

Value assessment and revision in legal interpretation

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ABSTRACT

The research aims at a formal definition of constructive interpretation in law as the dynamic of revision of theories about the normative system, embedding a model of balancing values [13] into an architecture of i/o logics representing conceptual, deontological and axiological rules [11]. We also introduce new revision operators which are relevant in the context of value assessments.

CCS CONCEPTS

• **Computing methodologies** → **Nonmonotonic, default reasoning and belief revision**; • **Applied computing** → **Law**;

KEYWORDS

normative systems, input/output logics, balancing values

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1 INTRODUCTION

Legal interpretation, broadly understood, may be assumed to include all reasoning processes that go from legal sources to the determination of the normative content that results from those sources (see recently [6]). In this broad sense, legal interpretation encompasses both the identification of the semantic/pragmatic content that is conveyed by a legal text (linguistic interpretation) and those further processes aiming at filling gaps, eliminating ambiguities and vagueness, solving inconsistencies between rules and incoherences between rules and its underlying values in concrete or hypothetical contexts ("constructive interpretation" or "legal construction", [14]).

The values at stake in this "constructive interpretation" can be internal to a positive legal system, their pursuit being required by the principles of that very system ([2]), as expressed by its sources (in particular, constitutional norms), or they can be external to it, being regarded as moral standards for (or advanced by) the legal

system. Our analysis is compatible with both uses of values in legal reasoning.

A key aspect of the debate in contemporary legal theory involves the incorporation of interpretation and moral or political values in the criteria of legality or the identification of valid law. However there is no corresponding formal definition of the concept of a legal or normative system, which includes the relations between rules, moral standards and meaning ascription. Although some may argue that such incorporation undermines the conception of law as a system of rules, turning law into an unsystematic practice of morally engaged argumentation, we believe that it is possible to reconstruct a formal theory of the legal system, which is compatible with more or less inclusive theories on the relation between law and morality. The idea is to provide an abstract framework where different conceptions of law may be reconstructed.

Pursuing this goal we bring together two parallel lines of research in AI & law: on the one hand the study of the role of values in case-based legal argumentation, and on the other hand the study of statutory interpretation as the dynamical modification of normative systems. In particular, it embeds the model of value assessment proposed by Sartor ([13]) into the architecture of i/o logics proposed by Maranhão ([11]) intended to represent legal construction, where different kinds of legal materials, such as conceptual classifications, moral values or goals and legal rules are subject to change. The embedding proposed enriches the architecture by making it possible to assess the impact of each action on all the values at stake, which is then balanced considering the weight of each impacted value. Sartor's model of balancing values is also enriched by the introduction of modulation rules, making each factor have an intensifying or attenuating influence on the impact of the action on the values at stake. So, instead of an assignment of impact of an action on the values, for a given constellation of factors, our model assigns the influence that each factor has on the impact of the action on those values considered in the assessment. This brings more flexibility to the balancing and makes the model more realistic: the direction of impact of an action on a value is still invariant (an action either promotes or demotes a value), but here the degree of impact of the action on the values may vary with the introduction of new factors.

2 NORMATIVE SYSTEMS

We shall use the term "*normative set*" to refer to sets of different kinds of rules: (i) a set of *conceptual rules*; (ii) a set of *modulation rules*; (iii) a set of *deontological rules* (iv) a set of *axiological rules*.

Conceptual rules consist in the ascription of a legal meaning or concept, *i.e.* they state that the entities described by certain factors *count as* (are to be classified as) instances of the ascribed concept (see [7]). We represent conceptual rules in the form (a, c) where a is the triggering factor, c is the ascribed concept. For instance, a conceptual rule stating that a message exchange stored in a mobile phone (*sms*) counts as "data" can be represented as (sms, dat) .

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Modulation rules specify the extent to which the presence of a factors affects the impact of actions on values. Such modulations reflect both causal connections (that the action, given the factor is likely to produce a certain individual or social outcome) and evaluative assessments (that the outcome of the action will count as an impact on the value). The values may consist in individual or social rights, moral principles, or collective goals.

We distinguish three kinds of modulation rules: baseline, intensifier and attenuator rules (following [5]). A baseline rule specifies that an action has a certain impact of an action on a value, in the absence of relevant circumstances. An intensifier rule specifies that the presence of a factor (the intensifier) increases the action's impact on the value. An attenuator rule specifies that the presence of a factor (the attenuator) decreases the action's impact on the value. We model modulation rules in the form $(a, V^x)_i$, where a is the triggering factor, V is the affected value, x action at stake, and i is the extent of the modulation. For a baseline example, consider the rule specifying that the action consisting in the unauthorised access to the content of a mobile phone by the police affects the value of privacy to the extent 0.5, which we model as $(\top, Priv^{acc})_{.5}$. For an intensifier, consider the rule that privacy impact of this action is increased if mobile phone is password protected $(pass, Priv^{acc})_{.2}$. For an attenuator, consider that the impact of the action on privacy is decreased if the mobile phone is not personal $(\neg pers, Priv^{acc})_{-.3}$.

With respect to obligation or permission rules, we make a distinction between deontological and axiological ones. Such rules lead to distinct deontic conclusions which may be in conflict.

Deontological rules link the (deontological) prohibition or permission of a given action to the presence of certain antecedent conditions. We model deontological rules in the form (a, x) , where a is the triggering factor (or concept) and x is the obligatory or permitted action. For instance, we represent as $(\neg sord, \neg acc)$ the rule prohibiting police officers from accessing personal documents without a search & seizure order.

Axiological rules make the (axiological) obligation or permission of an action dependant on on the action's impact on a value. They are partitioned into two sets: those linking the prohibition of an action to the value demoted by that action; and those linking the permission of an action to the value promoted by that action. We represent axiological prohibitions in the form $(V^x, \neg x)_i$, where V is the value demoted by action x , which is consequently prohibited, and i is the weight of the value, and axiological permissions as $(V^x, x)_i$ where V is the promoted value, and x is the consequently permitted action. For instance, let us assume that access to a mobile phone by police officers demotes privacy, which is a reason for prohibiting it, while it promotes public safety, which is consequently a reason to permit it. We can model these rules, for instance, as $(Priv^{acc}, \neg acc)_4$ and $(Saf^{acc}, acc)_5$.

We assume that reasoning with each kind of rule (conceptual, modulation, deontological, or axiological ones) has different logical properties and therefore requires a different output operator in an architecture of i/o logics [9].

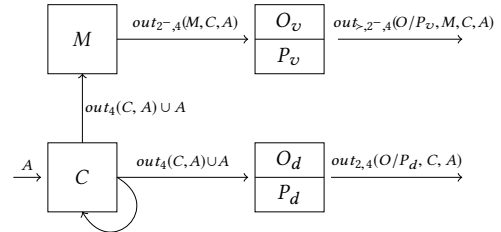
One may combine normative sets and output operators by making the output of a normative set (possibly joined with the input set) the input of the output operation on the other normative set. We call *sequence* a chain of combinations of normative sets. A *normative system* is then conceived as any class of sequences of normative

sets. That is, what makes the normative material given by the normative sets a *normative system* is the architecture structured by the sequences in an input/output frame and the corresponding logics used to prepare the inputs and outputs at each step in the sequences.

Our model constructs a particular structure or architecture of normative systems, where the set of conceptual rules (box C) contributes to the determination of which deontological rules and which value assessments are triggered. The deontological consequences are the result of an output operator on a set of obligations (O_d) and a set of explicit permissions (P_d), taking as input the output of conceptual rules and the original input.

The value assessment employs the set of modulation rules (box M) and two sets of axiological rules, one concerning the values which are promoted by the action at stake (box P_v) and the other concerning the values which are demoted by that action (box O_v). The set of modulation rules linking facts and concepts to values (i.e., value-impacts of the action at stake) is governed by a weakened basic output operator. The sets of axiological rules, linking values to permissions and obligations are governed by a preferential output operator out_{\succ} , defined in Section 6.

Within this abstract framework, a normative system is specified by indicating the rules of each normative set in the corresponding structure. The structure $\langle O/P_d, M, C \rangle$ of normative systems used in our model is represented in the figure below. The arrows indicate the direction of the outputs of each normative set, which serves as input for the subsequent normative set and output operator. The subscripts to each output operator indicates the i/o logics corresponding to each normative set in the sequence. For instance $out_{2,4}(O/P_d, C, A)$ indicates that box C is governed by a basic reusable output logic (out_4) and the boxes O_d and P_d are governed by a basic output logic (out_2)



An argument is based on a normative system if it is based on a normative sequence in the system (it is a sequence of subsets of the normative sets in the sequence), and a rule (a, x) is entailed by a normative systems if it is entailed by a sequence in the system. If the argument (X_1, \dots, X_n) supporting the derivation (a, x) is such that its top element X_1 is a non-empty set of deontological (axiological) rules, we say that (a, x) is an entailed deontological (axiological) rule.

3 NORMATIVE THEORIES

A normative system is the object of assertions by jurists (legal doctrine) who describe the systems through normative propositions, i.e., statements that certain obligations and permissions would hold given certain input factors, according to a normative system.

Normative propositions, while being descriptive of a given normative system (as viewed by the interpreter), also are evaluative, reflecting the evaluative aspects of the described system, namely, the ascription of intensities of influence (to modulation rules) or the ascription of weights of values (to axiological rules). Such evaluations, which we call λ -evaluations, contribute to determine the axiological obligations/permissions delivered by the system, and consequently, the deontological obligations/permissions resulting from axiology-driven revisions. That is, descriptions of the normative system are the result of legal construction, which, by its turn, is dependant on the revisions whose outcome takes evaluations into account. Therefore the model does justice and provide insights on the complex nature of normative propositions by legal doctrine, which is a polemic subject in legal theory.

Each normative proposition (evaluatively) describes an entailed deontological or axiological rule, with the exception of negative permissive propositions, which describe the non-derivability of such a rule. Thus, following Alchourrón [1], we distinguish a negative sense of permission $\mathbb{P}^-_{d/v}(x/b)$, as the absence of prohibition, from a positive sense of permission as an entailed deontological or axiological permission ($\mathbb{P}^+_{d/v}(x/b)$). We express normative propositions as dyadic formulae, which link possible inputs to deontological or axiological deontic qualifications:

$$\begin{aligned} NS &\models^\lambda \mathbb{O}_d(x/b) \text{ iff } x \in \text{out}_{2,4}(O_d, C, b) \\ NS &\models^\lambda \mathbb{P}^-_d(x/b) \text{ iff } \neg x \notin \text{out}_{2,4}(O_d, C, b) \\ NS &\models^\lambda \mathbb{P}^+_d(x/b) \text{ iff } x \in \text{perm}_{2,4}(O_d, P_d, C, b) \\ NS &\models^\lambda \mathbb{O}_v(x/b) \text{ iff } x \in \text{out}_{>,2-,4}(O_v, M, C, b) \\ NS &\models^\lambda \mathbb{P}^-_v(x/b) \text{ iff } \neg x \notin \text{out}_{>,2-,4}(O_v, M, C, b) \\ NS &\models^\lambda \mathbb{P}^+_v(x/b) \text{ iff } x \in \text{out}_{>,2-,4}(P_v, M, C, b) \end{aligned}$$

A normative theory Th^λ_{NS} about a normative system NS is the set of all normative propositions describing the rules entailed by that normative system based on the λ -evaluation. Different normative systems may have equal theories describing its obligations and permissions and, *vice versa*, the same system may have different theories.

We view constructive interpretation as the revision of a normative theory (possibly affecting the very system) to redetermine what actions are described as permitted or forbidden. This interpretive activity may or may not involve manipulation of the normative system, according to the dynamic of the revision functions. That is, the revision functions may change evaluations, what affects the balancing of axiological obligations and permissions, or may modify the legal material by refining its content, adding conceptual classifications or new values or by suppressing inconsistencies. Having this in mind we apply revision functions on normative theories, what is congenial to Kelsen's neo-kantian remark, according to which "legal science has a constitutive character and produces its own object of knowledge to the extent that it apprehends the legal material as meaningful" ([8], Ch. 3, Sec. XVI).

A key trigger of revisions in legal construction is the presence of normative conflicts. Again, we examine normative conflicts from the metalinguistic perspective of normative theories, since they are the product of legal construction. We distinguish conflicts of normative propositions according to the kind of rules which contribute to produce the conflict. *Inconsistency* captures cases in which deontological rules directly deliver incompatible conclusions, *proper*

incoherence the case in which the conflict of deontological rules is triggered by a conceptual classification, and *proper instability* the case in which deontological rules are in conflict with axiological rules expressing the values of the system. We also say that a normative theory is strongly stable, relatively to an input and an output, if the corresponding deontological normative proposition is matched by an axiological proposition, and that it is weakly stable, if the deontological propositions are not conflicted by an axiological proposition.

4 PREFERENTIAL OUTPUT

Our model of revisions presupposes a determination of the comparative legal merit of the choice of performing an action rather than abstaining from it, according to two distinct but complementary perspectives, the deontological and the axiological one. The action may consist in any behaviour that is regulated by the system, e.g. having an abortion rather than continuing the pregnancy or accessing a *sms* message, rather than respecting its confidentiality.

The determination of the axiological merit of performing or omitting an action depends on the evaluation of the entailed rule permitting or prohibiting the action, which, in its turn depends on the evaluations of the original rules used in the entailment.

Such evaluations are expressed by the quantitative indexes of modulation rules (for influence on impact on values) and axiological rules (for weighs of values). For generality's sake we assume that such index can take arbitrary numerical assignment within given ranges. These numbers can be restricted to any scales that may be convenient for the chosen domain of application (scales of 3, 5 or 10 positions may be appropriate). What matters is that the numerical assignments reflect some relative importance of the elements at stake, as part of a reasoning with dimensions and magnitudes, and how such assessment of relative importance affects the outputs of the systems and its overall coherence.

The entailment of axiological rules may involve three kinds of rules –conceptual, modulation, and axiological ones–, so that their evaluation depends on the intensity of factors and the weights of values.

We assume that the direction of impact of an action on a value –i.e., whether the action promotes or demotes the value– is invariant, although the extent of the promotion or demotion may be *intensified* or *attenuated* by the presence of factors in the context of performance.

Hence, given an action x , the set Val of values may be partitioned into a set of values Val^x_{Dem} which are demoted by the action and a set of values Val^x_{Prom} which are promoted by the action. The relative importance or weight of each value, denoted by w_V is given by a *weight function* $w : Val \rightarrow [0, 1]$.

The influence of a factor on the action's impact on a value is given by the *modulation function* $\Delta : L^2 \times Val \rightarrow [-1, 1]$. We denote by $\Delta^m_V(x)$ the influence of the modulating factor $m \in body(M)$ on the impact of the action $x \in L$ on the value $V^x \in Val$. If the influence is positive i.e. if $\Delta^m_V > 0$ the factor m is an *intensifier* of the impact of action at stake on value V . If $\Delta^m_V < 0$, then m is an *attenuator* of its impact on V . If $\Delta^m_V = 0$, m is *neutral*. Since we are not going to model assessment of the impact of different actions on values, we are going to omit the reference to the action at stake.

We call a λ -evaluation a couple of a modulation function and a weight function, that is $\lambda_i = [\Delta_i, w_i]$ is an evaluation assignment and we denote by Λ the set of all λ -evaluations.

The proportional influence of a modulating factor m , denoted by ϕ_v^m , is the product of the indexes of the modulation rule (indicating the intensification or attenuation due to the factor) and of the axiological rule (indicating the weight of the value), that is, $\phi_v^m = \Delta_v^m \times w_v$. Then we extend the definition of proportional influence to a set of factors $B = \{m_1, \dots, m_n\}$ on a set of values $W = \{V_1, \dots, V_n\}$, which is the sum of the proportional influences of each factor:

$$\Phi_W^B = \sum_{1 \leq i \leq n} \phi_{V_i}^{m_i}$$

Given this model of value assessment, we define the preferential output operator (out_{\succ}). The basic idea is to compare the proportional impact of an action on the values it demotes *vis-à-vis* its impact on the values it promotes, considering only those values which are triggered by the original input. If the proportional impact on the *demoted* values is positive and stronger, then there is an overall axiological obligation not to do the action or to obtain the state resulting from the action. On the other hand, if the proportional impact on the *promoted* values is positive and stronger, then there is an axiological explicit permission to do the action or to obtain its resulting state. As a result, the preferential output operator is defeasible.

Based on the strength of the impacts on the values triggered by an input, we define the proportional impact of an entailed axiological prohibition (permission), denoted by $\sigma_{(a,x)}$, as the difference between the sum of the proportional influence on the values demoted (promoted) and the sum of the proportional influences on the values promoted (demoted) by the entailed action x in the presence of the input factor a .

5 REVISION OF NORMATIVE THEORIES

Normative theories may be revised in various ways in order to restore stability. There are two basic forms of *revision* of normative theories that include value assessments. The first, which we call *revaluation*, consists in modifying the (modulation or weight) indexes of rules in the systems. The second, which we call *change*, consists in modifying the content of such rules. Whenever there is a conflict between an entailed axiological rule and an entailed deontological rule with respect to an action one may reevaluate, change the axiological rules, or change the deontological rules in order to reach axiological stability. We call *downward axiological revision*, the revision where axiology imposes changes of deontological rules, and *upward axiological revision*, the revision where deontology imposes the revision of axiology (by revaluation or change of axiological rules).

We call *revaluation functions* the revision meant to revise the λ -evaluation to achieve weak or strong axiological stability. In the first revision (weak stability), the deontological outcomes are not contradicted by axiologically preferred outcomes. In the the second revision (strong stability) deontological outcomes are paralleled by axiologically preferred outcomes.

Instability of a normative system is a problem of excess of output. When the λ -evaluation is fixed, such excess is solved by reducing

the output leading to conflict. So we introduce *change functions* that modify the normative sets in the normative system, by adding, deleting or refining rules.

Contraction, i.e. the suppression of an entailed rule, is an immediate form of avoiding excess. But since the conflict is contextual to a given input, we may also strengthen the antecedent of rules with respect to that input, whose presence makes the normative theory inconsistent, incoherent or unstable. Following [10], we call this operation refinement. Since in our architecture all the output operators are monotonic, except for the preferential output, contraction and refinement are the only change functions that may avoid the entailment of an “excessive” conceptual, modulation or deontological rule ([11] and [4]). For the preferential output, the addition of rules to the modulation set or to the axiological set may change the balance so as to avoid excess output or make the axiological output converge with the deontological one. But notice that depending on the ascribed λ -evaluation, the contraction or refinement of a modulation or a conceptual rule may also reduce the preferential output.

Besides these revision operators discussed in the literature we introduce new revision operators akin to the preferential output operator and which involve adding modulation rules or values to the respective normative sets, so that an entailed axiological rule, conflicting with a deontological obligation or permission, is no longer derived. We may achieve this result by including attenuators to the argument involved in the entailment of the axiological obligation or permission, so that it works as a kind of undercutting, or we may add intensifiers to the arguments leading to the entailment of the opposed axiological obligation or permission, mirroring a kind of rebuttal.

Hence, within the scope of a preferential output operator, an *undercutting expansion* of a prohibition (permission) consists in the addition of attenuators (possibly combined with the addition of new value rules) making the proportional impact of demoted (promoted) values negative or equal to the proportional impact of the promoted (demoted) values in the context specified by the factors considered. This means that the previously entailed axiological prohibition (permission) will not be derived. An *undercutting revision* will not only block the derivation of the axiological prohibition (permission) but also entail a permission of the action at stake. In its turn a *rebutting expansion* of a prohibition (permission) consists in the addition of intensifiers for the permission (prohibition) of the action at stake, making the proportional impact of the promoted (demoted) values equal to the proportional impact of the demoted (promoted) values in the context specified by the factors considered. Finally, a *rebutting revision* makes the proportional impact of the promoted (demoted) values stronger than the proportional impact of the demoted (promoted) values in the constalation of factors at stake. Therefore, not only the axiological prohibition (permission) will cease to be entailed, but also an axiological permission (prohibition) becomes entailed by the revised theory.

Note that undercutting and rebutting revisions may introduce new (attenuating or intensifying) factors in the modulation rules or may only introduce additional causal impacts on new values based on the existing factors. For instance, the extent to which a warrantless access to a password-protected phone interferes with relevant values can be increased through a rule according which

password-protection intensifies the access' impact on privacy as well as through a rule according to which access also interferes with the protection of dignity (this value not being previously considered).

6 LEGAL INTERPRETATION AS REVISION

The revision functions explored in our research provide classes of alternative normative systems whose corresponding normative theory derives or fails to imply a normative proposition.

Such revisions are meant to satisfy certain desiderata, namely, certain ideal properties of legal systems, which jurists (scholar, lawyers and judges) contribute to actualise through interpretation: consistency, coherence, stability, completeness and precision. The jurists' creativity, however, is constrained on the one hand by ideals of legal certainty and representative democracy, which require that the jurists respect the intention of the legislator or the ways in which the legislator's commands are understood by citizens, and on the other hand by the fact that jurists are not best equipped to address certain issues (e.g., they may have a limited grasp of complex economic, social or scientific issues) and lack political legitimacy. Various legal/political theories exist concerning the legitimate scope of jurists' interpretation and the extent to which they need to defer to legislators, and different legal systems may take different views on the matter [3].

Legal doctrine usually proposes revisions of legal systems to bring coherence to them: given two incompatible outcomes in an hypothetical case, jurists not only have to make a choice, but they have also to justify it in a general way, according to a legal theory that does not entail the alternative outcome. Similarly for completeness and precision: when considering how a non-regulated case should be decided, jurists are entitled to provide a consistent expansion of the legal systems that determines the outcome of the non-regulated case.

The case of stability is more problematic, since revisions of the legal system to meet value-requirements give jurists a political role: to achieve stability they must specify and implement the values of the legal system (as in constitutional adjudication) or of an extralegal conception of justice.

Our research proposes a model of legal interpretation reflecting the way in which legal doctrine constructs and compares alternative normative theories, which result from different forms of manipulation of the legal material, consisting legal rules, definitions of legal concepts and of legal, moral or political values. We show that different sorts of manipulation of the normative system are represented by a set of basic revision functions, which may be successively applied, leading to the construction of enriched normative theories.

Such result is relevant not only for artificial intelligence, by bringing a logical model for the activity of legal construction, but also for legal theory, provided that it reveals how the evaluative and multifarious activity of legal construction is supported by a basic rationality. And the model also unravel in a precise form the different trade-offs faced by legal doctrine to build a coherent and stable theory about the legal material, that is, if the best justification for the would be achieved by revising valuations of weigh and impact, by adding new values into account, by bringing new

modulating factors into consideration, or by revising and refining conceptual qualifications or the very deontological rules. Aspects of such trade-off in terms of maximizing obligations/permissions (outputs) or maximizing rules in the normative sets were indicated at [12].

The model also shows that it is still possible to conceive law as a system of rules even though the system's rules may be modified through different constructions and the outcomes of alternative constructions and (moral) evaluations can be described through different and incompatible legal theories. Systemic rationality is preserved when every construction satisfies the basic rationality of change, which is based on the postulates of coherence and minimal change.

In this enlarged conception of the legal system, a challenging question concerns to what extent should the jurist accept the system's instability, or rather revise it, and if so, by favouring deontology (upward axiological revision) or axiology (downward axiological revision)?

A balance between deontology and axiology might be achieved by allowing axiology to determine a revision of conceptual and deontological rules only when the axiological benefit reaches a certain threshold. In our model this idea could be translated into a comparison between the proportional impact σ of an entailed axiological rule conflicting with a derived deontological rule, and an stipulated threshold, which represents the minimal axiological benefit that justifies revisions of conceptual/deontological rules. The acceptability of axiology-driven revisions of entailed deontological rules may also depend on the reliability of the conceptual ascription upon which the deontological entailment is based. The formalization of the notion of reliability of an entailed deontological rule will be left to future research. It will also be interesting to extend the model to represent the reasoning where different actions are compared in terms of the value assessments we advance in our research.

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