Narrowing Legal Concepts

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Abstract We propose a framework for reconstructing the arguments supporting the restrictive interpretations of legal provisions. The idea is that the interpretation of legal concepts may require to change the counts-as rules defining them. Some connections with revision theory techniques are considered.

1. Introduction

Legal norms can often be viewed as plans which aim at achieving the goals considered by the lawmaker or society [13,6]. For example, the prohibition to smoke in public spaces promotes the goal of public health. As well as in AI, where universal plans are rarely a practicable solution, a feasible strategy for planning agents is to keep their goals fixed, generate partial plans, and revise them when needed. The law adopts *legal interpretation* as well as a method where goals are fixed and norms are adjusted to unforeseen situations. Indeed, due to the complexities of the world, norms are open to interpretation and cannot take into account all possible conditions where they should apply [11, chap. 7].

Constitutive rules, also known as counts-as, define the terms and concepts of normative systems [14]. These terms and concepts are used to define the conditions under which regulative rules, rules describing the ideal or legal behaviour, are applicable and produce normative effects. Often only the lawmaker has the power to modify regulative rules. On the other hand, the judicial system is typically empowered by interpreting norms under the restriction not to go beyond the purpose from which the legal rules stem.

In [4,5,12] we started investigating the process of narrowing and expanding legal concepts in terms of revision of counts-as theories using an extension of Defeasible Logic (DL) [9]. The benefit is twofold: (i) interpretive arguments are more transparent, and (ii) interesting connections with techniques from revision theory [1] are highlighted.

However, our earlier analysis is lacking in several respects. First, no real investigation of formal properties of the revision operations was presented in regard to well-known results of revision theory. Second, the analysis of [4,5,12] was based on only one form

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of revision working on the defeasible conclusions: here, we will discuss more technical options and present some preliminary results suggesting that standard AGM model [1] for theory revision is sometimes unsuitable in this legal context. Finally, no attempt was made to explore the dynamics of rule priorities in order to change legal concepts whenever the set of constitutive rules cannot be changed.

We study these open issues by focusing our attention on one type of revision: when the applicability scope of any legal rule is *narrowed*. The layout of the paper is as follows. Section 2 provides an informal background of [4,5,12] and describes the logic. A technical discussion about possible alternatives and results is offered in Section 3.

2. The Background

Normative systems define the terms and concepts to be used in it via *counts-as rules* [14]. For example, a counts-as rule stating that a bicycle counts as vehicle has this form: $r_0 : \mathit{Bike} \Rightarrow_c \mathit{Vehicle}$. Counts-as rules may be defeasible, e.g., a bicycle for children cannot be considered as a vehicle: $r_1 : \mathit{Bike}, \mathit{ForChildren} \rightsquigarrow_c \neg\mathit{Vehicle}$, where $r_1 > r_0$. In fact, the language of DL includes (i) special rules marked with $\rightsquigarrow$, called defeaters, which are not meant to derive conclusions, but to provide reasons against the opposite, (ii) a superiority relation $>$ that establishes the relative strength of rules and is used to solve conflicts.

We assume that the set of *regulative rules* is fixed: any judge (e.g., in civil-law systems) can argue about the conditions under which a regulative rule can be applied but cannot change the rule. An example of a regulative rule is $r_2 : \mathit{Vehicle}, \mathit{Park} \Rightarrow_{\mathrm{Obl}} \neg\mathit{Enter}$, which states that vehicles are (defeasibly) forbidden from entering parks. Moreover, we assign goals to regulative rules (see [13]): such goals bind the judicial interpretation process of regulative rules, since they are designed to promote the goals assigned to them. In this case, norms work like partial plans that the lawmaker sets up in advance: the judicial system is left with the task of dynamically adapting the applicability of the regulative rules by revising the counts-as rules which define their applicability conditions. This process aims at fulfilling the goal of the regulative rules under unforeseen circumstances.

More precisely, interpreting a regulative rule $r : b_1, \ldots, b_n \Rightarrow_{\mathrm{Obl}} \neg l$, with respect to a concrete case H, requires establishing if l violates r under the circumstances H. First, we have to check whether H, via the counts-as rules, matches with the applicability conditions $b_1, \ldots, b_n$ of r. If they match and l occurs we usually have a violation. Nevertheless, there are cases where H matches with $b_1, \ldots, b_n$ but we should not consider H as an instance of $b_1, \ldots, b_n$. This holds when the prohibition of l, if applied to H, would demote the goal of r. Jurists say that '*lex magis dixit quam voluit*', the law said more than what the lawmaker was meaning to say.

Example 1. *Let us suppose to have the following theory.*

$$T = \{r_0 : \mathit{Bike} \Rightarrow_c \mathit{Vehicle},\ r_3 : \mathit{2\_wheels}, \mathit{Transport}, \neg\mathit{Engine} \Rightarrow_c \mathit{Bike},$$
$$r_2 : \mathit{Vehicle}, \mathit{Park} \Rightarrow_{\mathrm{Obl}} \neg\mathit{Enter},\ \mathcal{G}(r_2) = \neg\mathit{pollution}\},$$

where the goal of r_2 is to reduce pollution around park areas. Mary enters a park on a bike, thus apparently violating r_2. The counts-as rules defining the concept of vehicle allows us to derive that all bikes are vehicles. Thus, the judge should establish that Mary is violating r_2. Suppose that instead the judge can show that, if Mary's case fulfils the applicability conditions *of r_2, then the goal assigned to r_2 would be demoted. For instance, prohibiting the circulation of bikes in parks would encourage people to get around parks by car. This demotes the goal of r_2 and in these circumstances the judge may have reasons to exclude that bikes are vehicles. Thus, we have to obtain in T that Mary's bike is not a vehicle in the current context.*

The revision procedure in [4,5,12] defines criteria to assign goals to regulative rules, to check whether these goals are promoted or demoted by some facts, and to determine what literals in a given regulative rule *r* are relevant, if derived, for the promotion of legal goals. Example 1, for instance, shows that the derivation of *Vehicle* of r_2 is critical, since r_2 for this reason would apply to bikes, but if any bike would comply with r_2, then the goal of r_2 would be demoted. Other cases can be considered [4,5,12], but we do not need to recall here all details. Just assume to work with a set $F = \{f_1, \dots, f_m\}$ of facts, a set R^{Obl} of regulative rules, a set R^c of counts-as rules, and a superiority relation $>$ that establishes the relative strength of conflicting rules. Consider any $r \in R^{\mathrm{Obl}}$ and suppose that the derivation of b of r is critical in regard to the promotion of the goal of r. Then, we must block the derivation of b and revise R^c: *narrowing the applicability of* r amounts to revising D into D_{-b} such that D_{-b} is equal to D except for the following two sets[3]:

$$R^c_{-b} = R^c \cup \{r : f_1, \dots, f_m \rightsquigarrow_c {\sim}b\} \qquad >_{-b} = > \cup \{r > t | \forall t \in R^c[b]\} \tag{1}$$

The revision mechanism of (1) is simple: in Example 1, this operation adds a defeater r_4 : *Bike*, *Park* $\rightsquigarrow_c \neg$*Vehicle* and states that r_4 is stronger than r_0: $> = \{r_4 > r_0\}$.

The remainder of the paper proposes alternative and more refined methods to revise R^c, i.e., procedures that are better and more general with respect to the operation (1). To do this, we need to formally introduce a language and a proof theory for reasoning with counts-as and regulative rules.

The language is as follows. A *literal* is either an atomic proposition or its negation; if l is a literal then $\mathrm{Obl}l$ and $\neg\mathrm{Obl}l$ are *modal literals*. If q is a literal, ${\sim}q$ denotes its complement (if q is a positive literal p then ${\sim}q$ is $\neg p$; and if q is $\neg p$, then ${\sim}q$ is p).

A *rule* consists of (i) a label r that uniquely identifies it, (ii) an antecedent $A(r)$, which is a finite set of literals, (iii) an *arrow* in $\{\rightarrow_Y, \Rightarrow_Y, \rightsquigarrow_Y\}$ where $Y \in \{c, \mathrm{Obl}\}$ is the *mode* of the rule, and (iv) a *consequent* $C(r)$, which is a literal. The intuition behind the different arrows is the following. *Strict rules* have the form $\phi_1, \dots, \phi_n \rightarrow_Y \psi$. *Defeasible rules* have the form $\phi_1, \dots, \phi_n \Rightarrow_Y \psi$. A rule of the form $\phi_1, \dots, \phi_n \rightsquigarrow_Y \psi$ is a *defeater*. The three types of rules establish the strength of the relationship. Strict rules provide the strongest connection between a set of premises and their conclusion: whenever the premises are deemed as indisputable so is the conclusion. A defeasible rule allows the derivation of its conclusion unless there is evidence for the contrary. Finally, a defeater suggests that the connection between its premises and the conclusion is not strong enough to warrant the conclusion on its own, but that it can be used to defeat rules for the opposite conclusion.

Given a set of rules R and a literal b, we denote the set of strict and defeasible rules in R, the set of strict rules in R, the set of defeaters in R and the set of rules in R whose consequent is b respectively with R_{sd}, R_s, R_{dft} and $R[b]$.

The reasoning mechanism used is based on structures called *normative theories* having the form $D = (F, R^c, R^{\mathrm{Obl}}, >)$, where (i) F is a finite set of literals called facts; (ii) R^c is a finite (non-empty) set of counts-as rules; (iii) R^{Obl} is a finite set of obligation rules; (iv) $>$ is an acyclic superiority relation defined over $R^c \cup R^{\mathrm{Obl}}$.

[3] $R[b]$ denotes the set of all rules whose consequent is b.

A *proof P in a normative theory D* is a finite sequence $P(1), \ldots, P(n)$ of tagged literals of the type $+\Delta^X q$, $-\Delta^X q$, $+\partial^X q$ and $-\partial^X q$, where $X \in \{c, \mathrm{Obl}\}$. The proof conditions below define the logical meaning of such tagged literals. As a conventional notation, $P(1..i)$ denotes the initial part of the sequence P of length i. Given a normative theory D, $+\Delta^X q$ means that literal q is provable in D with the mode X using only facts and strict rules, $-\Delta^X q$ that it has been proved in D that q is not definitely provable in D with the mode X, $+\partial^X q$ that q is defeasibly provable in D with the mode X, and $-\partial^X q$ that it has been proved in D that q is not defeasibly provable in D with the mode X.

The definition of Δ^X describes just forward (monotonic) chaining of strict rules[4]:

$+\Delta^X$: If $P(n+1) = +\Delta^X q$ then
(1) $q \in F$ if $X = c$ or $Xq \in F$ or
(2) $\exists r \in R_s^X[q]: \; \forall a \in A(r), +\Delta^c a$.

To show that a literal q is defeasibly provable with the mode X we have two choices: (1) We show that q is already definitely provable; or (2) we need to argue using the defeasible part of a normative theory D. For this second case, we must show that $\sim q$ is not definitely provable with that mode (2.1), we need to have a strict of defeasible rule for q with mode X whose antecedents are defeasibly provable (2.2) and such that all rules s attacking r are either not applicable or are successfully counterattacked by any other rule t.

$+\partial^X$: If $P(n+1) = +\partial^X q$ then
(1)$+\Delta^X q \in P(1..n)$ or
(2) (2.1) $-\Delta^X {\sim} q \in P(1..n)$ and
(2.2) $\exists r \in R_{\mathrm{sd}}^X[q] : \forall a \in A(r), +\partial^c a$, and
(2.3) $\forall s \in R^X[{\sim} q]$ either
(2.3.1) $\exists a \in A(r)$: $-\partial^c a$; or
(2.3.2) $\exists t \in R^X[q]$ such that $\forall a \in A(r)$, $+\partial^c a$ and $t > s$.

Given a normative theory D, the *universe* of D (U^D) is the set of all the atoms occurring in D. The *extension* (or conclusions) E^D of D is a structure $(\Delta_D^+, \Delta_D^-, \partial_D^+, \partial_D^-)$:

$$\Delta_D^+ = \{\mathrm{Obl}l : D \vdash +\Delta^{\mathrm{Obl}} l\} \cup \{l : D \vdash +\Delta^c l\}; \qquad \partial_D^+ = \{\mathrm{Obl}l : D \vdash +\partial^{\mathrm{Obl}} l\} \cup \{l : D \vdash +\partial^c l\};$$

$$\Delta_D^- = \{\mathrm{Obl}l : D \vdash -\Delta^{\mathrm{Obl}} l\} \cup \{l : D \vdash -\Delta^c l\}; \qquad \partial_D^- = \{\mathrm{Obl}l : D \vdash -\partial^{\mathrm{Obl}} l\} \cup \{l : D \vdash -\partial^c l\}.$$

3. Refining the Model

In this paper, we discuss how to logically model the *judicial* process of narrowing the applicability conditions of regulative legal norms. We proposed a basic procedure to block a counts-as conclusion b by introducing defeaters against rules proving b. This is possible either when such critical rules are not legally authoritative, or when the court has the power to add new counts-as rules derogating to them (for example, in most common-law systems). However, the judicial process of narrowing the applicability of regulative legal rules can take several other forms, which are summarised as follows.

[4]For space reasons, in the remainder we present only the proof conditions for $+\Delta$ and $+\partial$. Conditions for the negative tags can be easily obtained using the principle of *strong negation* [2].

(i) *Strict conclusions*: if b is in Δ_D^+, or the rule to be blocked is strict, no contraction is possible, and rule removal is the only solution. This is indeed possible if the critical counts-as rules do not express provisions that are legally codified (i.e., the lawmaker or any authoritative court has not explicitly stated them) or are not sufficiently authoritative (e.g., the existing rules are case law but the current court has a higher or equal ranking with respect to the court which produced those rules).
(ii) *Indirect conclusions*: the procedure does not cover the case where the contraction of the literal is not made by directly attacking the rules supporting it, which is sometimes more appropriate for legal reasons (see Remark 1).
(iii) *Superiority revision*: if the critical rules are authoritative and the court does not have any power to add new rules (such as in many civil law legal systems), it is still possible to work on the interpretation of existing rules by revising the superiority relation that establishes the relative strength of rules; in this way, we can still block b without changing the set of counts-as rules.

Section 3.1 addresses the first and second points; Section 3.2, the last one.

3.1. *Strict Conclusions and Indirect Conclusions*

Here we afford the issue of contracting a strict derivation of a literal. Let us introduce the following notion.

Definition 1. *Let $D = (F, R^c, R^{\mathrm{Obl}}, \succ)$ be a normative theory. A* counts-as reasoning chain *$\mathcal{C}$ in D for a literal b is a finite sequence $\mathcal{R}_1, \ldots, \mathcal{R}_n$ where*

- $\forall i \in \{1, \ldots, n\}$, $\mathcal{R}_i \subseteq R^c \setminus R_{dft}$,
- $\mathcal{R}_n = \{r : a_1, \ldots, a_m \hookrightarrow_c b \mid \hookrightarrow \in \{\rightarrow, \Rightarrow\}\}$,
- $\forall k \in \{1, \ldots, n\}$, *$\mathcal{R}_k$ is such that* $\forall r^k \in \mathcal{R}_k$, *for each* $d \in A(r^k) : d \in F$ *or* $\exists r^{k-1} \in \mathcal{R}_{k-1} : d = C(r^{k-1})$.

For all $s \in \mathcal{R}_k$, $1 \leq k \leq n$, s is in $\mathcal{C}$. If a literal l occurs in the head or the body of any s in $\mathcal{C}$, then l is in $\mathcal{C}$. A counts-as reasoning chain $\mathcal{C}$ is strict *iff all rules in $\mathcal{C}$ are strict.*

The general operation of rule removal is defined as follows.

Definition 2. *Let $D = (F, R^c, R^{\mathrm{Obl}}, \succ)$ be a normative theory and $\mathcal{C}_1, \ldots, \mathcal{C}_n$ the counts-as reasoning chains in D for a literal b.* Rule removal with respect to a literal b *is the operation that maps D into D^b_{-X} such that D^b_{-X} is equal to D except for R^c_{-X}, and:*

- $R^c_{-X} = R^c \setminus X$;
- $X = \{w_1, \ldots, w_m\}$ *is the smallest set of rules in R^c such that for every $\mathcal{C}_k$, $k \in \{1, \ldots, n\}$, there exists w_j in $\mathcal{C}_k$.*

The rule removal with respect to a literal b is strict *iff all rules in X are strict.*

As we argued above, rule removal is needed when the contracted literal is a strict counts-as conclusion or the rules that should be blocked are strict. Thus, Definition 2 necessarily applies when we consider *strict rule removal.*

Example 2. *Consider a normative theory D which contains $\{a, b\}$ as the set of facts and the following set of counts-as rules:*

$$R^c = \{r_1 : a \rightarrow_c \neg c,\ r_2 : d \Rightarrow_c c,\ r_3 : b \rightarrow_c d, r_4 : d, a \rightarrow_c \neg c\}$$

Suppose we want to contract $\neg c$*, which is in* Δ^+ *of the extension of D. In this theory we have only the following two strict counts-as reasoning chains for* $\neg c$*:*

$$\mathcal{C}^1 = \{r_1 : a \rightarrow_c \neg c\}^1_1 \qquad \mathcal{C}_2 = \{r_3 : b \rightarrow_c d\}^1_2, \{r_4 : d, a \rightarrow_c \neg c\}^2_2$$

Since the two chains do not share any rule, we have to remove at least two rules. An option is the removal of r_1 *and* r_4*, but also the removal of* r_1 *and* r_3 *would work.*

The previous example allows us to introduce the second question:

Remark 1. *Suppose we have the regulative legal rule* r_1 : *Homicide* $\Rightarrow_{\text{Obl}}$ *Prison, and the following set of counts-as rules defining the concept of homicide:*

$$R^c = \{r_2 : \mathit{Embryo} \rightarrow_c \mathit{Human\_Alive},\ r_3 : \mathit{Human\_Alive} \rightarrow_c \mathit{Person},$$
$$r_4 : \mathit{Person}, \mathit{Kill} \rightarrow_c \mathit{Homicide}.\}$$

Suppose a homicide is when someone kills a person, which is an alive human subject. Also, killing an embryo falls within the scope of homicide, because an embryo is considered, too, as an alive human subject. If we deny that killing an embryo amounts to a homicide, we have three options: removing r_2*,* r_3*, or* r_4*. However, it would be better to remove* r_2 *rather than* r_3 *or* r_4*: the second option would no longer allow to establish in general when a subject is a person, while the the third would deny that killing a person is a homicide, thus preventing the general application of* r_1*.*

Definition 2 allows us to flexibly change reasoning chains, as it permits to contract a literal by removing rules that do not directly support it. This, as we argued, may be needed in the law. The cost for this flexibility is that the contraction of strict conclusions no longer satisfies AGM postulates for minimal change [1]. Let us define the contraction D^-_p of a strict conclusion p as D^p_{-X}. We reframe the following two well-known AGM postulates (see [3]) in our setting: let $\# \in \{\Delta, \partial\}$

$$\text{If } p \notin \#^+_D \text{ then } E^{D^-_p} = E^D \qquad (\#\text{-Vacuity})$$

$$\text{If } p \in \#^+_D \text{ then } \Delta^+_D \subseteq \Delta^+_{(D^-_p)^+_p} \text{ and } \partial^+_D \subseteq \partial^+_{(D^-_p)^+_p} \qquad (\#\text{-Recovery})$$

Assume that expansion D^+_p is in general defined as follows: if $\# \in \{\Delta, \partial\}$

$$D^+_p = \begin{cases} D & \text{if } {\sim}p \in \#^+_D \\ (F, R'^c, R^{\text{Obl}}, >') & \text{otherwise} \end{cases}$$

where the following conditions hold:

$$\text{If } \# = \partial, \text{ then } R'^c = R^c \cup \{w :\Rightarrow_c p\} \qquad (2a)$$
$$>' = (> \cup \{w > r \mid \forall r \in R^c[{\sim}p]\}) - \{r > w \mid r \in R^c[{\sim}p]\}$$

$$\text{If } \# = \Delta, \text{ then } R'^c = R^c \cup \{w :\rightarrow_c p\}. \qquad (2b)$$

When we apply Definition 2, the only case of expansion we are interested in is the one at condition (2b) above. If so, it is easy to show that the following result holds:

Theorem 1. *For any literal p and any normative theory D, let* $D^-_p = D^p_{-X}$*. Then, the contraction operation does not satisfy the postulates of* Δ*-Vacuity and* Δ*-Recovery, unless* $\forall w \in X : w \in R^c[p]$.

In other words, rule removal only affects those rules that directly prove p. Notice that Definition 2 successfully removes any b from the set of strict conclusions of a theory:

Theorem 2. *Let D be any normative theory. Then* $p \notin \Delta^+_{D^p_{-X}}$.

Similar considerations apply to the contraction of defeasible conclusions. Let us first introduce another auxiliary concept:

Definition 3. *Let D be an extended normative theory. A counts-as reasoning chain* $\mathcal{C}$ *in D for a literal b is* active in D *iff for each literal a in* $\mathcal{C}$, $D \vdash +\partial_c a$.

A general procedure of defeasible contraction thus is the following:

Definition 4. *Let* $D = (F, R^c, R^{\mathrm{Obl}}, >)$ *be a normative theory and* $\{f_1, \ldots, f_j\}$ *be a set of conditions for contracting a literal p in D. The normative theory* $D_{\flat p}$ *is defined as the fixed point of the sequence* $D_0, D_1, \ldots,$ *where* $D_0 = D$, $\mathcal{A}_i = \{\mathcal{C}^i_1, \ldots, \mathcal{C}^i_n\}$ *is the set of all active counts-as reasoning chains in* D_i *for the literal p, and*

- $D_{i+1} = D_i$ *if* $\mathcal{A}_i = \emptyset$*, otherwise*
- $D_{i+1} = (F, R^c_i, R^{\mathrm{Obl}}, >_i)$ *where*
  - *(i)* $R^c_{i+1} = R^c_i \cup \{s : f_1, \ldots, f_j \leadsto_c {\sim}q | q \text{ is in } \mathcal{C}^i_k \ \forall k \in \{1, \ldots, n\}\}$,
  - *(ii)* $>_{i+1} = >_i - [\{r_k > s | r_k \in R^c_i[{\sim}C(s)], r_k \text{ occurs in } \mathcal{C}^i_k \ \forall k \in \{1, \ldots, n\}\}$.

Remark 2. *The apparent complexity of Definition 4 depends on the fact that, the removal of p from* ∂^+_D *without affecting the rules in* $R^c_d[p]$ *must take into account that blocking some other literals that are used to argue in favor of p may trigger in turn some rules proving p, like in the following set of rules:*

$$R^c = \{r_1 :\Rightarrow_c a,\ r_2 : a \Rightarrow_c b,\ r_3 : b \Rightarrow_c p,\ r_4 : a \Rightarrow_c c,\ r_5 :\Rightarrow_c \neg c,\ r_6 : \neg c \Rightarrow_c p\}$$

Here, if we only add a defeater like $s :\leadsto_c \neg a$*, we remove a from* ∂^+_D*, which occurred in all active reasoning chains for p, but in doing so, rule* r_4 *is no longer applicable and thus we trigger* r_5 *and* r_6*, once again having p in the defeasible extension. Hence, we have to repeat the procedure and add another defeater like* $t :\leadsto_c c$*, which blocks rule* r_5.

However, a result similar to the one in Theorem 1 can be proved also in this case:

Theorem 3. *For any literal p and any normative theory D, let* $D^-_p = D_{\flat p}$*. Then, the contraction operation does not satisfy the postulates of* ∂*-Vacuity and* ∂*-Recovery, unless, condition (i) and (ii) in Definition 4 are reframed in such a way as* $q = p$.

The following proposition states that the proposed operations for defeasible contraction are successful:

Theorem 4. *Let D be any extended normative theory. Then* $p \notin \partial^+_{D_{\flat p}}$ *unless* $p \in \Delta^+_D$.

3.2. *Narrowing Concepts by Changing Rule Priorities*

We have assumed that only the set of regulative legal rules cannot be changed. However, there are situations where it is not even allowed to revise the set of counts-as rules (at least by courts of civil law legal systems), for example, whenever such counts-as rules are explicit norms stated by the lawmaker. Indeed, legal rules may refer to

(1) ordinary concepts used in the law which are characterised by the counts-as rules of ordinary language;

(2) legal concepts that are authoritatively defined by the legal system (explicit legal definitions, case law, etc.), such as when such legal concepts

  (2.1) do not have any ordinary understanding: e.g., *adverse possession*;
  (2.2) may have both a legal and an ordinary understanding: e.g., *property*.

Typically a normal citizen has no power to change the law, nor to establish what norms are effective in the jurisdiction she is situated in, but she can argue that one norm instead of another can be applied in a specific case.

Prima-facie conflicts appear in legal systems for a few main reasons, such as (i) norms from different sources, (ii) norms emitted at different times, and (iii) exceptions. Accordingly, conflict resolution can be afforded by using *legal principles*. In Example 3, we show how these principles apply to handle exceptions.

Example 3. *A couple can have offspring but, since both mother and father are affected of cystic fibrosis, they know that every their child will be affected by the same genetic anomaly. Since they want their offspring to be healthy, they request for medically assisted reproduction techniques. Their case is disputed in Court where the judge has to establish which between Art. 4 of Italian Legislative Act 40/2004*[5] *(r_0 and r_1) and the* standard common medical practice *(r_3) in force in 15 countries of the EU prevails. The judge argues in favour of r_1 based on* lex superior *and refuses their request.*

$$\begin{aligned}
R^{\mathrm{Obl}} &= \{r_0 : \neg CandidateInVitroFertilization \Rightarrow_{\mathrm{Obl}} \neg Techniques\}\\
R^c &= \{r_1 : \neg Sterility \Rightarrow_c \neg CandidateInVitroFertilization,\\
&\quad r_2 : Embryo \Rightarrow_c \neg Sterility,\\
&\quad r_3 : \neg Sterility, GeneticAnomalies \rightsquigarrow_c CandidateInVitroFertilization,\\
&\quad r_4 : \neg Sterility, GeneticAnomalies \Rightarrow_c \neg Healthy\}\\
\succ &= \{r_1 \succ r_3\}.
\end{aligned}$$

The couple appeals to the European Court for Human Rights. The Court establishes that not permitting the medical techniques would demote the goal of family health promoted by Article 8 of the Convention. In our example, r_3 promotes the goal of family health, and thus we invert the priority between r_1 and r_3 based both on lex superior *and* lex specialis.

The problem of changing a defeasible theory by only modifying the preference relation has already been studied in [7] where three *canonical cases* were identified. Given a normative theory D and a literal p, we have: (i) a *contraction of p* if from $D \vdash +\partial p$ we obtain $D' \vdash -\partial p$, (ii) an *expansion of p* if from $D \vdash -\partial p$ we obtain $D' \vdash +\partial p$, and (iii) a *revision of p* if from $D \vdash +\partial{\sim}p$ we obtain $D' \vdash +\partial p$.

Definition 5. *Let $D = (F, R^c, R^{\mathrm{Obl}}, \succ)$ be a normative theory and $\mathcal{C}$ be a chain for p. We define $D^+_p = (F, R^c, R^{\mathrm{Obl}}, \succ^+)$ to be the* expansion theory of D by p*, where $\succ^+$ is a minimal preference relation such that*

(i) $D \nvdash +\partial^c p$ and $D^+ \vdash +\partial^c p$;
(ii) $\succ^+ = \succ \cup \{(r, s)\} \setminus \{(s, r)\}$ such that $r \in \mathcal{C}$, $C(r) = {\sim}C(s)$, and $\forall a \in A(s).D \vdash +\partial^c a$;
(iii) $\succ^+ = \succ^+ \cup \{(t, w)\} \setminus \{(w, t)\}$ such that $C(t) \in \mathcal{C}$, $C(t) = {\sim}C(w)$, $D \nvdash +\partial^c C(w)$, $D^+ \vdash +\partial^c C(w)$, and $\forall a \in A(w).D^+ \vdash +\partial^c a$.

[5] The recourse to medically assisted reproduction techniques is allowed only [...] in the cases of sterility.

To expand a theory by changing the superiority relation, we select a chain that can prove p. We identify the set of rules whose conclusion is the opposite of a literal in the chain for p and with all the antecedents proved. All these rules will be defeated in the new superiority relation. Again, we face the same issue as Remark 2. The solution proposed in (iii) is to block those conclusions opposite to a literal in the chain for p and that are proved in the theory whose superiority relation is that of (ii).

This can be addressed by an iterative procedure (as the one proposed in [8]) that computes such a set at every iteration. Since the number of the rules is finite, the procedure will eventually end, and since the new superiority relation minimally differs from the original one, no un-necessary operations are made.

An analogous procedure has been devised for contracting a literal p from a defeasible theory. The idea is to isolate the chains in D that defeasibly proves p, and to weaken them by using applicable arguments supporting literals opposite to elements of those chains. As for expansion, we afford the issue of Remark 2 by adopting counter-measures for those chains that become active for p during the computation.

Definition 6. *Let $D = (F, R^c, R^{\mathrm{Obl}}, >)$ be a normative theory and $\mathcal{C} = \{\mathcal{C}_1, \ldots, \mathcal{C}_n\}$ be the set of all active chains for p. We define $D^-_p = (F, R^c, R^{\mathrm{Obl}}, >^-)$ to be the* contraction theory of D by *p, where $>^-$ is a minimal preference relation such that*

(i) $D \vdash +\partial^c p$ and $D^- \not\vdash +\partial^c p$;

(ii) $>^- = > \setminus \{(r, s)\}$ such that $\exists j.r$ is in $\mathcal{C}_j$, $C(r) = {\sim}C(s)$, and $\forall a \in A(s).D \vdash +\partial^c a$;

(iii) $>^- = >^- \setminus \{(w, t)\}$ such that $\exists j.w$ is in $\mathcal{C}_j$, $D \not\vdash +\partial^c C(w)$, $D^- \vdash +\partial^c C(w)$, and $\forall a \in A(t).D^- \vdash +\partial^c a$.

In the same work, we also point out that two main problematics affect defeasible contraction and expansion by only changing the superiority relation: (i) *tautologicity* of a literal, i.e., a literal that is true in every interpretation; (ii) ∂-*unreachability* of a literal, i.e., a literal whose provability always depends from a literal and its complementary. We refer the interested reader to [8] for a formal characterisation of the topic. Clearly, these two literal states prevent the successfulness of the operations.

Theorem 5 (Success of Defeasible Expansion)**.** *Let $D = (F, R^c, R^{\mathrm{Obl}}, >)$ be any normative theory. Then $p \in \partial^+_{D^+_p}$, unless p is ∂-unreachable.*

Theorem 6 (Success of Defeasible Contraction)**.** *Let $D = (F, R^c, R^{\mathrm{Obl}}, >)$ be any normative theory. Then $p \notin \partial^+_{D^-_p}$, unless p is a tautology.*

In addition to the above restrictions to guarantee the success of the operations, [8] shows that only a few of the AGM principles for belief based on changes on the preference relation. As we have illustrated in Example 3 under the circumstances outlined in the introduction to this section, there are situations where narrowing legal concepts can be done naturally operating on the preference ordering of the rules. This is a further confirmation of the results in [10] claiming that the AGM postulates, in general, are not appropriate for legal reasoning. In particular, ∂-Recovery does not hold since, once the contracted theory has been obtained, the backward step does not uniquely correspond to expanding the obtained theory by the same literal.

Example 4. *Let us consider the following theory, where*

$$R^c = \{r_0 :\Rightarrow_c a, \quad r_1 : a \Rightarrow_c p, \quad r_2 :\Rightarrow_c \neg a, \quad r_3 :\Rightarrow_c b, \quad r_4 : b \Rightarrow_c p, \quad r_5 :\Rightarrow_c \neg b\}$$

and $r_0 > r_2$. If we contract for p erasing $r_0 > r_2$, then it is possible to expand the resulting theory adding $r_3 > r_5$.

4. Summary

We proposed a framework for reconstructing the arguments supporting the restrictive interpretations of legal provisions. The contribution is based on the idea that the interpretation of legal concepts may require to change the counts-as rules defining them. Indeed, if our ontology classifies, for example, a bike as a vehicle, but we have reasons that this is not the case, then this implicitly leads to conclude that the ontology must be revised and that a bike, at least in the contexts under consideration, is not a vehicle.

The revision procedure presented in this paper is driven and constrained by considering the goal of the regulative legal rules in which these concepts occur. Some interesting connections with revision theory techniques are considered.

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