An Approach to Legal Ontologies: the Case-Based Reasoning Perspective

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Argument

- From the viewpoint of an ontology consumer:
  - What is the state of the art in ontologies for case-based models of legal reasoning?
  - What kind of ontology to use in building a legal CBR system today and what guidance is available?
- Case-based legal reasoning:
  - Draw inferences about how to decide problem by comparing it with relevant cases
- Roles of CBR ontology:
  - *Support case-based comparisons*
  - *Distinguish deep and shallow analogies*
  - *Induce/test hypotheses*
- Extended example shows what a legal CBR ontology should provide.
  - Some roles are well supported; others require further innovation.
  - Concrete example helps to focus and define goals.

Outline

- Define "ontology" and specify general roles ontologies serve
- Three specific roles for ontologies supporting case-based legal reasoning.
- Extended example of case-based legal reasoning to be supported by ontology.
- Distill requirements of a CBR ontology for each role:
  1. Support case-based comparisons
  2. Distinguish deep and shallow analogies
  3. Induce/test hypotheses
- Discuss extent requirements met and remaining challenges .
- Conclusions

Definitions and Roles

- Ontology ≡
  - "explicit, formal, and general specification of a conceptualization of the properties of and relations between objects in a given domain (citations omitted)" (Wyner, 2008).

- Comprises:
  1. Ontological framework
     - Specifies fundamental types of things that exist for purposes of system
     - Sets out relations among the types or concepts
     - Defines a conceptual syntax for representing more complex concepts
  2. Domain ontology
     - Specifies objects, predicates, relations, and semantic constraints for a given domain.

- General roles:
  - Facilitate exchange and re-use of information among knowledge bases which may be distributed over the Internet (Breuker, et al., 2004).
  - Make assumptions about concepts explicit so program can reason with them, and
  - Manage relations and distinctions among concept types (Breuker, et al., 2004).
  - Help generate natural language explanations.

Specific Roles of CBR Ontology

Since case-based legal reasoning involves drawing inferences by comparing a problem with relevant cases, a CBR ontology should help:

1. *Support case-based comparisons*:
   - Find relevant cases, compare them with the problem, draw inferences based on the comparisons, and make arguments how to decide the problem.

2. *Distinguish deep and shallow analogies*:
   - Identify cases that are relevant despite superficial dissimilarities or irrelevant despite superficial similarities.

3. *Induce/test hypotheses*:
   - Induce defensible hypotheses about how to decide a problem from a database of suitably represented cases, and evaluate and modify the hypotheses (e.g., using hypothetical reasoning.)

Intro to Extended Example

- Illustrate ontology for new case-based legal reasoning system:
  - simulates arguments law professor and students make in classroom discussion.
- Example: intended output for property law course discussion of *Pierson v. Post.*
  - Deals with an issue of common (i.e., judge-made as opposed to statutory) law:
  - When may hunters have property rights in animals they pursue.
  - See Berman & Hafner, 1993; Gordon & Walton, 2006; Atkinson & Bench-Capon, 2007.
- Arguments to model include:
  - Draw analogies/distinctions wrt past cases (i.e., precedents)
  - Justify analogies in terms of underlying legal domain's principles/policies
  - Propose test or rule for deciding a case
  - Challenge proposed tests by posing hypotheticals
  - Respond to hypotheticals by modifying the proposed test, etc.
- Proposed test ≡ ako hypothesis about how to decide the case.
  - rule that advocates or judges propose for deciding a case
  - defend as consistent with past cases and underlying principles and policies.
- Hypothetical ≡ imagined situation that involves a hypothesis (proposed test)
  - explores its meaning or challenges it as too broad or too narrow.

Table 1: Cases / Hypotheticals

Case Name (Case or Hypo)	**Facts**	**Decision** Pltf / Def
Pierson v. Post (C)	D, knowing that the plaintiff was pursuing a fox with horse and hound on open land, intercepted the fox and killed it.	D
Keeble v. Hickeringill (C)	P property owner used decoys on his part of the pond to lure ducks. D used guns to scare ducks away.	P
Young v. Hitchens (C)	P commercial fisherman closed net on fish. When the opening was still a few fathoms wide, D went through the opening and caught fish.	D
Flushing Quail (H)	D, knowing that P was pursuing quail by flushing them out on open land and shooting them, intercepted the quail and killed them.	?
Competing School-masters (H)	D school master of competing new school frightens boys on way to old school of P master.	?
Escaping Boar (H)	D possessed wild boar that escaped and damaged P's crops	P
Popov v. Hayashi (H)	When Barry Bonds' record-breaking 73d home run ball was struck into the crowd, P caught it in the upper part of the webbing of his mitt, but was tackled by other fans. D (not one of the tacklers) picked up the ball and put it in his pocket.	Split proceeds

Table 2: Principles / Policies

Principles or Policies	Meaning
Protect Fair Play	Discourage unsportsmanlike conduct and unfair competition.
Reduce Nuisance Pests	Encourage eradication of deleterious pests
Promote Certainty of Possession	Maximize rule's ease and clarity of application so hunters know who owns what
Protect Livelihood	Protect livelihood of working parties
Avoid Property Rights in Public Property	Avoid assigning property rights in things on public property
Promote Economic Competition	Promote economic competition among businessmen
Protect Free Enterprise	Protect free enterprise of businessmen
Legally Protectable Interests	Only protect interests the law recognizes
Protect Landowner's Rights	Protect the rights of the landowner on his own land

Table 3: Factors

Factors	Short Name	Side Favored
Animal not caught or mortally wounded	Not Caught	D
Open Land	Open Land	D
Own Land	Own Land	P
P Pursuing Economic Livelihood	Livelihood	P
D in Economic Competition with Plaintiff	Competes	D
P manifestly closes in on goal	Manifest Closing In	P
D knows P closes in on goal	Knows Closing In	P
D intentionally interferes physically with P's closing in on goal	Intentional Interference	P
Animal is a nuisance pest	Nuisance	P

Table 4: Proposed Tests (i.e., Hypotheses)

Proposed Tests	Short Name
If plaintiff did not gain possession of the fox (e.g., by capturing or mortally wounding it), then he cannot recover.	Possession
If plaintiff did not gain possession of the quarry (e.g., by capturing or mortally wounding it), then he cannot recover.	Possession-1
If plaintiff did not gain possession of the quarry (e.g., by capturing or mortally wounding it), and the quarry was a nuisance pest, then he cannot recover.	Possession-2
If plaintiff manifestly intended to gain possession of the fox, and the defendant intentionally interfered causing plaintiff to fail, then he can recover.	Manifest - Intent
If plaintiff manifestly intended to gain possession of an economic goal, and the defendant intentionally interfered causing plaintiff to fail, then he can recover.	Manifest-Intent-1
...	...

Extended Example

Argument moves	Transcript
	Part 1. In *Pierson*, plaintiff (P) showed that as he was pursuing a fox with horse and hound on open land, the defendant (D) intercepted the fox and killed it (Tab. 1, Cases/Hypos); P claimed a property right to the fox with which D interfered. What is the appropriate legal test (if any) for deciding if P has such a property right and whether it is satisfied on these facts?
• Propose test for Pltf. • Justify test ito principles & precedents • Analogize precedent ito factors	**Part 2.** Student-A proposes a test for P: "If plaintiff manifestly intended to gain possession of the fox, and the D intentionally interfered causing plaintiff to fail, then he can recover," (Tab. 4, Prop. Tests, Manifest Intent). The test is consistent with underlying principles and past cases: it Protects Fair Play (Tab. 2, Principles/Policies) and is analogous to *Keeble* (Tab. 1, Cases/Hypos) in which P won where D scared away ducks P had lured to its part of a pond. The student draws a factual analogy in terms of relevant factors the cases share: Manifest Closing In, Knows Closing In, and Intentional Interference (Tab. 3, Factors).
• Distinguish precedent for Def. ito factors. • Justify distinction ito principles • Argue principle not legally enforceable • Cite trumping counter example ito factors	**Part 3.** Student-B responds for D by distinguishing *Keeble*, emphasizing pro-P factors present in that case not shared in Pierson: P in *Keeble* was on his Own Land (Tab. 3, Factors). This matters; the court may have aimed to Protect Landowner's Rights (Tab. 2, Principles/Policies). He might also suggest that Protects Fair Play, although morally relevant, is not a Legally Protectable Interest (Tab.2, Principles/Policies). Continuing to advocate for D, the Student-B might cite *Young* where D won (Tab. 1, Cases/Hypotheticals) despite the shared facts associated with Manifest Closing In, Knows Closing In, and Intentional Interference (Tab. 3, Factors).

Extended Example (cont.)

Argument schema/moves	Transcript
• Propose test for Def. • Justify test ito principles • Distinguish inconsistent precedent ito principles	**Part 4.** Professor asks for the test for D. Student-B proposes, "If plaintiff did not gain possession of the fox (e.g., by capturing or mortally wounding it), then he cannot recover" (Tab. 4, Prop. Tests, Possession). Student-B concedes his test is inconsistent with *Keeble*, but emphasizes that applying it in *Pierson* would Promote Certainty, Reduce Nuisance Pests (as, arguably, foxes were then seen in agrarian England) and Avoid Property Rights in Public Property (Tab. 2, Principles/Policies), considerations not present in *Keeble*.
• Pose hypo / challenge test as too broad • Justify challenge ito principles	**Part 5.** By posing a hypothetical case, the professor challenges the pro-D test as too broad. Instead of foxhunting, suppose P hunted quail to support his living (Flushing Quail, Tab. 1, Cases/Hypos.) In that case, the proposed test for D (or one generalized from "fox" to "quarry", Tab. 4, Prop. Tests, Possession-1) would not Reduce Nuisance Pests but, on the other hand, would detract from Protect Livelihood (Tab. 2, Principles/Policies).
• Justify test in cfs ito factors • Modify test to remove overbreadth • Concede scope for Pltf.'s test • Pose hypo / challenge test as too broad	**Part 6.** In response, Student-B justifies the proposed test in *Pierson*, where the Nuisance factor applied and there was no Livelihood (Tab. 3, Factors). He modifies the test so that it applies only if the quarry is a nuisance pest (Tab. 4, Prop. Tests, Possession-2) and concedes that P's test should otherwise apply where the quarry had economic value to someone's livelihood (Tab. 4, Prop. Tests, Manifest-Intent-1). The professor challenges that test as too broad with the Competing Schoolmaster hypo (Tab. 1, Cases/Hypos), and so on.

1. Support case comparison: representing cases

Domain-specific classes/values

Hunting venues: land, pond, ocean
Restrictions on venues: open, privately owned, or subject to regulatory restriction
Quarry: animals (wild, domestic, edible, nuisance pests, fox, quail, fish, frogs?)
Hunting steps re possession: seeking quarry, closing in on quarry, catching or mortally wounding quarry, missing quarry
Hunting occupations: pursuing livelihood, competing economically, avocational

General Concepts of Human Agency

Interference: not interfering, interfering physically with, preventing someone's reaching a goal, etc.
Intentionality: unintentionally, negligently, knowingly or intentionally
Objectiveness: hiding ones intentions, being ambiguous about them or manifesting them clearly

Factors (Table 3) with Focal slot values

- Part 5: hypo substitutes "quail" for "fox" as quarry.
  - Nuisance factor not applicable
  - Livelihood factor now applies

1. Support case comparison: explain case decisions ito tests & principles

Composing Tests as Logical Formulae with:

- General factual concepts
- Intermediate legal concepts
  - possession, manifestly intended, intentionally interfered, causing, and nuisance pest
- Orderings re intermediate legal concepts
  - Certainty of possession (e.g., catching or mortally wounding > seeking or closing in)
  - Intentionality class (i.e., unintentionally < negligently < knowingly or intentionally)

Concept Associations

- **Factors & principles**
  - Similarities/differences legally relevant b/c of related principles
  - Own Land (Factor) ~ Protect Landowner's Rights (Principles) in explaining *Keeble* and distinguishing *Pierson*, Part 3.
  - Open Land ~ Avoid Property Rights in Public Property.
- **Intermediate legal concepts & factors & principles**
  - "Possession" ~ Not Caught (Tab. 3, Factors) and with Promote Certainty (Tab. 2, Priniciples/Policies.)
  - "Intentionally interfered" ~ Intentional Interference and with Protect Fair Play.
  - "Nuisance pests" ~ Nuisance and Reduce Nuisance Pests.
- **Factual concepts & principles**
  - If "quarry" includes non-nuisance pests, game birds, or economic goals,
  - Then various principles apply more or less strongly.

1. Support case comparison: model argument schema/moves

- E.g., posing hypothetical to challenge test as too broad
- Given ontology's associations among factors, concepts and principles/policies…
- Hypothetical that changes appropriate fact takes case out of one policy and into another.
  - Part 5, switch quarry from nuisance pest to edible wild game
  - Apply modified Possession test (see below) that applies to foxes and quail,
  - Test's result no longer consistent with reducing pests;
  - Result now counters making a living!
  - Basis of challenge that test is too broad
- Ontological ordering of terms by abstractness and legal "inclusiveness" guides comparing/modifying test versions.
  - E.g., "quarry" is substituted for "fox" in modifying Possession test in Part 5 to Possession-1 (Tab. 4).
  - In Part 6, modification of Possession-1 to Possession-2 by adding condition that quarry be a nuisance pest removes the overbreadth.

2. Distinguish deep and shallow analogies

Case Name	Explanation	Factors
Escaping Boar case	Where D possessed a wild animal nuisance pest that damaged P's property, P won *claim* for negligence/strict liability on *issue* that animal escaped through/without D's fault.	Not Caught, Livelihood
Keeble v. Hickeringill	Where D used guns to scare away ducks that land owner lured to his part of the pond, P won claim of interference with property despite issue of possession where P had not killed or mortally wounded ducks.	Not Caught, Own Land, Livelihood, Competes, Manifest Closing In, Knows Closing In, Intentional Interference
Pierson v. Post	Where D killed a fox, a nuisance pest, that P hunted for sport, P lost *claim* of interference with property on *issue* of possession where P had not killed or mortally wounded the fox.	Not Caught, Open Land, Manifest Closing In, Knows Closing In, Intentional Interference, Nuisance
Popov v. Hayashi	Where D pocketed a very valuable baseball that P had caught, P won a *claim* of interference with property despite the *issue* of possession where P had not completely secured the ball before being knocked down, but was awarded only half the proceeds of sale of baseball.	Not Caught*, Open Land*, Livelihood*, Competes*, Manifest Closing In*, Knows Closing In*, Intentional Interference*
Competing School masters hypothetical	Where D schoolmaster scared away pupils from attending P's school, P won?/lost? a *claim* for interference with a property interest where an *issue* involved whether the P had a property interest in students attending his school.	Not Caught*, Open Land*, Livelihood*, Competes*, Manifest Closing In*, Knows Closing In*, Intentional Interference*

Table 5: Explanation of Cases, Issues, Claims, Factors

3. Induce/test hypotheses

- Goal: induce (abduce) legal tests or rules from cases
  - explainable ito principles, precedents, facts and decisions, issues, other rules.
- Process of proposing tests and evaluating with hypotheticals models incremental, explainable induction.
- Ontologically supported, driven by argument schema applied to problem cases.
  - Adaptive mechanism: substitution of facts/concepts from ontology to make hypotheticals and modify tests
  - ako case-based adaptation (Kolodner, 1995).
  - Solution is not a case alone but the test as proposed or modified.
  - Hypothetical case is a case adaptation that helps evaluate test

3. Induce/test hypotheses (cont.)

- Ontology's comprehensive organization of legal and factual concepts to guide substitutions essential…
- But is it enough?
- Human advocates invent new intermediate legal concepts for fitting tests with past cases, principles, and policies.
- Can ontology support "inventing" new terms?
  - Through composing existing terms or
  - Borrowing analogous terms from different legal domains?
- Ontology-based automated combinations of elements, E.g.,
  - Causal case explanations in terms of actions and intentions; Breuker and Hoekstra, 2004a)
  - Transformation rules (i.e., weak rules of inference abstracting and formalizing procedures empirically discovered in solving cases) (Zarri, 2007).

Discussion

- From Workshop CFP:
  - "At the same time we need to consider how to preserve the possibility of evolution and progress in the law (which presupposes disagreement and debate about legal concepts)."
- Ontologies for case-based legal reasoning models as rule-extraction vs. case comparison?
  - "When cases are considered as authoritative sources of rules (as in the rule extraction method), …, the extracted rules are applied, just like other rules. From an ontological point of view, the rule extraction method treats cases basically as sets of rules.
  - In the method of case comparison, cases are considered differently, namely as authoritative sources of arguments and decisions.… Ontologically, the case comparison method views cases basically as sets of arguments and decisions." (Roth and Verheij, 2004, p. 635)
- A false dichotomy? Rules may be:
  - derived from cases and applied deductively, but participants argue about what the rules mean;
  - challenged, changed, and reinterpreted through processes of case comparison.
- Case as an authoritative source of a:
  - rule vs.
  - result given its facts from which to extract a range of rules in light of precedents and underlying principles.
- Test is:
  - proposed for the cfs that deductively leads to a desired decision.
  - subjected to challenge with hypothetical examples that tease out its meaning and assess its fit with the past decisions and principles.
  - applied deductively to the hypothetical and prior case facts, but that is only part of the process.

Conclusions

- Case-based legal reasoning:
  - Draw inferences about how to decide problem by comparing it with relevant cases
- Roles of CBR ontology:
  - *1. Support case-based comparisons*
  - *2. Distinguish deep and shallow analogies*
  - *3. Induce/test hypotheses*
- Extended example shows what a legal CBR ontology should provide.
- Microworld approach to implementing CBR ontology?

Hypothetical Reasoning in Civil Law Context

- Civil law scholars discuss decisions in treatises.
  - Critique bad decisions to guide judges in future decision-making.
  - Pose situations with undesirable consequences resulting from decision.
  - "In performing their roles as organizers, rationalizers and critics of precedent, academics in some systems in the study make extensive use of hypothetical cases in their work…Indeed, it is a major technique used in the United Kingdom and in the United States, and also in most civil law countries…. D. MacCormick and R. Summers (ed.) *Interpreting Precedents*, pp. 528-9, Ashgate/Dartmouth (1997).
- Prior to decision, civil law judges engage in a series of deliberative meetings and talk about precedents.
  - European Court of Justice: Advocate General reviews case law and delivers a treatise reporting an alternate path from problem to solution.
  - French Court of Cassation: Reporting judge drafts alternate judgments leading to different results and submits before the oral hearing.