Renvoi in Private International Law: a Formalization with Modal Contexts

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Contribution: formalizing the renvoi in private international law

- We introduce a rule based (first-order) fragment of a multimodal logic including context modalities as well as a (simplified) notion of common knowledge
- The nesting of contexts in queries is exploited in the formalization of the renvoi problem

"Is Taro a heir of John?"

Given an international matter, one wants to decide whether the matter is valid in a given country or not.

In some cases, such as when *Taro's parents do not have the same nationality*, this matter cannot be answered only considering the legislation of one country, and requires the deciding the legal system according to which the court has to decide.

Contribution: formalizing the renvoi in private international law

Private international law

"*enables the coexistence of multiple normative systems, having distinct and often contradictory rules*" (Dung and Sartor, 2011)

In (Dung and Sartor, 2011):

- Deciding the jurisdiction of a court
- Deciding the competence of a court
- Deciding the legal system according to which the court has to decide (*choice of law*)

In this paper, we consider *simplified setting* in which the *competence* and *jurisdiction* issue are not considered.

We focus on "Renvoi"

Determining the *legal system* in one country may require for the determination of the legal system in another country, a situation which may generate a sequence of references to different countries (e.g. *Family Law*)

Contribution: formalizing the renvoi in private international law

Private international law enables the coexistence of multiple normative systems having contradictory rules without the necessity of defining priorities among the rules or systems: "*conflicts between competences and between rules are avoided by distributing the cases between authorities of the different normative systems (jurisdiction) and by establishing what set of norms these authorities have to apply to each given case (choice of law)*" (Dung and Sartor, 2011)

There are only limited exceptions to this principle.

Our choice

This motivates our choice of dealing with scenarios using a monotonic modal formalism, although, in the general case, *defeasible reasoning* approaches might be needed, such as *modular argumentation* in (Dung and Sartor, 2011) and *defeasible logic* in (Malerba et al., 2016).

Example: Renvoi

Laws that hold in every country:

1. *Inheritance matter*, such as a property of heir, will be determined in the home country of Descendant
2. A *legitimate child-parent relationship* between Child and Parent will be determined in the home country of Parent, or determined in the home country of Spouse of Parent if there is a biological child-parent relationship between Child and Parent
3. *Marriage* will be determined in the home country of either spouse
4. The *home country* is Person's nationality, if Person has only one nationality
5. The *home country* is decided by the most related country for a Person, if Person has multiple nationality
6. The *most related country* for Person is usually the country of Person's habitual residence.

Example (contd.)

Domestic Rules that hold in Japan:

1. A *marriage relationship* holds between Spouse 1 and Spouse 2 if there is an agreement on marriage between Spouse1 and Spouse 2 and they register their marriage in Japan
2. Child is a *heir* of a Parent if there is a *child-parent relationship* between them
3. Child and Parent have a *child-parent relationship* if there is a *legitimate child-parent relationship* between them, or if there is a *non-legitimate child-parent relationship* between them

Domestic Rules that hold in Country1:

1. A *marriage relationship* holds between Spouse 1 and Spouse 2 if there is an *agreement on marriage* between Spouse1 and Spouse 2 and they *register their marriage* in Country1
2. Child is a *heir* of a Parent if there is a *legitimate child-parent relationship* between them

Example (contd.)

We have the following facts:

- John has multiple nationalities of Country1 and Country2
- Yoko has a single nationality of Japan
- John usually lives in Country1
- John and Yoko agreed to get married and registered their marriage at Country1
- John and Yoko had a son named Taro

Consider the following questions:

- "*John is married with Yoko*" is valid in Japan?
- "*Yoko is married with John*" is valid in Japan?
- "*Taro is a heir of John*" is valid in Japan?
- "*Taro is a heir of Yoko*" is valid in Japan?

A rule-based multimodal language with contexts

Our proposal

We introduce a rule-based (first order) fragment of a multimodal logic including context modalities as well as a (simplified) notion of common knowledge.

In particular:

- legislation of Japan represented by a modal context
- general laws (such as the jurisdiction laws, which hold in any context, exploit context variables
- global facts captured as (a sort of) common knowledge

The formalism is a rule based fragment of the multi-modal language in (Baldoni et al., 1998), extended with context variables, and allows context variables to occur within modalities and context names to be used as predicate arguments, thus supporting a simple combination of meta-predicates and modal constructs.

A modal formalization

We consider the rule-based fragment of the language in (Baldoni et al., 1998), extended by allowing variables to occur within modalities in rule definitions.

Let $\mathcal{L}_k^{\Box}$ be a first order multimodal language containing:

- countably many variables, constants, function and predicate symbols
- a finite set $Ctx = \{c_1, \ldots, c_n\}$ of constant symbols, called contexts
- the logical connectives $\neg$, $\wedge$, $\supset$, and quantifiers $\forall$ and $\exists$
- the modalities $\Box$ and $[C]$, where C can be a variable or a context constant c_i in Ctx

Ground formulas of th language

may contain two kinds of modalities: the modalities $[c_1], \ldots, [c_k]$, which represent k different contexts and the modality $\Box$, which can be regarded as weak "common knowledge" operator.

A modal formalization

The syntax of the *clausal fragment* of $\mathcal{L}_k^{\Box}$ is the following:

$$G ::= \top \mid A \mid G_1 \wedge G_2 \mid \exists x G \mid [C]G \mid \Box G$$
$$D ::= H \leftarrow G \mid D_1 \wedge D_2 \mid [C]D \mid \Box D \mid \forall x D$$
$$H ::= A \mid [C]H \mid \Box H$$

G stands for a goal, D for a *clause* or *rule*, H for a clause head.

- Sequences of modalities may occur in front of goals, in front of rule heads and in front of rules
- A program P consists of a closed set of rules D. Free variables in a rule are implicitly universally quantified in front of it

Context safety

We say that a program P is context safe if each variable X occurring in a modality $[X]$ in a rule D of P, also occurs in an atom $context(X)$ in the body of D, whrere *context* is defined:

$$\forall X(context(X) \leftrightarrow (X = c_1 \vee \ldots \vee X = c_k))$$

Example: domestic rules for context `japan`

```
□[japan] {
    heir(Child, Parent) :− child_parent_rel(Child, Parent).
    child_parent_rel(Child, Parent) :−
        legitimate_child_parent_rel(Child, Parent).
    child_parent_rel(Child, Parent) :−
        non_legitimate_child_parent_rel(Child, Parent).
    marriage(Spouse1, Spouse2) :−
        agreement(marriage, Spouse1, Spouse2),
        registered(marriage, Spouse1, Spouse2, japan).  }
```

The modality □ in front of the context modality `[japan]` is needed to make each context definition globally visible from all the other contexts (as a goal `[japan]G` can occur in the body of any, local or global, rule in the program).

Example: domestic rules for context country1

```
□[country1] {
    heir(Child, Parent) :-
        legitimate_child_parent_rel(Child, Parent).
    child_parent_rel(Child, Parent) :-
        legitimate_child_parent_rel(Child, Parent).
    legitimate_child_parent_rel(Child, Parent) :-
        marriage(Parent, S),
        biological_child_parent_rel(Child, Parent).
    marriage(Spouse1, Spouse2) :-
        agreement(marriage, Spouse1, Spouse2),
        registered(marriage, Spouse1, Spouse2, japan).  }
```

Important! Non-modal atoms in the body of rules in a context (such as `marriage(Parent, S)` in the third rule of context `country1`) can be proved either locally to the same context or using other rule definitions as those introduced below.

Example: laws hold for any [CountryA] and [CountryB]

The following rules establish the validity of a property in some country, based on properties which may hold in the same or other countries, or globally (to capture laws (1) and (2)).

(A) $\square$[CountryA](heir(Child, Parent) :–
context(CountryA), context(CountryB),
home_country(Parent, CountryB)),
[CountryB]heir(Child, Parent)).

(B) $\square$[CountryA](legitimate_child_parent_rel(Child, Parent) :–
context(CountryA), context(CountryB),
home_country(Parent, CountryB),
[CountryB]legitimate_child_parent_rel(Child, Parent)).

(C) $\square$[CountryA](legitimate_child_parent_rel(Child, Parent) :–
[CountryA]marriage(Parent, Spouse),
home_country(Spouse, CountryB),
biological_child_parent_rel(Child, Parent),
[CountryB]legitimate_child_parent_rel(Child, Parent)).

Example: global rules and facts

They can be encoded prefixing them with the $\Box$ operator, to mean that they are visible anywhere in the program.

$\Box$(marriage(Spouse1, Spouse2) :– marriage(Spouse2, Spouse1)).

$\Box$(home_country(Person, Country) :–
    single_nationality(Person, Country)).
$\Box$(home_country(Person, Country) :–
    multi_nationality(Person, Country),
    most_related(Person, List, Country)).

$\Box$(most_related(Person, List, Country) :–
    habitual_residence(Person, Country),
    member(Country, List)).

$\Box$ multi_nationality(john, [country1, country2])).
$\Box$ habitual_residence(john, country1)).
$\Box$ single_nationality(yoko, japan)).
$\Box$ bilogical_child_parent_relation(taro, john)).

Example of a query: "is Taro a heir of John valid in Japan?"

This query is captured by the goal:

$$[\texttt{japan}]\texttt{heir}(\texttt{taro}, \texttt{john}).$$

This goal succeeds from the program above, using the following instance of rule (B):

$$\begin{aligned}\Box([\texttt{japan}]\texttt{legitimate\_child\_parent\_rel}(\texttt{taro}, \texttt{john}) :- \\ \texttt{context}(\texttt{japan}), \texttt{context}(\texttt{country1}), \\ \texttt{home\_country}(\texttt{john}, \texttt{country1}), \\ [\texttt{country1}]\texttt{legitimate\_child\_parent\_rel}(\texttt{taro}, \texttt{john})).\end{aligned}$$

and exploiting the definition of `heir` and `child_parent_rel` from the context `japan`, the definition of `legitimate_child_parent_rel` and `marriage` from the context `country1`, and the definition of `biological_child_parent_rel`, etc. from the global facts.

Semantics of the multi-modal rule based language

The semantic of the language $\mathcal{L}_k^{\Box}$ in (Baldoni et al., 1998) is a first order normal multimodal logic semantics, based on Kripke interpretations in which domains of worlds are increasing, each (ground) modality $[c_i]$ is associated with an accessibility relation R_i, and the $\Box$ modality is associated with a reflexive and transitive accessibility relation Π, such that $(\bigcup_{i=0}^{k} R_i)^* \subseteq \Pi$.

- For any context safe program P, each program P' (obtained by instantiating all context variables in P with constants from Ctx) has the semantics and proof procedure defined in (Baldoni et al., 1998)
- It can be shown that one can restrict to Kripke interpretations over the Herbrand universe of the program
- Completeness of the goal directed proof procedure can be established through a canonical model construction (while a different kind of proof was considered in (Baldoni et al., 1998)).

Dealing with Renvoi

The formalization above of the running example establishes the validity of a property in some country, based on properties which may hold in the same or other countries.

For instance, in rule (A), the validity of proposition `heir(Child, Parent)` in the context `CountryA`, depends on the validity of the same property in context `CountryB`.

However, the rules in the program do not make any distinction among the validity of a property in a context and the deciding the context of the same property. Introducing such a distinction is essential to capture renvoi.

- To check property `heir(taro, john)` in Japan, we need first to determine the context for the property `heir`, with Japan as applying country, using low (1), rather than using rule for `heir` in the context `japan`

Formalization revisited

According to law (1), an inheritance matter, such as a property of heir, is to be determined in the context of the home country of the parent (in this example, `heir(taro, john)` is to be determined in "country1", as "country1" is the home country of John).

We then reformulate our query as

$$\texttt{holds(heir(taro, john), japan)}$$

and we introduce for `heir`, as for every property whose context is to be determined, a rule:

```
□(holds(heir(Child, Parent), CountryA) :-
    [CountryA]choiceoflaw(heir(Child, Parent), CountryB),
    [CountryB]heir(Child, Parent)).
```

where a goal `[CountryA]choiceoflaw(Matter, CountryB)` is used to determine the context `CountryB` of the `Matter` in `CountryA`.

Formalization revisited

We reformulate rule 1. and 3. to determine the context of *heir* and marriage as follows:

(A) $\Box[\texttt{CountryA}](\texttt{choiceoflaw}(\texttt{heir}(\texttt{Child}, \texttt{Parent}), \texttt{CountryC}) :-$
$\texttt{home\_country}(\texttt{Parent}, \texttt{CountryB}),$
$[\texttt{CountryB}]\texttt{choiceoflaw}(\texttt{heir}(\texttt{Child}, \texttt{Parent}), \texttt{CountryC})).$

(B) $\Box[\texttt{CountryA}](\texttt{choiceoflaw}(\texttt{marriage}(\texttt{Spouse1}, \texttt{Spouse2}), \texttt{CountryC}) :-$
$\texttt{home\_country}(\texttt{Spouse1}, \texttt{CountryB}),$
$[\texttt{CountryB}](\texttt{choiceoflaw}(\texttt{marriage}(\texttt{Spouse1}, \texttt{Spouse2}), \texttt{CountryC})).$

Renvoi

- In rule (A) the context for the matter $\texttt{heir}(\texttt{Child}, \texttt{Parent})$ is determined as the country of the parent ($\texttt{CountryB}$), which may be different from the current context ($\texttt{CountryA}$)
- In such a case, we need again to decide the context according to the private international law in the new country (i.e., $\texttt{CountryB}$)
- This is called a "renvoi". If a loop in the "renvoi" is detected, the context is set to the starting country of the loop.
  For example, if the private international laws determines the following sequence of context A, B, C, D, B, then we can decide the context for the matter to be country B
- In order to deal with such a kind of loop in renvoi, we introduce the following general rule
  (R) $\Box[\texttt{CountryA}]\Box[\texttt{CountryA}]\texttt{context}(\texttt{Matter}, \texttt{CountryA}) :- \top.$

Renvoi

For instance, when applying rule (A) in case

$$\texttt{home\_country}(\texttt{Parent}, \texttt{CountryA})$$

holds, the second subgoal in the body of (A), i.e.,

$$[\texttt{CountryA}]\texttt{choiceoflaw}(\texttt{heir}(\texttt{Child}, \texttt{Parent}), \texttt{CountryC})$$

is proved in [CountryA] and it immediately succeeds by the instance

$$[\texttt{CountryA}][\texttt{CountryA}]\texttt{choiceoflaw}(\texttt{Matter}, \texttt{CountryA}) :\!- \top.$$

of rule (R) above, letting $\texttt{CountryC} = \texttt{CountryA}$, as the home country of the Parent is precisely CountryA, the country in which the determination of context was issued.

($\Box$ stands for any sequence of modalities, including the empty one)

Conclusions and Related work

- (Dung and Sartor, 2011) provide a logical model of private international law, based on modular argumentation, as a way of coordinating the different normative systems without imposing a hierarchical order on them. They do not consider the issue of modeling chains of references

  In this paper we exploit a rule based fragment of a modal logic with context modalities, to capture renvoi
- Our language is monotonic. Modeling private international law in its full generality might require nonmonotonicity such as in (Dung and Sartor, 2011) and in (Malerba et al., 2016), exploiting defeasible logic

  This motivates, for future work, the development of a nonmonotonic extension
- Our formalism is relate with other formalisms for dealing with multi-agent systems in computational logic and in ASP (we refer to (Dyoub et al., 2018) for a survey)

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