A Conceptual Frame-based Ontology for the Law

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Abstract

In this paper, the conceptual frame-based ontology as introduced in Van Kralingen (1995) is described. The backbone of the ontology is constituted by three frame structures. The structures have been coined the norm frame, the act frame and the concept-description frame. A legal-theoretical analysis has determined the form of the structures. In addition to the three frame structures, the ontology comprises some (generic) elements for the instantiation of the structures.

1. Introduction

The role and importance of ontologies has in recent years been a recurring topic in discussions on the development of models of the legal (and other) domain(s). An ontology aims at providing building blocks for a (conceptual) model. To be able to fulfil its role, an ontology must provide an abstract, usually simplified view on a domain (a conceptualization). This view comes to expression in the form of the specification of a number of concepts and relations that can be used as primitives for building (conceptual) models. Examples of ontologies for the legal domain are McCarty's LLD, Stamper's NORMA, Valente's functional ontology, and Van Kralingen and Visser's frame-based ontology (see Bench-Capon and Visser, 1996). In this paper the conceptual frame-based (Van Kralingen, 1995) ontology is elaborated upon. For a brief description of the other three ontologies, I refer to Bench-Capon and Visser (1996). A comparison between Valente's functional ontology and the frame-based ontology can be found in Visser and Bench-Capon (1997).

The frame-based ontology has been developed so as to comply with the criteria an ontology has to meet formulated by Gruber (1993). Though Gruber's focus has been on formal ontologies, most of his criteria apply equally to the development of conceptual ontologies. Gruber's first criterion is clarity; a model (based on an ontology) should effectively communicate the intended meaning of the knowledge it attempts to capture. Second, a conceptual model should be coherent; the various parts of a conceptual model should work together when representing knowledge. As a third criterion Gruber lists extendibility; an ontology should offer a foundation for a range of anticipated tasks, and it should be crafted so that it is possible to extend the model. Fourth, an ontology should have as low an encoding bias as possible (in Gruber's terms a 'minimal encoding bias'); representation choices should not be made purely for the convenience of notation and implementation. A fifth criterion put forward by Gruber is minimal ontological commitment; an ontology should make as few claims as possible about the world being modeled. In the development of the frame-based ontology, this criterion has not been considered particularly important. Claims about the world being modeled are perfectly acceptable as long as they do not conflict with application of the model for various goals. With Gruber's criteria in mind, it was attempted to capture the essence of the legal domain in the form of a limited number of modeling primitives. Some of the results are described in this paper. For the description of the modeling primitives and the underlying theory, parts of Van Kralingen (1995) have been used.

The focus of this paper is on the conceptual primitives used to model the legal domain. Little attention is spent on the development of legal-knowledge systems in general, the description of legal-reasoning tasks, a formal version of the ontology, comparisons of ontologies, *etc.* Some insights into these topics are provided in Visser, Van Kralingen and Bench-Capon (1997), Bench-Capon and Visser (1996), Visser and Bench-Capon (1996), Van Kralingen (1995) and Visser (1995).

The outline of this paper follows the approach taken in the research that has resulted in the frame-based ontology. The paper sets out by discussing the legal-theoretical background underlying the frame-based ontology (section 2). Once the theoretical basis has been established, the most important modeling primitives are introduced (sections 3, 4, and 5). Some other elements of the frame-based ontology are put forward in the next section (section 6). Application of the ontology is briefly touched upon in section seven. Finally, in section eight some conclusions are provided.

2. The legal-theoretical background

Norms are the most important elements of legal systems (see for instance Hart, Kelsen, Von Wright, Ross, *etc.*). An adequate definition of a norm is 'a statement to the effect that something ought to, ought not to, may or can be done' (*cf.* Von Wright, 1963, 1983). Norms come in many shapes and forms. In most classifications of norms, a difference is observed between norms laying down standards of behavior individuals and institutions must observe in going about their business and norms regulating the modification and application of existing norms and the creation of new norms. These types of norms can be coined norms of conduct and norms of competence, respectively. Though there are numerous differences between norms of conduct and norms of competence, there are also numerous points of resemblance. Most importantly, in both cases actions may be criticized or assessed by reference to norms as legally the 'right' or 'wrong' thing to do. Norms of conduct and norms of competence introduce standards by which particular actions may be critically appraised.

Both main types of norms can be divided into several subtypes. Norms of conduct can be differentiated as duty-imposing and permissive norms[1], as sein-sollen and tun-sollen norms[2], as individual and general norms[3], and as hypothetical and categorical norms.[4] Norms of competence can be divided into power-conferring norms[5] as opposed to duty-imposing and permissive norms[6], into individual and general norms[7], and into hypothetical and categorical norms.[8] We do not elaborate further on the peculiarities of the main or subtypes, but refer to Van Kralingen (1995).

Norms of conduct and norms of competence are by no means the only elements of legal systems. Some other important elements are, for instance, legal institutions (such as marriage, ownership and personality) and legal definitions (*e.g.*, a definition of unemployment). In legal theory, these phenomena have been approached from the angle of speech-act theory, and, more precisely, they have been defined as institutional facts (*e.g.*, MacCormick and Weinberger, 1986; Ruiter, 1993). An institutional fact is a fact whose interpretation not merely depends upon the occurrence of acts or events in the world, but also on the application of rules to such acts and events. Actually, since the interpretation of norms relies heavily on rules, the definition applies to norms as well. This brings us to a classification of elements of legal systems with at the top institutional facts, and at lower levels norms, definitions, subtypes of norms and definitions, *etc*.

Each element fulfils its own function within a legal system. However, the mere fact that different elements fulfil different functions does by no means imply that they should be modeled differently. Rather than just linking a function to a modeling method or a modeling primitive, the composition of the different elements should be analysed in order to provide the modeling primitives. In the frame-based ontology, an analysis has yielded three modeling primitives: a norm frame, an act frame and a concept-description frame. Below, the primitives are described.

3. The norm as a scheme of interpretation

A norm must convey information to fulfil its function of communicating standards of behavior. The way in which one is expected to behave must be clear from the norm. Thus, a norm serves as a scheme of interpretation. A person's behavior is measured against abstract descriptions of behavior included in the norm. By this process, someone's behavior acquires legal meaning (*cf.* Kelsen, 1978, pp.4-5; Hage *et al.*, 1994).

It can be assumed that legal subjects attune their behavior to the standards laid down in norms. A legal subject attempts to stay within the law and attempts to avoid the breach of norms. The reason for this behavior, whether it is social pressure or threat of sanctions, is not of importance to our discussion of

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[1]According to Hart a norm is of the duty-imposing kind if it is "... conceived and spoken of as imposing obligations, when the general demand for conformity is insistent and the social pressure brought to bear upon those who deviate or threaten to deviate is great." (Hart, 1961, p.84). In legal theory, permissive norms are sometimes not considered an independent type ('the mere absence of obligations'). However, there are persuasive arguments to maintain permissive norms as an independent norm type (see Van Kralingen, 1995, pp. 21-22).

[2]The distinction between *sein-sollen* and *tun-sollen* norms regards the object of the norm; it is possible that the object of a norm is neither an act nor an activity, but the mere existence of a certain state of affairs; these norms are not concerned with action, these norms envisage what may not or must not be. They are referred to as *sein-sollen* norms.

[3]A norm can be individual or general both with regard to the description of its object (an act, an activity or a state of affairs) and with regard to the description of its subject (the person or persons addressed by the norm). The standard form of, for instance, a criminal statute is general in two ways: it indicates a type of conduct and it applies to a class of persons who are expected to perceive that it applies to them and to comply with it (Hart, 1961, p.21). However, a norm need not be general. For instance, if a norm prohibits a specified person to conduct a specified activity, it is an individual norm.

[4]The difference between categorical and hypothetical norms is the difference between norms that decree that a certain behavior is obligatory *unconditionally* and those that decree that a certain behavior is obligatory only *under certain conditions*.

[5]Law has a peculiar property: law regulates its own modification, creation and application. Power-conferring norms install power on persons or institutions to fulfil this functions. Hart (1961, p.33), for instance, typifies power-conferring norms as recipes for creating duties.

[6]Powers are seldom absolute. Duty-imposing and permissive norms of competence regulate application of powers conferred upon individuals or institutions through power-conferring norms.

[7]See footnote 4.

[8]See footnote 5.

norms. What is important is the assumption that legal subjects can learn the behavior expected of them by examining norms. Consequently, norms must answer questions about the behavior expected of legal subjects.

Brouwer (1990, p.62) has formulated five questions about behavior that must be answered by a norm:

1. Who is obligated or permitted to do something?
2. Is there an obligation or a permission to do something or to leave something undone?
3. What must be done or forborne?
4. Where must something be done or forborne?
5. When must something be done or forborne?

If a norm provides us with an answer to all of these questions, it can be coined a complete norm. Consequently, a complete norm is defined as a norm that comprises information about how to answer each of these questions.

The elements of a norm

Before the essence of the concept 'norm' can be captured in a structure, it must be establishes what the elements of a norm are. If we consider the five questions, a link with the classification of norms as given in the previous section can be found (below the link with the classification is placed in brackets). The first question, 'who is obligated or permitted to do something?', is a question about the norm subject (individual and general norms). The second question, 'is there an obligation or a permission to do something or to leave something undone?', inquires after the legal modality of the norm (duty-imposing, permissive or power-conferring norms). The third question, 'what must be done or forborne?', addresses the description of the act (individual and general norms, and sein-sollen and tun-sollen norms). The fourth and the fifth question, 'where must something be done or forborne?' and 'when must something be done or forborne?', are also questions important to the description of the act (individual and general norms). The five questions form a stepping stone in the determination of the elements of a norm. The questions could be said to inquire after the various elements of a norm: the first three questions address the norm subject, the legal modality and the act description (norm object), respectively. The relation between these elements is as follows: the norm subject is commanded, prohibited, permitted or empowered (legal modality) to perform an act (act description).

Most authors acknowledge the importance of the norm subject, the legal modality and the act description. However, there is no consistent terminology to denote the elements. The norm subject is sometimes denoted by the term 'addressee' (e.g., Kelsen 1991). The element of a norm that determines whether we are dealing with a duty-imposing, permissive or power-conferring norm is referred to as the 'deontic modality' (Brouwer, 1990), the 'deontic operator' (Aarnio, 1987), the 'norm character' (Von Wright, 1963), the 'function of a norm' (Kelsen, 1991), the 'directive operator' (Ross, 1968) or the legal modality (Ross, 1968). We will use the term 'legal modality'. The description of the act (Brouwer, 1990) is also known as the 'content of a norm' (Von Wright, 1963), the 'object of a norm' (Kelsen, 1991), or the 'theme of a norm' (Ross, 1968).
In addition to the afore-mentioned elements of a norm, most authors name the 'conditions of application' or 'norm conditions' as a fourth norm element (hypothetical and categorical norms in the classification of section 2). This element of a norm is only relevant when dealing with a hypothetical norm.

The four norm elements mentioned above constitute what has been called the norm kernel (Von Wright, 1963, p.70). Every norm must comprise a norm subject, a legal modality and an act description. If one of these elements is missing (*i.e.*, the element is neither explicitly nor implicitly present), we are not dealing with a norm. Dependent on the type of norm, categorical or hypothetical, these three elements can be supplemented with conditions of application.

To be able to refer to a norm as a separate entity and to link a norm to its origin, some additional norm elements are introduced: the norm identifier, the norm promulgation and the scope. The norm identifier is used as a point of reference for a norm, the norm promulgation links a norm to its source (*e.g.*, an article in a statute), and the scope limits the range of application of a norm (*e.g.*, the range of application of a norm can be limited to the context of one statute). To distinguish these norm elements from the four primary elements, they are denoted as auxiliary elements.

The norm frame

Now that the primary and auxiliary elements of a norm have been introduced, they can be placed in a structure: a norm frame. A frame is defined as a data-structure for representing a stereotyped situation. The stereotyped situation under consideration here is the norm. Consequently, a norm frame is defined as a data-structure in which each element of a norm is represented. Hence, a norm frame can be seen as a template to represent norms.

In table 1 we present a norm frame. The frame is used to represent the elements of a norm coherently. Each row of the table is referred to as a slot of the norm frame. The second column of the table contains the elements of a norm, the third column contains a typification of the element.

	Element	Typification
1	Norm identifier	The norm identifier (used as a point of reference for the norm).
2	Norm type	The norm type (norm of conduct or norm of competence).
3	Promulgation	The promulgation (the source of the norm).
4	Scope	The scope (the range of application of the norm).
5	Conditions of application	The conditions of application (the circumstances under which a norm is applicable).
6	Subject	The norm subject (the person or persons to whom the norm is addressed).
7	Legal modality	The legal modality (ought, ought not, may, or can).
8	Act identifier	The act identifier (used as a reference to a separate act description).

Table 1. A norm frame.

The first, third and fourth slots are reserved for the auxiliary elements of a norm. They contain the norm identifier, the promulgation and the scope, respectively. The elements contained in these slots do not form an essential part of the norm; the norm identifier, for instance, is used as a point of reference for the norm. The second, fifth, sixth, seventh and eighth slots hold the primary elements of a norm. In the second slot, the norm type, we specify whether a norm is a norm of conduct or a norm of competence. The fifth slot facilitates the representation of the conditions of application of a norm. The slot is only instantiated when we deal with a hypothetical norm. The sixth slot, the norm subject, contains the persons or institutions to whom the norm is addressed. The seventh slot accommodates the legal modality. The legal modality determines the function of a norm; a norm is either an obligation (a command or a prohibition; ought and ought not, respectively), a permission (may), or a power-conferring norm (can). The combination of the second slot and the seventh slot provides us with a complete picture of the legal modality. The legal modality extends over the description of the act. The eighth slot holds a reference to a separate act description. The act description is the topic of the next section.

4. Act descriptions

Every action has many different aspects. To mention the most obvious ones: every action is performed by someone, at a certain time and at a certain place. Since actions have too many aspects to represent effectively in a single predicate, the frame-based ontology uses a separate structure for the representation of actions: the act frame.

The aspects of action

Rescher (1967, 1970; *cf.* Loth, 1988) has provided a description of aspects of action in which the miscellaneous aspects of action are taken into consideration. According to Rescher, an act has the following aspects (the sixth aspect has been added to Rescher's five aspects):

(1) An agent;
(2) An act type;
(3) A modality, divided into
  a modality of means; and
  a modality of manner;
(4) A setting, divided into
  a temporal aspect;
  a spatial aspect; and
  a circumstantial aspect;
(5) A rationale, divided into
  a cause;
  an aim; and
  an intentionality.
(6) A final state

The interpretation of the (primary) aspects of action is provided below, when discussing the act frame. To be able to refer to act descriptions, again some auxiliary elements are introduced: the act identifier, the promulgation and the scope. What has been said above about the auxiliary elements of a norm applies equally here.

The act frame

The six aspects of action (and their subdivisions) described in the previous section can be grouped in an act frame (table 2).

	Aspect	Typification
1	Act identifier	The act identifier (used as a point of reference for the act).
2	Promulgation	The promulgation (the source of the act description).
3	Scope	The scope (the range of application of the act description).
4	Agent	The agent (an individual, a set of individuals, an aggregate or a conglomerate).
5	Act type	The act type. Both basic acts and acts specified elsewhere can be used.
6	Means	The modality of means (material objects used in the act or more specific descriptions of the act).
7	Manner	The modality of manner (the way in which the act has been performed).
8	Temporal aspects	The temporal aspects (an absolute time specification).
9	Spatial aspects	The spatial aspects (a specification of the location where the act takes place).
10	Circumstances	The circumstantial aspects (a description of the circumstances under which the act takes place).
11	Cause	The cause for the action (a specification of the reason(s) to perform an action).
12	Aim	The aim of an action (the goal visualized by the agent).
13	Intentionality	The intentionality of an action (the state of mind of the agent).
14	Final state	The final state (the results and consequences of an action).

Table 2. An act frame.

In the frame, the division between primary and auxiliary aspects is maintained. The first three slots of the act frame contain the auxiliary aspects of action 'act identifier', 'promulgation' and 'scope', respectively. The fourth to the fourteenth slots contain the primary aspects of action. The fourth slot is reserved for the agent who performs the act (the agent and the norm subject are the same person). The fifth slot contains a (general) typification of the act. The sixth and the seventh slots are reserved for a description of the modality of action. The modality of means can be specified in the sixth slot, the modality of manner in the seventh slot. The eighth, ninth and tenth slots facilitate a specification of the setting or context of an act. They are used to specify the time, location and circumstances of an act, respectively. The rationale of an act is specified in the eleventh, twelfth and thirteenth slots. The eleventh slot can contain information about the cause of an act, the twelfth slot contains the aim of an act, and the thirteenth slot comprises the state of mind of the agent. Finally, the results and consequences of an act are represented in the fourteenth slot.

The fourteen slots of the act frame provide an overview of the aspects actions can have. Not every aspect proves relevant in each case. If an aspect proves irrelevant, the slot can remain uninstantiated. However, instantiation of the agent slot and the act type slot is essential to the description of an action.

5. Concept descriptions

The description of acts and act frames has already brought us into the realm of concept descriptions: act descriptions are a specific form of concept descriptions. A concept description determines the meaning of a concept. In the legal domain, the concepts that need description are usually specific legal terms. The best known type of concept description has already been introduced in section 2. This type is referred to as the (legal) definition.

The elements of a concept description

A concept description comprises seven elements. The first element is the concept to be defined: every concept description describes a concept or term. It does so by either stating the conditions under which a concept is applicable or by naming some instances of a concept (combinations are also possible). An important element of the concept description is the concept type. Four concept types can be distinguished: legal definitions, deeming provisions, factors, and meta concepts. Deeming provisions are used to introduce legal fictions. Deeming provisions allow things which are not true to be treated as if they were, and things which are true to be treated as if they were not. The concept type 'factor' is used when we are not dealing with necessary and sufficient conditions. A factor merely contributes to the applicability of a concept; it assigns a weight factor to properties that play a role in the determination of the meaning of a concept. Factors can be positive or negative. A positive factor increases the likelihood of applicability of a concept, a negative factor decreases the likelihood of applicability. Finally, meta concepts are used to deal with textual constructions such as application provisions and (some types of) exceptions. Application provisions make provisions operative, or render others inoperative. Again, promulgation and scope are introduced as auxiliary elements (no identifier is needed, since the concept itself serves as an identifier).

The concept frame

The elements of a concept description can be molded into a concept frame. The result is displayed in table 3.

The first slot of a concept frame is reserved for the concept that is described. The second slot contains the concept type, or, in other words, the type of description that is provided of the concept. The third slot is only relevant when we are dealing with a concept description of the factor type. This slot holds the appropriate weight of the properties (conditions) contained in the sixth slot. The fourth and fifth slots accommodate the auxiliary elements promulgation and scope, respectively. The sixth slot contains the conditions under which a concept is applicable. Finally, the seventh slot can be used to represent instances of the concept.

	Element	Typification
1	Concept	The concept to be described.
2	Concept type	The concept type (definition, deeming provision, factor or meta).
3	Priority	The weight assigned to a factor (only relevant when we deal with the concept type 'factor').
4	Promulgation	The promulgation (the source of the concept description).
5	Scope	The scope (the range of application of the concept description).
6	Conditions	The conditions under which a concept is applicable.
7	Instances	An enumeration of instances of the concept.

Table 3. A concept frame.

6. Other elements of the frame-based ontology

Of course, the three frame structures need to be instantiated in order to create a model. To this end a vocabulary is needed. Within the vocabulary, eleven categories are distinguished: (1) words denoting actions; (2) words denoting agents; (3) words denoting objects; (4) words expressing relations; (5) words assigning properties to other entities; (6) words indicating time; (7) words indicating place; (8) words indicating source; (9) words marking textual constructions; (10) words marking arithmetical operations; and (11) words indicating the legal modality.

The division into categories is partly based on the structure of the three frame types. The categories acts, agents, time, place, source, and legal modality are directly traced back to the frames. To give an example: the act-type slot of an act frame can only contain expressions from the acts category of the vocabulary. However, some slots (*e.g.*, the circumstance slot of the act frame) can contain entries from nearly all categories of the vocabulary. The distinction between objects, relations, and properties is partially based on the need to distinguish the six aforementioned categories; these categories are negatively defined as the categories that contain entities unsuited for any of the other categories. The objects category comprises material entities (as opposed to human entities; agents). The relations category contains words that express the status of objects or agents in their relation to other objects or agents. The properties category is constituted by words that ascribe certain qualities to objects or agents. The categories textual constructions and arithmetics are reserved for words expressing textual constructions (*e.g.*, exceptions) and mathematical operations (*e.g.*, adding or subtracting), respectively. Note that categories such as acts and agents also contain relations or properties. The act of 'hitting someone' could be represented as 'person *p1* hits person *p2*', and this clearly expresses a relation. Another example: if we state that a person *p* is a fisherman, this qualifies both for the properties and the agents category (the agents category is selected). The time category also contains relations (*e.g.*, 'later' expresses a relation between time points). In fact, it is true that every category comprises relations in the broadest sense of the word. The content or meaning of the relation determines its category.

From the point of view of generic ontologies, it is interesting that the vocabulary can be divided into two parts: a generic and a statute-specific part (corresponding with a generic and a statute-specific ontology (Visser, 1995)). Some of the categories in the vocabulary only have generic elements (the categories source, textual constructions, arithmetics and legal modality). The category legal modality, for instance, contains four entries: ought, ought not, may and can. Other categories have both generic and statute-specific elements.

7. Application of the ontology

In order to create a model out of the elements provided by the frame-based ontology, seven heuristics are introduced in Van Kralingen (1995). The heuristics guide the process of assembling a model from the generic and statute-specific elements and are described extensively in Van Kralingen (1995). The heuristics aim at creating an adequate representation of a domain while keeping the number of frames to a minimum.

To illustrate the usefulness of the frame-based ontology, it has been applied in the representation of several legal domains. Its main test has been the representation of the Dutch Unemployment Benefits Act (a conceptual model in Van Kralingen, 1995 and a formal model in Visser, 1995). Visser has proven that it is possible to apply a frame-based model of the Unemployment Benefits Act for two distinct tasks (an assessment task and a planning task). Other domains in which the ontology has been tested are penal law, procedural law (the Dutch Code of Criminal Procedure) and civil law (an IT contract and the relevant provisions of the Dutch Civil Code). Most recently, the Imperial College Library Regulations have been modeled using the frame-based ontology (Visser *et al.*, 1997).

Another interesting application of the frame-based ontology has been pursued by Voermans (1995). Voermans has used the frame structures in the process of providing support for the development of new legislation. Currently, research continues in this area as we are looking into the possibility of extending an existing system for drafting support (LEDA) with some functionalities based on the ontology (Voermans and Van Kralingen, 1997).

8. Conclusions

The frame-based ontology provides adequate means to represent different legal domains. In doing so, it adheres to the first four criteria formulated by Gruber. By using concepts and structures that come natural to lawyers (norms, acts and concepts), models based on the ontology can be easily understood; the demand of clarity is met. The ordering of different elements or aspects of entities in frame structures and the clear definition of relations within and between frames provide for a coherent model. Extendibility of a frame-based model is possible, but can be seriously hampered by the selection of a vocabulary with a large grain size (Van Kralingen, 1995). It has been proven that frame-based models can be applied for different tasks. Finally, the fourth criterion, minimal encoding bias, has been implemented by using legal theory as a point of departure, instead of some representation formalism. Thus, the ontology is shaped by legal issues and not by implementation issues.

A complete conceptual frame-based model of the Dutch Unemployment Benefits Act is available in Van Kralingen (1995), a formal frame-based model of the act can be found in Visser (1995).

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