Deliverable number: D1.1

Report and tutorial materials on research perspectives for theoretical models of legal knowledge representation and reasoning

<table>
<thead>
<tr>
<th>Grant Agreement n.:</th>
<th>690974</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Acronym:</td>
<td>MIREL</td>
</tr>
<tr>
<td>Project Title:</td>
<td>Mining and REasoning with Legal texts</td>
</tr>
<tr>
<td>Website:</td>
<td><a href="http://www.mirelproject.eu">http://www.mirelproject.eu</a></td>
</tr>
<tr>
<td>Contractual delivery date:</td>
<td>31/12/2016</td>
</tr>
<tr>
<td>Actual delivery date:</td>
<td>17/01/2017</td>
</tr>
<tr>
<td>Contributing WP:</td>
<td>WP1</td>
</tr>
<tr>
<td>Dissemination level:</td>
<td>Public</td>
</tr>
<tr>
<td>Deliverable leader:</td>
<td>UNIBO</td>
</tr>
<tr>
<td>Contributors:</td>
<td>UNIBO, Data61, UL</td>
</tr>
</tbody>
</table>

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 690974
Document History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Author</th>
<th>Partner</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>23/12/2016</td>
<td>Antonino Rotolo</td>
<td>UNIBO</td>
<td>Initial draft</td>
</tr>
<tr>
<td>0.2</td>
<td>30/12/2016</td>
<td>Giovanni Sartor</td>
<td>UNIBO</td>
<td>Revision of Sections 2.2 and 4.2</td>
</tr>
<tr>
<td>0.3</td>
<td>02/01/2017</td>
<td>Erica Calardo</td>
<td>UNIBO</td>
<td>Revision of Sections 5.1 and 5.2</td>
</tr>
<tr>
<td>0.4</td>
<td>04/01/2017</td>
<td>Guido Governatori</td>
<td>Data61</td>
<td>Survey and revision of all chapters</td>
</tr>
<tr>
<td>0.5</td>
<td>07/01/2017</td>
<td>Monica Palmirani</td>
<td>UNIBO</td>
<td>Survey and revision of all chapters</td>
</tr>
<tr>
<td>0.6</td>
<td>08/01/2017</td>
<td>Livio Robaldo</td>
<td>UL</td>
<td>Survey of all chapters</td>
</tr>
<tr>
<td>0.7</td>
<td>10/01/2017</td>
<td>Clara Smith</td>
<td>UNLP</td>
<td>Survey of all chapters</td>
</tr>
<tr>
<td>0.8</td>
<td>17/01/2017</td>
<td>Antonino Rotolo</td>
<td>UNIBO</td>
<td>Final survey</td>
</tr>
</tbody>
</table>

Contributors

<table>
<thead>
<tr>
<th>Partner</th>
<th>Name</th>
<th>Role</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIBO</td>
<td>Antonino Rotolo</td>
<td>Editor and WP leader</td>
<td>Contributor to all chapters</td>
</tr>
<tr>
<td>UNIBO</td>
<td>Erica Calardo</td>
<td>UNIBO team member</td>
<td>Contributor to Sections 5.1 and 5.2</td>
</tr>
<tr>
<td>UNIBO</td>
<td>Monica Palmirani</td>
<td>UNIBO team member</td>
<td>Contributor to all chapters</td>
</tr>
<tr>
<td>UNIBO</td>
<td>Giovanni Sartor</td>
<td>UNIBO team member</td>
<td>Contributor to Sections 2.2 and 4.2</td>
</tr>
<tr>
<td>Data61</td>
<td>Guido Governatori</td>
<td>Data61 team leader</td>
<td>Contributor to all chapters</td>
</tr>
<tr>
<td>UL</td>
<td>Livio Robaldo</td>
<td>UL team member</td>
<td>Reviewer of all chapters</td>
</tr>
<tr>
<td>UNLP</td>
<td>Clara Smith</td>
<td>UNLP team leader</td>
<td>Reviewer of all chapters</td>
</tr>
</tbody>
</table>

Disclaimer: The information in this document is provided “as is”, and no guarantee or warranty is given that the information is fit for any particular purpose. MIREL consortium members shall have no liability for damages of any kind including without limitation direct, special, indirect, or consequential damages that may result from the use of these materials subject to any liability which is mandatory due to applicable law.
## Contents

1. **Introduction** 9  
   1.1. Layout and Purpose of This Report ................................. 12

2. **Normative Concepts in the Legal Domain** 14  
   2.1. Legal Provision vs Legal Norm: Basic Definitions and General Research Challenges 14  
   2.2. Legal Norm vs Legal Judgement ........................................ 15  
      2.2.1. Normative Judgements .............................................. 15  
           2.2.1.1. Deontic Judgements ....................................... 15  
           2.2.1.2. Conclusions and Research Challenges ......................... 18  
   2.2.2. Norms ............................................................... 19  
      2.2.2.1. Conclusions and Research Challenges .......................... 20

3. **Temporal Dimensions of Legal Norms** 22  
   3.1. Introduction ......................................................... 22  
   3.2. Temporalised Norms and Normative Systems .......................... 22  
      3.2.1. Basics ............................................................ 22  
      3.2.2. From Norms to Meta-Norms ...................................... 24  
   3.3. Conclusions and Research Challenges .................................. 27

4. **The Content of Legal Norms** 29  
   4.1. Introduction .......................................................... 29  
      4.1.1. Qualitative Methods: Normative Goals and Interpretation as Semantic Revision ................................. 29  
           4.1.1.1. Restricting the Applicability of Legal Norms .............. 31  
           4.1.1.2. Expanding the Applicability of Legal Norms ................... 32  
      4.1.2. Quantitative Methods: Normative Goals and Interpretation as Fuzzy Reasoning 32  
   4.2. Formal Intuitions on Legal Interpretation ........................... 34  
   4.3. Conclusions and Research Challenges .................................. 38

5. **Tools for Legal Reasoning** 39  
   5.1. Possible-World Semantics ............................................. 39  
      5.1.1. Language .......................................................... 40  
      5.1.2. Semantics and Results .......................................... 41  
   5.2. Quantification in Deontics ............................................ 43  
      5.2.1. Introduction ...................................................... 43  
      5.2.2. Quantification in Non-normal Deontic Logic ..................... 46  
           5.2.2.1. Our Contribution to Quantified Non-normal Modal Logics for Deontics ............................................. 47  
   5.3. Conclusions and Research Challenges .................................. 49

6. **Conclusions** 50
A. Appendix: Tutorial Slides
List of Figures

3.1. Temporalised Legal Systems ...................................................... 25
Executive Summary

This document reports on the first year of research activities conducted in MIREL for WP1. As planned, two tasks have been mainly considered:

• **Task 1.1 Transdisciplinary Research and Conceptual Models for Legal Knowledge Representation and Reasoning:** “This task will offer suitable theoretical foundations for the subsequent tasks of this WP. Studies in legal theory on issues such as context sensitivity in normative language (concept holism, ordinary vs. legal concepts) and the structure of legal interpretation of legal provisions have reached a sophisticated level of analysis but often fail to offer operative and rigorous models of legal argumentation. On the contrary, efforts in Artificial Intelligence and Law are complementary to the ones in legal theory: they have computational and formal concerns that make them effective; however, they often move from simplifying theoretical assumptions. This tasks aims at identifying new directions for further cross-fertilization of these disciplines.”

• **Task 1.2 Formal Languages for Representing Norms, Policies, and Values in the Law:** “Given work of Task 1.1, we expect to provide new ideas for developing formal languages and a standard extensible language for representing norms, policies, and values. Relevant aspects to be considered are: (i) temporal properties of policies (the times when they are in force, when they produce effects, and when such effects hold) and other temporal dimensions; (ii) different effects of policies (deontic, rights, powers, interdictions, etc.); and (iii) epistemic dimension of policies for modelling norms, policies, and values and information flow control.”

Preliminarily, the Introduction of the report recalls from the literature a comprehensive picture of the requirements that all formal languages for the legal domain should handle. On the basis of this, this document reports on the contribution to WP1 as follows:

• **In regard to Task 1.1:** by offering a survey of previous results in the literature (especially, those developed by MIREL research groups) and by identifying the basic research challenges which will drive the MIREL partners in WP1;

• **In regard to Task 1.2:** by preliminarily considering some research issues on the temporal aspects of legal reasoning, on formal methods for modelling, e.g., legal compliance, and on the role of values and goals in legal interpretation.

The layout of the deliverable is thus as follows. Chapter 2 accounts for research on basic normative concepts: legal provision, legal norm, and legal judgement. Chapter 3 recalls previous research on the temporal qualification of legal norms and identifies future research lines for MIREL. Chapter 4 discusses some qualitative methods for modelling the propositional and conceptual content of norms and recalls recent results on legal interpretation in MIREL. Chapter 5 briefly offers the basic ideas behind two MIREL contributions on formal methods for legal reasoning.

An Appendix collects slides prepared to start our MIREL activities for WP1 and which have been used in conference tutorials and events.

The main contribution of all chapters is to offer a state of the art on the above research issues: all chapters
• recall and are based on previous research and on publications by MIREL partners for the project;
• summarise open problems by formally stating research challenges for future MIREL research.
1. Introduction

The law is a complex phenomenon, which can be analysed into different branches according to the authority who produces legal norms and according to the circumstances and procedures under which norms are created. But, independently of these aspects, it is possible to identify some general features that norms should enjoy.

First of all, it is widely acknowledged in legal theory and AI & Law that norms have basically a conditional structure like (1; 2)

\[
\text{if } A_1, \ldots, A_n \text{ then } B \tag{1.0.1}
\]

where \( A_1, \ldots, A_n \) are the applicability conditions of the norm and \( B \) denotes the legal effect which ought to follow when those applicability conditions hold\(^1\).

This very general view highlights an immediate link between the concepts of norm and rule. However, there are many types of rules. The common sense, dictionary meaning of rule is “One of a set of explicit or understood regulations or principles governing conduct within a particular sphere of activity.” (3). In classical logic, rules can be inference rules or material implications. In computer science, rules can be production rules, grammar rules, or rewrite rules.

When the term ‘rule’ is used in the legal field, it usually means rule in the regulatory sense. But rules express not only regulations about how to act. For example, von Wright (4) classified norms into the following main types (among others):

1. determinative rules, which define concepts or constitute activities that cannot exist without such rules. These rules are also called in the literature ‘constitutive rules’.
2. technical rules, which state that something has to be done in order for something else to be attained;
3. prescriptions, which regulate actions by making them obligatory, permitted, or prohibited. These norms, to be complete, should indicate
   - who (the norm-subjects)
   - does what (the action-theme)
   - in what circumstances (the condition of application) and
   - the nature of their guidance (the mode).

Notice that the notion of norm proposed by von Wright is very general and extends well over the notion of norm in legal reasoning; but in some cases the component of a rule have to modified. For example, legal systems can have provisions to handle changes in the systems itself. Thus, it is possible to have norms about how to change other norms. These rules have again a prescriptive character, but we have to adjust the element, in particular these rules should specify, what (the content to be modified), how (the new content), in what circumstances, and the nature of the

---

\(^1\)Indeed, norms can be also unconditioned, that is their effects may not depend upon any antecedent condition. Consider, for example, the norm “everyone has the right to express his or her opinion”. Usually, however, norms are conditioned. In addition, unconditioned norms can formally be reconstructed in terms of (1.0.1) with no antecedent conditions.
modifications (e.g., substitution, derogation, abrogation, annulment, . . .)
Many of these aspects have been acknowledged in the field of legal theory and artificial intelligence and law, where there is now much agreement about the structure and properties of norms (5; 6; 7; 8; 2).

**Definition 1.** According to (9; 10), requirements for representing legal norms from the field of AI & Law include the following:

**Norms vs Legal Provisions (11; 12; 13).** It is standard in legal theory to distinguish between legal provisions (authoritative legal texts) and legal norms, this last being the meaning of provisions resulting from the interpretive process.

**Isomorphism (14).** To ease validation and maintenance, there should be a one-to-one correspondence between the norms in the formal model and the units of natural language text which express the norms in the original legal sources, such as sections of legislation. This entails, for example, that a general norm and separately stated exceptions, in different sections of a statute, should not be converged into a single norm in the formal model.

**Reification (5).** Norms are objects with properties, such as

- **Jurisdiction.** The limits within which the norm is authoritative and its effects are binding (of particular importance are spatial and geographical references to model jurisdiction).
- **Authority (6).** Who produced the norm, a feature which indicates the ranking status of the norm within the sources of law (whether the rule is a norm constitutional provision, a statute, is part of a contract clause or is the ruling of a precedent, and so on).

**Temporal properties (15).** Norms usually are qualified by temporal properties, such as:

1. the time when the legal provision and the corresponding norm is in force and/or has been enacted;
2. the time when the norm can produce legal effects (when the norm is applicable and supports the derivation of legal effects);
3. the time when the normative effects hold.

**Semantics.** Any language for modelling legal norms should be based on a precise and rigorous semantics, which allows for correctly computing the legal effects that should follow from a set of legal norms.

**Defeasibility (5; 6; 2).** When the antecedent of a norm is satisfied by the facts of a case, the conclusion of the norm presumably holds, but is not necessarily true. The defeasibility of legal norms breaks down into the following issues:

**Conflicts (6).** Norms can conflict, namely, they may lead to incompatible legal effects. Conceptually, conflicts can be of different types, according to whether two conflicting norms

- are such that one is an exception of the other (i.e., one is more specific than the other);
- have a different ranking status;
- have been enacted at different times;

Accordingly, norm conflicts can be resolved using principles about norm priorities, such as:

- lex specialis, which gives priority to the more specific norms (the exceptions);
D1.1
Models of Legal Knowledge Representation and Reasoning

- lex superior, which gives priority to the norm from the higher authority (see ‘Authority’ above);
- lex posterior, which gives priority to the norm enacted later (see ‘Temporal properties’ above).

**Exclusionary norms** (6; 2; 5). Some norms provide one way to explicitly undercut other norms, namely, to make them inapplicable.

**Contraposition** (6). Norms do not counterpose. If some conclusion of a norm is not true, the norm does not sanction any inferences about the truth of its premises.

**Contributory reasons or factors** (2). It is not always possible to formulate precise norms, even defeasible ones, for aggregating the factors relevant for resolving a legal issue. For example: “The educational value of a work needs to be taken into consideration when evaluating whether the work is covered by the copyright doctrine of fair use.”

**Norm validity** (15). Norms can be invalid or become invalid. Deleting invalid norms is not an option when it is necessary to reason retroactively with norms which were valid at various times over a course of events. For instance:

1. The annulment of a norm is usually seen as a kind of repeal which invalidates the norm and removes it from the legal system as if it had never been enacted. The effect of an annulment applies ex tunc: annulled norms are prevented from producing any legal effects, also for past events.

2. An abrogation on the other hand operates ex nunc: The norm continues to apply for events which occurred before the norm was abrogated.

**Legal procedures**. Norms not only regulate the procedures for resolving legal conflicts (see above), but also for arguing or reasoning about whether or not some action or state complies with other, substantive norms (16). In particular, norms are required for procedures which

1. regulate methods for detecting violations of the law and checking compliance;
2. determine the normative effects triggered by norm violations, such as reparative obligations, namely, which are meant to repair or compensate violations.

**Normative effects**. There are many normative effects that follow from applying norms, such as obligations, permissions, prohibitions and also more articulated effects such as those introduced, e.g., by Hohfeld (see (2)).

**Persistence of normative effects** (17). Some normative effects persist over time unless some other and subsequent event terminate them. For example: “If one causes damage, one has to provide compensation.”. Other effects hold on the condition and only while the antecedent conditions of the norms hold. For example: “If one is in a public office, one is forbidden to smoke”.

**Values and goals** (18). Usually, some values and goals are promoted by the legal norms. Modelling norms sometimes needs to support the representation of values and value preferences (and of goals and goal preferences), which can play also the role of meta-criteria for solving norm conflicts. (Given two conflicting norms \( r_1 \) and \( r_2 \), value/goal \( v_1 \), promoted by \( r_1 \), is preferred to value/goal \( v_2 \), promoted by \( r_2 \), and so \( r_1 \) overrides \( r_2 \).)

---

Note that these constructions can give rise to very complex norm dependencies, because we can have that the violation of a single norm can activate other (reparative) norms, which in turn, in case of their violation, refer to other norms, and so forth.
1.1. Layout and Purpose of This Report

This document reports on the contribution to WP1 in regard to

- **Task 1.1 Transdisciplinary Research and Conceptual Models for Legal Knowledge Representation and Reasoning**: by offering a survey of previous results in the literature (especially, those developed by MIREL research groups) and by identifying the basic research challenges which will drive the MIREL partners in WP1;

- **Task 1.2 Formal Languages for Representing Norms, Policies, and Values in the Law**: by preliminarily considering some research issues on the temporal aspects of legal reasoning, on formal methods for modelling, e.g., legal compliance, and on the role of values and goals in legal interpretation.

According to the workplan of WP1, the research conducted in this first year worked in particular on some of the requirements we have recalled in Definition 1. The layout of the deliverable is thus as follows. Chapter 2 accounts for basic normative concepts: legal provision, legal norm, and legal judgement. Chapter 3 recalls previous research on the temporal qualification of legal norms and identifies future research lines for MIREL. Chapter 4 discusses some qualitative methods for modelling the propositional and conceptual content of norms and recalls recent result on legal interpretation in MIREL project. Chapter 5 briefly offers the basic ideas behind two MIREL contributions on formal methods for legal reasoning.

An Appendix collects slides prepared to start our MIREL activities for WP1 and which have been used in conference tutorials and events.

The main contribution of all chapters is to offer a state of the art on the above research issues: all chapters

- recall and are based on previous research and on publications by MIREL partners for the project;
- summarise open problems by formally stating research challenges for future MIREL activities: see the list of Research Challenges in the subsequent page for a complete overview.
List of MIREL Research Challenges in WP1

1. Research Challenge (Legal Provisions vs Legal Norms) .......................... 14
2. Research Challenge (Legal Norms vs Legal Judgements) .......................... 18
3. Research Challenge (Types of Legal Norms) ........................................ 20
5. Research Challenge (Interpreting Legal Provision: Goals, Qualitative vs Quantitative Methods) ................................................................. 38
6. Research Challenge (Integrating Interpretive Models) ............................ 38
7. Research Challenge (Decidability, Complexity and Implementation for the Logics for Legal Compliance) ......................................................... 49
8. Research Challenge (Integrating Quantification in Deontic Logics for Compliance) 49
2. Normative Concepts in the Legal Domain

2.1. Legal Provision vs Legal Norm: Basic Definitions and General Research

Challenges

According to contemporary legal theory and philosophy, there is usually no legal norm without interpretation. A norm practically is equivalent with one or more provisions plus the activity of their interpretation\(^1\). Hence:

**Definition 2.** [Provision vs Norm] A legal provision \(p\) is an authoritative legal text within a given legal system. A legal norm \(n\) is usually the result of the interpretive process of one or more legal provisions \(p_1, \ldots, p_n\) (19).

The following definitions are corollaries of Definition 2.

**Definition 3.** Legal interpretation is the process through which we ascribe a meaning to one or more legal provisions (a piece of authoritative legal text).

Legal interpretation is thus made by procedures—typically, arguments called canons—that map a piece of legal text into a meaning (possibly, a sentence paraphrasing the interpreted text) (20).

**Definition 4** (A- and O-interpretation). The legal doctrine often assumes the distinction between interpretation as activity and as outcome (11, p. 117) (cf. (12, p. 39)):

- interpretation as activity (A-interpretation) (literal or from ordinary language, by coherence, etc.) views any argumentative canon as a means through which a certain meaning is ascribed to a legal provision, and

- interpretation as outcome (O-interpretation) is precisely the meaning obtained through a certain interpretive act and ascribed to the provision.

The distinction between interpretation as activity and as outcome is well known in continental legal theory, and it was introduced precisely to capture cases where, e.g., one has legal reasons to prefer a certain interpretive canon over others even though all considered canons support the same interpretive outcome (20).

The following research challenge seems inevitable to design any formal language for modelling legal knowledge:

**Research Challenge 1** (Legal Provisions vs Legal Norms). Design a formal language that at least differentiate between

a set of legal provisions \(n_1, n_2, \ldots\) to be interpreted;

as set \(a, b, \ldots\), corresponding, e.g., to any sentences, which can be used to offer a sentential meaning to any provision \(n\) (a literal \(a\) is the meaning of provision \(n\)).

\(^1\)Legal and social theorists are of course aware of exceptions, i.e., legal norms without corresponding provisions: canonical examples are from customary law, where norms are not positively stated—namely, textually formulated—by any formal authorities.
2.2. Legal Norm vs Legal Judgement

Once it is clear that legal provision are different from norms, a basic classification of legal concepts, which possibly result from legal texts, includes two main classes:

- Norms,
- Normative judgements, which are typically (but not only) the effects of the application of legal norms.

In the remainder we report on research and on how these concepts can be analysed and how they can be further classified.

2.2.1. Normative Judgements

Let us consider the concept of normative judgement.

**Definition 5** (Legal Judgements). A normative judgement is the propositional constituent expressing a normative fact. Legal judgments can be classified into the following kinds (21):

- **evaluative**, which indicates that something is good or bad, is a value to be optimised or an evil to be minimised (for example, “human dignity is value”, “participation ought to be promoted”);
- **qualificatory**, which ascribes a legal quality to a person or an object (for example, “x is a citizen”, “x is an intellectual work”, “x is a technical invention”);
- **definitional**, which specifies the meaning of a term (for example “x means y” or “by x it is meant y”);
- **deontic**, which imposes the obligation or confers the permission to do a certain action (for example “x has the obligation” or “x has the permission to do A”);
- **potestative**, which attributes powers (for example “a worker has the power to terminate his work contract”);
- **evidentiary**, which establishes the conclusion to be drawn from certain evidence (for example “it is presumed that dismissal was discriminatory”);
- **existential**, which indicates the beginning or the termination of the existence of a legal entity (for example “the company ceases to exist”);
- **norm-concerning judgements**, which state the modifications of provisions or norms such as abrogation, repeal, substitution, and so on, or how other norms should be applied or interpreted.

In the following we account in more detail for the concepts of deontic judgements and potestative judgements.

2.2.1.1. Deontic Judgements

2.2.1.1.1. Basic deontic modalities A deontic judgement expresses the fact that a certain content is qualified by deontic modalities, such as typically obligation, prohibition and permission. Deontic concepts can be reduced to those of obligation and permission. Classically, prohibition can be defined in terms of the notion of obligation (Obl→).

---

2 Parts of this section recall and elaborate texts from (21).
Basic deontic modalities correspond to the standard deontic qualifications in deontic discourse. They are also called undirected deontic modalities, as no explicit reference is made to any subject which may be the beneficiary of the deontic qualification.

Basic deontic modalities can be further classified into ought-to-be and ought-to-do judgements: the former express deontic qualifications whose content are states of affairs without necessarily mentioning actors or actions bearing relations with such states of affairs; the latter may be interpreted as expressing deontic qualifications of explicit actions. Although in many cases ought-to-be statements can be reframed as ought-to-do statements, it is quite controversial that this can be done in general and ought-to-be statements are often made when it is not known who will have the responsibility of realising the state of affairs though it is known that somebody has this responsibility (for a survey, see (2)).

An example of normative judgement involving an undirected ought-to-be qualification is the following: “The balance of a bank account ought to be non-negative”. An example of normative judgement involving an undirected ought-to-do qualification is the following: “Everybody has the obligation to pay taxes”.

2.2.1.1.2. Weak and strong permissions

An important distinction is between weak (or negative) permission, consisting in the non-derivability of a prohibition, and strong permission, equivalent to the explicit negation of a prohibition (22). This distinction may be crucial in characterising notions such as those of authorisation and derogation (23; 2; 24). For example, consider when we subscribe to an on-line sale agreement accepting to enter our personal data on the condition that this information is only used for shipping, and other necessary purposes to communicate with us or deliver the products to us. Here, the permission to use our personal data is an exception to a general prohibition.

Despite this fact, the concept of permission is still elusive in deontic logic and has not been extensively investigated in this field as the notion of obligation. For a long time, deontic logicians mostly viewed permission as the dual of obligation: \( \text{Perm} a \equiv \neg \text{Obl} \neg a \). This view is unsatisfactory, as it hardly allows us to grasp the meaning of examples like the one previously mentioned. This is one of the reasons why the attempt to reduce permissions to duals of obligations has been criticised (see (25; 26)).

Weak (or negative) permission (22) corresponds to saying that some \( a \) is permitted if \( \neg a \) is not provable as mandatory. In other words, something is allowed by a code only when it is not prohibited by that code. At least when dealing with unconditional obligations, the notion of weak permission is trivially equivalent to the dual of obligation (27).

The concept of and strong (or positive) permission is more complicated, as it amounts to saying that some \( a \) is permitted by a code iff such a code explicitly states that \( a \) is permitted. It follows that a strong permission is not derived from the absence of a prohibition, but is explicitly formulated in a permissive norm. The complexities of this concept depend on the fact that, besides “the items that a code explicitly pronounces to be permitted, there are others that in some sense follow from the explicit ones”. The problem is hence “to clarify the inference from one to the other” (27, p. 391–2). For example, if some \( b \) logically follows from \( a \), which is strongly permitted, is \( b \) strongly permitted as well?

Comprehensive accounts of different types of permissions have been offered by (27; 24; 28).
2.2.1.3. Directed deontic judgements  
Normative judgements stating directed deontic modalities can indicate the bearers (as originally proposed by seminal works such as (29)) or the beneficiaries of the deontic qualifications specified in such judgements. Here, we focus on classifications taking into account beneficiaries only (for a comprehensive overview, cf. (2)).

We distinguish two ways in which the indication of beneficiaries can take place: either the deontic qualification holds towards specified individuals, in which case we speak of an individualised qualification, or it holds towards everybody, in which case we speak of an erga-omnes qualification. An example of normative judgement involving a directed erga-omnes ought-to-be qualification is the following: “Traffic ought to be reduced in the interest of the every Italian citizen”. An example of normative judgement involving a directed individualised ought-to-do qualification is the following: “In the interest of Mr. Jones, Ms. Smith has the obligation to pay him one thousand euros”. An example of normative judgement involving a directed erga-omnes ought-to-do qualification is the following: “In the interest of the owner everybody is forbidden to use his/her property without his/her consent”.

Directed obligative ought-to-do are also called obligative rights. Agent k has the obligative right that j does A iff it is obligatory, towards k, that j does A. An example of obligative right is “it is obligatory, towards Mary, that Tom pays 1,000 euros to John”. Another type of obligative rights are the exclusionary rights which concern the prohibition against performing certain inferences (against reasoning in certain ways), or against using certain kinds of premises for certain purposes, in the interest of a particular person. This is especially the case with anti-discrimination rules. For instance, in many legal systems employers are prohibited from adopting any decision having a negative impact on their employees on the basis of race or sex, and this prohibition, though also serving some collective purposes, is primarily aimed at promoting the interest of the employees in question.

Let us now specifically consider how we can conceptualise the difference between directed ought-to-do deontic judgements having a positive or a negative content, that is, concerning actions or omissions. Both obligations and permissions can be divided into positive and negative according to whether they concern an action or an omission. Directed negative permissions constitute what is also called privilege in the Hohfeldian language (30; 31): j has a privilege towards k, with regard to action A, iff it is permitted towards k that j omits to do A. Following again Hohfeld, we may use the less controversial expression noright to express that one does not have the obligational right that another does a certain action, that is, to denote the situation when the latter is permitted towards the former to omit that action. Therefore, we can say that k has a noright that j does A iff j is permitted, towards k, to omit A. Let us make an example both for privileges and norights. Assume for instance that Mary, a writer, has made a contract with Tom, a publisher, and has committed herself to write a novel for him. Mary’s privilege would consist in the Mary having permission towards Tom not to write the novel, a normative situation which could also be described as Tom’s noright that Mary writes the novel.

Positive and negative permissions can be merged into the concept of faculty (for instance, by saying that a woman has the faculty of wearing a miniskirt when going to work, we mean that it is permitted both to wear it and not to wear it). When, for the benefit of a person, this person is both permitted to perform and to omit an action—that is, when the action is facultative—we can say that he or she has a liberty right with regard to that action. This notion can be further developed according to the fact that others (or the government) may have, always in the interest of that person, a prohibition to prevent the facultative action, and they may even have the obligation to provide means for its
performance. This leads us to distinguish three kinds of liberty rights: a mere liberty right, a negatively protected liberty right, and a positively protected liberty right. In general we speak of a right to characterise the situation where a normative judgement is intended to benefit a particular person.

According to this notion of a right, the directed obligations of agent $j$ for the benefit of agent $k$ can be viewed as $k$’s right, namely as $k$’s obligative right towards $j$. The negation of a directed obligation is a directed permission. However, it counts as a right, namely, a permissive right, only when such negation is aimed at benefitting the author of the permitted action.

Another notion of a right is that of liability rights. That $j$ has a liability right concerning $k$’s action $A$ means that if $k$ performs the permitted action $A$ then $k$ will have to perform another action $B$ for the benefit of $j$. For example, consider a copyright regime when one is permitted to reproduce a protected work, but the author is entitled to a royalty for the reproduction of his or her work. In this case we have a normative connection between a permitted action and an obligation of the agent, to the benefit of another. However for us this kind of legal position represents a conditional, namely, a norm, rather than a normative judgement.

### 2.2.1.4. Potestative judgements

Potestative judgements concern the attribution of powers. The first level of classification proposed in (2; 21; 32) includes the categories Hohfeldian powers, enabling powers and declarative powers: the first covers any action which determines a legal effect, the second only cases when the law aims at enabling the agent to produce the effects in this way, the third the case when the effect is produced through the party’s declaration of it. In more detail, we say that $j$ has the declarative power to realise $A$ to mean that if $j$ declares $A$, then it is legally valid that $A$. For example, if $x$ has the declarative power to terminate $y$’s obligation towards $x$ to do then if $x$ declares that $y$’s obligation towards $x$ finishes, then it is legally valid that this obligation finishes.

The second Hohfeldian set includes immunities, action powers, subjections (the normative position that Hohfeld denotes as liability), and disabilities. Agent $k$ has an immunity towards $j$ with regard to the creation of position $Pos$ in the head of $k$, exactly if is not the case that $j$ has that power. An action-power consists in a generic power to produce a legal effect through an action determining it. That $k$ is in a state of subjection towards $j$, with regard to normative position $Pos$, means that $j$ has the abstract enabling-power of determining $Pos$ in the head of $k$. For instance, debtor $k$ is subject to creditor $j$ in relation to $j$’s power of freeing $k$ from $j$’s obligation. Agent $j$ has a disability towards $k$, with regard to the creation of position $Pos$ exactly if it is not the case that $j$ has the abstract enabling power of creating $Pos$ in the head of $x$.

A special kind of enabling powers, called potestative rights, can be distinguished, that is, powers which are meant to benefit the holder of the power. For example, if $y$ does not belong to anybody, then $x$ has the potestative-right to start $x$’s ownership of the animal, by capturing $y$.

### 2.2.1.2. Conclusions and Research Challenges

An important research challenge is thus the following:

**Research Challenge 2** (Legal Norms vs Legal Judgements). *Define a formal language that clearly distinguishes between legal norms and legal judgements and that covers all basic types of legal judgements mentioned in Definition 5.*
2.2.2. Norms

Norms are propositions stating normative judgements. Norms can be unconditioned, that is their judgement may not depend upon any antecedent condition (consider, for example, the norm “everyone has the right to express his or her opinion”). Usually, however, norms are conditioned. The framework proposed in (2) distinguishes conditioned norms into rules, which make a normative judgement dependent upon defeasibly sufficient conditions and factor links, which make a normative judgement dependent upon contributory conditions. However, the literature proposing norm classifications is very rich (cf. (4; 34; 2) and other options are available.

A fundamental distinction is made by some theorists, such as Ronald Dworkin and Robert Alexy, between rules and principles (for an overview, see (35; 2)). While rules apply to cases according an all-or-nothing logic, principles express legal values or fundamental rights; they “are norms which require that something be realized to the greatest extent possible given the legal and factual possibilities. Principles are optimization requirements, characterized by the fact that they can be satisfied to varying degrees, and that the appropriate degree of satisfaction depends not only on what is factually possible but also on what is legally possible.” (36, p. 47)

Rules, instead,

“are norms which are always either fulfilled or not. If a rule validly applies, then the requirement is to do exactly what it says, neither more nor less.” (36, p. 48)

While it has been disputed that this distinction makes sense from the logical point of view, it is still an interesting research issue to explore the formal role of values and principles in legal reasoning (38).

Other classifications are proposed in literature, most of them motivated by the fact that different normative judgements follow from the application of norms. However, we can also identify different mechanisms and functions for norms, which are relatively independent of the legal effects resulting from them. In particular (see (21)),

Definition 6 (Norm types). We can distinguish the following types of legal norms

initiation norms, that is, norms stating that a certain normative proposition starts to hold when the rule’s conditions are satisfied. An example is “if one causes a damage, one has to compensate it”;

termination norms, that is, norms stating that a normative proposition ceases to hold when the rule’s conditions are satisfied. An example is “if one pays a debt, the obligation terminates”;

supervenience norms, that is, norms stating that a normative proposition holds as long as the conditions the conditions are satisfied. An example is “if one is in a public office, one is forbidden to smoke”.

Other important basic taxonomies include the distinction between regulative and constitutive norms, which was initially proposed in philosophy (39; 40):

---

3We should also consider the antecedents of conditioned norms, and introduce the traditional classification between juridical fact, acts (facts relevantly determined by humans), and declarations of will or intentions (2; 33). In this way we might also characterise the notion of a source of law, by which we mean any fact that embeds normative propositions and makes them legally valid by virtue of such an embedment. Some sources of the law are events (like the issuing of a high court decision), while others are state of affairs (like the practice of a custom or a result declaration).

4For instance, in (37) it was argued that principles are nothing but rules with high degree of defeasibility.
“[R]egulative rules regulate antecedently or independently existing forms of behaviour […] But constitutive rules do not merely regulate, they create or define new forms of behaviour. The rules of football or chess, for example […] create the very possibility of playing such games.” (40, p. 33)

“A marriage ceremony, a baseball game, a trial, and a legislative action involve a variety of physical movements, states, and raw feels, but a specification of one of these events only in such terms is not so far a specification of it as a marriage ceremony, baseball game, a trial, or a legislative action. The physical events and raw feels only count as parts of such events given certain other conditions and against a background of certain kinds of institutions. Such facts as are recorded in my above group of statements I propose to call institutional facts. They are indeed facts; but their existence, unlike the existence of brute facts, presupposes the existence of certain human institutions. […] These “institutions” are systems of constitutive rules. Every institutional fact is underlain by a (system of) rule(s) of the form “X counts as Y in context C.” Our hypothesis that speaking a language is performing acts according to constitutive rules involves us in the hypothesis that the fact that a man performed a certain speech act, e.g. made a promise, is an institutional fact.” (40, pp. 51–52)

The idea of constitutive rule has been later imported in legal theory (see, e.g., (41)) and in legal logic (see, e.g., (42; 43)) to model, e.g., the concept of institutionalised power and the one of power-conferring norm.

Notice that different logical characterisations of constitutive rules may lead to see them as similar to the above mentioned initiation norms. In particular, (42) developed an analysis of the notion of institutionalised power by introducing a new conditional connective ‘⇒มงคล’. This connective expresses the counts-as connection holding in the context of an institution. In short, this approach is roughly in line with Goldman’s theory of actions generating actions (44). In this perspective, it was argued that the generation of institutional facts via constitutive rules is quite close to the idea of a causal relation—contrary to (45)’s argument—and assumes that some well-known axiom schemata, such as A ⇒มงคล A, do not hold. Another formalisation, though openly inspired by Jones and Sergot, proposed some substantial changes in the light of a different philosophical interpretation of the counts-as relation (32). Counts-as rules are meant to capture the constitutive character of institutional ontology and express institutional taxonomies. Accordingly, their function is to represent the constitutive ingredients of institutional facts, whose nature is conceptually distinct from that of the empirical facts.

2.2.2.1. Conclusions and Research Challenges

To sum up, the following research perspective needs to be explored:

**Research Challenge 3 (Types of Legal Norms).** Design a formal language that covers and accommodates all basic normative logics and functions behind norms, which cannot be formalised by simply distinguishing between different legal effects/judgements. In particular, the formal language must handle

- **rules and principles;**
- **dynamic normative effects**—distinction between initiation norms, termination norms, and supervenience norms;
• **constitutive vs regulative**—distinction between regulative and constitutive norms.
3. Temporal Dimensions of Legal Norms

3.1. Introduction

Jurists usually distinguish at least three temporal dimensions for legal provisions and/or for norms (46):

- the time when the legal provision—and the corresponding norm—is in force and/or has been enacted;
- the time when the norm can produce legal effects (when the norm is applicable and supports the derivation of legal effects);
- the time when the normative effects hold.

In (47) we have developed a logical model for formally representing these temporal dimensions of legal norms and for modelling normative dynamics. Subsequent work, which was finalised at the beginning of MIREL project, systematised our previous effort and integrated it with deontic operators (48).

The following section reports on our basic achievements and identifies research challenges for MIREL.

3.2. Temporalised Norms and Normative Systems

3.2.1. Basics

Legal knowledge and legal systems can be structured in three logical components:

- A set of facts.
- A set of rules. A rule, having the form \( a_1, \ldots, a_n \rightarrow c \), establishes a connection between a set of premises \( a_1, \ldots, a_n \) and a conclusion \( c \). In particular, for reasoning with norms, a rule provides the formal representation of a norm. Accordingly, the premises encode the conditions under which the norm is applicable, and the conclusion is the normative effect of the norm.
- A preference relation over the rules. The preference relation just gives the relative strength of rules. It is used in contexts where two rules with opposite conclusions fire simultaneously, and determines that one rule overrides the other in that particular context.

The temporal aspects of legal norms are represented by attaching a temporal parameter to the atomic components of the language, i.e., to the atomic propositions. For the logic, different temporal underlying models are possible, but we can simply assume a discrete totally ordered set of instants of time \( T = \{ t_0, t_1, t_2, \ldots \} \). Based on this we can introduce the notion of temporalised literals. Thus, if \( l \) is a plain literal and \( t \in T \), then \( l^t \) is a temporalised literals. The intuitive interpretation of \( l^t \) is that \( l \) is true (or holds) at time \( t \). We use TempLit to denote the set of temporalised literals.

---

1For the technical details, see (48)
The set DeonLit of deontic literals is obtained as follows: a deontic literal is an expression like \( \text{Obl}_l \), where its natural reading is that \( l \) is obligatory at time \( t \), or that the obligation of \( l \) is in force at time \( t \). Finally, given a time instant \( t \) and \( y \in \{ \text{pers}, \text{tran} \} \) we call the combination of \((t, y)\) duration specification, and literals labelled with a duration specification duration literals. A duration literal has the form \( l(t, y) \). The indication that \( y \in \{ \text{pers}, \text{tran} \} \) is meant to indicate whether the literal is either transient or persistent. We denote the set of duration literals DurLit. The set of literals is now composed by the set of temporalised literals and the set of deontic literals, namely \( \text{Lit} = \text{DeonLit} \cup \text{TempLit} \).

The idea behind the distinction between a transient and persistent literals is related to the fact that they can be guaranteed to hold for a single instant (transient literal) or it continues to hold until it is terminated (persistent literal).

The signature of rules is

\[
\text{Rule: } 2^{\text{Lit}} \times \text{DurLit} \tag{3.2.1}
\]

this means that a rule has the following form

\[
r : a_1^{t_1}, \ldots, a_n^{t_n} \rightarrow X^{(t, y)} \tag{3.2.2}
\]

where \( X \in \{ \text{C, Obl} \} \), specifying whether the rule is a constitutive norm or a regulative one (see Section 2.2.2), and \( y \in \{ \text{tran, pers} \} \) indicating, as stated above, whether the conclusion of the rule is either transient or persistent.

Notice that the distinction between a transient and persistent conclusions is particular relevant for prescriptive rules, since their conclusions are obligations (or, in general deontic effects), and obligations, once triggered, remain in force until they are complied with, violated, or explicitly terminated. Accordingly we can use the duration specification \((t, tran)\) to indicate that on obligation is in force at a specific time \( t \), and must be fulfilled at that time, while the duration specification \((t, pers)\) establishes that an obligation enters in force at time \( t \).

The inference mechanism proposed in (47; 48) extends that of Defeasible Logic with deontic operators, taking into account the temporal and durations specification. To assert that \( p \) holds at time \( t \) we have two ways:

1. Give an argument for \( p \) at time \( t' \);\(^2\)
2. Evaluate all counterarguments against it. Here, we have a few cases:
   a) If the duration specification of \( p \) is \((t, tran)\) \((t' = t)\), then, the counterargument must be for the same time \( t \) given that \( p \) is ensured to hold only for \( t \).
   b) If the duration specification of \( p \) is \((t', pers)\), then \( t' \) can precede \( t \) and we can ‘carry’ over the conclusion from previous times. In this case, the counterarguments we have to consider are all rules whose conclusion has a duration specification \((t'', z)\) such that \( t' \leq t'' \leq t \).
3. Rebut the counterarguments. This is the same as the corresponding step of basic Defeasible Logic, the only thing to pay attention to is that when we rebut with a stronger argument, the stronger argument should have \( t'' \) in the duration specification of the conclusion.

The general idea of the conditions outline above is that, as we have already alluded to, it is possible

\[^{2}\text{We equate arguments with rules, thus this is the same as saying that there is (defeasible) rule such that all the elements in its antecedent are provable and the conclusion is } p^{(t', y)}\]
to assert that something holds at time $t$, because it did hold at time $t'$, $t' < t$, by persistence, but there must be no reasons to terminate it. Thus new information defeats previous one.

To illustrate the intuition we just described consider Section 8.2.1.a of the Australian Telecommunications Consumers Protection Code 2012 (TCPC 2012).

A Supplier must take the following actions to enable this outcome:

(a) **Demonstrate fairness, courtesy, objectivity and efficiency:** Suppliers must demonstrate, fairness and courtesy, objectivity, and efficiency by:

   (i) Acknowledging a Complaint:

   A. immediately where the Complaint is made in person or by telephone;

   B. within 2 Working Days of receipt where the Complaint is made by email;

   ....

The normative fragment above can be represented by the following set of rules:

\[
\begin{align*}
&\text{tcpc}_1: \text{Complaint}^t, \text{inPerson}^t \Rightarrow \text{Obl} \text{Acknowledge}^{(t,\text{tran})} \\
&\text{tcpc}_2: \text{Complaint}^t \Rightarrow \text{Obl} \text{Acknowledge}^{(t,\text{pers})} \\
&\text{tcpc}_3: \text{Complaint}^t \sim \text{Obl} \neg \text{Acknowledge}^{(t+2d,\text{tran})}
\end{align*}
\]

Rule $\text{tcpc}_1$ covers the case of a complaint made in person of by phone. Given that the complaint must be acknowledged immediately, we can use the duration specification $(t,\text{tran})$, where $t$ is the time when the complaint is received. The $\text{tran}$ specification implies that the obligation to acknowledge the complain is in force only at $t$ and not acknowledging at $t$ results in a violation. For the case regulated by paragraph B, we use two rules. The first $\text{tcpc}_2$ is to initiate the obligation (at the same time $t$ when the complaint is received, while $\text{tcpc}_3$ gives the deadline by when the content of the obligation must be fulfilled. Notice that we use a defeater to terminate the obligation.

Suppose we have a complaint by email on day 10. From this we can defeasibly derive that $\text{Acknowledge}^{10}$ is obligatory from rule $\text{tcpc}_2$. By temporal persistence we have that $\text{Acknowledge}^{11}$ is obligatory as well. On day 12 the effect of rule $\text{tcpc}_3$ kicks in, and we have $\text{Acknowledge}^{12}$ is no longer obligatory.

For thorough presentations of temporal defeasible logic, its properties and application to modelling obligation with time and deadlines preliminary results were offered in (17; 49; 50).

3.2.2. From Norms to Meta-Norms

The formalism just recalled allows for reasoning about the times specified inside norms, but it is not able to capture the lifecycle of norms. To obviate this problem (47; 48) proposed to introduce meta-norms, i.e., norms supporting the derivation of *norm-concerning judgements* (see Definition 5). To do so, we consider a legal system as a time-series of its versions, where each version is obtained from previous versions by some norm changes, e.g., norms entering in the legal system, modification of existing norms, repeals of existing norms, .... This means that we can represent a legal system $\text{LS}$ as a sequence

\[
\text{LS}(t_1), \text{LS}(t_2), \ldots, \text{LS}(t_j)
\]

Rules marked with $\sim$ are called defeaters in Defeasible Logic: they are not meant to derive conclusions, but to provide reasons against the opposite.
where each $LS(t_i)$ is the snapshot of the rules (norms) in the legal system at time $t_i$. Graphically it can be represented by the picture in Figure 3.1.

As we said above, a rule is a relation between a set of premises (conditions of applicability of the rule) and a conclusion. The admissible conclusions are either literals or rules themselves; in addition the conclusions and the premises will be qualified with the time when they hold. We consider two classes of rules: meta-rules and proper rules. Meta-rules describe the inference mechanism of the institution on which norms are formalised and can be used to establish conditions for the creation and modification of other rules or norms, while proper rules correspond to norms in a normative system. In what follows we will use Rule to denote the set of rules, and MetaRules for the set of meta-rules, i.e., rules whose consequent is a rule.

A temporalised rule is either an expression $(r: \bot)^{(t,x)}$ (the void rule) or $(r: \emptyset)^{(t,x)}$ (the empty rule) or $(r: A \rightarrow^X B)^{(t,x)}$, where $r$ is a rule label, $A$ is a (possibly empty) set of temporalised literals, $X \in \{C, Obl\}$, $B$ is a duration literal, $t \in T$ and $x \in \{tran, pers\}$.

We have to consider two temporal dimensions for norms in a normative system. The first dimension is when the norm is in force in a normative system, and the second is when the norm exists in the normative system from a certain viewpoint. So far temporalised rules capture only one dimension, the time of force. To cover the other dimension we introduce the notion of temporalised rule with viewpoint. A temporalised rule with viewpoint is an expression

$$(r: A \rightarrow^X B)^{(t,x)} @ (t', y),$$

(3.2.4)

where $(r: A \rightarrow^X B)^{(t,x)}$ is a temporalised rule, $t' \in T$ and $y \in \{tran, pers\}$.

Finally, we introduce meta-rules, that is, rules where the conclusion is not a simple duration literal but a temporalised rule. Thus a meta-rule is an expression

$$(s: A \rightarrow (r: B \rightarrow^X C)^{(t', x)}) @ (t, y),$$

(3.2.5)

where $(r: B \rightarrow^X C)^{(t', x)}$ is a temporalised rule, $r \neq s$, $t \in T$ and $y \in \{tran, pers\}$. Notice that meta-rules carry only the viewpoint time (the validity time) but not the “in force” time. The intuition behind this is that meta-rules yield the conditions to modify a legal system. Thus they specify what rules (norms) are in a normative system, at what time the rules are valid, and the content of the rules. Accordingly, these rules must have an indication when they have been inserted in a
normative system, but then they are universal (i.e., apply to all instants) within a particular instance of a normative system.

Every temporalised rule is identified by its rule label and its time. Formally we can express this relationship by establishing that every rule label \( r \) is a function

\[
 r: \mathcal{T} \mapsto \text{Rule}. 
\]  

(3.2.6)

Thus a temporalised rule \( r' \) returns the value/content of the rule ‘\( r \)’ at time \( t \). This construction allows us to uniquely identify rules by their labels\(^4\), and to replace rules by their labels when rules occur inside other rules. In addition there is no risk that a rule includes its label in itself. In the same way a temporalised rule is a function from \( \mathcal{T} \) to Rule, we will understand a temporalised rule with viewpoint as a function with the following signature:

\[
 \mathcal{T} \mapsto (\mathcal{T} \mapsto \text{Rule}). 
\]  

(3.2.7)

As we have seen above a legal system \( LS \) is a sequence of versions \( LS(t_0), LS(t_1), \ldots \). The temporal dimension of viewpoint corresponds to a version while the temporal dimension temporalising a rule corresponds to the time-line inside a version. Thus the meaning of an expression \( r^{t,v} @ r_t \) is that we take the value of the temporalised rule \( r^{t,v} \) in \( LS(t) \). Accordingly, a version of \( LS \) is just a repository (set of norms) implemented as temporal functions.

Accordingly, given a rule \( r \), the expression \( r' @ t' \) gives the value of the rule (set of premises and conclusion of the rule) at time \( t \) in the repository \( t' \). The content of a void rule, e.g., \( (r: \bot)^t @ t' \) is \( \bot \), while for the empty rule the value is the empty set. This means that the void rule has a value for the combination of the temporal parameters, while for the empty rule, the content of the rule does not exist for the given temporal parameters. Another way to look at the difference between the empty rule and the void rule is to consider that a rule is a relationship between a set of premises and a conclusion. For the void rule this relationship is between the empty set of premises and the empty conclusion; thus the rule exists but it does not produce any conclusion. For the empty rule, the relationship is empty, thus there is no rule. Alternatively, we can think of the function corresponding to temporalised rules as a partial function, and the empty rule identifies instants when the rule is not defined.

For a transient fully temporalised literal \( l^{(t,x)} @ (t', tran) \) the reading is that the validity of \( l \) at \( t \) is specific to the legal system corresponding to repository associated to \( t' \), while \( l^{(t,x)} @ (t', pers) \) indicates that the validity of \( l \) at \( t \) is preserved when we move to legal systems after the legal system identified by \( t' \). An expression \( r^{(t, tran)} \) sets the value of \( r \) at time \( t \) and just at that time, while \( r^{(t, pers)} \) sets the values of \( r \) to a particular instance for all times after \( t \) (\( t \) included).

Meta-rules describe the inference mechanism of the institution on which norms are formalised and can be used to establish conditions for the creation and modification of other rules or norms, while proper rules correspond to norms in a normative system. Thus a temporalised rule \( r' \) gives the ‘content’ of the rule ‘\( r \)’ at time \( t \); in legal terms it tells us that norm \( r \) is in force at time \( t \). The expression

\[
(p^{t,p}, q^{t,q} \Rightarrow (p^{t,p} \Rightarrow \text{Obh} s^{(t_x,pers)}))^{(t_x,pers)} @ (t, tran) 
\]  

(3.2.8)

means that, for the repository at \( t \), if \( p \) is true at time \( t_p \) and \( q \) at time \( t_q \), then \( p^{t,p} \Rightarrow \text{Obh} s^{(t_x,pers)} \) is

\(^4\)We do not need to impose that the function is an injective: while each label should have only one content at any given time, we may have that different labels (rules) have the same content.
in force from time \( t \) onwards.

A legal system is thus represented by a temporalised defeasible theory, called \textit{normative theory}, i.e., a structure

\[
(F, R, R^{\text{meta}}, \prec)
\]

where \( F \) is a finite set of facts (i.e., fully temporalised literals), \( R \) is a finite set of prescriptive and constitutive rules, \( R^{\text{meta}} \) is a finite set of meta rules, and \( \prec \), the superiority relation over rules is formally defined as \( T \rightarrow (T \rightarrow \text{Rule} \times \text{Rule}) \) accounting that we can have different instances of the superiority relation depending on the legal systems (external time) and the time when the rules involved in the superiority are evaluated\(^5\).

In the current logic a conclusion has the following form: \(+\partial t \rightarrow t' p\), meaning that the conclusion that \( p \) holds at time \( t \) is derivable at time \( t' \) using the information included in the version of the legal system at time \( t' \).

The inference mechanism with meta-rules is essentially an extension of that of Temporal Defeasible Logic, but it involves more steps. Rules are no longer just given, but they can be derived from meta-rules. Thus to prove \(+\partial t \rightarrow t' p\) the first thing to do is to see if it is possible to derive a rule \( r \) having \( p \) as its head. But we have to derive such rule at the appropriate time. Here, we want to remember that a rule is a function from time (validity time or version of a legal system) to the content of the rule (relationship between a set of premises and a conclusion). The basic intuition is that a rule corresponds to a norm, and there could be several modifications of a norm, thus deriving a rule means to derive one of such modifications.

Meta-rules (or more generally a set of meta-rules) can be used to encode a modification of a norm\(^6\). In short, one rule \( r \) can be modified if another version of \( r \) is derived using metal-rules, it is abrogated when \( r \) is derived as a void rule, it is annulled when is made empty (see (47)).

In general it is possible to have multiple (conflicting) modifications of a norm. Accordingly, to derive a rule, we have to check that there are no conflicting modifications\(^6\) or the conflicting modifications are weaker than the current modification. The final consideration is that in this case we have two temporal dimensions, and the persistence applies to both. Thus we can have persistence inside a legal system, thus we can conclude \(+\partial t' \rightarrow t'' p\) from \(+\partial t \rightarrow t' p\), where \( t < t'' \) as well as persistence over versions, thus \(+\partial t \rightarrow t'' p\) from \(+\partial t \rightarrow t' p\), where \( t' < t'' \).

3.3. Conclusions and Research Challenges

The research so far proposed is able to capture some basic aspects of time in the law. In addition, it can offer a framework for modelling specific types of legal modification and dynamics, including derogations, substitutions, temporal modifications, annulments, and abrogations.

The current versions of the formalism need to improved and extended for the following reasons:

- the proposed logics do not directly capture the law of inertia, i.e., the fact that effects that persist in time return to last once the blocking events no longer apply; this is important to

\(^5\)For instance, if we have \( s \prec 2007 \) \text{Monday} and \( r \prec 2007 \) \text{Tuesday}, it means that, according to the regulation in force in 2007, on Monday rule \( s \) is stronger than rule \( r \), but on Tuesday \( r \) is stronger than \( s \).

\(^6\)Two meta-rules are conflicting, when the two meta-rules have the same rule as their head, but with a different content.
model in the law a phenomenon called revival of norms (46);

• not all legal modifications are currently modelled;
• the current model offers a uniform and rather ad hoc treatment of modifications, while some of them are textual and affect legal provisions (e.g., substitutions), or affect norms through the textual modifications (temporal modifications), while others are mainly focused on the norms resulting from provisions.

Hence, the following is a research challenge for future work in MIREL:

**Research Challenge 4 (Temporal Dimensions of the Law).** *Design a language and a logic able to*

- *cover different temporal mechanisms in the law;*
- *model all types of legal dynamics;*
- *distinguish between modifications affecting legal provisions and legal norms.*
4. The Content of Legal Norms: Open Texture and Interpretation

4.1. Introduction

Legal norms can be viewed as plans which aim at achieving the social goals that the members of a society share (51; 52). However, legal norms are often uncertain: the concepts used to describe them are not always precise and the purpose of the norm may be differently perceived (53; 54). Legislators try to specify all the circumstances which a norm applies to and all the exceptional contexts where it does not apply, but ordinary and legal languages are inherently general and abstract, vague, and open-textured, meaning with this last concept that it is not possible to anticipate all potential occurrences falling within the application scope of any legal norm (55; 13): in other words, there persists the ineliminable potential that a definition of an empirical concept bounded in all now-foreseeable dimensions can break down in the face of unforeseen and unforeseeable events.

As well known in the planning community of AI, universal plans rarely are a practicable strategy. An agent should rather produce a partial plan and revise it when part of it becomes unfeasible. In the same way as replanning allows an agent to revise its plans while keeping fixed its original goals, law has a mechanism, called interpretation, to make legal systems adaptive and to allow legal norms to fit after their creation to the unforeseen situations in order to achieve the social goal they have been planned for. After all, not only the world changes, giving rise to circumstances unexpected to the legislator who introduced the norm, but even concepts can change with respect to the one constructed by the law to describe the applicability conditions of norms (see, e.g., all the problems concerning the application of existing laws to privacy, intellectual property or technological innovations in healthcare). This adaptation can be made only at the moment of evaluating whether a given behaviour in a particular situation should be considered as a violation, i.e., by judges in courts.

In what follows, we briefly report on two research lines and methods for handling the open-textured content of norms in the light of the role played in legal systems by normative goals.

4.1.1. Qualitative Methods: Normative Goals and Interpretation as Semantic Revision

Courts interpret the law and deal with penumbral cases by further developing the content of legal norms: courts act in such a way as to expand or restrict the core of determinate meaning of norms taking into account their goals/purposes (55, chap. 7). Herbert Hart suggested that, in those cases, courts act as surrogate legislatures by filling legal gaps. Indeed, this view can be reconstructed by arguing that legal concepts can be holistically and inferentially characterised by arbitrarily large and connected theories of semantic rules, and so, when we expand or restrict the scope of legal concepts we are doing nothing but revising or contracting those theories (56). This analysis also sheds light on the relation between the legal and the ordinary understanding (if any) of a given concept: in the case this takes place, we should compare and aggregate both corresponding theories, the one corresponding to the ordinary reading and the one corresponding to the legal reading.

The advantages of this approach, which was proposed in (51; 52; 56) and which we recall in this
chapter, it allows us to make these interpretive arguments more transparent.

According to (51; 52; 56), the ontology of legal concepts in legal norms is built via semantic rules having the form \( r : a_1, \ldots, a_n \Rightarrow_c b \). For example, a bicycle is considered as a vehicle by the following semantic rule:

\[ r_0 : \text{Bike}(x) \Rightarrow_c \text{Vehicle}(x). \]

This rule, if instantiated by any bicycle \( a \), says that \( a \) is a vehicle.

Semantic rules have a defeasible character, for example, a bicycle for children cannot be considered as a vehicle:

\[ r_1 : \text{Bike}(x), \text{ForChildren}(x) \sim_c \neg \text{Vehicle}(x) \]

\[ r_0 > r_1 \]

In general, note that in legal systems semantic rules may either specify conceptual links between “brute” facts or acts (i.e., non-institutional facts or acts whose status is independent of the existence of any institutional provision; example: being over 18 years) and types of institutional facts or acts (e.g., being adult), or rather specify conceptual links where institutional facts or acts (e.g., a contract made by person \( j \) in the name of person \( k \)) and other institutional facts or acts (e.g., a contract made by \( k \)). This view basically implies that the consequents of semantic rules always correspond to institutional facts or acts. Moreover, there are two sources of semantic rules, explicit norms like the one defining what means to be adult, but also the usual meaning of the terms, as they appear in a law according to the ordinary meaning and intention of the lawmaker, e.g., ‘Good pater familiae’ or ‘Due diligence’.

If the set of legal norms is kept to be fixed, any judge during the interpretation process can argue about their applicability conditions but cannot either add new norms nor cancel them. Only legislators have the power to change legal norms. Legal norms are for example (see Chapter 3):

\[ r_2 : \text{Vehicle}(x), \text{Park}(y) \Rightarrow_{\text{Old}} \neg \text{Enter}(x, y) \]

This norm reads as follows: if \( x \) is a vehicle and \( y \) is a park, then it is (defeasibly) forbidden for any \( x \) to enter \( y \).

For the sake of simplicity, we assume that legal norms only impose duties and prohibitions, and state permissions.

Finally, as usually assumed in legal theory (19; 57), we can assign goals or values to legal norms. In the social delegation cycle (58) norms are planned starting from goals shared by the community of agents. However, such goals play also another role: they pose the limits within which the interpretation process of the judicial systems must stay when interpreting norms.

Note that the goal alone is not sufficient to specify a norm, since there could be many ways to achieve that goal and some guidance should be given to the citizens. Thus, the norm works like a partial plan the legislator set up in advance. The judicial system is left with the task of dynamically adapt the applicability of the regulative norm by revising the semantic rules referring to its applicability conditions, in order to fulfil the goal of the norm also under unforeseen circumstances.

---

1 In (51; 52; 56), we argued that semantic rules are in fact constitutive norms (see Section 2.2.2) to highlight the fact that legal concepts are constituted by legal systems. However, this assumption, though robust, is not needed, and so we generically speak here of semantic rules.
We define a set $\text{Goal}$ of goals and a function $G$ which maps legal norms into elements of $\text{Goal}$. For example, if $G(r_2) = \text{road\_safety}$, this means that the goal of the norm prohibiting to enter into parks is to promote road safety. The idea is quite standard in legal theory (19; 57; 59) and has been already investigated in AI$\&$Law, even though most works were mainly devoted to case-based reasoning and modelling case-law (60). Note that goals are considered as directly specified by the legal norms themselves. In general, the task to determine what goals are supposed to be promoted by norms is usually accomplished by judges by developing suitable arguments during the trial.

As largely acknowledged in legal theory, when it is possible to establish the relative weight of normative goals, this can be used both to determine the relative strength of any legal norm in case of conflicts with other norms and to interpret any legal norm when it is not clear whether this norm can be applied to a given concrete case (19). As regards the first issue—solving conflicts by referring to normative goals—it seems natural then to define a partial order $\succ$ over $\text{Goal}$ to capture cases where any goal $g$ is more important than any other goal $g'$. If $g \succ g'$ then $g$ is more important than $g'$, otherwise they have equal importance. Hence, $\succ$ may be used to solve conflicts between legal norms. Consider the following norms:

$$r_3 : \text{HighWay}(x), \neg\text{Authorized\_Area}(x) \Rightarrow \text{Obl}\neg\text{Stop}(x)$$
$$r'_3 : \text{HighWay}(x), \neg\text{Authorized\_Area}(x), \text{Crash}(y) \Rightarrow \text{Obl}\text{Stop}(x)$$

Norm $r_3$ states that it is forbidden for drivers to stop in highways except in authorized areas; norm $r'_3$ says that drivers have to stop when they are responsible for serious car crashes in highways. Suppose that the legal system does not explicitly state what norm should prevail here. If so, resorting to normative goals can help. In fact, we may assume that the goal of $r_3$ is to promote road safety, while the one of $r'_3$ is to protect life when it is in serious and imminent danger. Since the latter goal should be more important than the former one, $r'_3$ will have to prevail over $r_3$.

In the remainder of this section, let us informally recall the procedures for revising theories of semantic rules that support the restriction or expansions of the applicability conditions of norms. We will use the following running example.

**Example 1.** Suppose Mary enters a park with her bike, thus apparently violating rule $r_2$ above about vehicles’ circulation. Police stops her when she is still on her bike in the park and fines her. Mary thinks this is unreasonable and sues the municipality because she thinks that here the category “vehicle” should not cover bikes.

4.1.1.1. Restricting the Applicability of Legal Norms

In a first case, the set $T$ of semantic rules characterising the concept of vehicle allows us to derive that any bike $a$ is indeed a vehicle:

$$T = \{r_0 : \text{Bike}(x) \Rightarrow \text{Vehicle}(x),$$
$$r_4 : \text{2\_wheels}(x), \text{Transport}(x), \neg\text{Engine}(x) \Rightarrow \text{Bike}(x)\}$$

If $T$ is the case, the judge could argue that Mary should be fined, as $r_2$ clearly applies to her. But suppose that the goal/value of $r_2$ is to reduce pollution. In court, the judge has to establish if Mary violated $r_2$ or not. The judge can show that, if Mary’s case fulfils the applicability conditions

---

2Let us use bold type expressions to denote goals or values.
of \( r_2 \) (Mary’s bike is a vehicle) then a goal which is incompatible with the goal assigned to \( r_2 \) would be promoted. For example, prohibiting to circulate with bikes in parks would encourage people to get around parks by car and then walk. This would be against the goal of \( r_2 \) and so the judge has good reasons to exclude that bikes are vehicles when \( r_2 \) should be applied. Accordingly, when arguing in this way, the judge may interpret \( r_2 \) by reducing its applicability conditions as far as Mary’s case is concerned, and so by contracting \( T \) in order to obtain in \( T \) that Mary’s bike is not a vehicle in the context of the current situation. Reducing the applicability of \( r_2 \) may amount to removing \( r_0 \) from \( T \) or by adding an exception to it, which overrides this rule and blocks the derivation of \( \text{Vehicle}(x) \) in this theory.

4.1.1.2. Expanding the Applicability of Legal Norms

Alternatively, the characterisation of the concept of vehicle could exclude that bikes are vehicles and the goal of \( r_2 \) could be the safety of people walking in the park:

\[
T' = \{ r_4 : \text{2\_wheels}(x), \text{Transport}(x), \neg\text{Engine}(x) \Rightarrow_c \text{Bike}(x), \\
r_5 : \text{Bike}(x) \Rightarrow_c \neg\text{Vehicle}(x), \\
r_6 : \text{Transport}(x) \sim_c \neg\text{Vehicle}(x) \}
\]

where \( r_5 \) overrides \( r_6 \), which states that, if we know that something has purpose of transport, then we have reasons against arguing that it is not a vehicle (i.e., reasons to block other rules which would lead to exclude that this something is a vehicle). However, in \( T' \) \( r_6 \) is weaker than \( r_5 \), and so, if we have a bike, we conclude by \( r_5 \) that we do not have a vehicle.

Now, suppose the judge has to settle Mary’s case starting from \( T' \). Again, the goal of legal norms such as \( r_2 \) may be decisive. The judge could argue that Mary should not be fined, as \( r_2 \) clearly does not apply. But suppose that, since \( r_2 \) is not fulfilled, this would be against the goal of \( r_2 \), which is now pedestrians’ safety. In this case, the judge has rather good reasons to consider bikes as vehicles when \( r_2 \) is concerned. Hence, the judge may interpret \( r_2 \) by broadening its applicability conditions as far as Mary’s case is concerned, and so by revising \( T' \) in such a way as Mary’s bike is a vehicle. Broadening the applicability conditions of \( r_2 \) may amount to removing \( r_5 \) from \( T' \), or by adding an exception to it, which overrides this rule and blocks the derivation of \( \text{Vehicle}(x) \) in this theory.

4.1.2. Quantitative Methods: Normative Goals and Interpretation as Fuzzy Reasoning

An alternative approach to model the interpretation of open-textured norms is by taking graded categories into account. A technical option is to use fuzzy logic: indeed, this logic is a suitable tool to capture the imprecision related to legal categories. More precisely, a category may be represented as a fuzzy set: the membership of an element to a category is a graded concept.

In addition to taking graded categories into account, we recall again that a norm is always associated with a goal (or set of goals). The idea is then to capture the fact that, when a legislator writes a norm, (s)he has in mind a state of affairs to be reached thanks to the compliance to that norm. With that in mind, the degree to which a concept in the rule belongs to a category would also depend on the goal associated with the norm.
Consider Italian Legislative Act n. 40/2004 (on Medically Assisted Reproduction). Before the declaration of unconstitutionality ruled by the Constitutional Court (opinion n. 96/2015), the statute included section 4, par. 1: “The recourse to medically assisted reproduction techniques is allowed only [...] in the cases of sterility or infertility [...]”. Sterility, as a gradual concept, offers a good example: the definition of its membership function may depend on the purpose of the norm. For instance, if the purpose of Legislative Act 40/2004 is to avoid abuses like character selection (“I want a boy, not a girl”) or other eugenic manipulations, which is probably the correct historical interpretation of the act, given the public debates in Italy at the time that act was passed, then the definition of *sterile* will have to be rather strict. For instance, the membership might be defined as

\[
\mu_{sterile}(x) = 1 - \frac{k}{n(x)},
\]

(4.1.1)

where \(0 < k \leq 1\) a constant and \(n(x)\) is the number of ovulations after which repeated attempts at obtaining pregnancy succeed for couple \(x\), independently of whatever happens next. With \(k = 1\), this would yield zero if the woman gets pregnant after the first ovulation, 0.5 after the second ovulation, 0.75 after the third, etc. If one considers that an embryo is a human being since its conception, that’s a reasonable definition. If one considers, as Italian laws on abortion implicitly do, that an embryo “becomes” human, as it were, after a certain number of weeks of pregnancy, than one could modify the above definition by defining the “success” of an attempt as when the woman gets pregnant and she does not have a spontaneous abortion before her embryo becomes human.

If, at the other extreme, the purpose is to maximise the chances of propagation of the couple’s genes, then the definition will have to take into account the capability of the offspring to reach maturity and beget offspring at their turn. According to such a definition, a couple with a severe genetic anomaly like thalassemia major would have a very high membership in the fuzzy set of sterile couples (perhaps even a full membership if the probability of having an embryo not affected by the disease is zero). Couples with other, less severe, genetic anomalies might have a sterility degree comprised between 0 and 1, whereas a couple begetting only perfectly healthy and “functional” children would have a sterility degree of zero.

Purpose of the discussion is to see whether this legal provision at stake can be interpreted so that non-sterile or fertile couples, in which one or both spouses are immune carriers of a serious genetic anomaly, could access those techniques. These couples are able to conceive and bear a child, though the probability that the baby will contract the disease is high. These diseases are normally severely disabling, provoke physical dysfunctions, often prevent the full psychological development of the baby, and can cause premature death. The mentioned medical techniques can detect the illness in advance and consequently let the parents take aware decisions about the pregnancy.

One might come up with other definitions reflecting other, perhaps less extreme, possible purposes of the norm, but this should be enough to convince the reader of the fact that (i) vague concepts like “sterile” can be understood as graded (= fuzzy) concepts (ii) whose definition may depend on the purpose of the norm.

Now, putting the example aside, we turn to describe how legal norms are evaluated under the hypothesis of graded categories.

Since the category of an item in the left-hand-side of a rule may be vague or imprecise, the degrees of truth of such an item with respect to the actual (known, believed) situation may be partial. This implies that a rule can be partially activated, i.e., the state of affairs to be reached thanks to the
compliance to that rule can be uncertain.

Let us consider the following rule $r: b_1, \ldots, b_n \Rightarrow_{\text{Obl}} l$, and let $c_1, \ldots, c_n$ be the categories of $b_1, \ldots, b_n$ respectively. Let $\alpha_{i,g}$ be the degree of truth of the proposition "$b_i$ belongs to category $c_i$ if we consider that the goal (purpose) of the norm is $g$". The degree of activation of a rule $r$ with respect to purpose $g$ may be defined as:

$$\text{Deg}(r, g) = \min_{i=1,\ldots,n} \alpha_{i,g}.$$ 

The state of affairs which will be reached thanks to the compliance of $r$ will be associated with the truth degree of $\text{Deg}(r, g)$ — this is also the degree associated to $l$ after the activation of $r$.

### 4.2. Formal Intuitions on Legal Interpretation

The discussion in Sections 4.1.1 and 4.1.2 was focused on the interpretation of open-textured norms and the role of legal goals. Let us now identify some general issues concerning the formalisation of legal interpretation.

Legal interpretation\(^3\) is a complex process that may be based on several methods and reasoning patterns. In particular, the legal doctrine and judicial practice distinguish among a number of canons for interpreting legal provisions (such as statutes), i.e., different rules that are employed in legal systems as patterns for constructing arguments aimed at justifying certain interpretations, while attacking other interpretations. (13), summarising the outcomes of a vast study on (statutory) interpretation, involving scholars from many different legal systems, distinguishes eleven types of arguments. A different list of interpretive arguments was developed by (12) and identifies fourteen types of arguments. (13)'s classification includes:

- **Arguments from ordinary meaning** express the principle that if a statutory provision can be interpreted according to the meaning a native speaker of a given language would ascribe to it, it should be interpreted in this way, unless there is a reason for a different interpretation.

- **Arguments from technical meaning** express the principle that if a statutory provision concerns a special activity that has a technical language, it ought to be interpreted in the appropriate technical sense, as opposed to its ordinary meaning.

- **Arguments from contextual harmonization** express the principle that if the statutory provision belongs to a larger scheme in a statute or set of statutes, it should be interpreted in light of the whole statute it is part of, or in light of other statutes it is related to.

- **Arguments from precedent** express the principle that if a statutory provision has a previous judicial interpretation, it should be interpreted in conformity with it. Where there is a hierarchy of courts, this principle needs to be applied in such a way to imply that the lower court must conform to the judgment of higher one.

- **Arguments from analogy** express the principle that if a statutory provision is similar to provisions of other statutes, then it should be interpreted to preserve the similarity of meaning, even if this requires a departure from ordinary meaning.

- **Arguments from a legal concept** express the principle that if the general legal concept has been previously recognized and doctrinally elaborated in law, it should be interpreted in such a

\(^3\)This section reports on research initiated in (20) and developed in MIREL by (61).
way as to maintain a consistent use of the concept through the system as a whole.

**Arguments from general principles** express the principle that whenever general principles, including principles of law, are applicable to the statutory provision, one should favour the interpretation of that is most in conformity with these general legal principles.

**Arguments from history** express the principle that if the statute has come to be interpreted over a period of time in accord with the historically evolved understanding of a particular point, its application to a case should be interpreted in line with this historically evolved understanding.

**Arguments from purpose** express the principle that if a purpose can be ascribed to a statutory provision, or even to the whole statute, the provision should be interpreted as applied to a particular case in a way compatible with this purpose.

**Arguments from substantive reasons** express the principle that if there is some goal that can be considered to be fundamentally important to the legal order, and if the goal can be promoted by one rather than another interpretation of the statutory provision, then the provision should be interpreted in accord with the goal.

**Arguments from intention** express the principle that if a legislative intention concerning a statutory provision can be identified, the provision should be interpreted in line with that intention.

Recall that Definition 3 in Chapter 2 states that legal interpretation is performed through interpretive canons, which are ways supporting a certain meaning ascription to a piece of legal text: each canon maps a text into a meaning.

(62; 20) argued that any interpretive canon for legal provisions can be formalised as follows: if provision \( n \) occurs in document \( D \), \( n \) has a setting of \( S \), and \( n \) would fit this setting of \( S \) by having interpretation \( a \), then, \( n \) ought to be interpreted as \( a \). For instance, the contextual-harmonization canon has the following structure: if provision Section 1 of Privacy Act (abbreviated as \( n \)), stating that

“It is a defence to the prohibition of collecting personal medical information, if an entity immediately destroys the illegally collected personal medical information before making any use of the personal medical information”

occurs in document \( D = \text{Privacy Act} \), \( n \) has a setting of contextual harmonization with respect to the data protection regulation in force, and \( n \) would fit this setting of contextual harmonization by having interpretation

\( a = \) “It is a defence to the prohibition of collecting personal medical information, if an entity immediately destroys, using one of the methods recommended by the National Institute of Standards and Technology (NIST) in their Guidelines for Media Sanitation, the illegally collected personal medical information before making any use of the personal medical information”

then \( n \) ought to be interpreted as \( a \).

As proposed in (20) the following intuitions pave the way for any robust formal model of legal interpretation.

**Intuition 1** (Reasoning and canons). *Legal interpretation canons can be represented by defeasible rules, where*

- antecedent conditions of interpretation rules can be of any type (assertions, obligations, etc.), including the fact that another canon is refuted or that another legal provision ought to be interpreted in a certain way;
• the conclusion of interpretation rules is an interpretive act leading to an interpretation of a certain provision \( n \) and thus to a sentence which expresses the result of such an interpretation and paraphrases \( n \) (63). If \( n \) and \( n' \) are legal provisions, the following is an example of interpretation rule regarding \( n' \):

\[
\text{IF} \quad \begin{align*}
\text{Guidelines for Media Sanitation ought to be interpreted} \\
\text{literally as } b, \quad \text{AND} \\
\text{\( n \) is related with the Guidelines for Media Sanitation}
\end{align*} \\
\text{THEN} \\
\text{\( n \) is interpreted by contextual harmonization as } a. 
\]

**Definition 7** (Legal interpretation). In legal interpretation each interpretive canon maps the interpreted text into a sentence paraphrasing \( a \).

Notice that Intuition 1 distinguishes the interpretive act from the result of the interpretation: see Definition 4 in Chapter 2.

Since different competing canons can be employed, different conflicting rules can be accordingly applied for interpreting statutes. Interpretation rules are thus defeasible. As argued in (62; 20; 61), some priority criteria should be applied to interpretation rules (64). Such criteria impose preference relations over conflicting interpretive acts and outcomes. In other words, to address interpretive conflicts, we need to assume that one of the conflicting arguments is stronger than its competitors. Some legal traditions provide indeed general criteria for addressing conflicts of arguments on the basis of their priorities: for instance, several continental legal systems explicitly state that literal interpretation ought to be preferred, or that an argument concerning constitutional values ought to prevail over a historical argument (e.g., an argument based on the intent of the historical legislator).

**Intuition 2** (Preferences over interpretations). A standard priority relation (65) over interpretation rules can be introduced to handle and solve conflicts between different interpretation rules. Suppose that

\[
b = \text{“It is a defence to the prohibition of collecting personal medical information, if an entity immediately cleans the files encoding the illegally collected personal medical information before making any use of the personal medical information”}.
\]

Consider then the following example and assume that \( b \) implies \( \neg a \):

**Rule 1**

\[
\text{IF} \quad \begin{align*}
\text{Guidelines for Media Sanitation ought to be interpreted} \\
\text{literally as } b, \quad \text{AND} \\
\text{\( n \) is related with the Guidelines for Media Sanitation}
\end{align*} \\
\text{THEN} \\
\text{\( n \) is interpreted by contextual harmonization as } a.
\]
Rule2
IF
   destroying a file = cleaning a file
THEN
   n is interpreted literally as b.

Here, we can handle the conflict by stating that Rule1 > Rule2 (or vice versa).

Following some doctrinal and judicial practice, (62) argued that interpretive canons are defeasible rules licensing deontic interpretive claims, namely, the claim that a certain expression in a statute ought, ought not, may or may not be interpreted in a certain way. For example, art. 12 in the general provisions of the Italian civil code states that the literal interpretation of statutes ought to be preferred and this option is nothing but an interpretive prescription. Here, we follow this intuition with some adjustments.

Intuition 3 (Obligatory interpretations). An interpretation can be admissible or obligatory. In the case of A-interpretations, for instance, an interpretive act of n (A-interpretation of n) is admissible, if it is provable using a defeasible interpretation rule; it is obligatory, if this interpretation of n is the only one admissible. Similarly for O-interpretations. Indeed, consider the general provisions of the Italian civil code, which state at art. 12 that literal interpretation I_lit ought to be preferred: this would support that such interpretation is obligatory, unless another interpretation prevails. We have two options here:

- other conflicting interpretations can be derived, thus requiring to check if literal interpretation overrides the other options; if it does not, then the interpretation at stake is not even admissible;
- other non-conflicting interpretations can be provable; if they are, the interpretation at stake is only admissible, otherwise, it is obligatory.

On the basis of the above intuitions, two options are available for modelling reasoning about interpretations: reasoning about the interpretation of abstract, non-analysed provisions and of structured provisions.

Intuition 4 (Abstract or structured provisions). A provision n is abstract if it is taken in its sentential entirety for interpretive purposes, i.e., as a non-analysed sentence without considering its internal (logical) structure. This amounts to interpreting n by ascribing to n, intended as an abstract provision, a sentential meaning that can be expressed by another sentence paraphrasing this provision as a whole.

Rather, a provision n’ is logically structured if it corresponds to a linguistic sentence having the structure of a rule $a_1, \ldots, a_n \Rightarrow b$: this means that n’ is semi-interpreted provision, since expressing the logical structure of n’ requires an interpretive effort on the original textual version of n’. This second option amounts to interpreting n’ by considering the components $a_1, \ldots, a_n, b$ of n’ and ascribing to some of them a meaning as already explained above.

In other words, given a rule $r : a_1, \ldots, a_n \Rightarrow b$, an interpretation maps the sequence $x = \langle a_1, \ldots, a_n, b \rangle$ of literals in $r$ onto another sequence $y$ of literals that can be identical (literal interpretation), partially different or completely different from $x$. Hence, an interpretation $I_i$ is meant to make the original version of rule $r$ unusable and the new one—where the literals are
changed according to \( y \)—usable to derive a legal conclusion. For instance, if \( r : a_1, a_2 \Rightarrow b \) and the interpretation \( l_i \) returns \( y = \langle a_1, a_2', b' \rangle \), the interpreted version of \( r \) according to \( l_i \) is \( r : a_1', a_2' \Rightarrow b' \).

The interpretation of an abstract provision has been already illustrated above: interpretation by contextual harmonization of Section 1 of Privacy Act maps \( n \) into \( a \). Let us now represent Section 1 as a logically structured rule like:

\[
\text{Norm } n
\]
\[
\text{IF}
\]
\[
\text{An entity illegally collects personal medical information, AND}
\]
\[
\text{An entity destroys this information before making any use of it}
\]
\[
\text{THEN}
\]
\[
\text{This is a defence to the prohibition of collecting personal medical information.}
\]

Interpretation of \( n \) by contextual harmonization means mapping the antecedent “An entity destroys this information before making any use of it” into “An entity destroys, using one of the methods recommended by the National Institute of Standards and Technology (NIST) in their Guidelines for Media Sanitation, this information before making any use of it”. The new version of Norm \( n \) paraphrasing it after the proposed interpretation is thus the following:

\[
\text{Norm } n'
\]
\[
\text{IF}
\]
\[
\text{An entity illegally collects personal medical information, AND}
\]
\[
\text{An entity destroys this information using one of the methods recommended by the National Institute of Standards and Technology in their Guidelines for Media Sanitation, before making any use of it}
\]
\[
\text{THEN}
\]
\[
\text{This is a defence to the prohibition of collecting personal medical information.}
\]

4.3. Conclusions and Research Challenges

While existing works have already contributed to several issues, the above sections indicate the following research challenges for MIREL:

**Research Challenge 5** (Interpreting Legal Provision: Goals, Qualitative vs Quantitative Methods). *Define formal models for semantic holism, explore qualitative and quantitative methods for modelling legal interpretation where values and goals are decisive, and clearly identify pros and cons for all approaches.*

**Research Challenge 6** (Integrating Interpretive Models). *Define formal methods that integrate qualitative or quantitative models of interpretation with argumentation systems about interpretive canons.*
5. Tools for Legal Reasoning: Formal Methods

This first year of research has also focused on developing general formal methods for modelling several aspects of legal knowledge and reasoning. We worked in particular on

- **Legal compliance** (see Definition 1, entry ‘Legal procedures’) — Possible-world semantics for compliance (66; 67): this contribution is significant for future research on Task 1.3 (WP1) and we also expect that we can offer a theoretical achievement for partners working on Task 3.2 (WP3);
- **Representing legal texts** (see Definition 1, entry ‘Rule semantics’) — Quantified deontic logics (68): this is expected to contribute to Tasks 1.2 and 1.3 (WP1) and to give useful tools for partners working on NLP techniques in deontics (WP2).

5.1. Possible-World Semantics for Normative Systems and Compliance

Most of the work in deontic logic has focused on the study of the concepts of obligation, permission, prohibition and related notions, but little attention has been dedicated on how these prescriptions are generated within a normative system. The general idea of norms is that they describe conditions under which some behaviours are deemed as ‘legal’. In the simplest case, a behaviour can be described by an obligation (or a prohibition, or a permission), but often norms additionally specify what are the consequences of not complying with them, and what sanctions follow from violations and whether such sanctions compensate for the violations.

To address the above issues, (69) presented a Gentzen style sequent system to describe a non classical operator (⊗) which models chains of obligations and compensatory obligations. The interpretation of a chain like $a \otimes b \otimes c$ is that $a$ is obligatory, but if it is violated (i.e., ¬$a$ holds), then $b$ is the new obligation (and $b$ compensates for the violation of $a$); again, if the obligation of $b$ is violated as well, then $c$ is obligatory (and so on).

As we argued in (69; 70), the logic of ⊗ offers a proof-theoretic approach to normative reasoning (and in particular, CTD reasoning), which, as done by (71; 72) in the context of Input/Output Logic, follows the principle “no logic of norms without attention to the normative systems in which they occur” (73). This idea draws inspiration from the pioneering works, e.g., in (74), and focuses on the fact that normative conclusions derive from of norms as interplaying together in normative systems. Indeed, it is essential in this perspective to distinguish prescriptive and permissive norms from obligations and permissions (75; 76): the latter ones are merely the effects of the application of norms.

While Input/Output approach mainly works by imposing some constraints on the manipulation of conditional norms, the ⊗-logic uses ⊗-chains to express the logical structures (norms) that generate actual obligations and permissions. In (77), we proposed a model-theoretic semantics (called sequence semantics) for the ⊗-logic, that addresses the problem identified in (78) that

---

1A normative system can be understood as a, possibly hierarchically structured, set of norms and mechanisms that systematically interplay for deriving deontic prescriptions in force in a given situation.
affects most of the existing approaches for the representation of norms, in particular compensatory obligations, using ‘standard’ possible world semantics. A compensatory obligation is a sub-class of a contrary-to-duty obligation, where the violation of the primary obligation is compensated by the fulfilment of the secondary obligation. Compensatory obligations can be modelled by $\otimes$-chains. As we have already discussed, an expression like $a \otimes b$ means that $a$ is obligatory, but its violation is compensated by $b$ or, in other terms, it is obligatory to do $b$ to compensate the violation of the obligation of $a$. Thus, a situation where $a$ does not hold (or $\neg a$ holds) and $b$ holds is still deemed as a ‘legal’ situation. Accordingly, when we use a ‘standard’ possible world semantics, there is a deontically accessible world where $\neg a$ holds, but this implies, according to the usual evaluation conditions for permission (something is permitted, if there is a deontically accessible world where it holds), that $\neg a$ is permitted. However, we have the norm modelling the compensatory obligation that states that $a$ is obligatory (and if it were not, then there would be no need for $b$ to compensate for such a violation since, there would be no violation of the obligation of $a$ to begin with). The sequence semantics solves this problem by establishing that to have an obligation, we must have a norm generating the obligation itself (where a norm is represented by an $\otimes$-chain), and not simply that something is obligatory because it holds in all the deontically accessible worlds.

Our contribution in (67) has completed the picture in three points.

- We extended sequence semantics and split the treatment of $\otimes$-chains and obligations; the intuition was that chains are the generators of obligations and permissions, we hence semantically separated structures interpreting norms from those interpreting obligations and permissions (see the distinction between norms and deontic judgements in Chapter 2).
- We added $\oplus$-sequences to express ordering among explicit permissions (70); as for $\otimes$, given the chain $a \oplus b$, we could proceed through the $\oplus$-chain to obtain the derivation of $\text{Perm} b$. However, permissions cannot be violated. Consequently, it does not make sense to obtain $\text{Perm} b$ from $a \oplus b$ and $\neg a$. Here, the reason to proceed in the chain is rather that the normative system allows us to prove $\text{Obl} \neg a$;
- We systematically studied several options for the axiomatisation of $\otimes$ and $\oplus$.

### 5.1.1. Language

The language consists of a countable set of atomic formulae. Well-formed-formulae are then defined using the typical Boolean connectives, the $n$-ary connectives $\otimes$ and $\oplus$, and the modal (deontic) operators $\text{Obl}$ for obligation and $\text{Perm}$ for permission. The intended reading of $\otimes$ is that it encodes a sequence of obligations where each obligation is meant to compensate the violation of the previous obligation. The intuition behind $\oplus$ is instead meant to model ordered lists of permissions, i.e., a preference order among different permissions (70).

Let $L$ be a language consisting of a countable set of propositional letters $\text{Prop} = \{p_1, p_2, \ldots \}$, the propositional constant $\bot$, round brackets, the boolean connective $\rightarrow$, the unary operators $\text{Obl}$ and $\text{Perm}$, the set of $n$-ary operators $\otimes^n$ for $n \in \mathbb{N}^+$ and the set of $n$-ary operators $\oplus^n$ for $n \in \mathbb{N}^+$. We shall refer to the language where $\oplus$ does not occur as $L^\otimes$, and the language where $\otimes$ does not occur as $L^\oplus$. There is no technical difficulty in avoiding that $\otimes$ and $\oplus$ be binary operators: the reason why we define them as $n$-ary ones is mainly conceptual and is meant to exclude the nesting of $\otimes$- and $\oplus$-expressions. Consider $a \otimes \neg(b \otimes c) \otimes d$. The expression $\neg(b \otimes c)$ means either that $b$ is not obligatory or that it is so but $c$ does not compensate the violation of $\text{Obl} b$. What does it mean this
as a compensation of the violation of \textit{Obla}? Also, what is the meaning of \( a \otimes (b \oplus c) \otimes d \)?

\textbf{Definition 8 (Well Formed Formulae).} \emph{Well formed formulae (wffs) are defined as follows:}

- Any propositional letter \( p \in \text{Prop} \) and \( \bot \) are wffs;
- If \( a \) and \( b \) are wffs, then \( a \rightarrow b \) is a wff;
- If \( a \) is a wff and no operator \( \otimes^m \), \( \oplus^m \), \text{Obl} \) and \text{Perm} \) occurs in \( a \), then \text{Obla} \) and \text{Perma} \) are a wff;
- If \( a_1, \ldots, a_n \) are wffs and no operator \( \otimes^m \), \( \oplus^m \), \text{Obl} \) and \text{Perm} \) occurs in any of them, then \( a_1 \otimes^n \cdots \otimes^n a_n \) and \( a_1 \oplus^n \cdots \oplus^n a_n \) are a wff, where \( n \in \mathbb{N}^+;^2 \)
- Nothing else is a wff.

We use \( \text{WFF} \) to denote the set of well formed formulae.

Other Boolean operators are defined in the standard way, in particular \( \neg a = \text{def} a \rightarrow \bot \) and \( \top = \text{def} \bot \rightarrow \bot \).
We use \( \odot \) to refer to either \( \otimes \) or \( \oplus \). Accordingly, we say that any formula \( a_1 \odot \cdots \odot a_n \) is an \( \odot \)-chain; also the negation of an \( \odot \)-chain is an \( \odot \)-chain. The formation rules allow us to have \( \odot \)-chains of any (finite) length, and the arity of the operator is equal to number of elements in the chain; we thus drop the index \( m \) from \( \odot^m \). Moreover, we use the prefix notation \( \odot_{i=1}^n a_i \) for \( a_1 \odot \cdots \odot a_n \).

\textbf{5.1.2. Semantics and Results}

Sequence semantics is an extension of neighbourhood semantics. The extension is twofold: (1) we introduce a second neighbourhood-like function, and (2) the new function generates a set of sequences of sets of possible worlds instead of set of sets of possible worlds. This extension allows us to provide a clean semantic representation of \( \odot \)-chains.

Before introducing the semantics, we provide some technical definitions for the operation of \emph{s-zipping}, i.e., the removal of repetitions or redundancies occurring in sequences of sets of worlds. This operation is required to capture the intuition described for the \( \odot \)-shortening axioms.

\textbf{Definition 9.} Let \( X = \langle X_1, \ldots, X_n \rangle \) be such that \( X_i \in 2^W \) (1 \( \leq \) \( i \) \( \leq n \)). \( Y \) is s-zipped from \( X \) iff \( Y \) is obtained from \( X \) by applying the following operation: for \( 1 \leq k \leq n \), if \( X_j = X_k \) and \( j < k \), delete \( X_k \) from the sequence.

\textbf{Definition 10.} A set \( S \) of sequences of sets of possible worlds is closed under s-zipping iff if \( X \in S \), then (i) for all \( Y \) such that \( X \) is s-zipped from \( Y \), \( Y \in S \); and (ii) for all \( Z \) such that \( Z \) is s-zipped from \( X, Z \in S \).

Closure under s-zipping essentially determines classes of equivalences for \( \odot \)-chain.

The next three definitions provide the basic scaffolding for sequence semantics: frame, valuation, and model.

\textbf{Definition 11.} A sequence frame is a structure \( \mathcal{F} = \langle W, C, N \rangle \), where

- \( W \) is a non empty set of possible worlds,

\[ ^2 \text{We use the prefix forms } \odot^1 a \text{ and } \oplus^1 a \text{ for the case of } n = 1. \]
• \( C \) is a function with signature \( W \rightarrow 2^{(2^W)^n} \) such that for every world \( w \), every \( X \in C_w \) is closed under s-zipping.

• \( N \) is a function with signature \( W \rightarrow 2^W \).

**Definition 12.** A sequence model is a structure \( M = \langle F, V \rangle \), where

• \( F \) is a sequence frame, and

• \( V \) is a valuation function, \( V : \text{Prop} \rightarrow 2^W \).

**Definition 13.** The valuation function for a sequence model is as follows:

• usual for atoms and boolean conditions,

• \( w \models \bigcirc \bigotimes_{i=1}^n a_i \iff \langle \parallel a_1 \parallel V, \ldots, \parallel a_n \parallel V \rangle \in C_w \),

• \( w \models \Box a \iff \parallel a \parallel V \in N_w \).

Sequence models are meant to be used for the combination of a deontic operator (in this paper \( \Box \) ranges over \( \text{Obl} \) and \( \text{Perm} \)) and the corresponding \( \bigotimes \)-chain operator (\( \bigotimes \) and \( \oplus \), respectively). We are going to use sequence models for the logics where we consider only \( \bigotimes \) and \( \text{Obl} \), and \( \text{Perm} \) is defined as the dual of \( \text{Obl} \).

The next three definitions extend sequences semantics to the case of two sets of independent combinations of \( \bigotimes \) and the corresponding unary deontic operator.

**Definition 14.** A bi-sequence frame is a structure \( F = \langle W, C^{\text{Obl}}, C^{\text{Perm}}, N^{\text{Obl}}, N^{\text{Perm}} \rangle \), where

• \( W \) is a non-empty set of possible worlds;

• \( C^{\text{Obl}} \) and \( C^{\text{Perm}} \) are two functions with signature \( W \rightarrow 2^{(2^W)^n} \), such that for every world \( w \in W \), for every \( X \in C^{\text{Obl}}_w \) and \( Y \in C^{\text{Perm}}_w \), \( X \) and \( Y \) are closed under s-zipping;

• \( N^{\text{Obl}} \) and \( N^{\text{Perm}} \) are two functions with signature \( W \rightarrow 2^W \).

**Definition 15.** A bi-sequence model is a structure \( M = \langle F, V \rangle \), where

• \( F \) is a bi-sequence frame, and

• \( V \) is a valuation function, \( V : \text{Prop} \rightarrow 2^W \).

**Definition 16.** The valuation function for a bi-sequence model is as follows:

• usual for atoms and boolean conditions,

• \( w \models a_1 \bigotimes \cdots \bigotimes a_n \iff \langle \parallel a_1 \parallel V, \ldots, \parallel a_n \parallel V \rangle \in C^{\text{Obl}}_w \),

• \( w \models a_1 \bigoplus \cdots \bigoplus a_n \iff \langle \parallel a_1 \parallel V, \ldots, \parallel a_n \parallel V \rangle \in C^{\text{Perm}}_w \),

• \( w \models \text{Obl} a \iff \parallel a \parallel V \in N^{\text{Obl}}_w \),

• \( w \models \text{Perm} a \iff \parallel a \parallel V \in N^{\text{Perm}}_w \).

Various logical systems have been presented in \((67; 66)\) and the corresponding soundness and completeness results of these logics have been proved.
5.2. Quantification in Deontics

5.2.1. Introduction

Legal theorists traditionally formalise the basic structure of the judicial application of law through the so-called judicial syllogism, which corresponds to the following inference schema (79):

\[
\forall x (T(x) \rightarrow \text{Obl}R(x)) \\
T(s) \\
\text{Obl}R(s)
\]  

(5.2.1)

Indeed, suppose the major premise states that, for each individual \( x \), if \( x \) commits a theft, then it is obligatory that \( x \) be punished. Hence, if Schulze committed a theft, this of course entails that Schulze ought to be punished. Likewise, however, some legal theorists—who are not so familiar with the complications arising in quantified modal logics—would not probably appreciate why a judicial syllogism is correctly captured by (5.2.1) rather than by inferences such as, for example,

\[
\text{Obl}\forall x (T(x) \rightarrow R(x)) \\
T(s) \\
\text{Obl}R(s)
\]  

(5.2.2)

Technical reasons lead, of course, to reject schema (5.2.2) as incorrect. But, on the philosophical side, positive arguments—also based on the nature of judicial dynamics—may explain the preference of those who adopt (5.2.1). This holds in particular if we adopt the actualist interpretation of quantification, according to which quantifiers get an existential interpretation as they range over individual domains depending on possible worlds, while parameters of a formula are evaluated as arbitrary individuals (81). In effect, the judicial application of law implies that one or more legal provisions are applied to a concrete case presented before the judge: for example, from the fact that Schulze committed a theft it follows that Schulze ought to be punished. For it is often said that judges formulate a “decision rule” that makes the law applicable to the concrete case. Of course, (5.2.1), too, can be problematic. But, as far as the interplay between quantifiers and modalities is concerned, only the major premise of (5.2.1) permits to refer to concrete and existing individuals. These issues are somehow discussed in the deontic literature. Lou Goble (82; 83; 84), for example, provides interesting reasons to say that deontic operators are referentially transparent with respect to singular terms, since this assumption seems required to account for an intuitive analysis of the instantiation of general obligations into concrete cases. His argument runs starting from semantical considerations. Suppose that Jones ought to give $20 to the first homeless person who begs from him in 2006 and that Smith is such a homeless person. The question is: Is Jones obligated to give $20 to Smith? The answer is, of course, yes, but the point is that, if deontic contexts are taken fully intensional, we may argue that Smith is not the individual corresponding to the first homeless begging from Jones in every ideal world. Goble’s proposal is thus to change the standard truth-conditions of any formula \( \text{Obl}F(t) \), where \( t \) is a singular term: rather than checking whether, for every ideal world \( v \) related to the actual world \( w \), the denotation of \( t \) at \( v \) is in the extension of \( F \) in \( v \), the formula \( \text{Obl}F(t) \) is true iff the denotation of \( t \) at \( w \) is in the extension of \( F \) at \( v \). Under this

---

\(^3\)But notice that deontic logicians, too, sometimes recognise that the major premise of (5.2.1) is a good rendering of practical statements: cf., among others, (80).
view, we can argue that, strictly speaking, \(\text{Obl}_F(x)\) and \(\text{Obl}_F(a)\) are instances of \(\forall x \text{Obl}_F(x)\).

Clearly, the foregoing is a roundabout way of considering in deontic logic the meaning of the distinction between \textit{de dicto} and \textit{de re} modal formulas, namely, between formulas with and without free occurrences of variables within the scope of the modal operator \(\text{Obl}\). According to Goble’s analysis, it seems that \textit{de re} formulas play a specific deontic role, as only \(\forall x \text{Obl}_F(x)\) can be reasonably instantiated into \(\text{Obl}_F(a)\). However, one may argue that, unlike alethic and other kinds of modalities, in deontic logics it does not make any sense to distinguish between \textit{de dicto} and \textit{de re} modal formulas. In fact, despite what we said about (5.2.1) and (5.2.2), von Wright (85, p. 40) clearly maintains that “the operators ‘P’ and ‘O’ […] yield sentences” and so “deontic modalities cannot be taken alternatively \textit{de dicto} and \textit{de re}\”. Hector-Neri Castañeda (86), too, is sceptical in this regard, as he argues in favour of the complete extensionality of ordinary deontic concepts, thus making deontic \textit{de re} and \textit{de dicto} formulas virtually equivalent. In effect, \(\forall x \text{Obl}_F(x)\) and \(\text{Obl}_F(x)\) are intuitively different: the former is about existing individuals with respect to which we may say that \(P\) an essential property, whereas the latter modal statement is purely sentential. This does not hold with the two sentences “There is someone for whom it is obligatory that he do \(A\)” and “It is obligatory for someone to do \(A\)” ; according to semantical conventions in English, “deontic operators do not in any way affect the range of quantifiers” and so deontic logic is extensional (86, p. 67). Notice that Goble, too, defended the view that deontic logic is extensional, but, as we mentioned, his conclusions are not radical as those of von Wright and Castañeda.

There may be good reasons to subscribe to von Wright’s and Castañeda’s criticism, but still we have in our hands a formalism—quantified deontic logic based on possible-world semantics—which technically can embed the distinction between \textit{de re} and \textit{de dicto} sentences. In general, if we adopt the actualist interpretation of quantifiers, it seems to us that \textit{de dicto} and \textit{de re} deontic sentences may correspond, respectively, to \textit{non-contextual} (or generic) and \textit{contextual} (or concrete, actual) obligations. This alternative reading, given Castañeda criticism that essential deontic predication does not make any sense, seems roughly in line with our comments of schemata (5.2.1) and (5.2.2) and, also, with Goble’s general intuitions. In fact, when we have formulas like \(\text{Obl}_F(x)\), obligations may leave the problem of reference (application) to existing individuals out of consideration, as the question of their concrete application is somehow put into brackets. In other words, we may state that something is obligatory for some individuals independently of any concern about concrete applicability. This is not absurd as we may argue that something is deontically correct, it ought to be case, for conceivable individuals that, as far as we know, may not exist. In the second case—when we have formulas like \(\forall x \text{Obl}_F(x)\)—the focus is rather on the actual world with respect to which we want to state whether something is or is not obligatory\(^4\).

On the other hand, the distinction between contextual and non-contextual (or \textit{de re} and \textit{de dicto}) deontic sentences is still far from being conceptually clear, as a lot depends on the philosophical role one wants to assign to deontically ideal worlds. This is evident if we just consider a formula such as \(\exists x \text{Obl}_x(x = a)\). In effect, given this formula, Goble himself (83, p. 344) asks: “What would it be for a term to ‘deontically’ denote something”? Indeed, the question can be more generally reframed as follows: What does it mean that an individual exists in some deontically perfect worlds

\(^4\) The thesis that the \textit{de dicto/de re} distinction is significant in deontic logic is not new (see, e.g., (87; 88; 89; 90)). Notably, Jacko Hintikka (87; 88), at least in some passages, seems to read \textit{de re} deontic formulas as contextual statements, though he does not seem to be fully consistent in this regard. However, Hintikka’s analysis is peculiar as, in his approach, quantifiers range over act-individuals and not over ordinary individuals. Makinson (91) criticizes the choice of quantifying over act-individuals, but he seems still to acknowledge the meaningfulness of the \textit{de dicto/de re} distinction.
but does not in other perfect worlds? We think this is still an open question. If we do not have
general and conclusive insights about the meaning of the *de re/de dicto* distinction in quantified
deontic logic, the role of the deontic versions of Barcan schemata may become crucial. Consider
the following schemata:

\[
\forall x \text{Obl} \phi(x) \rightarrow \text{Obl} \forall x \phi(x) \quad \text{(BF)}
\]

\[
\text{Obl} \forall x \phi(x) \rightarrow \forall x \text{Obl} \phi(x) \quad \text{(CBF)}
\]

As is well-known, in standard Kripke semantics BF corresponds to the condition that domains
of quantification never increase across possible worlds, CBF to the condition that domains never
decrease; their joint validity leads then to constant domains, which makes inessential the problem
of the existence of individuals. A common philosophical interpretation of this choice is that quantifiers
range over all (conceivable, i.e., existing and non-existing) individuals (92). Thus, accepting BF
and CBF means weakening the existential reading of quantifiers, thus leading to the *possibilist
interpretation of quantification* (81), which classically corresponds to the well-known standard
Kripke semantics with constant domains. This position makes some sense in deontic logic, as
we have seen when we mentioned von Wright’s and Castañeda’s view. It is not by accident, we
feel, that Castañeda himself (86) accepts as theorems of his logic both BF and CBF. In effect,
indipendently of any different views such as the peculiar one proposed by Goble, subscribing to
both BF and CBF is one of the most direct options to weaken the conceptual distinction between
*de re* and *de dicto* sentences. And this seems a good achievement, given the unclear nature of
this distinction in deontic logic. In addition, the joint validity of CBF and BF also permits to keep
standard first-order logic (FOL) untouched as it does not require any constraint on it.

What’s the intuitive reading of BF and CBF in deontic logic? On the sematical side, once again,
much depends on the philosophical interpretation one adopts in clarifying the notion of individuals’
existence across deontically ideal worlds. At least provisionally, if we recall the ideas of contextual
and non-contextual deontic sentences, BF states that a (universally quantified) contextual obligation
implies a (universally quantified) non-contextual obligation. Semantically, this is guaranteed by
the fact that BF determines decreasing domains. In other words, the price to pay, for moving from
contextual obligations (for which, in the perspective of their instantiation, actual existence matters)
to non-contextual obligations (for which actual instantiation does not count anymore), is to assume
that all individuals, existing in the ideal worlds, exist as well in the actual world. This intuitive,
though partial reading of BF seems to be confirmed if we introduce the common and weak notion
of permission Perm corresponding to the dual of Obl. This permits to reframe BF as follows:

\[
\text{Perm} \exists x \phi(x) \rightarrow \exists x \text{Perm} \phi(x) \quad \text{(BF’)}
\]

(BF’) permits to move from a non-contextual (existential) deontic statement to a contextual
(existential) one. But this should not confuse the reader as we have to take into account the peculiar
nature of the weak permission, which is nothing but the dual of an obligation, namely the negation
of a prohibition. Analogous considerations may be reiterated for CBF, which is a principle stating
that any non-contextual (generic) obligation implies that this obligation is applicable to all concrete

---

5Notice that these principles are also adopted in (80). Hintikka rejects BF, but, again, his scepticism mainly depends
on the fact that quantifiers range over act-individuals.

6As is well known, Barcan schemata alone are not, however, sufficient in general to eliminate *de re* modalities,
namely, to prove that, given any modal logic S, for each formula φ, there exists a *de dicto* formula ϕ′ such that S ⊢ φ ≡ ϕ′.
This can be done only adding some extra-conditions and within strong modal systems such as S5; see, e.g. (93; 94).
cases.

It is clear that, under this intuitive but still partial reading, we do not have conclusive reasons to adopt in general BF and CBF. BF, in particular, can be highly problematic, both for its intuitive consequences and for the semantic conditions required to validate it in Kripke models. CBF seems less controversial: if a generic obligation holds, such an obligation must be applicable in the actual case, at least unless there is no contrary reason against this. (Also the corresponding condition that domains never decrease looks more reasonable, from the deontic point of view, as the range of a generic obligation may exceed the range of an obligation applying to a concrete case.) Goble’s discussion is illuminating in this regard.

On the other hand, as we have seen the joint validity of BF and CBF seems a first step towards milding Castañeda’s objections. In addition, independently of any philosophical reflection on the meaning of BF and CBF, their logical role is significantly that of making apparent possible deontic conflicts. Suppose to have

$$\forall x \text{Obl}\phi(x) \quad \text{Obl}\exists x \neg\phi(x)$$

Are these formulas in conflict with each other? Syntactically, it is clear that the appeal to BF is essential if we think that the formulas above are incompatible: $$\forall x \text{Obl}\phi(x)$$ implies $$\text{Obl}\forall x \phi(x)$$ by BF, while $$\text{Obl}\exists x \neg\phi(x)$$ is equivalent to $$\text{Obl}\neg\forall x \phi(x)$$. Analogously, CBF is essential, for example, if we want to make apparent the conflict between the following formulas:

$$\text{Obl}\forall x \phi(x) \quad \exists x \text{Perm}\neg\phi(x).$$

5.2.2. Quantification in Non-normal Deontic Logic

What happens if we move from normal to non-normal modal logics? Indeed, there are specific reasons to pose this question in deontic logic. It is well known that normal deontic logics, paradigmatically Standard Deontic Logic (SDL), are problematic. This is due to some unpleasant deontic schemata that we obtain there. Needless to say, a great part of the debate in deontic logic, implicitly or explicitly, still revolves around these questions. Non-normal deontic logics have been considered a solution to avoid many drawbacks of SDL (i.e., deontic KD), which does not tolerate deontic conflicts and gives rise to a number of paradoxes and puzzles (95; 96).

Research on quantification in non-normal modal logics (and on deontic logics) has been neglected and mainly focused on frames with constant domains of individuals (for an overview of the literature, see (68)), which ensures to keel FOL untouched. This assumption has been relaxed in (68), which offered the most general semantic treatment. Indeed, as we have recalled above, we may have have good arguments to keep constant domains,

- the distinction between de dicto and de re normative (deontic) statements looks controversial (85; 86);
- What does it mean that an individual exists in some deontically preferred worlds but does not in other ideal worlds?

The above arguments, however, could be rejected. In particular:

- Why should we assume that exactly the same individuals populate all (normatively) ideal worlds? Indeed, it is known that the assumption of constant domains is often associated
with precise metaphysical views, such as—but not only—logical atomism (97); it is far from obvious whether this is required from the normative viewpoint.

- The equivalence between *de dicto* and *de re* statements is not in general guaranteed by the assumption of constant domains:
  - Barcan schemata alone are not sufficient in general to eliminate *de re* modalities (93; 94);
  - Barcan schemata are not in general characterised in non-normal modal logics by constant domains (68).

### 5.2.2.1. Our Contribution to Quantified Non-normal Modal Logics for Deontics

Let us recall (68)’s machinery and define an appropriate semantics for quantified non-normal modal logic.

**Definition 17 (Multi-relational frames).** A multi-relational frame is a tuple \( F := \langle W, R, D, U \rangle \) where:
- \( W \) is a non-empty set of worlds
- \( R \) is a (possibly infinite) set of binary relations over \( W \)
- \( D \) is a function associating to each world \( w \in W \) a set \( D_w \) of individuals (the inner domain of \( w \))
- \( U \) is a function associating to each world \( w \in W \) a set \( U_w \) of individuals (the outer domain of \( w \)) such that for any \( w \in W \), \( U_w \neq \emptyset \) and \( D_w \subseteq U_w \) and if \( wRv \) for some \( R \), then \( U_w \subseteq U_v \).

Models, assignments, and the concepts of satisfaction, truth, validity are defined in the standard way.

**Definition 18 (Multi-relational models).** A multi-relational model is a tuple \( M := \langle W, R, D, U, I \rangle \) where \( \langle W, R, D, U \rangle \) is a multi-relational frame and \( I \) is a function \( I : L \times W \mapsto \bigcup_{w \in W} U_w \) such that:
- \( I_w(P^n) \subseteq (U_w)^n \)
- \( I_w(c) \in U_w \).

**Definition 19 (Assignments).** For any \( w \in W \), a \( w \)-assignment \( \sigma \) is a function \( \sigma : \text{Var}(L) \mapsto U_w \). An \( x \)-variant \( \tau \) of a \( w \)-assignment \( \sigma \) is a \( w \)-assignment which may differ from \( \sigma \) for the value assigned to \( x \).

**Definition 20 (\( \sigma \)-interpretation).** Given a \( w \)-assignment \( \sigma \), define
(a) \( I^\sigma_w(c) = I_w(c) \), and
(b) \( I^\sigma_w(x) = \sigma(x) \).

**Definition 21 (Truth conditions).** Let \( M := \langle W, R, D, U, I \rangle \) be any multi-relational model, \( \sigma \) any assignment, and \( w \in W \). Truth evaluation clauses are as follows:
- \( M \models^\sigma_w P^n(t_1, \ldots, t_n) \text{ iff } (I^\sigma_w(t_1), \ldots, I^\sigma_w(t_n)) \in I_w(P^n) \)
- \( M \not\models^\sigma_w \bot \)
- \( M \models^\sigma_w \forall xA \text{ iff for every } \tau \text{ such that } \tau(x) \in D_w, M \models^\tau_w A(x) \)
- \( M \models^\sigma_w \text{ Obl}A \text{ iff } \exists R_x \in R \forall v \in W(wR_v \Rightarrow M \models^\tau_v A) \).
5.2.2.1.1. Satisfaction, Truth, Validity. A model $\mathcal{M}$ satisfies a set of formulae $\Delta$ iff for some world $w$ and some $w$-assignment $\sigma$, $\mathcal{M} \models^\sigma_w \Delta$ for all $\Delta \in \Delta$. A formula $A$ is true in a world $w$ of a model $\mathcal{M}$, $\mathcal{M} \models_w A$, iff for any $w$-assignment $\sigma$, $\mathcal{M} \models^\sigma_w A$. A formula $A$ is true in a model $\mathcal{M}$, $\mathcal{M} \models A$, if for all $w$, $\mathcal{M} \models_w A$. A formula $A$ is valid on a frame $\mathcal{T}$, $\mathcal{T} \models A$, iff for any model $\mathcal{M}$ on $\mathcal{T}$, $\mathcal{M} \models A$. Given a class of frames $\mathcal{F}$, a formula $A$ is $\mathcal{F}$-valid, $\mathcal{F} \models A$, iff for any frame $\mathcal{T} \in \mathcal{F}$, $\mathcal{T} \models A$. $\mathcal{M}$ is a model for a logic $L$ iff $\mathcal{M} \models A$ for all $A \in L$.

We assume all individual terms to be rigid designators.

The above semantics characterises the system $Q^\circ MN$, which contains the following axioms and inference rules:

- Propositional tautologies;
- $\text{UI} := \forall y (\exists x A(x) \rightarrow A(y/x))$;
- $\forall x \forall y A \leftrightarrow \forall y \forall x A$;
- $A \rightarrow \forall x A$, $x$ not free in $A$;
- $\forall x (A \rightarrow B) \rightarrow (\forall x A \rightarrow \forall x B)$

We must notice that the propositional modal schemata and inference rules in $Q^\circ MN$ amount to a deontic system proposed by (98; 99).

**Theorem 1** (Soundness and Completeness of $Q^\circ MN$). The logic $Q^\circ MN$ is sound and strongly complete with respect to the class of all multi-relational frames.

Other systems and results have been presented with a language integrated by the standard identity symbol (68). Among others:

**Lemma 1** (CBF Characterisation result). For any multi-relational frame $\mathcal{F} := \langle W, R, D, U \rangle$, $\mathcal{F} \models \text{Obl} \forall x A \rightarrow \forall x \text{Obl} A$ iff for all $w \in W$, if $w$ is locally serial—i.e., for any relation $R_i$ from $\mathcal{F}$ there is a world $v$ such that $wR_i v$—then for any $a$ such that $a \in D_w$, for any relation $R_j$, there is some relation $R_i$ such that $R_i(w) \subseteq R_j(w)$ and for all $t$, $(wR_i t \Rightarrow a \in D_t)$.

**Lemma 2** (CBF and Restricted Increasing Domains). For any multi-relational frame $\mathcal{F} := \langle W, R, D, U \rangle$, $\mathcal{F} \models \text{Obl} \exists x A \rightarrow \exists x \text{Obl} A$ iff for all $w \in W$, if $w$ is locally serial, then for all $R_j$, there is some relation $R_i$ such that $R_i(w) \subseteq R_j(w)$ and for all worlds $v$ in $R_i(w)$, $D_v \subseteq D_w$.

Consider the following system:

The system $Q^\circ_1 MN$ (Free Quantified N-monotonic modal logic) contains the following axioms and inference rules:

- Propositional tautologies;
- $\text{UI} := \forall y (\exists x A(x) \rightarrow A(y/x))$;
- $\forall x \forall y A \leftrightarrow \forall y \forall x A$;
- $A \rightarrow \forall x A$, $x$ not free in $A$;
- $\forall x (A \rightarrow B) \rightarrow (\forall x A \rightarrow \forall x B)$
- $\text{I} := t = t$
- $(s = t) \rightarrow (A(s/x) \rightarrow A(t/x))$
Theorem 2 (Completeness of $Q^o_{MN}$). The logic $Q^o_{MN}$ is sound and strongly complete with respect to the class of all multi-relational frames.

In addition, if

$$\text{Obl} \exists := \text{Obl} A \land \exists x_1 \ldots \exists x_n (x_1 = t_1 \land \ldots \land x_n = t_n) \rightarrow \text{Obl} (A \land \exists x_1 \ldots \exists x_n (x_1 = t_1 \land \ldots \land x_n = t_n))$$

then

Theorem 3 (Completeness of $Q^o_{MN} \oplus \text{CBF} \oplus \text{Obl} \exists$). The logic $Q^o_{MN} \oplus \text{CBF} \oplus \text{Obl} \exists$ is complete with respect to the class of multi-relational frames with finite restricted increasing inner domains, i.e. frames with the following property: $\forall w \in W$, if $w$ is locally serial, then for all $R_i$, there is some relation $R_i$ such that $R_i(w) \subseteq R_j(w)$ and for all worlds $v$ in $R_i(w)$, $D_w \subseteq D_v$, as in Lemma 2.

Finally,

Lemma 3 (BF Characterisation Result). For any multi-relational frame $\mathcal{F} := \langle W, R, D, U \rangle$, $\mathcal{F} \models \forall x \text{Obl} A \rightarrow \text{Obl} x A$ iff $\forall w \in W$, either there is an $R_i \in \mathcal{R}$ such that $R_i(w) = \emptyset$ or for any (possibly infinite) sequence of worlds $z_1, z_2, \ldots$ of length $n$ (if the sequence is infinite $n$ is $\aleph_0$) such that $n$ is also the cardinality of $\mathcal{R}$ and $wR_z z_k$ for any $R_k \in \mathcal{R}$, for any (possibly infinite) sequence $R_{j_1}, R_{j_2}, \ldots$ of length $m$ where $\|D_w\| = m$, i.e., $m$ is the number of individuals belonging to the inner domain of $w$, there is a world $t \in \{z_1, z_2, \ldots\} \cap \bigcap_{i \leq m} R_{j_i}(w)$ such that $D_w \supseteq D_t$.

5.3. Conclusions and Research Challenges

While many results have been proved in MIREL for the logics for compliance and for quantification in non-normal deontic logics, several research perspective for WP1 are still open. In particular,

Research Challenge 7 (Decidability, Complexity and Implementation for the Logics for Legal Compliance). Investigate decidability, complexity issues for the logics for compliance and develop implementation methods.

Research Challenge 8 (Integrating Quantification in Deontic Logics for Compliance). Define logics that integrate methods from (67) with those from (68).
6. Conclusions

This document reported on the first year of research activities conducted for WP1 of MIREL. Two tasks have been mainly considered:

- **Task 1.1 Transdisciplinary Research and Conceptual Models for Legal Knowledge Representation and Reasoning**;

- **Task 1.2 Formal Languages for Representing Norms, Policies, and Values in the Law**.

In particular,

- **In regard to Task 1.1**: we offered a survey of previous results in the literature (especially, those developed by MIREL research groups) and by identifying the basic research challenges which will drive the MIREL partners in WP1;

- **In regard to Task 1.2**: we preliminarily considered some research issues on the temporal aspects of legal reasoning, on formal methods for modelling, e.g., legal compliance, and on the role of values and goals in legal interpretation.

More precisely, we worked on the following topics:

**Distinction between legal norms and legal provisions;**

**Reification**: Provisions and norms are objects with properties, such as

- **Temporal properties.** Norms usually are qualified by temporal properties, such as:
  1. the time when the legal provision and the corresponding norm is in force and/or has been enacted;
  2. the time when the norm can produce legal effects (when the norm is applicable and supports the derivation of legal effects);
  3. the time when the normative effects hold.

- **Rule semantics.** Any language for modelling legal norms should be based on a precise and rigorous semantics, which allows for correctly computing the legal effects that should follow from a set of legal norms. We worked on some logical methods for compliance and quantification in deontic logic.

- **Norm validity.** We worked on languages and logics which model various aspects of norm validity.

- **Legal procedures.** We devised methods for
  1. for detecting violations of the law;
  2. determining the normative effects triggered by norm violations, such as reparative obligations, namely, which are meant to repair or compensate violations.

- **Temporal persistence of normative effects.**

**Values and goals in legal interpretation.**

Several research challenges for MIREL have been formulated: see the list before Chapter 2.
Models of Legal Knowledge Representation and Reasoning

References


Q1:scholar.google.com/&output=citation&hl=de&as_sdt=0,5&ct=citation&cd=1


A. Appendix: Tutorial Slides

We include in the following pages slides which we used as a preliminary materials for starting our activities in MIREL, and which we presented or employed at the MIREL tutorial sessions at the conference ECAI 2016\(^1\) and at the workshop MIREL@JURIX 2016\(^2\).

\(^{1}\)http://www.ecai2016.org/program/tutorials/
\(^{2}\)http://jurix2016.unice.fr/?page_id=127
Basic Deontic Notions
Outline

- **Basics**: obligations, prohibitions, and permissions

- Refinements on norm representation and reasoning (among others):
  - obligative positions (rights)
  - deriving obligations
  - types of permission
  - coherence and defeasibility
  - norms governing norm violations
  - types of obligations
Outline

- Basics: obligations, prohibitions, and permissions
- Refinements on norm representation and reasoning (among others):
  - derivable positions (rights)
  - types of permission
  - coherence and defeasibility
  - norms governing norm violations
  - types of obligations
Outline

- **Basics:** obligations, prohibitions, and permissions
- **Refinements on norm representation and reasoning** (among others):
  - obligative positions (rights)
Outline

- **Basics**: obligations, prohibitions, and permissions
- **Refinements on norm representation and reasoning** (among others):
  - obligative positions (rights)
  - deriving obligations
Outline

- Basics: obligations, prohibitions, and permissions
- Refinements on norm representation and reasoning (among others):
  - obligative positions (rights)
  - deriving obligations
  - types of permission
Outline

- Basics: obligations, prohibitions, and permissions
- Refinements on norm representation and reasoning (among others):
  - obligative positions (rights)
  - deriving obligations
  - types of permission
  - coherence and defeasibility
• **Basics:** obligations, prohibitions, and permissions

• **Refinements on norm representation and reasoning** (among others):
  - obligative positions (rights)
  - deriving obligations
  - types of permission
  - coherence and defeasibility
  - norms governing norm violations
Outline

- **Basics**: obligations, prohibitions, and permissions
- **Refinements on norm representation and reasoning** (among others):
  - obligatory positions (rights)
  - deriving obligations
  - types of permission
  - coherence and defeasibility
  - norms governing norm violations
  - types of obligations
Are you compliant?

Norms
1. If you are in Italy, you ought to pay taxes in Italy
2. If you are in Italy and are underage, it is forbidden for you to drink alcohol
3. It is not obligatory for you not to be in Italy or it is forbidden to pay taxes in Italy

Facts
(i) You are in Italy
(ii) You are underage
Definition (Norms)

(Prescriptive) norms are rules that, if triggered, generate obligations, prohibitions, or permissions

1. If you are in Italy, you ought to pay taxes in Italy
2. If you are in Italy and are underage, it is forbidden for you to drink alcohol
3. It is not obligatory for you not to be in Italy or it is forbidden to pay taxes in Italy
Are you compliant?

Norms
1. If you are in Italy, you ought to pay taxes in Italy
2. If you are in Italy and are underage, it is forbidden for you to drink alcohol
3. It is not obligatory for you not to be in Italy or it is forbidden to pay taxes in Italy
Are you compliant?

Norms
1. If you are in Italy, you ought to pay taxes in Italy
2. If you are in Italy and are underage, it is forbidden for you to drink alcohol
3. It is not obligatory for you not to be in Italy or it is forbidden to pay taxes in Italy

Facts
(i) You are in Italy
(ii) You are underage
The basic deontic modalities

- obligation, OBL
- permission, PERM
- prohibition, FORB
The basic deontic modalities

- It is obligatory that you do not carry your rucksack on your back (it is forbidden that you carry your rucksack on your back).
- It is permitted that you carry your rucksack with your hand.

OBL [you do not carry your rucksack on your back] = FORB [you carry your rucksack on your back]

PERM [you carry your rucksack on your hand]

OBL ¬B = FORB B

PERM H = ¬FORB H

How many deontic modalities are necessary?

6
The basic deontic modalities

- it is obligatory that you do not carry your rucksack on your back (it is forbidden that you carry your rucksack on your back)
- it is permitted that you carry your rucksack with your hand
The basic deontic modalities

- it is obligatory that you do not carry your rucksack on your back (it is forbidden that you carry your rucksack on your back)
- it is permitted that you carry your rucksack with your hand
- \(\text{OBL} \ [\text{you do not carry your rucksack on your back}] = \text{FORB} \ [\text{you carry your rucksack on your back}]\)
- \(\text{PERM} \ [\text{you carry your rucksack on your hand}]\)
The basic deontic modalities

- it is obligatory that you do not carry your rucksack on your back (it is forbidden that you carry your rucksack on your back)
- it is permitted that you carry your rucksack with your hand

- OBL \([\text{you do not carry your rucksack on your back}]\) = \(\equiv\) FORB \([\text{you carry your rucksack on your back}]\)
- PERM \([\text{you carry your rucksack on your hand}]\)

- \(\text{OBL} \neg B = \text{FORB} B?\)
- \(\text{PERM} H = \neg \text{FORB} H?\)
The basic deontic modalities

- it is obligatory that you do not carry your rucksack on your back (it is forbidden that you carry your rucksack on your back)
- it is permitted that you carry your rucksack with your hand
- OBL \( \neg B \) = FORB \( B \)
- PERM \( H \) = \( \neg \) FORB \( H \)

How many deontic modalities are necessary?
Deontic possibilities

<table>
<thead>
<tr>
<th>country</th>
<th>wearing the veil (V)</th>
<th>not wearing the veil (¬V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>FORB V</td>
<td>OBL ¬V</td>
</tr>
<tr>
<td>Iran</td>
<td>OBL V</td>
<td>FORB ¬V</td>
</tr>
<tr>
<td>UK</td>
<td>PERM V</td>
<td>PERM ¬V</td>
</tr>
</tbody>
</table>
Normative positions

Please translate in the formal language the following sentence:

*If it is obligatory in the interest of John that Mary pays her debts, then it is permitted in the interest of John that Tony helps Mary to pay her debts*
Obligation Addressees

\( M = \text{“the merchandise is delivered”} \)
\( I = \text{“internet access is provided”} \)

- \( \text{OBL}_j(M) \)
  - \( j \) has the obligation to ensure that \( M \)
  - \( \text{OBL}_{\text{state}}(I) = \text{state} \) has the obligation to ensure that \( M \), \( j \) is responsible for \( M \)

- \( \text{PERM}_j(A) \)
  - \( j \) has a permission that he smokes
  - \( \text{PERM}_j(S) \)
Beneficiaries

- **OBL\(^j\)(A)**
  It is obligatory that A toward j, j is the beneficiary of A

- **OBL\(^{Scott}\)(M)**
  It is obligatory that the merchandise is delivered for the benefit of the creditor Scott

- **PERM\(^{Henry}\)(¬I)**
  it is permitted that Internet access is not provided with regard to Henry
Addressees and beneficiaries: Rights

- $OBL_j^k(A)$
  - $j$ has the obligation toward $k$ to ensure that $A$

- $OBL_{Henry}^{Scott}(M)$
  - $Henry$ has the obligation toward $Scott$ to ensure that the merchandise is delivered
Addressees and beneficiaries: Rights

- $\text{OBL}_j^k(A)$
  $j$ has the obligation toward $k$ to ensure that $A$
- $\text{OBL}^{\text{Scott}}_{\text{Henry}}(M)$
  $\text{Henry}$ has the obligation toward $\text{Scott}$ to ensure that the merchandise is delivered

$\text{Scott}$ has the right toward $\text{Henry}$ that $\text{Henry}$ ensures that the merchandise is delivered
What does it mean to be the active party or the beneficiary of an obligation

- Interest-based notion of a right (Bentham Jhering): The beneficiary is the person whose interest is meant be satisfied through the obligation
- Jhering (vs. Power-based notion of a right: Kelsen, Hart): The beneficiary is the person having control over the obligation (e.g. power to start proceeding for its enforcement)
Deriving obligations: Always indisputable?
Deriving obligations: Always indisputable?

\[
A \rightarrow \text{OBL } B \quad A \quad \text{OBL } B
\]  

(1)

\[
\text{Income} \rightarrow \text{OBL } \text{PayTaxes} \quad \text{Income} \quad \text{OBL}(\text{PayTaxes})
\]  

(2)
Deriving obligations: Always indisputable?

\[
\frac{\text{OBL} A}{\text{PERM} B}
\]  

(1)

\[
\frac{\text{OBL}(\text{PayTaxes})}{\text{PERM}(\text{PayTaxes})}
\]  

(2)
Deriving obligations: Always indisputable?

\[ A \rightarrow B \quad \text{OBL } A \]
\[ \quad \text{OBL } B \]

(1)

\[ (\text{bombing } \& \text{ killing }) \rightarrow \text{killing} \quad \text{OBL}(\text{bombing } \& \text{killing}) \]
\[ \quad \text{OBL}(\text{killing}) \]

(2)
Permission or permissions?

- **Weak (or negative) permission**: something is weakly permitted by a (legal) code iff it is not prohibited by that code;
- **Strong (or positive) permission**: something is strongly permitted by a (legal) code if such a code explicitly states that it is permitted.
Permission or permissions?

- **Weak (or negative) permission**: something is weakly permitted by a (legal) code iff it is not prohibited by that code;
- **Strong (or positive) permission**: something is strongly permitted by a (legal) code if such a code explicitly states that it is permitted.

*Strong legal permissions are exceptions to legal prohibitions*
Weak permission: Example

Consider a normative system consisting of the following norm:

*If one lives in Italy for more than 183 consecutive days over a 12-month period, then she is obliged to pay taxes in Italy on her worldwide income.*
Consider a normative system consisting of the following norm:

*If one lives in Italy for more than 183 consecutive days over a 12-month period, then she is obliged to pay taxes in Italy on her worldwide income.*

Hence, if

*you lived in Italy for 60 consecutive days*

then

*it is permitted for you not to pay your taxes in Italy.*
**Strong permission: Example**

Consider a normative system consisting of the following norm:

*If one subscribes to an on-line sale agreement accepting to enter her personal data, then it is permitted for the seller to use this information only on the condition that it is used for shipping, and other necessary purposes to communicate with the buyer or deliver the products to her.*
Consider a normative system consisting of the following norm:

*If one subscribes to an on-line sale agreement accepting to enter her personal data, then it is permitted for the seller to use this information only on the condition that it is used for shipping, and other necessary purposes to communicate with the buyer or deliver the products to her.*

Hence, there are good reasons to assume that

*It is forbidden for the seller to use this information for other purposes.*
Coherence and defeasibility

FORB Use_Buyer Information
Buyer Accepts & Shipping Purposes \(\rightarrow\) PERM Use_Buyer Information
Norms governing norm violations
Norms governing norm violations

Please provide an intuition for the following scenario

\[ A \rightarrow OBL \ B \]
\[ \neg B \rightarrow OBL \ C \]
\[ \neg C \rightarrow OBL \ D \]
Norms governing norm violations

\[ A \rightarrow \text{OBL } B \quad \text{buy} \rightarrow \text{OBL pay} \]
\[ \neg B \rightarrow \text{OBL } C \quad \neg \text{pay} \rightarrow \text{OBL pay}_\text{interest} \]
\[ \neg C \rightarrow \text{OBL } D \quad \neg \text{pay}_\text{interest} \rightarrow \text{OBL foreclosure} \]
Reasoning in Legal Interpretation

Antonino Rotolo
CIRSFID - University of Bologna, Italy

Tutorial *Mining and Reasoning with Legal Documents (MIREL)*
Fundamental Concepts
Outline: Some issues

- Why legal interpretation?
- Legal interpretation and interpretive canons
- An example: The concept of *Defence*
- Interpretation as activity or outcome
- Canons as defeasible rules: competing arguments and interpretive conflicts
- Preferences over interpretations
Why Interpret? The open texture of the legal language
Why Interpret? The open texture of the legal language
A general concept is *characterized* by those items to which it *clearly* applies: a car is a vehicle.

A general term is *not characterized* by those items beyond the penumbra to which it *clearly* does not apply: a sandwich is not a vehicle.

Is a tricycle a vehicle?
Applying norms and arguing about legal concepts

- reasoning about legal provisions in order to determine what actual obligations obtain in a given situation
Applying norms and arguing about legal concepts

- reasoning about legal provisions in order to determine what actual obligations obtain in a given situation
- reasoning about the scope of legal concepts (e.g., broadening or restricting the legal concept and change the core meaning)
Applying norms and arguing about legal concepts

- reasoning about legal provisions in order to determine what actual obligations obtain in a given situation
- reasoning about the scope of legal concepts (e.g., broadening or restricting the legal concept and change the core meaning)
- reasoning about the scope of legal concepts is often a goal-driven process or it is based on coherence (i.e., on a systematic interpretation, which requires to relate the meaning of a provision with the meaning of other connected provisions).
Legal interpretation and interpretive canons
Legal interpretation and interpretive canons

Definition

Legal interpretation is sometimes defined as the process through which we ascribe a meaning to one or more legal provisions (a piece of authoritative legal text).
Legal interpretation and interpretive canons

Definition

Legal interpretation is made by acts that map a piece of legal text into a meaning (possibly, a sentence paraphrasing the interpreted text)
Canons are arguments (ways for) supporting a certain meaning ascription. In statutory interpretation, we have among others (MacCormick and Summers 1991 identified 11 canons):

**Argument from ordinary (or literal) meaning:** a provision should be interpreted according to the (literal) meaning a native speaker of a given language would ascribe to it.

**Argument from systematic reading or contextual harmonisation:** a provision should be interpreted in light of the whole statute it is part of, or in light of other statutes it is related to.

**Argument from precedent:** a provision should be interpreted in conformity with previous interpretations.

**Arguments from goal or purpose:** a provision should be interpreted as applied to a particular case in a way which is in line with the purpose that the provision is supposed to promote.
Example

Section 1: (Prohibition to collect personal medical information)

Offence: It is an offence to collect personal medical information.
Defence: It is a defence to the prohibition of collecting personal medical information, if an entity immediately destroys the illegally collected personal medical information before making any use of the personal medical information.

Section 2: An entity is permitted to collect personal medical information if the entity acts under a Court Order authorising the collection of personal medical information.

Section 3: (Prohibition to collect personal information) It is forbidden to collect personal information unless an entity is permitted to collect personal medical information.

Offence: an entity collected personal information
Defence: an entity being permitted to collect personal medical information.
A realistic legal example (a Privacy Act)

Example

Section 1: (Prohibition to collect personal medical information)

Offence: It is an offence to collect personal medical information.

Defence: It is a **defence** to the prohibition of collecting personal medical information, if an entity immediately destroys the illegally collected personal medical information before making any use of the personal medical information.

Section 2: An entity is permitted to collect personal medical information if the entity acts under a Court Order authorising the collection of personal medical information.

Section 3: (Prohibition to collect personal information) It is forbidden to collect personal information unless an entity is permitted to collect personal medical information.

Offence: an entity collected personal information

Defence: an entity being permitted to collect personal medical information.
Example

Section 1: (Prohibition to collect personal medical information)

Offence: It is an offence to collect personal medical information.

Defence: It is a defence to the prohibition of collecting personal medical information, if an entity immediately destroys the illegally collected personal medical information before making any use of the personal medical information.

Section 2: An entity is permitted to collect personal medical information if the entity acts under a Court Order authorising the collection of personal medical information.

Section 3: (Prohibition to collect personal information) It is forbidden to collect personal information unless an entity is permitted to collect personal medical information.

Offence: an entity collected personal information

Defence: an entity being permitted to collect personal medical information.
A realistic legal example (a Privacy Act)

Example

Section 1: (Prohibition to collect personal medical information)

Offence: It is an offence to collect personal medical information.

Defence: It is a defence to the prohibition of collecting personal medical information, if an entity immediately destroys the illegally collected personal medical information before making any use of the personal medical information.

Section 2: An entity is permitted to collect personal medical information if the entity acts under a Court Order authorising the collection of personal medical information.

Section 3: (Prohibition to collect personal information) It is forbidden to collect personal information unless an entity is permitted to collect personal medical information.

Offence: an entity collected personal information

Defence: an entity being permitted to collect personal medical information.
A realistic legal example (a Privacy Act)

Example

Section 1: (Prohibition to collect personal medical information)

Offence: It is an offence to collect personal medical information.
Defence: It is a defence to the prohibition of collecting personal medical information, if an entity immediately destroys the illegally collected personal medical information before making any use of the personal medical information.

Section 2: An entity is permitted to collect personal medical information if the entity acts under a Court Order authorising the collection of personal medical information.

Section 3: (Prohibition to collect personal information) It is forbidden to collect personal information unless an entity is permitted to collect personal medical information.

Offence: an entity collected personal information
Defence: an entity being permitted to collect personal medical information.
Interpreting the concept of *Defence*

**Question**

What does a *defence to a prohibition* mean in the Privacy Act?

**Answer (Version I)**

Prima facie, a defence to a prohibition means that there is a case where the prohibition does not apply.

**Answer (Version II)**

More precisely, a defence to a prohibition means that there is an exception (i.e., a permission) with respect to the prohibition.
Interpreting the concept of *Defence*

**Question**

What does a *defence to a prohibition* mean in the Privacy Act?

**Answer (Version I)**

*Prima facie,* a *defence to a prohibition* means that there is a *case where the prohibition does not apply.*
Interpreting the concept of *Defence*

**Question**

*What does a *defence to a prohibition* mean in the Privacy Act?*

**Answer (Version I)**

*Prima facie, a *defence to a prohibition* means that there is a *case where the prohibition does not apply*.*

**Answer (Version II)**

*More precisely, a *defence to a prohibition* means that there is an *exception (i.e., a permission)* with respect to the prohibition.*
Example

Section 3: (Prohibition to collect personal information) It is forbidden to collect personal information unless an entity is permitted to collect personal medical information.

- Offence: an entity collected personal information
- Defence: an entity being permitted to collect personal medical information.
Interpreting the concept of *Defence*: Section 3

**Example**

Section 3: *(Prohibition to collect personal information)* It is forbidden to collect personal information unless an entity is permitted to collect personal medical information.

- **Offence:** an entity collected personal information
- **Defence:** an entity being permitted to collect personal medical information.
Interpreting the concept of *Defence*: Section 3

**Example**

Section 3: (Prohibition to collect personal information) It is forbidden to collect personal information unless an entity is permitted to collect personal medical information.

- **Offence**: an entity collected personal information
- **Defence**: an entity being permitted to collect personal medical information.

**Remark**

- There is a general prohibition to collect personal information
- Personal medical information is personal information
- Being permitted to collect personal medical information is an exception to the general prohibition.
Interpreting the concept of *Defence*: Section 3

**Example**

Section 3: *(Prohibition to collect personal information)* It is forbidden to collect personal information unless an entity is permitted to collect personal medical information.

**Offence:** an entity collected personal information  
**Defence:** an entity being permitted to collect personal medical information.

**Answer**

*In Section 3 of the Privacy Act, a defence to the prohibition to collect personal information is the permission to collect personal medical information, which is an exception with respect to the general prohibition.*
# Interpreting the concept of *Defence*: Section 3

## Example

**Section 3: (Prohibition to collect personal information)** It is forbidden to collect personal information unless an entity is permitted to collect personal medical information.

- **Offence:** an entity collected personal information
- **Defence:** an entity being permitted to collect personal medical information.

## Answer

*According to Section 3 of the Privacy Act, when we have an exception, we are permitted to collect personal (medical) information, which means that no prohibition applies in that case.*
Interpreting the concept of *Defence*: Section 1

**Example**

**Section 1**: (Prohibition to collect personal medical information)

**Offence**: It is an offence to collect personal medical information.

**Defence**: It is a defence to the prohibition of collecting personal medical information, if an entity immediately destroys the illegally collected personal medical information before making any use of the personal medical information.
Interpreting the concept of *Defence*: Section 1

**Example**

**Section 1**: (Prohibition to collect personal medical information)

**Offence**: It is an offence to collect personal medical information.

**Defence**: It is a *defence* to the prohibition of collecting personal medical information, if an entity immediately destroys the illegally collected personal medical information before making any use of the personal medical information.
Interpreting the concept of *Defence*: Section 1

**Example**

**Section 1:** *(Prohibition to collect personal medical information)*

**Offence:** It is an offence to collect personal medical information.

**Defence:** It is a defence to the prohibition of collecting personal medical information, if an entity immediately destroys the illegally collected personal medical information before making any use of the personal medical information.
Interpreting the concept of *Defence*: Section 1

**Example**

Section 1: (Prohibition to collect personal medical information)

**Offence:** It is an offence to collect personal medical information.

**Defence:** It is a defence to the prohibition of collecting personal medical information, if an entity immediately destroys the illegally collected personal medical information before making any use of the personal medical information.
Interpreting the concept of *Defence*: Section 1

**Example**

Section 1: *(Prohibition to collect personal medical information)*

**Offence:** It is an offence to collect personal medical information.

**Defence:** It is a defence to the prohibition of collecting personal medical information, if an entity immediately destroys the illegally collected personal medical information before making any use of the personal medical information.

**Question**

*Does defence to a prohibition in Section 1 mean that in such a case no prohibition applies?*
Interpreting the concept of *Defence*: Section 1

**Example**

**Section 1: (Prohibition to collect personal medical information)**

**Offence:** It is an offence to collect personal medical information.

**Defence:** It is a defence to the prohibition of collecting personal medical information, if an entity immediately destroys the illegally collected personal medical information before making any use of the personal medical information.

**Answer**

*Not at all!*

- The *permission to collect personal medical information* is stated in *Section 3* as an exception, under certain conditions (being authorised by a Court Order), to the general prohibition to collect personal information;

- Since the offence here presumes that no Court Order authorising to collect personal medical information has been issued (*Section 2*), if no prohibition would apply here, we could not say that the personal medical information has been collected *illegally*!
Interpreting the concept of *Defence*: Section 1

1 Interpretation by coherence and harmonisation of Sections in the Privacy Act – The interpretation of *Defence* in Section 1 depends on the interpretation of Sections 2 and 3;
Interpreting the concept of *Defence*: Section 1

1. **Interpretation by coherence and harmonisation of Sections in the Privacy Act** – The interpretation of *Defence* in Section 1 depends on the interpretation of Sections 2 and 3;

2. **Goal-driven interpretation of Section 1** – The goal of Section 1 is preventing that any non-authorised collection of personal medical information be used to infringe the right to privacy of any person:

   - A violation has been committed (collecting without authorisation) and destroying the illegally collected medical information is a measure restoring the law (as if the personal medical information would never be collected): it is a *compensation measure*, not a simple exception; destroying the illegally collected medical information prevents the infringement of the right to privacy.
Interpreting the concept of *Defence*: Section 1

1. **Interpretation by coherence and harmonisation of Sections in the Privacy Act** – The interpretation of *Defence* in Section 1 depends on the interpretation of Sections 2 and 3;

2. **Goal-driven interpretation of Section 1** – The goal of Section 1 is preventing that any non-authorised collection of personal medical information be used to infringe the right to privacy of any person:
   - Is *defence* here ("destroying the illegally collected personal medical information before making any use of the personal medical information") a simple exception to the prohibition?
Interpreting the concept of *Defence*: Section 1

1. **Interpretation by coherence and harmonisation of Sections in the Privacy Act** – The interpretation of *Defence* in Section 1 depends on the interpretation of Sections 2 and 3;

2. **Goal-driven interpretation of Section 1** – The goal of Section 1 is preventing that any non-authorised collection of personal medical information be used to infringe the right to privacy of any person:
   - Is *defence* here (“destroying the illegally collected personal medical information before making any use of the personal medical information”) a simple exception to the prohibition?
   - A violation has been committed (collecting without authorisation) and destroying the illegally collected medical information is a measure restoring the law (as if the personal medical information would never be collected): it is a *compensation measure*, not a simple exception;
Interpreting the concept of *Defence*: Section 1

1. **Interpretation by coherence and harmonisation of Sections in the Privacy Act** – The interpretation of *Defence* in Section 1 depends on the interpretation of Sections 2 and 3;

2. **Goal-driven interpretation of Section 1** – The goal of Section 1 is preventing that any non-authorised collection of personal medical information be used to infringe the right to privacy of any person:

   - Is *defence* here (“destroying the illegally collected personal medical information before making any use of the personal medical information”) a simple exception to the prohibition?
   - A violation has been committed (collecting without authorisation) and destroying the illegally collected medical information is a measure restoring the law (as if the personal medical information would never be collected): it is a *compensation measure*, not a simple exception;
   - As a compensation measure, destroying the illegally collected medical information prevents the infringement of the right to privacy.
Optional Materials
Interpretation as activity or as outcome (Ross 1958)
Definition

We assume the distinction between interpretation as activity and as outcome:

- interpretation as activity (A-interpretation) (literal or from ordinary language, by coherence, etc.) views any argumentative canon as a means through which a certain meaning is ascribed to a legal provision and thus obtained, and

- interpretation as outcome (O-interpretation) is precisely the meaning obtained through a certain interpretive act and ascribed to the provision.
Interpretation as activity or as outcome (Ross 1958)

Provisions

1. Blue circle
2. Green circle
3. Orange circle
Interpretation as activity or as outcome (Ross 1958)
Canons as defeasible rules
Art. 575 Italian Penal Code. Homicide. Whoever causes the death of a man [uomo] is punishable by no less than 21 years in prison.
Canons as defeasible rules

Are you safe if you kill your wife in Italy?
Canons as defeasible rules

Art. 575 Italian Penal Code. Homicide. Whoever causes the death of a man [uomo] is punishable by no less than 21 years in prison.

Art. 3 Italian Constitution. All citizens have equal social status and are equal before the law, without regard to their sex, race, language, religion, political opinions, and personal or social conditions.
Canons as defeasible rules

IF
   art. 3 ought to be interpreted literally as \( d \), AND
   art. 3 is related with art. 575
THEN
   art. 575 is interpreted by coherence as \( b \).

where \( b = \)
Whoever causes the death of a human being is punishable by no less than 21
Canons as defeasible rules

\[ r : \text{Obl}_I(\text{art. } 3, d), \text{related} \Rightarrow \text{l}_C'(\text{art. } 575, b) \]
Interpretive conflicts (competing canons and beyond)
Interpretive conflicts (competing canons and beyond)

\[ r : \text{Obl} \ll (\text{art. 3, d}), related \Rightarrow \ll (\text{art. 575, b}) \]

\[ s : \neg \text{citizen} \Rightarrow \ll (\text{art. 575, b'}) \]

where \( b \) and \( b' \) are legally incompatible (e.g., \( b = \neg b' \) or even simply \( b \neq b' \)).
Interpretive conflicts (competing canons and beyond)

\[ \text{Obl}_I(\text{art. } 3, d), \text{related} \Rightarrow \text{I}_c(\text{art. } 575, b) \]

\[ \text{Obl}_I(\text{art. } 3, a), \text{related} \Rightarrow \text{I}_c(\text{art. } 575, b') \]

where \( b \neq b' \).
Preferences over interpretations
Preferences over interpretations

\[ r : \text{Obl}_I(\text{art. } 3, d), related \Rightarrow \text{l}_c(\text{art. } 575, b) \]

\[ s : \neg \text{citizen} \Rightarrow \text{l}_I(\text{art. } 575, b') \]
Preferences over interpretations

\[ r : \text{Obl}l_i(\text{art. } 3, d), \text{related} \Rightarrow l_c(\text{art. } 575, b) \]

\[ s : \neg \text{citizen} \Rightarrow l_i(\text{art. } 575, b') \]

\[ r > s \]
Preferences over interpretations

Preferences are employed as usual in defeasible reasoning to solve conflicts
Deontic qualification of interpretations
Deontic qualification of interpretations

General provisions of the Italian civil code, art. 12 (simplified):

In applying the law judges ought to ascribe to statutes their literal meaning, an ascription that can be done by also considering to the intent of the legislator. If a case cannot be solved in this way, judges have to employ arguments by analogy and, when this does not remove all doubts, the decision ought to be based on the general principles of the legal system.
Deontic qualification of interpretations

Definition

An interpretation can be *admissible* or *obligatory*. In the case of A-interpretations, for instance, an interpretive act I of n (A-interpretation of n) is admissible, if it is provable using a defeasible interpretation rule; it is obligatory, if this interpretation of n is the only one admissible. Similarly for O-interpretations.
Beyond abstract norms....
Beyond abstract norms....

Interpretation manipulates elements of rules like

\[ \text{art.575} : \text{kill} \_ \text{man} \Rightarrow \text{Obl} \atLeast21y \]
Beyond abstract norms...

Interpretation manipulates elements of rules like

\[
\text{art.575} : \text{kill } \_ \text{man} \Rightarrow ^{\text{Obl}} \text{atLeast } \_ \text{21y}
\]
Interpretation acts map into new versions of the same provision by replacing some elements

\[ I_s(\text{art.575}, \langle \text{kill\_man}, \text{atLeast\_21y} \rangle, \langle \text{kill\_human}, \text{atLeast\_21y} \rangle) \]
Beyond abstract norms....

Interpretation acts map into new versions of the same provision by replacing some elements

\[ l_s(\text{art.575}, \langle \text{kill\_man}, \text{atLeast\_21y} \rangle, \langle \text{kill\_human}, \text{atLeast\_21y} \rangle) \]

takes

\[ \text{art.575} : \text{kill\_man} \Rightarrow^{\text{Obl}} \text{atLeast\_21y} \]
Beyond abstract norms....

Interpretation acts map into new versions of the same provision by replacing some elements

\[
I_s(\text{art.575, } \langle \text{kill}_\text{man}, \text{atLeast}_\text{21y} \rangle, \langle \text{kill}_\text{human}, \text{atLeast}_\text{21y} \rangle)
\]

takes

\[
\text{art.575: } \text{kill}_\text{man} \Rightarrow^{\text{Obl}} \text{atLeast}_\text{21y}
\]

and returns

\[
\text{art.575: } \text{kill}_\text{human} \Rightarrow^{\text{Obl}} \text{atLeast}_\text{21y}
\]
Beyond abstract norms....

Interpretation as norm change? (From the logical viewpoint....)
Beyond abstract norms....
Conclusions

- interpretation as a process to assign meaning
- interpretive canons are represented by defeasible rules
- different reasoning patterns can be identified depending on whether we work on interpretations as activities or as outcomes
- preferences are important
- canons license deontic interpretive claims
- abstract vs structured provisions
Thanks!
The MIREL project

17/01/2017

MIREL-D1.1

Horizon 2020