up **abstact** conceptualisations. This has lead us to the hypothesis that the mental world is conceived as an intentional metaphor of the physical world, i.e. mental life consists of objects and processes, i.e. the categories used to understand one's own and other's mental events are shaped in analogy with those of the physical world. The enablement of conscious planning and prediction of one's own (and other's) behavior has lead to the conceptualization of **roles** that make up social organization. This suggests the following main categories of LRI-Core: physical, abstract and mental concepts, and roles. [9] Finally, LRI-Core knows about a fifth category: **occurrences**. Strictly speaking, occurrences are not part of an ontology, as we will explain below. Before discussing these categories in the next sub-sections, we should state that LRI-Core is still under development. It is implemented in OWL, using Protégé [10].

4.1 Naive physics

In *LRI-Core*, the physical world evolves around two main classes: physical **objects** and **processes**. Objects are pieces of matter, while matter is typed by substances. Objects have mass, extension, viz. form and aggregation state (which limits form). Objects are the specification of the notion that **matter** (in particular solid objects) is what makes the physical world relatively stable and observable. We define (physical) situations in the first place by the arrangement of physical objects (entities).

The same apparently clear intuition does not exist for the second major class that governs the physical world: **process**. Where objects are pieces of matter, processes change matter (or energy) and consume or produce **energy**. Changes *occur* and therefore we would rather reserve this term for the world of occurrences where an event is a change of state (see Section 4.5). This intimate relationship between events and processes – often viewed as more or less the same in many ontologies about processes – has its basis in the fact that we *explain* events by seeing these as instances of processes. Processes are changes, and by interacting in some situation they may cause one another, leading to series of events that only stop at some equilibrium: in general conceived as that there are no interactions at all.

Processes are contained by objects and change objects. The change of objects is the primary view on processes. However, a secondary view shows that processes may also affect energy. Most processes consume energy: this is not an insight that comes from the second thermodynamic law, but has even its roots in the biblical view that labour is required to make things happen: there is no free lunch. However, some processes also produce energy (most notably: burning) and many transform or transduce energy. Electrolytic processes change the chemical composition of a battery and produce electrical energy. In *LRI-Core*, processes are typed according to two views: (1) The formal kind of change (transformation, transduction and transfer) and (2) the kinds of (properties of) objects involved. (e.g. movements are the change of position of objects; chemical processes change the substance of objects, etc.).

The concept of process is not only often used as synonymous with event, but also with **action** and activity. In *LRI-Core*, actions are processes that are initiated by an agent acting as actor. Despite this mental origin – agent-causation – the action itself is a physical one: some muscle movement. The Dutch or German translation for action is 'handeling', respectively 'Handlung' and the word

[9] One may argue that we have omitted another major category: life, or rather agenthood. Indeed, the distinction between non-living physical objects and living ones (agents) is crucial in common-sense. We have not (yet) investigated this category.

[10] See http://protege.stanford.edu

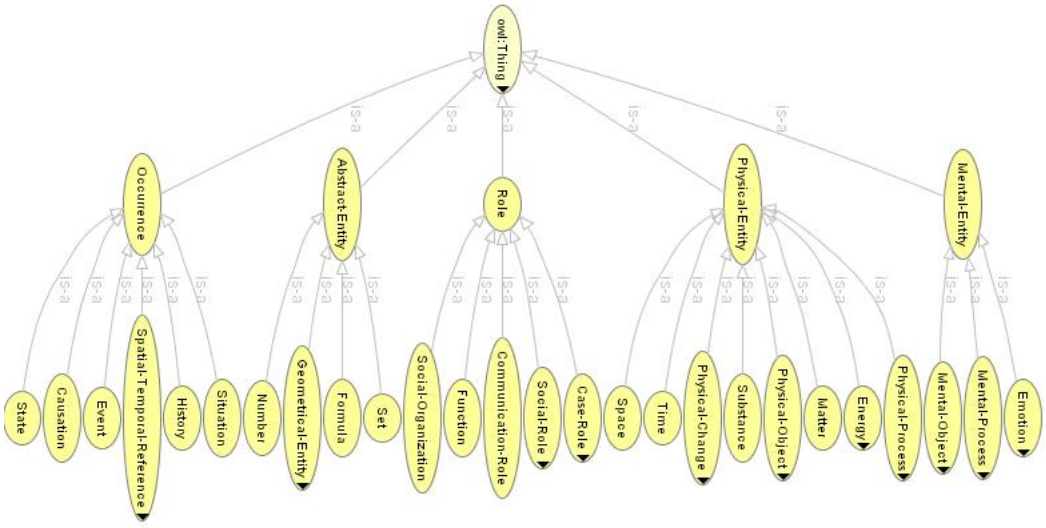

Figure 4: LRI-Core, first two layers

manipulation conveys also this hand-movement notion. The mental perspective implied by agent-causation is that actions are **intended**.

4.2 Mental world

We made the assumption that conceptions of the mental world have been developed in analogy with our knowledge about physical processes. Mental objects like **thoughts** are made of elementary parts: **concepts**. The contents (substance) of these objects are **representations**. The conceptual content of thoughts are 'intended' by propositional attitudes, like belief, desire, **norm** etc. [11] Mental objects are processed or stored in containers like a **mind** which has parts like various **memories**. Mental processes like thinking, memorizing, imaging are operations on mental objects. The energy equivalent of mental processing are **emotions**: the forces that make us focus our mental 'energies' (see [Frijda, 1986] and [Damasio, 1994] on the intimate relation between reasoning and emotion.).

There is an important difference between the mental world and the physical one. Physical processes occur causally, but mental processes are controlled by an intentional stance. The outcome of mental processes can be the intention to act. The intention to act may consist of a structure of primary actions: **a plan**. The actions can be aimed at bringing about physical changes, but they may also be aimed at changing the mental state of another agent: these intended actions are communication actions (which also need some physical medium to transfer the intended mental state). Speech act is the common term for these actions.

The mental world is not only a reflective one situated in our mind's eye. We may observe the stream of conscious mental processes, but the role of the mental conceptualizations is of even more importance in understanding and communicating with other people. They are in the first place intended as building stones of making models of the minds of other people: "user-models". This intentional stance means in the first place that we attribute to others – and to some extent also to many animals – intentions and intention directed mental processing and belief. [Dennett, 1987].

[11] Here intention is meant in the classical, phenomenological sense.

4.3 Roles

Roles cover functional views on physical objects (devices), on agent behaviour or on mental processes. In particular, social behavior and social organizations are explained as (consisting of) roles. Typical mental roles are epistemological ones. For instance conclusion, evidence and hypothesis are roles in problem solving processes and can therefore also be categorized under mental classes. From a role perspective, functions are roles of physical objects, e.g. we may use objects for non-intended functions.

Roles are entities in the mind, they do not 'really' exist. Roles are idealizations: we may not play a role correctly. In fact, the only real instantiation of a role could be a "role model": an exemplarary executor of a role that reinforces the ideal character of role. An important distinction should be made between playing a role and the role itself: "agents can act, and roles cannot" [Pacheco & Carmo, 2003]. Correcting incorrect role playing does not mean that we change the role: we change our behaviour. Like plans and processes, roles in ontologies are often confounded with their execution. The original meaning of the term role refers to a role of paper that contained the text of an actor in a play. Also the role-taker (some agent) and the role are often confounded, which may become obvious when we identify a role with a person. These kinds of confusions have made conceptual modelers aware of the tricky issues about roles (see e.g. [Steimann, 2000]).

Roles are often viewed as relationships. [Sowa, 2000, Steimann, 2000, Masolo *et al.*, 2004]. Indeed, social roles have mutuality and complementarity. No students without teachers; no parents without children; no speakers without hearers, etc. A related view in theory of law exists about the mutuality of legal positions: i.e. rights and duties [Hohfeld, 1919], [Kelsen, 1991]. For instance, if citizens have the obligation to vote, the government has the duty to enable this voting.

Role as a relationship is different from role as a concept. Roles are behavioral requirements on role execution and on qualifications for role taking. Requirements are prescriptions, i.e. they are normative. In modern society for many roles there are formally enforced requirements by law. For instance legislation addresses us by roles (with the exception of criminal law). If actual behaviour deviates from the norms attached to these roles we violate the law. Violations of law are based upon the distinction between the prescription (role) and role performance. Therefore, in court, it is the actor of the role who is made responsible: as a person; not as a role. Even the fictitious concept of legal-person for social organizations turns into concrete responsibilities of the liable persons who have mis-performed their roles.

4.4 Abstract classes

As all concepts are abstractions, [12] one may argue that a separate abstract world is difficult to see. In common sense, a circle has more properties and is less abstract than in mathematics. Even mathematicians marvel about the fact that their pure abstractions enable us to predict very concrete things. However, we are not directly concerned with these mappings. The most important is that common sense knows about a (small) number of proto-mathematical concepts, such as collections, sequences and count-numbers (positive integers). We know also about geometric simplifications such as line, circle, square, cube, etc. [Lakoff & Núñez, 2000] even argue that these common sense notions are the real roots of our mathematics. However, these kind of semi-formal abstractions do not play a very central role in law, and therefore LRI-Core is thinly populated with abstract classes.

[12] The fact that all concepts 'are in the mind' does not mean that all concepts are mental concepts. An ontology categorizes what the concepts are about, i.e. what they represent; not what the concepts are (except for the notion concept itself.)

4.5 Where it all happens: occurrences

An ontology should not be structured according to the way things are situated and happen in physical, mental worlds or phantasy worlds. How things happen is not what an ontology describes: it provides the classes with which we can identify individual entities in situations. Frameworks may capture generic patterns of occurrences. Therefore, occurrences (instances) by themselves are not part of an ontology; only the classes of the entities that make up a situation. However, we need terms to talk about occurrences in general. For example, above we have used the term situation. This refers to occurrences in an abstract sense that can be legitimitely part of an ontology that define concepts. Therefore, LRI has a category of 'occurrences' containing terms like 'event', 'state', 'history', etc.

5 Conclusions

In this paper we have presented two core ontologies for law, developed at the Leibniz Center for Law. The first one, *FOLaw* [Valente *et al.*, 1999] turned out to be rather an epistemological framework that represents the major lines of argument in legal reasoning. Mixing epistemological views in ontology development is not limited to *FOLaw*, or other legal ontologies. It also occurs in non-legal ontologies. From a purist perspective, that holds that an ontology captures only *terminological* knowledge, selling (epistemological) frameworks as ontologies is at least confusing. However, pragmatically speaking, a more serious consequence is that ontologies mixed with epistemological frameworks have a far more limited re-use and may pose more interoperability problems than clean ontologies.

The second core ontologie for law presented is *LRI-Core*. This is a 'clean' ontology rooted in a common-sense foundation [Breuker & Hoekstra, 2004]. The major categories of this ontology are: physical concepts (notably: object and process); mental concepts analogous to the physical ones; roles that represent notions about social behaviour; abstract concepts for simple proto-mathematical ideas, and finally a number of terms to talk about occurrences.

LRI-Core is still under development. A prototype version has been the basis for an ontology of Dutch criminal law in the e-Court project (see www.intrasoft-intl.com/e-court). *LRI-Core* is written in OWL which enables us to do verification of the specifications (consistency checking). However, the question of how we can assess its validity is also actual, but not easy to resolve and certainly not in a very near future. Up till now, some "face-validity" has been established by comparing it with other core or foundational ontologies – in particular: DOLCE – by arguments. That was thusfar the methodology also used through the centuries by philosophers. The evidence of this methodology is that it brings rather divergence of opinions than convergence (but always increased insight). A good illustration of the working of this methodology in a nutshell is the SUMO mailinglist (http://ontology.teknowledge.com/).

We may obtain some more insight in its *operational* validity by using it in developing knowledge bases of systems that reason with the implied knowledge. *LRI-Core* is now also part of a PhD project aimed at the construction of an interpreter that is capable of inferring causal relationships between events, such as described by legal cases (see for a first steps in this enterprise the work of [Lehmann, 2003]; (see also [Lehmann *et al.*, 2004]). This work will of course not completely validate *LRI-Core*. Its major objective is to provide a support for developing legal domain ontologies. It should clarify common conceptual denominators in legal domains in particular notions like role, norm, responsibility. Validation by re-use will provide neither strong empirical evidence (in an epistemological sense), but it is the best we may expect.

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