

Formalizing legal coherence

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ABSTRACT

This paper briefly argues for a (particular variant of) a coherence theory of legal justification and theory construction. It does so by placing coherentism in a tradition of general epistemology and practical reasoning. One part of the theory, namely the part that deals with the relation between abstract goals and concrete regulations, is described in detail, and formalized.

Keywords

theory construction, coherence, legal justification, goal-based reasoning

1 THEORY CONSTRUCTION

The reasoning task about the legal consequences for a particular concrete case can be subdivided in at least three subtasks. One subtask is the establishment of the facts of the case. Legal proof is regulated by the law and legal theory construction is consequently also relevant for issues of proof. Leenes' thesis [23] contains a nice illustration of this point. I will leave proof out of consideration here. Another one is the establishment of the law that is to be applied to the case at hand. And the third task is the application of the law as established in the second subtask to the case as fixed in the first task. I take this third task to be no more than a Modus Ponens like argument. The hard legal work is done in the first two tasks.

Here I focus on the second task, the establishment of the law. If application of the law to the case at hand is to be no more than a Modus Ponens like argument, the second task must lead to rule like entities which can be applied to concrete cases in a simple manner [25]. Often these rule like entities are easy to find. This is in particular the case when written regulations are available that provide the necessary rules. It is more difficult if the rules have to be distilled from case law, if only because the ratio *decendi* of a case is not always conspicuous. However, even when the rules seem easy to identify, there is at least in theory the possibility to argue for non-obvious interpretations and for exceptions to the written rules [19]. Even the (implicit) decision to take the written rules at face value is a decision about the contents of the law. The law that must be applied to a concrete case is always the outcome of legal theory construction, no matter how trivial this construction may be in many cases.

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The title of this paper is therefore overambitious in the sense that this paper does not, and could not, offer a full formalization of what legal justification in general, and coherence theories of legal justification in particular, amount to. My purpose in this paper is more modest. I will start with an account of legal justification from the background of general epistemological theories. This account leads to the adoption of what I will call 'integrated coherence' as the standard against which theories about the law are to be measured. Then I choose one aspect of integrated coherence as a topic for a more thorough treatment, that forms the beginning of what might optimistically be described as the formalization of legal coherence.

2 EPISTEMOLOGY OF THE LAW¹

Epistemology, or the theory of knowledge, is an old branch of philosophy that deals with the question how we can obtain knowledge of the world around us, and how such knowledge can be justified. Most epistemology is concerned with knowledge about 'factual issues', such as how we can know that metals expand when heated, or that the butler killed the mysteriously murdered victim. There is, however, also a trend to apply epistemological considerations to normative 'knowledge'. This trend, which seems particularly relevant for legal purposes, is problematic in the sense that besides the normal skeptical reasons against the possibility of any knowledge, normative knowledge is additionally dubious because it is often doubted whether there is something to be known at all in the fields of evaluation and prescription. Is it a matter of knowledge whether a particular painting is beautiful, whether it is wrong to kill people, or whether it is obligatory to pay one's debts, or is it merely a matter of taste (to mention the extreme alternative)?

In the subsections to come I discuss two epistemological currents, foundationalism, especially in the form of empiricism, and coherence theory, with special attention for the question what they mean for the possibility of normative knowledge in general, and legal knowledge in particular.

2.1 Foundationalism

Foundationalism is the view that there are some beliefs, the immediate ones, that take a special position in one's belief system in that the other beliefs, the mediated ones, are based upon them [5]. The immediate beliefs are there without being based on other beliefs.

Foundationalism gives directly rise to the question whether and how the immediate beliefs can be justified. One answer is that the immediate beliefs should be based on sense perception, thereby forming an empirical basis for the rest of one's knowledge. This form of foundationalism, called empiricism, has been

¹ For more details on epistemological issues in the context of the law, see [26].

influential in this century through the work of the so-called Vienna Circle of logical empirists [21].

Empiricism leads to difficulties for the possibility of normative and evaluative ‘knowledge’. These difficulties were eloquently worded by Ayer [7] in the view that normative and evaluative theories are literally nonsense, because there is no way to verify them. No sensory perception can show a normative view to be true or false, and such views are therefore merely a matter of taste.

Even if one adheres to such a crude form of empiricism, it is still possible to salvage legal knowledge. The crucial step is then to assume that the law is not ‘really’ a normative phenomenon, but rather a social phenomenon of people who hold normative views. Which views are held individually, or by a social group, is a matter of fact, and can therefore be the object of empirical knowledge. This step is taken by a number of jurisprudential views, including particular variants of legal positivism [e.g. 37], legal realism [e.g. 38], and institutional theories of the law [e.g. 22]. However, if one assumes that the contents of the law are to some extent determined by what is good and bad, and that good and bad themselves are not merely a matter of (social) fact, crude empiricism pushes toward the view that legal knowledge is (often) impossible.

2.2 Coherence

The theory that sensory perception forms the rock bottom upon which all other knowledge is built is amenable to serious criticism. The core of this criticism can be traced back to Neurath [27], who observed that the sentences about sense experience (protocol sentences) that should form the basis for all knowledge, are not sentences about the external world, but about the experience of the observer. They describe self-observations of the observer. Neurath gives as an example of such a ‘protocol sentence’: ‘Otto’s protocol at 3:17 o’clock: [At 3:16 o’clock Otto said to himself: (at 3:15 o’clock there was a table in the room perceived by Otto)]’.

The question is how such information about the psychological state of the observer could form the basis of knowledge of the external world. Somehow the transition must be made from ‘I have observed that X’ to ‘X is the case’, and this transition itself, or the knowledge needed to make it, cannot be justified purely on the basis of empirical knowledge. Simply stated, it is principally impossible to compare theories about the world with the world itself. *Theories can only be compared with other theories.* This insight forms the basis upon which coherence theories of knowledge are built.

An important next step was then made by Popper [31], who defended the view that scientific progress was made by freely hypothesizing new theories and then testing them against other theories. One of Popper’s starting points was that no definitive knowledge is possible. The best we can obtain is theories that are as yet not falsified. This means that the ‘data’ used to falsify theories must also be hypotheses that are as yet not falsified, and which are provisionally taken as ‘true’. But then falsification can go both ways. If we have the theory that metals expand when heated, and we test this theory by heating a particular piece of metal, which turns out not to expand, we can choose which theory was falsified. It might be the theory that all metals expand when heated, but it might also be the theory that this particular piece of metal did not expand (the observation might be made wrongly).

This seemingly obvious step has far-reaching consequences for the possibility of normative science. If theories are not tested against the world but against theories, there is no fundamental

objection anymore against testing normative theories against other normative theories [30]. Normative science works in the same way as physical science, namely by testing theories against other theories that are provisionally accepted.

This model of testing normative theories is elaborated in Hare [20, chapter VI]. Hare gives the following example: A owes money to B and B owes money to C, and it is the law that creditors may exact their debts by putting their debtors into prison. B considers whether he should put A into prison in order to get his money. If he should do so, he would implicitly adopt the principle that creditors should put their debtors into prison in order to obtain their money. But this principle also leads to the conclusion that C should put B into prison. Acceptance of the principle would involve acceptance of this last conclusion too.² If B cannot accept the conclusion that he should be put into prison by C, he cannot accept the principle either, and then he cannot base the conclusion that A should be put into prison on this principle.

This example shows how normative reasoning and theory construction (formulation of the principle) can be conducted along the same lines as it is done in the physical sciences (as perceived by Popper and Hare). However, Popper and Hare still have in common that the testing of theories is primarily one-directional. The abstract theories (in Hare’s case the principles) are tested against concrete judgments, and not the other way round.

The insight that the direction of the test can go both ways was explicitly formulated for the normative sciences by Rawls [35, 36] as the theory about *reflective equilibrium*. According to this theory, moral reasoning (morality being Rawls’ subject) takes place by mutually adapting intuitively held general principles and concrete judgments, until the principles reflect the judgments and the judgments are justified by the principles. Apparently there is not one starting point, either abstract principles or concrete judgments, but rather a mixture of the two. Through a process of mutual adaptation a coherent theory is reached (what Rawls calls a ‘reflective equilibrium’) and the principles and judgments that are part of this coherent theory are justified. As Rawls points out, this process of mutual adaptation has also been defended for scientific theory construction [14].

Under what circumstances, then, can a theory be said to be coherent? Three characteristics of coherent theories present themselves [9]:

First a coherent theory must be *consistent*, where consistency is usually taken in the sense of deductive logic.

Second, a coherent theory must be *comprehensive*. Ideally, a coherent theory is a theory of everything. This demand is important in order to prevent that consistency is bought by isolating a theory from one’s other beliefs that are not consistent with it. Theories of everything are not very feasible, and therefore this second demand is best interpreted as indicating a possibility for attack on a consistent theory, namely that it can be pointed out that the theory is not consistent with another accepted belief outside the theory.

Finally it is usually assumed that the elements of a coherent theory must *support each other*. This demand can be found back in Rawls’ view that in a theory in reflective equilibrium the concrete judgments are justified by the principles, while the principles reflect the concrete judgments. In the next subsection, on integrated coherentism, I will briefly indicate why this third demand seems superfluous to me.

² Hare does not take defeasibility into consideration here.

2.3 Integrated coherentism

The coherence theory of justification gives standards that must be met by justified theories. We have seen that standards, e.g. evaluative principles, may themselves be parts of a coherent theory. This raises the question whether a theory can be justified that contains standards for justified theories which it does not meet itself. On a simple view of coherence, the standards for theory evaluation are strictly separated from the theories that evaluated by them. Such a separation does not fit well in coherentism, however, because coherent theories are ideally theories about 'everything', and 'everything' seems to include the issue of theory evaluation.

Let me illustrate the issues at stake with a real life example, stemming from the time when I received some elementary education in chemistry. My teacher wanted to demonstrate that if two substances, A and B, were put together some specific chemical reaction would take place, with the effect that a new substance, C, would result. This new substance would be recognizable by its color, which is different from the colors of A and B. The teacher took the substances A and B from two jars labeled 'A' and 'B'. He put them together in a third jar and shook it. However, instead of exhibiting the color of the substance C, nothing special happened, even after shaking the jar for the second time. Somewhat frustrated my teacher then gave as his explanation of this happening that one of the substances was probably spoiled by the long time that it had been kept in the school.

'Logical' as this explanation may sound at first hearing, it is not so obvious from a more philosophical perspective. Why not assume that this experiment tested the chemical theory that putting together A and B results in a reaction in which C is generated and that the outcome of the experiment falsified this theory? Or that in fact C was generated, but that on this particular occasion C did not have its normal color? Or that somebody put a different substance in the jar labeled 'A'? Or that there were some exceptional circumstances in the school room which made that the general chemical law was not applicable? Or why not assume in general (rather than only under exceptional circumstances) that the truth (or validity?) of the chemical theory is logically compatible with cases in which the law does not hold?

All that the experiment shows is that either not all the premises are true, or that the outcome was described wrongly, or that the logic is incorrect. Somehow one must make a choice from these options in order to account for the outcome of the experiment. The point of this is that such an experiment has no unequivocal outcome. It does not show that either chemical law 1, or chemical law 2 is false. Neither does it show that the substances in the jars were not A and B. And it also does not show that the logic used to describe the argument is incorrect. But the experiment does show that at least one of these elements of the experiment must be revised. Quine [34], following Duhem, observed in this connection

'that our statements about the external world face the tribunal of sense experience not individually but as a corporate body'.

According to the coherence theory exposed here, it should be added that the corporate body is not juxtaposed to our sense experience, but includes the propositional expressions of our sense experience. Experience adds propositions to the complex whole of our presumed knowledge, and if the results are unacceptable the totality of the presumed knowledge must be made acceptable

again, by modifying it.³ The modifications can take place on any level of the whole, from removing or modifying the sentences that express sense experiences, via removing or modifying laws that generalize connections between types of facts, to adopting a different logic. Even the standards by means of which we evaluate a whole of presumed knowledge as acceptable, and the standards of rationality that should guide the process of adaptation are part of the whole that is the object of mutual adaptation.

On the basis of considerations like the ones given above, I formulate a theory of integrated coherence. According to it a theory is *integratedly coherent* if:

- a. it is comprehensive, where comprehensiveness means
 1. that there are no beliefs outside the theory and
 2. that the theory is closed under the logic that is part of the theory, and
- b. it is consistent under the logic that is part of the theory.

On this view, the demands of comprehensiveness and consistency taken together take over the role that the demand of mutual support plays under traditional coherence, because the standards for support are part of the comprehensive theory and are enforced by the demands of closure and consistency under the logic of the theory. The notion of logic should in this connection be taken broadly, and the resulting logic should be relatively powerful in comparison to, say, predicate logic, because only such a powerful logic can partly replace the additional demands of mutual support between the elements of a coherent theory.

2.4 Legal coherence

One way to look at legal reasoning is to see it as a combination of theory construction and theory application [25]. The constructed theory must provide a clear answer to the case at hand for which one must find a legal 'solution'; this is the theory application part. Since the constructed theory should provide a clear answer to the case, this application part is not very interesting. Presumably it does not involve more than a Modus Ponens-like argument, and therefore I will not pay attention to theory application here.

The theory must be constructed from 'raw' legal materials such as case law, legislation, doctrinal literature, legal principles, values, policies, ... etc. Many authors are of the opinion that the constructed theory should be coherent [e.g. 24, 13, 4, 28, 29, 8].

A version of the coherence theory of law which has recently drawn much attention is Dworkin's theory of *law as integrity* [13]. This theory recognizes three stages in constructing the law. The first stage, the so-called pre-interpretative stage, consists of a preliminary identification of the rules, standards, and (generalized) decisions that make up the law. In this connection one might think of an inventory of the rules and standards that can be found in statutes, cases, and doctrinal literature. The second, interpretative, stage consists of an identification of the principles (in this connection including values and policies) that underlie (in the sense of explain), or are part of the legal phenomena identified in the first stage. The rules etc. identified in the first stage are to be seen as means to realize the principles identified in the second stage.

The rules identified in the first stage are sometimes not the best way to realize the principles identified in the second stage. The purpose of the third, reforming, stage is to formulate (relevant

³ It would beg the question to use the expression 'inconsistent' instead of the more neutral 'unacceptable' in this connection, because it presupposes an independent logic by means of which consistency can be established.

parts of) the set of rules, including (generalized) decisions of cases, that best realizes the principles identified in the second stage.⁴

The theory construction model involved in this theory counts two steps. In the first, constructive, step, the raw legal materials identified in the pre-interpretative stage are used to formulate a set of principles that explains them. In the second, reconstructive step the raw materials are replaced by the set of rules that provides the best realization of the formulated principles. Obviously this constitutes a form of mutual adaptation of principles and their applications to concrete cases as envisaged by Rawls in his theory of reflective equilibrium.

Dworkin's theory is too vague to be useful for computational purposes. To overcome this problem, I will complement it with an elaboration of Alexy's theory of legal principles and their logic.

2.5 Goals and regulations

Alexy [1, 2, 3] developed the view that legal principles are 'Optimierungsgebote'. With this he meant that legal principles are a kind of goals which are to be realized as much as possible. There is, however, a tension between goals, because the realization of the one goal may detract from the realization of another goal. Take for instance the question how strict ecological rules should be. The stricter the rules, the more the goal to protect the environment is realized. Weaker ecological rules contribute less to the environment, but may contribute more to economic prosperity, which is another goal. The choice which ecological rules should be adopted, depends on the balance between, amongst others, these two goals.

In general it may be said that if (the adoption of) a regulation contributes to a goal that is accepted in the legal system at issue, this fact is a reason that pleads for this regulation. This reason is the stronger, the more important the goal and the contribution of the regulation to the goal are. Analogously, if a regulation detracts from a goal, this is a reason that pleads against the regulation. Again it holds that this reason is the stronger, the more important the goal is and the more the regulation detracts from the goal. On the basis of a set of goals and a regulation one can therefore construct a set of reasons that plead for the regulation, and a set of reasons that plead against it.⁵

Assuming that there are no other reasons pleading for or against the regulation, the regulation can be evaluated by weighing the reasons that plead for and against it. If the reasons that plead for the regulation outweigh the reasons against it, the regulation is said to be *acceptable*.

Often there will be different ways in which a subject can be regulated. The different possible regulations for the same subject can be competitors in the sense that adoption of one of them precludes adoption of the other ones. As a consequence it is useful to distinguish another way of evaluating regulations, next to the question whether they are acceptable. The other question at issue is which regulation is the best one of the competing regulations for one and the same subject. Normally, a regulation should only be

introduced in a legal system if it is both acceptable, and if there is no better one. Such regulations are called *preferable*.

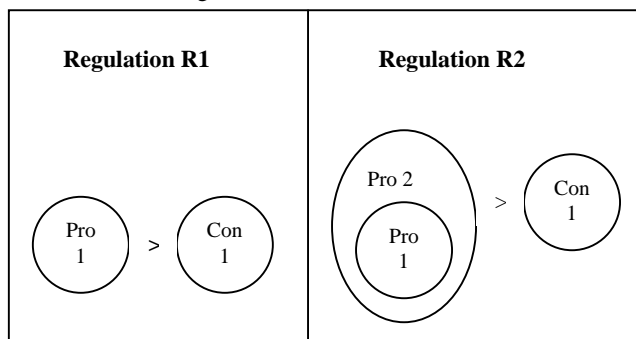
The question whether some set of reasons outweighs another set is not always easy to answer. Reasons usually do not come labeled with a weight, and neither is it the case that a set of reasons with more elements always outweighs sets of reasons with less elements. In general it depends on contingent additional information which set of reasons outweighs which other sets. I call this kind of information *weighing knowledge*.

There are a few exceptions to the general observation that it depends on contingent information which set of reasons outweighs which other sets. One is that an empty set of reasons is outweighed by any non-empty set. So if there are only reasons that plead for a regulation, and no reasons pleading against it, the regulation is acceptable. Similarly, if there are only reasons that plead against a regulation, and no reasons pleading for it, the regulation is unacceptable.

Other exceptions to the observation that the relative weight of sets of reasons is contingent information depend on a fortiori reasoning with respect to already available weighing knowledge. The best way to explain these exceptions is by means of examples. I will use variations on the so-called Lebach-case, which was made familiar by Alexy [1, 2].

The standard case runs as follows: A person, let us call him E, who was condemned for abduction and subsequent murder of his victim is released from prison after ten years. A tabloid journal uses the occasion to publish an article on the dangers of abduction in general. The article is illustrated with a photograph of E just after his release. E attempts to prevent circulation of the journal. The judge who must decide on this case should balance two principles (goals). One is the principle of freedom of the press, the other one is the principle that one should respect other persons' privacy. Let us assume that the judge decides that in cases like this, (the reason based upon) privacy protection outweighs (the reason based upon) freedom of the press. This decision amounts to the adoption of certain weighing knowledge.

Suppose, in general, that we have two sets of reasons, PRO₁ and CON₁ pleading respectively for and against a regulation R1, where PRO₁ outweighs CON₁. Suppose moreover that we have another regulation R2, with as pro- and con-reasons respectively PRO₂ and CON₂. CON₁ and CON₂ are identical, meaning that the regulations subtract from the same goals in the same degree. PRO₁ and PRO₂ differ from each other, however. PRO₂ contains the same reasons as PRO₁, with the same weight, but it also contains one or more other reasons that plead for R2. The set of pro-reasons has consequently become stronger in comparison to the reasons for R1, while the set of con-reasons has remained the same. Since the reasons pleading for R1 already outweighed the reasons against it, one can conclude a fortiori that the stronger set of reasons pleading for R2 outweighs the reasons against R2. So, if R1 is acceptable, R2 is normally acceptable too. In fact, R2 will even be a better regulation than R1.



⁴ From a logical point of view, there need not be one single set of best rules. Dworkin, however, has gone to some length in arguing that every case has one right answer, thereby implicitly assuming that there is one best set of rules.

⁵ I assume here that the goals are independent. It is for instance not the case that one goal is (merely) a subgoal of another goal.

Let us assume that in our example case, the judge decides that privacy protection outweighs freedom of the press. As a consequence a regulation to the effect that, *ceteris paribus*, it is not allowed to publish photographs of recently released prisoners in a context that connects them with the crime they committed, is an acceptable one.

As yet, the question whether the released prisoner objects against the publication has not been taken into consideration. It was tacitly assumed that he did object, but this need not be the case, in particular not if he were to be compensated financially for the publication. A regulation to the effect that publication is only allowed with explicit consent of the person concerned would take a new principle into consideration, namely the principle of autonomy. This regulation would have the pro- and the con-reason of the first case, presumably with the same weights, but would have an additional pro-reason in that it is supported by the principle of autonomy. Moreover, this last regulation is a competitor for the first proposed regulation which amounts to a blunt prohibition of the publication. As a consequence, the last regulation is better than the first one.

A similar argument can be made for the case that PRO_1 and PRO_2 are identical, and that CON_2 is a strict subset of CON_1 . Then the reasons against R2 are weaker than those against R1, while the pro-reasons have remained the same. Again one can conclude that the reasons PRO_2 outweigh the reasons CON_2 and that R2 is a better regulation than R1.

This would be illustrated by the case in which the tabloid journal has contracted with E that no publication of his photograph would be made. It is arguable that the freedom of the press is not infringed by a prohibition that was voluntarily undertaken by the journal. Since the freedom of the press was a reason against the prohibition, the balance of reasons is moved towards the prohibition if this con-reason is taken away. As a consequence the regulation that publication is prohibited if the potential publisher has voluntarily undertaken the obligation not to publish, has even stronger support than the original prohibition.

It is possible that a set of reasons is strengthened by adding new reasons to it, but also by strengthening the reasons that occur in it. Suppose that the sets of reasons PRO_2 and CON_2 that plead for, respectively against R2, contain the same reasons as the PRO_1 and CON_1 that plead for, respectively against R1. In other words, the regulations R1 and R2 contribute to and detract from the same goals. However, the contribution of R2 to one or more of the goals is bigger than that of R1, while R1 does not contribute more to any goal than R2 does. Again we can conclude that the set of pro-reasons has become stronger in comparison to the reasons for R1, while the set of con-reasons has remained the same. Since the reasons pleading for R1 already outweighed the reasons against it, one can conclude a fortiori that the stronger set of reasons pleading for R2 outweighs the reasons against R2. So, if R1 is acceptable, R2 is acceptable too, and R2 is a better regulation than R1. This is illustrated by the regulation that not only forbids publication of the photograph, but also prescribes that the photograph is destroyed. This regulation provides better protection of privacy, and is therefore better than the simple prohibition.⁶

A similar argument can be made for the case that PRO_1 and PRO_2 are identical, and that one or more of the reasons in CON_2 are weaker than the corresponding reasons in CON_1 . Then the

reasons against R2 are weaker than those against R1, while the pro-reasons have remained the same. Again one can conclude that the reasons PRO_2 outweigh the reasons CON_2 and that R2 is a better regulation than R1.

For instance, a regulation that allows photographs, as long as the persons on the photographs are not recognizable, makes a smaller infringement on the freedom of the press, while the protection of the privacy remains the same. Such a regulation would therefore be better than a mere prohibition of publishing photographs.

The two kinds of a fortiori argument, based on changes in the sets of reasons and on the weights of the reasons, can be combined. If a set of reasons R_{1a} outweighs R_2 , and if R_{1a} is strengthened both by adding new reasons and by increasing the weight of the existing reasons, the resulting set R_{1b} will still outweigh the set R_2 . If a set of reasons R_1 outweighs R_{2a} , and if R_{2a} is weakened both by removing one or more reasons from it and by decreasing the weight of the existing reasons, the resulting set R_{2b} will still be outweighed by the set R_1 . The combination of strengthening the stronger set (in one or both of the two mentioned ways) and weakening the weaker set (also in one or both of the two mentioned ways) should also lead to the conclusion that the strengthened set outweighs the weakened set.

2.6 Back to legal coherence

The theory developed in the previous subsection about when a regulation is preferable in the light of a set of underlying goals is part of a theory about legal coherence. To give this theory a more precise place in the picture of coherence, I will elaborate a bit on the contents of a coherent theory of the law.

It is possible to distinguish a number of layers within a theory of the law, *c.q.* a legal system. The precise number of layers is somewhat arbitrary. In my [15] I assumed two layers; here I will assume four.

The first, and most abstract, layer consists of a number of independent goals, including values and policies, in the sense of Alexy.

The second layer consists of a number of subgoals, the pursuit of all of which can be evaluated in terms of the ways in which they contribute to and detract from the goals of the first layer. I only mention this layer to emphasize that not all goals in a legal system are goals in the first layer, which are for my present purposes the important ones.

The third layer consists of legal rules, which can be based on legislation, but may also be the result of abstracting from case law. Legal rules are characterized by that they attach generic legal consequences to generic cases. *E.g.* they attach the consequence of punishability to the generic case of being a thief.

The fourth and most concrete layer consists of the sentences that describe concrete legal consequences, such as that John is punishable, or that Mary is the owner of a car.

The model that I have developed in the previous subsection deals with the relation between the first and the third layer. It indicates which (sets of) rules in the third layer are justified, given the goals in the first layer and the causal relations which are part of the non-legal part of the comprehensive coherent theory. It can be applied analogously to the relation between the first and the second layer, if the adoption of a sub-goal is treated like the adoption of a regulation. The relation between the third and the fourth layer is the application of the law to concrete cases that was mentioned briefly in the introduction and in section 2.4 of this paper.

⁶ Arguably this regulation would infringe the property right of the journal, but for the sake of the example, this complication is ignored.

2.7 Intermediate conclusions

I started to argue why coherentism is an attractive view of how theories, both empirical, evaluative, and normative, can be justified. Then I pointed out that coherence theories are quite fashionable as theories of legal justification. In the way they are formulated in the jurisprudential literature, e.g. [13], coherence theories are too little precise to form a suitable starting point for computational theories of theory construction. Therefore I complemented Dworkin's theory with Alexy's theory about the nature and logic of legal principles. I elaborated Alexy's theory to make it possible to determine for a number of cases which regulations are justified given a number of presupposed legal goals. The logical results that were arrived at in this way should be incorporated in the theory of the law, in order to realize an integratedly coherent theory.

It seems to me that the thus elaborated theory is sufficiently precise to be amenable to formalization. Such a formalization would not be a full formalization of legal coherence, but it would deal with a central aspect of coherence, namely the logical relation between abstract goals and more concrete parts of a theory.

3 FORMALIZATION

The language in which the theory of section 2.5 is formalized is that of predicate logic, with a number of additional conventions. The most important convention is an ontological one. The language recognizes states of affairs, rules, and regulations (sets of rules) as logical individuals. A state of affairs is what is expressed by a sentence. All sentences are assumed to express states of affairs, while true sentences express states of affairs that actually obtain.

All predicates (zero- or more placed) start with an uppercase letter. All function expression (zero- or more placed) and variables start with a lowercase letter. If S is a sentence, then $*s$ is a term that denotes the state of affairs expressed by S . For instance, the sentence $\text{Loves}(\text{john}, \text{mary})$ expresses the state of affairs that John loves Mary, which is denoted by the term $*\text{loves}(\text{john}, \text{mary})$.

In formalizing the above theory about the evaluation of regulations I will use a number of predicates that fulfil a special role:

$\text{Goal}/1$ is used to express that a particular state of affairs is a goal within the theory.

$\text{Ct}/3$ is used to express that a regulation contributes to a certain degree to a goal. For instance, $\text{Ct}(\text{regulation1}, *goal1, d1)$ expresses that regulation 1 contributes to goal 1, to degree $d1$. The two-place predicate $\text{Ct}/2$ is also used, in the construction $\text{Ct}(\text{it}, *goal)$.

$\text{Df}/3$ is analogously used to express that a regulation detracts to a certain degree from a goal. The two-place predicate $\text{Df}/2$ is also used, in the construction $\text{Df}(\text{it}, *goal)$.

A regulation is a set of one or more rules.⁷ A regulation cannot contribute in different degrees to one and the same goal, and it cannot both contribute to, and detract from one and the same goal.

$\text{R}/2$ is used to express that a certain fact is a reason for or against a particular conclusion, expressed as a state of affairs. For instance, $\text{R}(*a, *b)$ expresses that the fact $*a$ is a reason for state of affairs $*b$.

$\text{R}(*\text{ct}(\text{it}, *goal1, d1), *acceptable(\text{regulation1}))$

⁷ But see note 11.

expresses that the fact that it contributes to goal 1, to a degree $d1$ is a reason for the acceptability of regulation 1.⁸

$\text{R}(*\text{df}(\text{it}, *goal1, d1), *~\text{acceptable}(\text{regulation1}))$

expresses that the fact that regulation 1 detracts from goal 1, to a degree $d1$ is a reason against the acceptability of regulation 1.

If $*g$ is a goal, and if regulation r contributes to $*g$ to some degree d , then this last fact is normally a reason for the acceptability of r . If regulation r detracts from $*g$ to some degree d , then this fact is normally a reason against the acceptability of r . For instance, it normally holds that

$\text{R}(*\text{ct}(r, *g, d), *acceptable(r))$

There is, however, a complication here. If two regulations contribute to the same goal, they intuitively have the same reason pleading for them, namely that *they* contribute to that goal. However, in a strict sense, the first regulation has as a reason pleading for it that the *first* regulation contributes to the goal, while the second regulation has as a reason pleading for it that the *second* regulation contributes to the goal. This complicates the comparison of sets of reasons that plead for different regulations.

To avoid this complication, I want to introduce the notion of an *abstract reason*. In an abstract reason the reference to the conclusion for or against which it pleads is replaced by the deictic expression 'it'. So in the sentence

$\text{R}(*\text{ct}(r, *g, d), *acceptable(r))$

the first occurrence of the term ' r ' can be replaced by 'it', because the reference of this term also occurs in the conclusion of the reason. The thus obtained reason replaces the original reason that mentions the regulation explicitly. This leads to the following axioms concerning the relation between a regulation and a goal:

A1. $\text{Valid}(*goal(*g) \ \& \ *\text{ct}(r, *g, d)) \Rightarrow *r(*\text{ct}(\text{it}, *g), *acceptable(r))$ ⁹
A2. $\text{Valid}(*goal(*g) \ \& \ *\text{df}(r, *g, d)) \Rightarrow *r(*\text{df}(\text{it}, *g), *~\text{acceptable}(r))$

$>_g/2$ is a weakly transitive¹⁰, a-symmetric, a-reflexive relation on the relative importance of goals, which expresses that the first mentioned goal is more important than the last mentioned.

$=_g/2$ is a weakly transitive, symmetric, reflexive relation on the relative importance of goals which expresses that two goals are equally important.

$>_d/2$ is a weakly transitive, a-symmetric, a-reflexive relation on the degrees to which regulations contribute to, or detract from goals. For instance, $d1 >_d d2$ might express that the contribution of regulation 1 to goal 1 is bigger than the contribution of regulation 2 to goal 2.

$=_d/2$ is a weakly transitive, symmetric, reflexive relation on the degrees to which regulations contribute to, or detract from

⁸ The use of the expression 'it' is explained later in this section.

⁹ The symbol \Rightarrow is a functor that combines two states of affairs into a Reason-based Logic rule. If the conditions of such a rule are satisfied and there is no exception to the rule, the conclusion of the rule follows.

¹⁰ A relation R is weakly transitive if the following RBL-rule is valid: $(aRb \ \& \ bRc) \Rightarrow aRc$.

goals, which expresses that the contribution or detraction of two regulations to their respective goals is equal.

$w/2$ is a function the value of which is the weight of a fact as a reason for a particular conclusion. For instance,

$$w(*ct(\text{regulation1}, *goal1, d1), *acceptable(\text{regulation1})) = w1$$

expresses that the fact that regulation 1 contributes to goal 1, to a degree $d1$ is a reason (for the acceptability of regulation 1) with weight $w1$.

$=_w/2$ is an equivalence relation on the weight of *individual* reasons. For instance, $w1 =_w w2$ expresses, that the weight of two reasons is equal.

$>_w/2$ is a weakly transitive, a-symmetric, a-reflexive relation on the weight of *individual* reasons. For instance, $w1 >_w w2$ expresses, that the first reason (to which is implicitly referred) weighs more than the second.

If two regulations contribute to equally important goals in the same degree, these facts are normally reasons for the acceptability of these two regulations with the same weight. Formally:

$$\begin{aligned} \text{A3. Valid}(&Ct(r1, *g1, d1) \ \& \ Ct(r2, *g2, d2) \ \& \\ &(*g1 =_g *g2) \ \& \ (d1 =_a d2) \ \Rightarrow \\ &(w(*ct(it, *g1), *acceptable(r1)) = \\ &w(*ct(it, *g2), *acceptable(r2)))) \end{aligned}$$

If two regulations detract from equally important goals in the same degree, these facts are normally reasons against the acceptability of these two regulations with the same weight. Formally:

$$\begin{aligned} \text{A4. Valid}(&Df(r1, *g1, d1) \ \& \ Df(r2, *g2, d2) \ \& \\ &(*g1 =_g *g2) \ \& \ (d1 =_a d2) \ \Rightarrow \\ &(w(*df(it, *g1), *~acceptable(r1)) = \\ &w(*df(it, *g2), *~acceptable(r2)))) \end{aligned}$$

If regulation $r1$ contributes to a larger degree to $*g1$ than $r2$ contributes to $*g2$, and if $*g1$ is equally or more important than $*g2$, then the contribution by $r1$ to $*g1$ is normally a stronger reason for the acceptability of $r1$, than the contribution by $r2$ to $*g2$ is a reason for the acceptability of $r2$. Formally:

$$\begin{aligned} \text{A5. Valid}(&(Ct(r1, *g1, d1) \ \& \ Ct(r2, *g2, d2) \ \& \\ &((*g1 =_g *g2) \ \vee \ (*g1 >_g *g2)) \ \& \\ &(d1 >_a d2)) \ \Rightarrow \\ &(w(*ct(it, *g1), *acceptable(r1)) >_w \\ &w(*ct(it, *g2), *acceptable(r2)))) \end{aligned}$$

If regulation $r1$ detracts from $*g1$ to a larger degree than $r2$ detracts from $*g2$, and if $*g1$ is equally or more important than $*g2$, then the detraction by $r1$ from $*g1$ is normally a stronger reason against the acceptability of $r1$, than the detraction by $r2$ from $*g2$ is a reason against the acceptability of $r2$. Formally:

$$\begin{aligned} \text{A6. Valid}(&(Df(r1, *g1, d1) \ \& \ Df(r2, *g2, d2) \ \& \\ &((*g1 =_g *g2) \ \vee \ (*g1 >_g *g2)) \ \& \\ &(d1 >_a d2)) \ \Rightarrow \\ &(w(*df(it, *g1), *~acceptable(r1)) >_w \\ &w(*df(it, *g2), *~acceptable(r2)))) \end{aligned}$$

If $*g1$ is a more important goal than $*g2$, and if regulation $r1$ contributes to $*g1$ to the same or a larger degree than $r2$ contributes to $*g2$, then the contribution by $r1$ is normally a stronger reason for the acceptability of $r1$, than the contribution by $r2$ to $*g2$ is a reason for the acceptability of $r2$. Formally:

$$\begin{aligned} \text{A7. Valid}(&(Ct(r1, *g1, d1) \ \& \ Ct(r2, *g2, d2) \ \& \\ &(*g1 >_g *g2) \ \& \ ((d1 >_a d2) \ \vee \ (d1 =_a d2)) \ \Rightarrow \\ &(w(*ct(it, *g1), *acceptable(r1)) >_w \\ &w(*ct(it, *g2), *acceptable(r2)))) \end{aligned}$$

If $*g1$ is a more important goal than $*g2$, and if regulation $r1$ detracts from $*g1$ to the same or a larger degree than $r2$ detracts from $*g2$, then the detraction by $r1$ is normally a stronger reason against the acceptability of $r1$, than the detraction by $r2$ from $*g2$ is a reason against the acceptability of $r2$. Formally:

$$\begin{aligned} \text{A8. Valid}(&(Df(r1, *g1, d1) \ \& \ Df(r2, *g2, d2) \ \& \\ &(*g1 >_g *g2) \ \& \ ((d1 >_a d2) \ \vee \ (d1 =_a d2)) \ \Rightarrow \\ &(w(*df(it, *g1), *~acceptable(r1)) >_w \\ &w(*df(it, *g2), *~acceptable(r2)))) \end{aligned}$$

$\text{Stronger}_w/2$ (stronger in individual weight) is an a-symmetric, a-reflexive relation on *sets* of reasons that plead for or against the same conclusion. This relation holds between two sets of reasons for or against the same conclusion, if and only if from the reasons which the two sets *have in common* at least one reason of the first set weighs more than the corresponding reason from the second set, while the opposite is not the case. Formally:

$$\begin{aligned} \text{A9. } \forall s1, s2 (\text{Stronger}_w(s1, s2) \equiv \\ \exists *r1, *r2 (*r1 \in s1 \ \& \ *r2 \in s2 \ \& \\ *r1 = *r2 \ \& \ r1 >_w r2) \ \& \\ \sim(\exists *r1, *r2 (*r1 \in s1 \ \& \ *r2 \in s2 \ \& \\ *r1 = *r2 \ \& \ r2 >_w r1))) \end{aligned}$$

$\text{Weaker}_w/2$ (weaker in individual weight) is an a-symmetric, a-reflexive relation on *sets* of reasons that plead for or against the same conclusion. This relation holds between two sets of reasons for or against the same conclusion, if and only if from the reasons which the two sets *have in common* at least one reason of the first set weighs less than the corresponding reason from the second set, while the opposite is not the case. Formally:

$$\begin{aligned} \text{A10. } \forall s1, s2 (\text{Weaker}_w(s1, s2) \equiv \\ \exists *r1, *r2 (*r1 \in s1 \ \& \ *r2 \in s2 \ \& \\ *r1 = *r2 \ \& \ r2 >_w r1) \ \& \\ \sim(\exists *r1 \exists *r2 (*r1 \in s1 \ \& \ *r2 \in s2 \ \& \\ *r1 = *r2 \ \& \ r1 >_w r2))) \end{aligned}$$

$\text{Equal}_w/2$ (equal in individual weight) is a symmetric and reflexive relation on *sets* of reasons that plead for or against the same conclusion. This relation holds between two sets of reasons if the reasons *which the two sets have in common*, pair wise have the same weights. Formally:

$$\begin{aligned} \text{A11. } \text{Equal}_w(s1, s2) \equiv \\ \forall *r1 \forall *r2 ((*r1 \in s1 \ \& \ *r2 \in s2 \ \& \\ *r1 = *r2) \rightarrow \\ w(*r1, *c1) = w(*r2, *c2)) \end{aligned}$$

Notice that two sets that either plead for or against the same conclusion will often *not* stand in one of the relations Stronger_w , Weaker_w , or Equal_w to each other. Instead they will be incommensurable in this respect. This is the case if both sets contain a reason that also occurs in the other set, while the reason in the one set has a bigger weight than its counterpart in the other set. For this reason, the three relations cannot be defined in terms of each other, and are they not (weakly) transitive.

$r^+(*s)$ denotes the set of reasons that plead for the presence of state of affairs $*s$. Formally:

$$r^+(*s) = \{*r : R(*r, *s) \text{ is true}\}$$

$r^-(*s)$ denotes the set of reasons that plead against the presence of state of affairs $*s$. Formally:

$$r^-(*s) = \{*r : R(*r, \sim s) \text{ is true}\}$$

The relation $\text{Stronger}^+/2$ (stronger in pro-reasons) holds between two regulations if and only if either:

- the set of reasons pleading for the first regulation is a proper superset of the set of reasons pleading for the second regulation, and the set of reasons pleading for the first regulation is equal to or stronger in individual weight than the set of reasons pleading for the second regulation, or
- the set of reasons pleading for the first regulation is identical to the set of reasons pleading for the second regulation, while the set of reasons pleading for the first regulation is stronger in individual weight than the set of reasons pleading for the second regulation.

Formally:

$$\begin{aligned} \text{A12. } \forall r1, r2 (\text{Stronger}^+(r1, r2) \equiv & \\ ((r^+(*\text{acceptable}(r1)) \supset & \\ r^+(*\text{acceptable}(r2)) \ \& \\ (\text{Stronger}_w(r^+(*\text{acceptable}(r1)), & \\ r^+(*\text{acceptable}(r2))) \vee & \\ \text{Equal}_w(r^+(*\text{acceptable}(r1)), & \\ r^+(*\text{acceptable}(r2)))))) \vee & \\ (r^+(*\text{acceptable}(r1)) = & \\ r^+(*\text{acceptable}(r2)) \ \& \\ \text{Stronger}_w(r^+(*\text{acceptable}(r1)), & \\ r^+(*\text{acceptable}(r2)))))) & \end{aligned}$$

The relation $\text{Weaker}^+/2$ (weaker in pro-reasons) holds between two regulations if and only if either:

- the set of reasons pleading for the first regulation is a proper subset of the set of reasons pleading for the second regulation, and the set of reasons pleading for the first regulation is equal to or weaker in individual weight than the set of reasons pleading for the second regulation, or
- the set of reasons pleading for the first regulation is identical to the set of reasons pleading for the second regulation, while the set of reasons pleading for the first regulation is weaker in individual weight than the set of reasons pleading for the second regulation.

Formally:

$$\begin{aligned} \text{A13. } \forall r1, r2 (\text{Weaker}^+(r1, r2) \equiv & \\ ((r^+(*\text{acceptable}(r1)) \subset & \\ r^+(*\text{acceptable}(r2)) \ \& \\ (\text{Weaker}_w(r^+(*\text{acceptable}(r1)), & \\ r^+(*\text{acceptable}(r2))) \vee & \\ \text{Equal}_w(r^+(*\text{acceptable}(r1)), & \\ r^+(*\text{acceptable}(r2)))))) \vee & \\ (r^+(*\text{acceptable}(r1)) = & \\ r^+(*\text{acceptable}(r2)) \ \& \\ \text{Weaker}_w(r^+(*\text{acceptable}(r1)), & \\ r^+(*\text{acceptable}(r2)))))) & \end{aligned}$$

The relation $\text{Equal}^+/2$ (equal in pro-reasons) holds between two regulations if and only if both:

- the set of reasons pleading for the first regulation is identical to the set of reasons pleading for the second regulation, and
- the set of reasons pleading for the first regulation is equal in individual weight to the set of reasons pleading for the second regulation.

Formally:

$$\begin{aligned} \text{A14. } \forall r1, r2 (\text{Equal}^+(r1, r2) \equiv & \\ (r^+(*\text{acceptable}(r1)) = r^+(*\text{acceptable}(r2))) & \\ \ \& \ \text{Equal}_w(r^+(*\text{acceptable}(r1)), & \\ r^+(*\text{acceptable}(r2)))) & \end{aligned}$$

The relation $\text{Stronger}^-/2$ (stronger in con-reasons) holds between two regulations if and only if either:

- the set of reasons pleading against the first regulation is a proper superset of the set of reasons pleading against the second regulation, and the set of reasons pleading against the first regulation is equal to or stronger in individual weight than the set of reasons pleading against the second regulation, or
- the set of reasons pleading against the first regulation is identical to the set of reasons pleading against the second regulation, while the set of reasons pleading against the first regulation is stronger in individual weight than the set of reasons pleading against the second regulation.

Formally:

$$\begin{aligned} \text{A15. } \forall r1, r2 (\text{Stronger}^-(r1, r2) \equiv & \\ ((r^-(*\text{acceptable}(r1)) \supset & \\ r^-(*\text{acceptable}(r2)) \ \& \\ (\text{Stronger}_w(r^-(*\text{acceptable}(r1)), & \\ r^-(*\text{acceptable}(r2))) \vee & \\ \text{Equal}_w(r^-(*\text{acceptable}(r1)), & \\ r^-(*\text{acceptable}(r2)))))) \vee & \\ (r^-(*\text{acceptable}(r1)) = & \\ r^-(*\text{acceptable}(r2)) \ \& \\ \text{Stronger}_w(r^-(*\text{acceptable}(r1)), & \\ r^-(*\text{acceptable}(r2)))))) & \end{aligned}$$

The relation $\text{Weaker}^-/2$ (weaker in con-reasons) holds between two regulations if and only if either:

- the set of reasons pleading against the first regulation is a proper subset of the set of reasons pleading against the second regulation, and the set of reasons pleading against the first regulation is equal to or weaker in individual weight than the set of reasons pleading against the second regulation, or
- the set of reasons pleading against the first regulation is identical to the set of reasons pleading against the second regulation, while the set of reasons pleading against the first regulation is weaker in individual weight than the set of reasons pleading against the second regulation.

Formally:

$$\begin{aligned} \text{A16. } \forall r1, r2 (\text{Weaker}^-(r1, r2) \equiv & \\ ((r^-(*\text{acceptable}(r1)) \subset & \\ r^-(*\text{acceptable}(r2)) \ \& \\ (\text{Weaker}_w(r^-(*\text{acceptable}(r1)), & \\ r^-(*\text{acceptable}(r2))) \vee & \\ \text{Equal}_w(r^-(*\text{acceptable}(r1)), & \\ r^-(*\text{acceptable}(r2)))))) \vee & \\ (r^-(*\text{acceptable}(r1)) = & \\ r^-(*\text{acceptable}(r2)) \ \& \end{aligned}$$

$$\text{Weaker}_w(r^-(\text{*acceptable}(r1)), \\ r^-(\text{*acceptable}(r2))))$$

The relation $\text{Equal}^-/2$ (equal in con-reasons) holds between two regulations if and only if both:

- the set of reasons pleading against the first regulation is identical to the set of reasons pleading against the second regulation, and
- the set of reasons pleading against the first regulation is equal in individual weight to the set of reasons pleading against the second regulation.

Formally:

$$\text{A17. } \forall r1, r2 (\text{Equal}^-(r1, r2) \equiv \\ (r^-(\text{*acceptable}(r1)) = r^-(\text{*acceptable}(r2))) \\ \& \text{Equal}_w(r^-(\text{*acceptable}(r1)), \\ r^-(\text{*acceptable}(r2))))$$

$\text{Outweighs}/2$ is an a-symmetric, a-reflexive, a-transitive relation between two sets of reasons the elements of one of which pleads for a particular conclusion, while the elements of the other plead against this conclusion. So $\text{Outweighs}(s1, s2)$ presupposes that there is some conclusion $*c$, such that either both $s1 \subseteq r^+(*s)$ and $s2 \subseteq r^-(*s)$ are true, or both $s1 \subseteq r^-(*s)$ and $s2 \subseteq r^+(*s)$ are true.

$\text{Acceptable}/1$ is used to express that a regulation is acceptable.

That a regulation is acceptable is equivalent to that the reasons for the acceptability of this regulation outweigh the reasons against the acceptability. Formally:

$$\text{A18. } \forall \text{reg} (\text{Acceptable}(\text{reg}) \equiv \\ \text{Outweighs}(r^+(\text{*acceptable}(\text{reg})), \\ r^-(\text{*acceptable}(\text{reg}))))$$

One regulation is better than a second regulation if and only if either:

- the first regulation is stronger in pro-reasons than the second, while it is equal or weaker in the con-reasons, or
- the first regulation is weaker in con-reasons than the second, while it is equal in the pro-reasons, or
- the second regulation is weaker in pro-reasons than the first, while it is equal or stronger in the con-reasons, or
- the second regulation is stronger in con-reasons than the second, while it is equal in the pro-reasons.

$$\text{A19. } \forall r1 \forall r2 (\text{Better}(r1, r2) \equiv \\ \text{Stronger}^+(r1, r2) \& \\ (\text{Equal}^-(r1, r2) \vee \text{Weaker}^-(r1, r2)) \vee \\ \text{Weaker}^-(r1, r2) \& \text{Equal}^+(r1, r2)) \vee \\ \text{Weaker}^+(r2, r1) \& \\ (\text{Equal}^-(r2, r1) \vee \text{Stronger}^-(r2, r1)) \vee \\ \text{Stronger}^-(r2, r1) \& \text{Equal}^+(r2, r1))$$

If some regulation is acceptable, and another one is even better, than this other regulation is normally also acceptable:

$$\text{A20. } \text{Valid}(\text{Acceptable}(r1) \& \text{Better}(r2, r1)) \Rightarrow \\ \text{Acceptable}(r2))$$

$\text{Preferable}/1$ is used to express that a regulation is preferable. $\text{Competitors}/2$ is a symmetric a-reflexive relation between regulations. This relation holds between two regulation if the join of the two regulation is logically inconsistent in the sense of [17].

A regulation is preferable if and only if it is acceptable, and there is no better competing regulation¹¹:

$$\text{A21. } \text{Preferable}(r1) \equiv \text{Acceptable}(r1) \& \\ \sim \exists r2 (\text{Competitors}(r1, r2) \& \text{Better}(r2, r1))$$

4 FINAL CONCLUSION, RELATED RESEARCH AND ACKNOWLEDGMENTS

Bench-Capon and Sartor [8] and Prakken [32] have, in somewhat different settings, also published on the evaluation of regulations in the light of goals (values). Their discussion only deals with goals towards a regulation contributes, however, and they do not discuss degrees of contribution or the detraction from goals. The technique for the mutual comparison of regulations was inspired by the work of Burg [11] and by my analysis [15, 16] of the logical mechanism behind the Hypo system [6].

This paper places the analysis of the evaluation of regulations in the light of a coherence theory of the law. The same analysis can also be given different readings however. One reading is as a means to deal with incommensurability of values. Independent values are often considered to be incommensurable, and for some this implies that arguments based on such values cannot be compared rationally [12]. The present theory indicates how such a comparison can, under certain circumstances, be made rationally, without having an order on the values.

And second, the present theory can be read as an extension of Reason-based Logic that allows the comparison of alternatives. The work in [15, 16] and in [39] merely focussed on balancing reasons for and against one particular conclusion, and did not pay attention to making a choice between different conclusions. The present work, especially in the axioms A8 and following, makes the beginning of an extension to Reason-based Logic that can deal with making choices. Seen in this light, the present paper partly deals with the same subject as [10].

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APPENDIX

An example of how the formalism presented above can be used is to be found on <http://www.rechten.unimaas.nl/metajuridica/hage/webpublications>

¹¹ Alexander Boer pointed out to me that two regulations that are both preferable when considered individually may be not preferable if considered together. The solution to this complication seems to be that one should only judge alternative *complete* sets of rules as to their preferability, and to assume that a smaller set of rules is preferable if and only if it is a subset of one or all (credulous or sceptical) preferable complete sets.

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