THE LOGICAL STRUCTURE OF LEGAL META-INFERENCE*

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1 Introduction

"Legal meta-inference" is legal inference for controlling a legal inference, in other words, inference which decides the way to infer legally.

It seems that knowledge about our social life is incomplete. It may lead to contradictions. The knowledge is constantly increasing with time and a conclusion from the knowledge at a former time might contradict a conclusion from the knowledge at a later time. In classical logic, the proved theorem should still be a theorem in the increased knowledge. However, we should get an different appropriate resolution according to the increase of knowledge with time, without leading to a contradiction with the existing knowledge. How can we do this? This is the problem 'non-monotonic reasoning'.

Various studies on default reasoning, non-monotonic logic and so on, have tried to explore principles and methods of the inference applying such incomplete knowledge, (cf. McDermott 1982, McCarty 1986, Poole 1988). Contrary to those approaches, I start with a thesis that metaknowledge has been prepared well enough in law so that lawyers can control their inference through legal meta-inference by applying meta-knowledge to lead to an appropriate conclusion corresponding to the increase of knowledge. If we describe legal meta-knowledge exactly, then we need not have any other special inference method than classical first order logic.

Moreover, I would like to emphasize that legal meta-inference is extremely widespread in the legal reasoning. In my opinion, the whole legal reasoning is controlled by legal meta-inference. All legal text is written on the supposition that this legal meta-inference will be done[1].

This paper aims to clarify the knowledge structure of legal meta-inference in respect to the relation between legal rules and legal meta-rules which regulate

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*This paper is based on: Yoshino and Takuta 1992; Yoshino 1994b.

the validity of the rules. Based on it I establish the way to systematize legal meta-inference toward systematizing of legal system itself.

2   Examples of Legal Reasoning

Below, I examine an example of legal reasoning in the field of Japanese contract law. In order to decide what kinds of obligations the contract parties have, one should resolve whether the contract is concluded. In order to resolve the latter problem, one should decide whether an acceptance of an offer becomes effective. The following example concerns this last problem. It is very simple, but a simple example of a larger class of typical legal reasoning[2]. At first we assume a case and the relevant rules:

Case 4:

> f4.1: An offer by Anzai to Bernard reaches Bernard on November 7.
> f4.2: Bernard dispatches an acceptance of the offer to Anzai on November 11.
> f4.3: Bernard's acceptance of the offer reaches Anzai on November 17.

Legal rules:

> r1: A declaration of intention becomes effective when it reaches the other party. (Cf.: Japanese Civil Code Article 97-1)
> r2: An acceptance becomes effective when it is dispatched. (Cf.: Japanese Civil Code Article 526-1)
> r3: An acceptance is an declaration of an intention. (Common sense in law)
> r4: An offer is an declaration of an intention. (Common sense in law)

We suppose :

> fv1: r1 becomes valid on October 1.
> fv2: r3 becomes valid on October 1.
> fv3: r2 becomes valid on October 30.
> fv4: r4 becomes valid on October 1.
> The time of the inference: December 17.

Let's resolve the following goal:

> Goal: "When does the acceptance become effective?"

(1) Inference without meta-inference.   One could get here two answers by applying the above rules as follows:

> answer 1.2.1: "the acceptance becomes effective on Nov. 17"
> answer 1.2.2: "the acceptance becomes effective on Nov. 11."

The former is to be deduced as a result of applying rules r1 and r3 to the fact f4.3. The latter is to be deduced as a result of applying rule r2 to the fact f4.2. These two answers contradict each other.

(2) Legal Reasoning (Inference with meta-inference).   In the practical legal reasoning process, Japanese lawyers would get here a single answer :

> answer 2-2: "the acceptance becomes effective on Nov. 11"

by applying r2. It is legal meta-inference that rejects applying r1 and applies only r2 to solve the goal to get the appropriate answer. I would like to clarify the logical structure of legal meta-inference in terms of the relevant knowledge.

3   Knowledge Structure of Law

3.1   *Legal Rule and Meta-Rule*

Legal knowledge consists of legal rules. A legal system can be understood as a logical connection of legal rules. We can distinguish two kinds of legal rules. One is the rule that prescribes obligations of people as the addressee of the law which I call legal *'object rule'*. The other is the rule that prescribes rules, the validity of rules, which I call *'legal meta-rules'* (cf. Yoshino 1988, 52). A legal system ultimately prescribes legal obligations of people to perform or refrain from a certain type of behavior. The legal obligations exist if the legal rule which describes the relevant obligations is legally valid. In order to decide whether a rule is valid, there is a series of legal rules which describe the validity of the rule. These are to be called legal meta-rules, as mentioned above. (In my opinion the greater part of Japanese contract law consists of this kind of legal metarules, which prescribe the validity of a contract as a set of legal rules prescribing legal obligations of the parties). There is also a legal meta-rule, which prescribes the validity of legal meta-rules.

3.2   *Validity of Rules*

Legal rules are either valid or invalid. The validity of a rule is to be thought of a truth value in the logical sense. Just as only true rules are to be applied to solve a problem, so only valid rules can be applied, as axioms of legal reasoning, to solve a legal problem. Legal meta-rules control legal reasoning on the way they prescribe what rule is applicable to solve the relevant problem. Legal meta-rules prescribe the validity of rules in these two ways: a) prescribing the scope of the validity of rules and b) prescribing the priority of rules.

3.3   *Scope of the Validity of Rules*

Unlike rules of natural science, in the legal world, the valid rules are not always valid for every time or for everywhere or for everyone or for everything. Every legal rule has its scope of validity. A legal rule is valid only in a given scope, and applicable in a given range. A legal rule is not valid outside of its specified range and therefore not applicable. The scope of the validity of legal rules is

limited in terms of "time", "place", "person" and "matter". A type of legal meta-rules prescribes the scope of the validity of rules. They determine when the rules become valid or null, where, to whom and to in reference to what. For instance, Article 1 of Law Concerning the Application of Laws in General of Japan determines the enforcement date of laws. And, article 1 (1) of the United Nations Convention on Contracts for the International Sale of Goods specifies that the convention applies to a certain matter.

3.4   *Priority of Rules*

To avoid contradictions, which might come out as a result of the application of legal rules, there are legal meta-rules which determine the priority relation of rules. The principles are introduced as below (cf. Yoshino 1986 38f.; 1988, 52f.):

> pr1: An upper law derogates a lower law,
>
> pr2: A particular law derogates a general law,
>
> pr3: A new law derogates an old law.

It is the meta-rule pr2 that remedies the seeming contradiction between the above legal rules to solve case 4. This meta-rule is to be formalized as follows:

> pr2': The validity of rule r1 is derogated for scope G by rule r2, if rule r2 is a particular rule to rule r1 and the scope G of the validity of rule r2 overlaps with the scope of the validity of rule r1.
>
> pr2'-1: A rule is a particular rule to the other rules, if and only if the scope of the validity of the rule in terms of time, place, person and matter is the subset of the other.

In the above legal meta-rules pr1, pr2 and pr3, legal rules with higher priority '*derogate*' legal rules with lower priority. In my opinion, the derogation of a rule by another rule means that the validity of the former is derogated by the validity of the latter rule. Among above legal meta-rules from pr1 to pr3, there are also priority relations. pr1 is prior to pr2 and pr2 is prior to pr3.

3.5   *General Principles to Determine the Validity of Rules*

I have analyzed the validity of legal rules and endeavored to abstract general principles to determine the validity of rules. The present results are following two rules[3]. In order to make the description of this paper more simple, the scope of the validity of rules is taken account of only in terms of matter and time here, and terms of place and person are eliminated. The matter which a rule regulates is conceived here as a goal to be solved by the rule in the inference.

> mr1: Rule R is valid for goal G at the time of T, if

> – R becomes valid at the time of T1 before T for goal G1 including G, and
>
> – R does not become null between T1 and T for goal G2 included in G1.

> mr2: Rule R is valid for goal G at the time of T, if
>
> – R becomes valid at the time of T1 before T for goal G1 including G, and
>
> – G is included in goal G3 where G3 is the intersection of G1 and the complement to goal G2 if R becomes null for G2 between T1 and T where G2 is included in G1.

There is no other rule, which regulates directly that a rule is valid, than mr1 and mr2. We could unify the above two rules into one rule in which the condition and the consequence are connected by not '*if*' but '*if and only if*'. Under this rule there are many meta-rules. Here I introduce only one rule which connects the above two rules with pr2':

> mr2-2: Rule R becomes null for goal G at the time of T, when its validity for G is derogated by the other rule at T.

I will illustrate later indirectly what the above rules means with the meta-inference examples concerning the given case 4.

4   Legal Meta-Inference as Logical Inference

Legal reasoning is controlled by determining the validity of rules, for only valid rules can be applied to cases as premises (axioms) of the legal reasoning. It can be said, that legal meta-inference is inference which deduces a valid legal rule to solve a problem.

Legal meta-inference solves the meta-goal "the rule is valid for the goal to be solved at the time of the event". The nature of this inference is to be concieved as logical inference. This inference can be formalized in terms of first order predicate logic. In this meta-inference, meta-rules prescribing the validity of the rule are conceived as axioms — in other words, premises of the meta-inference — and the above meta-goal is logically proved from these axioms together with the goal and the facts of the case to which the rule is applied, where the metagoal is logically proven by the application of the meta-rule.

5   Logical Structure of Legal Meta-Inference

As far as the formalization of Legal Inference is concerned, we can apply CPF, which is an abbreviation of '*Compound Predicate Formula*' and was developed

and used by me as a knowledge representation method of law since 1985[4]. However, the formalization of the present legal meta-inference by CPF has been eliminated because of the space limitation of this paper. I would like to demonstrate the logical structure of legal meta-inference by describing the inference process to solve the examples 4 in natural language.

Before the demonstration, the above supposition fv1, fv2 and fv3 are to be reformed more exactly in terms of the scope of the validity of rules described in the chapter 3.3 as follows:

> fv1': r1 becomes valid for 'a declaration of intention becomes effective' on October 1.
>
> fv2': r3 becomes valid for 'declaration of intention' on October 1.
>
> fv3': r2 becomes valid for 'an acceptance becomes effective' on October 30.

It is to be noted also that the concept 'acceptance' is a subset of the concept 'declaration of intention' as rule r3 also shows, so that we can conclude (also through a meta-inference, which is not explained here):

> fmrv4a: "Rule r2 is a particular rule to rule r1."

Our inference follows the steps below to prove the goal:

> "When does the acceptance become effective?"

1. Rule r1 becomes a candidate to solve the goal. If r1 is applied to this case, it is proved through r3 together with the f4.3 that:

   > "the acceptance becomes effective on November 17".

2. The time of the event is to be got from the proved goal as: '11_17'.
3. Then, the meta-inference is invoked to prove the meta-goal:

   > "The rule r1 is valid on November 17 for the goal 'the acceptance becomes effective on November 17' "

4. In the application of the meta-rule mr1, for the first requirement it is proved that:

   > "r1 becomes valid on October 1 before November 17 for the goal 'a declaration of intention becomes effective' which includes the goal 'the acceptance becomes effective on November 17'"

   on the basis of the fact fv1' together with r3 which describes that 'declaration of intention' is a super concept of 'acceptance'.

5. But the second requirement

> "r1 does not become null between October 1 and November 17 for the goal 'the acceptance becomes effective on November 17' included in the goal 'a declaration of intention becomes effective' "

is not provable, because it is to be proved that:

> "r1 becomes null for goal 'acceptance becomes effective' on October 30 between October 1 and November 17"

and

> " 'become_effective of acceptance' is included in 'become_effective of declaration of intention".

The proof process is as follows:

> 5-1) Rule r2 is a particular rule to ruler1 and r2's validity scope for 'become_effective of acceptance' overlaps with r1's validity scope for 'become_effective of declaration of intention'. Therefore it is provable, through meta-rule pr2', in the meta-inference:
>
> > "The validity of r1 is derogated for goal 'acceptance becomes effective' by r2 on October 30."(On the basis of fv3').
>
> 5-2) Consequently it is also, through mr2-2, provable that:
>
> > "r1 becomes null for goal 'acceptance becomes effective' on October 30."
>
> 5-3) As 'acceptance' is subset of 'declaration of intention', it is provable that:
>
> > "'becomes_effective of acceptance' is included in 'become_effective of declaration of intention'".

6. After the trial of mr1 failed, the inference tries mr2. Here also the second requirement cannot be satisfied, for r1 becomes null for goal 'becomes_effective of acceptance' which is included goal 'become_effective of declaration of intention' on October 30 between October 1 and November 17, and there cannot be any goal G which is included in 'becomes_effective of acceptance' and at the same time included in the intersection of 'become_effective of declaration of intention' and the complement of 'becomes_effective of acceptance'.

7. As the both applications of mr1 and mr2 fail, it cannot prove the meta-goal

   > "the rule r1 is valid for the goal 'the acceptance of offer becomes effective on November 17' at the time of the event on November 17".

That means that rule r1 cannot be applied to prove the goal

"the acceptance becomes effective".

8. Consequently, the answer 'the acceptance of the offer becomes effective on November 17' as the result of the application of r1, is abandoned.
9. Then the second candidate r2 is applied, it can be proved that

   "the acceptance becomes effective on November 11"

   on the basis of f4.1.
10. The meta-inference is to prove the meta-goal

    "the rule r2 is valid for the goal 'the acceptance becomes effective on November 11' at the time of November 11".

The inference follows the proof steps below.

11. Applying meta-rule mr1,

    "rule r2 becomes valid for the goal on October 30 for the goal"

    is to be proved (Cf. fv3'), and

    "r2 becomes null for a goal included in the goal 'the acceptance becomes effective' between October 1 and November 11"

    fails to be proved. Therefore it is proved that:

    "the rule r2 is valid for the goal 'the acceptance becomes effective' on November 11."

    (This means that the application of the mr1 succeeds).
12. Therefore the following 'one' answer is accepted as proved:

    "the acceptance becomes effective on November 11".

In this way, the conclusion of inference is checked by a meta-level inference applying the legal meta-rules to prove that the applied rule in the inference is valid for the problem. Any step in the process of deriving this answer – the both levels of inference and meta-inference – is to be formalized as first order deductive inference. Strictly speaking, the meta-inference and the inference belong to the different levels of inference. A transition is done here between the meta-inference to prove the validity of the applied rule and the inference to prove the goal by applying the rule. The application of the valid rule, i.e., the true rule, is a presupposition of inference for a practical purpose, or is a conduct to do the inference itself. Therefore this transition is necessary for every inference. We could admit the transition, the transition of the meta-inference to the inference, as a rule, which is to be called a 'transition rule'.

On the basis of the above described principles and methods, we can develop a legal inference system with the legal knowledge-base which entails legal meta-rules[5]. This approach of the study could open the way to systematize the whole legal system from the logical point of view.

6 Conclusion

In this paper it has been shown, what legal meta-inference is, in an example of legal reasoning. The knowledge structure of the legal meta-inference has been clarified in respect of the relation between legal rules and legal metarules which regulate the validity of the rules. The legal reasoning, which entails the legal meta-inference, has been formalized. Thus the legal reasoning, which entails legal meta-inference, was analyzed and its logical structure was clarified on the basis of first order language, so that the way of systematization of a legal reasoning with meta inference was established.

7 Acknowledgments

Notes

1. This is one of the target theses of my logical jurisprudence. The further investigation would be necessary for me to demonstrate this thesis.

2. As it will become clear later, this example is an example of legal problems, where the reasoning about validity of legal rules is necessary and therefore to be done. The example concerns the change of the validity of legal rules with time on the one hand and the priority relations of the validity of rules, which contradict each other, on the other hand. This problem is a typical legal problem to be solved where legal rules are applied.

3. Since 1991 I have excluded the concept 'application' and formalize legal meta-knowledge only in terms of the concept of 'validity' (cf. Yoshino 1991, 22ff.). There is no positive law provision which describes directly when a rule 'is valid'. The positive law provisions describe when rules 'becomes valid' or when rules 'become null'. In order to decide whether a legal rule 'is valid', we have to presuppose these rules. mr1 and mr2 are necessary presupposition for law or legal science to cognize legal rules as a system of valid rules. These rules should be presupposed unconsciously by lawyers and all legal meta-rule provisions, which are issued in the statutes, must have these as tacit axioms of the rule system. Man could call this kind of rules as 'basic rules' in comparison to Hans Kelsen's 'basic norm' (Kelsen 1960).

4. CFP was used at first for constructing LES-2 (Legal Expert System-2) in 1985, (cf. Yoshino et al. 1986, 36ff.; Yoshino and Kitahara 1988, 56). It was used also for LES-3, (cf. Yoshino and Kakuta 1992, 1ff.) as well as for legal analogical reasoning system (Yoshino et al. 1993, 111f.). The semantic foundation was given in 1994, (cf. Yoshino 1994, 134f.). We are developing LES-4 using CPF.

5. We have already developed an experimental legal expert system with legal meta-inference, i.e., LES-3.3 (cf. Yoshino and Kakuta 1992, 4ff.). This system is described with ESP (Expanded Sequential Prolog) on PSI-II, both of which are developed by ICOT (Institute for the New Generation Computer Technology). I Am now analyzing and formalizing the whole legal system in terms of the validity of the legal rules. The present developing system will load the result.

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