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Editors:
J.A.P.J. Breuker
R.V. De Mulder
J.C. Hage

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More information about the JURIX foundation and its activities can be obtained by contacting the JURIX secretariat:

Mr. C.N.J. de Vey Mestdagh
University of Groningen, Faculty of Law
Oude Kijk in 't Jatstraat 26
P.O. Box 716
9700 AS Groningen
Tel: +31 50 3635790/5433
Fax: +31 50 3635603
Email: sesam@rechten.rug.nl

http://jurix.bsk.utwente.nl/

REASONING ABOUT DEFINITIONS IN STATUTES

P.R.S. Visser and R.W. van Kralingen
Department of Law and Computer Science
Faculty of Law, University of Leiden
Hugo de Grootstraat 32
P.O. Box 9521
2300 RA Leiden
The Netherlands

Summary

The formalization of texts of law entails the analysis of its structure. Often, the structure is modified and (parts of) legal norms are reformulated on an ad hoc *basis, to suit the selected representation method. A theory about coherence in law can serve as a basis to extract and represent knowledge about the structure of texts of law. This knowledge can be used to reason about separate text elements, thus making it possible to preserve the structure of these texts. As we will show, meta-level reasoning is needed to deal with conflicts that arise if the structure of the statute is preserved. In this paper, we concentrate on reasoning about definitions.*

1. Introduction

Statute-based-legal-knowledge systems employ formalized models of texts of law to conduct reasoning processes. The formalization process often reveals relations within and between legal texts not explicitly present in the statute text. This circumstance necessitates an extensive interpretation during the formalization process, often yielding intertwined images of parts of the statute's texts. The resulting formal representations are often difficult to survey.
A possible solution to this problem is a formal representation that leaves the implicit relations out of consideration and concentrates on the direct formalization of elements of the texts of law. However, since reasoning with statutes largely depends on the relations between text elements, it is imperative to have a representation formalism and a reasoning mechanism that can deal with coherence. As we will show, this approach implies the use of meta-level reasoning.

In this paper we describe part of a framework for dealing with coherence in law. We depart from the theoretical framework provided by Brouwer (1990). This framework facilitates the mapping of different text elements onto an abstract model of a legal norm. This mapping enables us to dissociate conclusions from the underlying rules, thus making it possible to use these abstract conclusions further on in the reasoning process. The approach necessitates reasoning with text elements as well as reasoning about relations between these elements. Only a limited part of the framework, namely reasoning with and about definitions in statutes, is elaborated (these definitions constitute parts of norms). In the next chapter we outline the framework.

2. Coherence in law

Brouwer (1990) argues that in order to elucidate the notion of coherence, two sorts of elements must be distinguished: those that appear in the texts of law, such as chapters and sections, and those that can be regarded as legal norms. The structure of texts of law is generally not the same as the structure of the law seen as a collection of norms (Brouwer, 1990, p.5). However, if we accept the proposition that law consists of norms, it must be possible to map the texts of law onto a collection of norms (Brouwer's argument not only concerns texts of law, but also other sources of law).
The formalization of texts of law entails the analysis of the structure of these texts. Often, during the formalization, the structure is modified and (parts of) legal norms are reconstructed on an *ad hoc* basis, to suit the selected representation method. In the JURICAS system (De Mulder *et al*., 1989) this procedure has resulted in a criss-cross of relations between the texts of law and the formal rules reflecting the norms contained in these texts. In the TESSEC system, it has been tried to preserve the structure of the statute texts. However, Nieuwenhuis has neither been able to preserve a direct correspondence between the statute texts and the formal rules. In his formal rules he incorporates exceptions as conditions in rules, thus losing the exceptions as separate elements of the statute text (Nieuwenhuis, 1989, pp.193-197).
The designers of JURICAS and TESSEC do not report to have used a theory about coherence in law. Such a theory could serve as a basis to extract and represent knowledge about coherence in law, thus making it possible to preserve the structure of a statute texts as well. Before going into some of the possibilities this approach has to offer, we discuss the theory about coherence in law as formulated by Brouwer (1990).

2.1. Legal norms

What is a legal norm? Von Wright (1983) defines a norm as 'a statement to the effect that something ought to or may or must not be done'. This definition denotes a diversity of norms. In the legal domain, Brouwer claims that the concept *legal norm* covers four different types of norms:

- **Duty-imposing norms**: duty-imposing norms determine what types of conduct constitute actionable wrongs. They impose duties on persons to abstain from such conduct, or they impose obligations on persons to perform a specified conduct (Hart, 1961). An instance of a duty-imposing norm is the obligation of employees to sign in at an employment exchange if they become unemployed.
- **Permissive norms**: permissive norms grant persons the right to act or to refrain from acting. If we take the adage 'everything that is not forbidden, is allowed' to be true, permissive norms do not have an independent function. However, there are sufficient reasons to consider the 'permissive norms' an independent category. An instance of such a reason is the possibility of a conflict in a norm-hierarchy (Brouwer, 1990) (*e.g*. an explicit permission issued by the central government cannot be restricted by regulations issued by government institutions lower in the hierarchy).
- **Power-conferring norms**: power-conferring norms provide individuals (or institutions) with facilities to realize their goals. Power-conferring norms provide facilities to create structures of rights and duties within the coercive

framework of law (Hart, 1961 p. 27; *cf*. Brouwer, 1990). An instance of a power-conferring norm is the norm providing the Dutch Minister for Social Services and Employment with the right to label someone as an employer.

- **Norms of adjudication**: norms of adjudication are defined as norms that regulate the authoritative determination of the question whether a duty-imposing or power-conferring norm has been broken as well as the legal consequences thereof. They may be of the duty-imposing, permissive and even power-conferring kind. (Brouwer, 1990; Hart, 1961). An instance of a norm of adjudication is the norm granting the Industrial Insurance Board the right to cut back on social security benefits in certain specified cases.

2.2. Properties of legal norms

A norm must have certain properties to fall within the definition given in the previous chapter. Brouwer (1990) (*cf*. Von Wright, 1983) mentions five properties that correspond to as many questions:

- The description of the norm subject (*who* is obliged or allowed to act?).
- The description of the act (*what* must be done or left undone?).
- The deontic modality (is there an *obligation* or a *permission* to act or to refrain from acting?).
- The description of the place of the act (*where* must or may the act take place?).
- The description of the time of the act (*when* must or may the act take place?).

A norm that comprises these elements is a *complete norm*. A complete norm is a theoretical construct and does not appear as such in the legal sources. The theoretical model of a complete norm forms the basis for Brouwer's theory about the structure or coherence in law.
The miscellaneous elements of complete norms are distributed over the texts of law. In their mutual coherence these texts express a (collection of) norms. The core of a norm (the description of the norm subject, the act and the deontic modality) is often represented in one section. This section can serve as a root for the reasoning process. Other elements of the norm can often be found in other sections. Definitions, for instance, being part of different norms, are often placed under separate headings (*e.g*. in chapters containing general provisions). If we start the reasoning process at the core of the norm we can extend this root to include all remaining text elements relevant to the norm.
In this paper we restrict ourselves to duty-imposing norms. We illustrate the applicability of the Brouwer framework and of some of the reasoning techniques needed to reach conclusions about these norms with the help of examples originating from the Dutch Unemployment Act.

3. The Dutch Unemployment Act

We deem the Dutch Unemployment Act a fitting domain for application of the framework we have introduced in chapter 2. The structure of the statute is as follows: the statute comprises eleven chapters. The first chapter of the statute contains general sections. In this chapter several notions used elsewhere in the statute are defined (*e.g*., employer, employee, employer-employee relationship, pay). Chapter two of the statute deals with the compulsory unemployment insurance. It starts with

some general sections that address unemployment, the right to unemployment benefits, etc.
The sections 24, 25 and 26 form the core of the Unemployment Act; they lay down the rules (duties) employees have to comply with in order to realize their rights to unemployment benefits. Chapter two further contains some sections about procedural aspects of the payment of unemployment benefits, duration of the benefits, etc. In the remainder of the statute diverse subjects are dealt with, such as the voluntary unemployment insurance (chapter three), finance of the act (chapter seven), implementing bodies (chapter eight) and penalty clauses (chapter eleven).

3.1. Section 24 of the Unemployment Act

Section 24 of the Unemployment Act contains some obligations an employee has to meet in order to realize his right to unemployment benefits. If an employee fails to comply with one of these obligations his benefits can be docked. Paragraph one of the section can be translated as follows:

Section 24 paragraph 1
The employee avoids:
a. becoming culpably unemployed;
b. being or remaining unemployed as a result of;
  1. insufficiently trying to obtain commensurate work;
  2. failing to accept commensurate work or failing to acquire commensurate work through his own fault;
  3. failing to keep commensurate work through his own fault; or
  4. having job-related demands that hinder the acceptance or obtention of commensurate work;
c. not receiving benefits as indicated in section 19, paragraph 1, items *a, b, c*, or *d* because of any act or abstention that he can reasonably be blamed for.

Paragraph 1 of section 24 comprises the cores of at least six duty-imposing norms (it is a *compound norm*), namely: paragraph 1 item a, paragraph 1 item b 1°, paragraph 1 item b 2°, paragraph 1 item b 3°, paragraph 1 item b 4°, and paragraph 1 item c (paragraph 1 item b 2° and paragraph 1 item b 4° can be split further). The paragraph contains a single norm subject (the employee), descriptions of the acts (items *a, b* and *c*) and a single deontic modality (avoids). It does not accommodate any information about the *places of the acts* or the *times of the acts*.

3.2. Reasoning about norms

The first norm contained in section 24 reads: 'the employee avoids becoming culpably unemployed'. Section 27 of the statute links a sanction to the breach of this norm (section 27 paragraph 1 reads: 'if an employee fails to comply with one of the obligations laid down in the sections 24, 25 and 26 ...'). The application of section 27 requires information about the compliance with *norms* laid down elsewhere in the Unemployment Act; an abstract conclusion about the duty-imposing norms (has the norm been breached or not) contained in the sections 24, 25 and 26 is needed to be able to apply section 27. Abstract conclusions about norms or definitions are often used as conditions in other rules. We will refer to these abstract conclusions *about* norms or definitions as meta-level conclusions.
To reach a conclusion about whether a duty-imposing norm has been breached or not, one has to reason about the conditions related to the norm. In the following

section we elaborate on one condition of the norm of which the core is represented in section 24 paragraph 1 item *a.* Since the Unemployment Act grants the right to unemployment benefits to employees, we have chosen to elaborate the question 'is the person involved an employee?' ('Right to unemployment benefits' is a concept defined in the sections 17 to 21 of the Act. The concept 'employee' is used in the definition.).

4. Representation of texts of law

Our representation has the following characteristics. First, the representation is chosen to preserve the relations between the text elements as much as possible (we elaborate the idea of multi-layered structures (*c.f.* Routen, 1989)). A consequence of this approach is that all text elements referred to in other text elements must be addressable in the formalized version. The normal indexing mechanism used in statutes (*e.g.*, chapters, sections) is extended to be able to refer to sentences as well. Elements that are addressable in the formalized version are called *addressable units*.
The second characteristic is related to the first: all conclusions based on the represented texts of law are linked to addressable units. This makes it possible to distinguish, for instance between an employee according to section 3 paragraph 1 and an employee according to section 3 paragraph 3. This facility is used to discriminate between (possibly contradictory) conclusions reached on the basis of different formalized text elements (meta-level reasoning).
As a third characteristic, we mention that the formalized text elements are expressed as predicate-logical rules.

Because the representation does not integrate several sections in one logical rule, the translation from section to formal rule is relatively straightforward. A section defining a notion can be translated without explicitly referring to exceptions to its contents made elsewhere in the statute. This contributes to an important aim of our approach, namely the decrease of the amount of interpretation needed to translate the texts of law into logical rules.
Another advantage arises as a result of the need to reason at meta level. As can be seen in the next chapter, meta-level reasoning necessitates elicitation of knowledge that remains implicit in several other approaches. Because this kind of knowledge is only used at meta level this knowledge is stored separately from the formalized texts of law.

To illustrate the representation formalism we present three examples of translations of texts of law. The first example is part of a section that defines the notion employee. We will refer to this as an *affirmative statement* because the statement affirms a person to be an employee. An example of an affirmative statement can be found in section 3 paragraph 1 of the Unemployment Act. This paragraph reads:

> 'Employee is the natural person, under the age of 65, having an employer-employee relationship, according either to private law or to public law.'

The statement is translated into (the consequent of the following rule must be read as 'according to section 3 paragraph 1, *person* is an employee in the employment of *employer*'):

Employee (sec_3_par_1, employer, person) ⇐

Natural_person (person) ∧

Under_the_age_of (person, 65) ∧

(

Private_law_employer_employee_relationship (employer, person) ∨
Public_law_employer_employee_relationship (employer, person)

)

Besides affirmative statements we recognize *negative statements*. A negative statement is a statement that potentially negates a conclusion drawn by another statement. By representing negative statements separately, we maintain a direct correspondence between the original texts and the formalization (*cf.* Sartor, 1991). The formalization is chosen to avert *logical* contradictions, thereby making it possible to concurrently confirm an affirmative statement and a negative statement about the same notion. If such a conflict occurs, it is resolved at meta level. Section 3 paragraph 2 of the Unemployment Act is a negative statement:

> 'Whoever fulfils his employer-employee relationship outside of the Netherlands, is not an employee, unless he lives in the Netherlands and his employer lives or resides in the Netherlands.'

The statement translates:

Not_an_employee (sec_3_par_2, employer, person) ⇐

Fulfils_employer_employee_relationship_outside_the_Netherlands (employer, person) ∧

¬ (Lives_in_the_Netherlands (person) ∧

(

Lives_in_the_Netherlands (employer) ∨
Resides_in_the_Netherlands (employer)

)

)

The last type of statement we mention is a *statement restricting the applicability*. Such a statement potentially withholds another statement from being applicable. Note that a statement restricting the applicability of another statement differs from a negative statement. Consider an affirmative statement indicating someone is an employee. If a more specific statement indicates the same person is not an employee, the latter prevails. Thus the conclusion must be the person is not an employee.
If the negative statement in this example would have been a statement restricting the applicability, it would be impossible to reach a conclusion. The conclusion the man is an employee can not be drawn, but neither can we conclude the man not to be an employee. The difference being the conclusion 'the other statement is not applicable' is a statement about another statement instead of a statement about a definition. Therefore, the conclusion is a meta-level conclusion. We will go into this in more detail in the next chapter. A good example of a statement restricting the applicability can be found in the Unemployment Act section 4 paragraph 2 (the example concerns a statement restricting the applicability of a statement defining an employer-employee relationship):

'The first paragraph, items *a* and *b* do not apply if the agreement referred to in item *a* has been entered into with a natural person on behalf of his personal affairs.'

The translation of this section is (the conclusion is bold to distinguish it from object-level conclusions, the consequent of the rule must be read as 'according to section 4 paragraph 2, section 4 paragraph 1 item *a* and section 4 paragraph 1 item *b* do not apply'):

Not_applicable (sec_4_par_2, sec_4_par_1a_and_sec_4_par_1b) ←

Natural_person (employer) ∧

Agreement (sec_4_par_1a, employer, employee) ∧
Agreement_on_behalf_of_personal_affairs (sec_4_par_2, employer, employee)

Note that the condition *Agreement* has a reference to section 4 paragraph 1 item *a.* This must be read as: 'an agreement as referred to in section 4 paragraph 1 item *a*' .
The translated text elements potentially contradict each other with respect to the notion employee. To be able to draw a conclusion, meta-level reasoning is necessary to solve this conflict by deciding which rule has priority (here: is the person an employee or is he not?). In the next chapter we discuss these conflict-resolution mechanisms.

5. Meta-level reasoning

In this section two types of meta-level reasoning will be discussed. The first is reasoning about text elements with contradictory conclusions (§ 5.2). This type of reasoning can be seen as a special case of preferring the most specific argument (*cf.* Prakken, 1991). The second type is reasoning about explicit restrictions on the applicability of text elements (§ 5.3). Before we discuss meta-level reasoning, we distinguish between object- and meta-level reasoning (§ 5.1).

5.1. Separating object level and meta level

The knowledge used to reason with texts of law will be divided into object-level knowledge and meta-level knowledge. At the object level all texts of law are represented. As said previously, the representation preserves the implicit and explicit references to other text elements. The meta level is used to reason about the text elements represented at object level. The knowledge used for this reasoning is not explicitly available in the texts of law. Moreover, this knowledge often remains implicit in human reasoning processes. An example of this kind of knowledge is: an exception has priority over a general section. These implicit links between several sections related to one notion are made explicit at the meta level (*cf.* Breuker and den Haan, 1991).
Related to the meta-level function of dealing with contradictions at the object level, another function of the meta level is to make abstractions from object-level conclusions. This is necessary because conclusions at object level are always linked to an addressable unit. If all text elements related to a certain notion are examined, an abstract conclusion can be drawn. Typical examples of these abstractions are: (1) the person is an employee as indicated in section 3 because the person is an employee as indicated in section 3 paragraph 3, and (2) the person is an employee because the person is an employee as indicated in section 3. It is the abstract conclusion that is

referred to in other (object-level) statements (these abstract conclusions are made available at the object level by downward reflection (*cf.* Brumsen *et al.*, 1990)). We point out that a text element sometimes refers to a conclusion which is not abstract (in chapter 4 we have used the example 'an agreement as referred to in section 4 paragraph 1, item *a*').

5.2. Reasoning about text elements with contradictory conclusions

As can be seen we are not able to draw the conclusion that a man is an employee until all text elements dealing with the definition of the notion employee, have been examined. At least we have to know if the statements that have not been examined yet, potentially affect the conclusion so far. To express that a statement potentially affirms a notion we use the meta-level predicate **Affirmative_statement**. To express that a statement potentially rejects a certain notion we use the meta-level predicate **Negative_statement**. Below we list predicates with respect to the notion employee (in the Unemployment Act more statements are relevant to the notion employee).

Affirmative_statement (employee, sec_3_par_1)
Affirmative_statement (employee, sec_3_par_3)
Negative_statement (employee, sec_3_par_2)

When trying to confirm someone is an employee, reasoning starts with an affirmative statement. If such a statement can be confirmed, a negative statement for the same notion is searched for and conformation is pursued. If this succeeds, a conflict results (the conflict does not have to be a problem in a legal sense). If a negative statement can be found in which an exception is stated to a general (affirmative) rule it is clear that the exception prevails over the general rule. We consider this kind of reasoning as reasoning with the meta-level criterion: preferring the most specific argument. We want to make the meta-level knowledge used for this decision explicit. To express one statement prevails over another because the latter is more specific, we use the meta-level predicate **More_specific**. Below we list these relations with respect to section 3.

More_specific (sec_3_par_2, sec_3_par_1)
More_specific (sec_3_par_3, sec_3_par_2)

Thus, relations concerning specificity are represented explicitly (this can be contrasted to the approach proposed by Prakken, (1991) who infers these relations from the statements themselves). The relations are used to discriminate between two text elements by giving the first section priority over the second.

5.3. Reasoning about explicit restrictions on the applicability of text elements

Section 4 paragraph 1 (items *a* and *b*) of the Unemployment Act defines two types of employer-employee relationships. Paragraph 2 of the same section states that under certain conditions, paragraphs 1 item *a* and *b* are not applicable. In case both paragraph 1 item *a* (or *b*) and paragraph 2 are confirmed, a conflict situation is reached. The conclusion based on the first paragraph must be abrogated to solve this conflict. This is done at meta level, using
the already introduced meta-level predicate **Not_applicable** (see: section 4). As we have seen, section 2 leads to the conclusion **Not_applicable** (sec_4_par_2, sec_4_par_1a_and_sec_4_par_1b). Before this conclusion can be used it is split up in its two subconclusions: **Not_applicable** (sec_4_par_2, sec_4_par_1a) and

Not_applicable (sec_4_par_2, sec_4_par_1b). These predicates are used to abrogate conclusions derived earlier. In the reasoning process, only the conclusions for which no applicability restrictions are derived will be forward.

6. Conclusions and future research

The framework proposed by Brouwer can be used to reason about text elements at different levels. At the highest level of abstraction we can reason about norms. On lower abstraction levels we can reason about separate text elements that constitute these norms (*e.g.* definitions). The use of explicit knowledge about the structure of statutes (meta-level knowledge) enables us to reason about separate text elements. This makes it possible to leave the structure of texts of law intact, thus simplifying the formalization of the text elements. This, in turn, improves the readability and maintainability of the knowledge base.
Furthermore, the framework offers opportunities to integrate other legal sources (such as cases and government directives) in the reasoning process. The possibility to reason about priorities of norm elements (meta-level reasoning) enables us to reason about elements of norms contained in other legal sources as well.

Future research will concentrate on other types of meta-level reasoning. More specifically, we will concentrate on meta-level reasoning about different norm types and on the integration of norm elements from various legal sources. An experiment will be staged to implement the presented ideas in the DESIRE specification framework (Kowalczyk and Treur, 1990).

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