Logical Reasoning as Argumentation,

Or: How Lessons from the Law Are Changing Artificial Intelligence

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Lecture 1: Argumentation and Artificial Intelligence
An overview is given of how ideas from argumentation theory have been picked up in artificial intelligence. The focus will be more on general ideas and approaches, and less on formal detail.

http://www.ai.rug.nl/~verheij/ssa2016/

Lecture 1: Argumentation and Artificial Intelligence
An overview is given of how ideas from argumentation theory have been picked up in artificial intelligence. The focus will be more on general ideas and approaches, and less on formal detail.

Lecture 2: Argumentation in the law: case-based and rule-based
In the law, argumentation is central. Two kinds of argument-based reasoning are prominent. In the first kind, precedent cases are followed by analogy; in the second, rules are applied when their conditions are fulfilled.

http://www.ai.rug.nl/~verheij/ssa2016/

Argumentation with Rules and with Cases

Topics:
- Reasoning with Rules
- Case-based Reasoning

Goals:
- Acquire knowledge about reasoning with rules
- Acquire knowledge about case-based reasoning
- Acquire insight into the relations between reasoning with rules and case-based reasoning

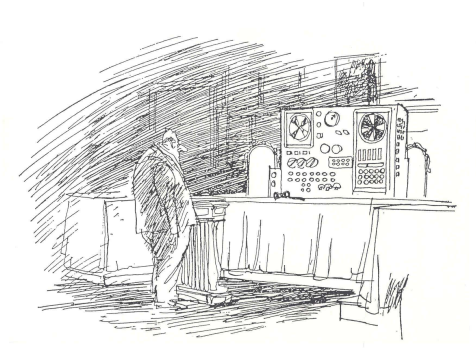
Literature:
- Van Eemeren et al. (in preparation). Sections 11.8, 11.9

Machines can decide legal cases (?)

Deciding legal cases consists of applying the law.
The law consists of rules.
Machines can apply rules.

THEREFORE:

Machines can decide legal cases.



Maar edelachtbare, u drinkt toch ook wel eens een glaasje?
But, Your Honour, you sometimes have a drink too, haven't you?

Some hard questions

Deciding legal cases consists of applying the law.
- -> Is applying the law sufficient for deciding cases?
- -> How does one apply the law?

The law consists of rules.
- -> Does it?
- -> Where are they?

Machines can apply rules.
- -> Can they?

THEREFORE:
Machines can decide legal cases.
- -> Well, I don't know!

Working hypothesis:

Deciding legal cases can be automated.

Research agenda:

Find out how!

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Digitale editie

Binnenland | Buitenland | Economie | Cultuur | Sport | Opinie | Wetenschap | Tech & Media | Meer

Een robot als geachte confrère?

Advocatuur Grote advocatenkantoren bereiden zich nog maar mondjesmaat voor op technologische vernieuwing.

Teri van der Heijden · 2 januari 2016

Hier is ROSS de robot: een machine die alle wetten, jurisprudentie en andere juridische documentatie kent. Een juridische vriend die op alle vragen een antwoord geeft. Een digitale advocaat-stagiair die écht dag en nacht beschikbaar is, ook in het weekend.

Robot ROSS is de grote belofte op het gebied van *legaltech*, technologie op het gebied van juridische dienstverlening. En daarmee een bedreiging van de traditionele advocatuur. Een advocaat verkoopt de kennis en ervaring in zijn hoofd. Die expertise rechtvaardigt zijn uurtarief. Wat als een robot straks net zo goed kan wat hij kan, of misschien zelfs sneller en beter?

Zo ver is het nog niet, maar de advocatuur staat wel onder druk. Het uurtarief blijft sinds de crisis „flink achter bij de inflatie", schreef het ING Economisch Bureau in een rapport in oktober. Bijna de helft van de twintig grootste advocatenkantoren zag zijn

Foto Arjen Born

Disruption speak

Richard Susskind:
The Future of Lawyers: From Denial to Disruption

CODEX presents FutureLaw 2014 CONFERENCE
MAY 2, 2014 AT STANFORD LAW SCHOOL, RM 290

Harvard conference 2014
Disruptive Innovation in the Market for Legal Services

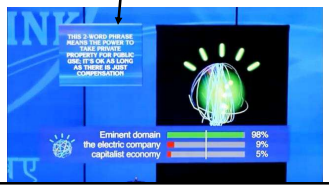
ReInvent Law NYC

"Watson is almost certainly the most significant technology ever to come to law"

As Seen in Vox: *This Computer Program Can Predict 7 Out of 10 Supreme Court Decisions*

IBM's Watson playing Jeopardy

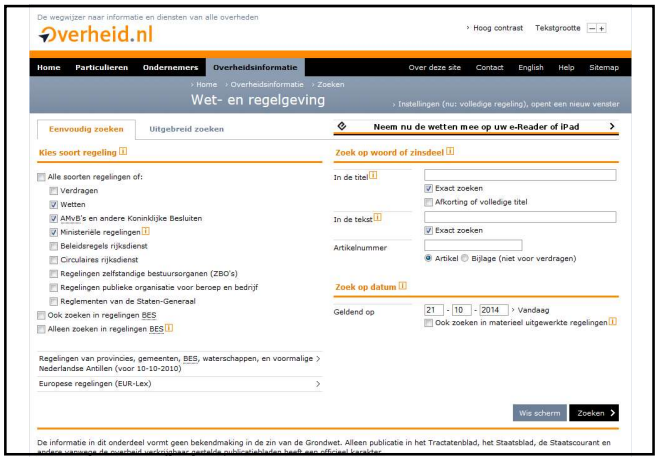
"This 2-word phrase means the power to take private property for public use: it's ok as long as there is just compensation"

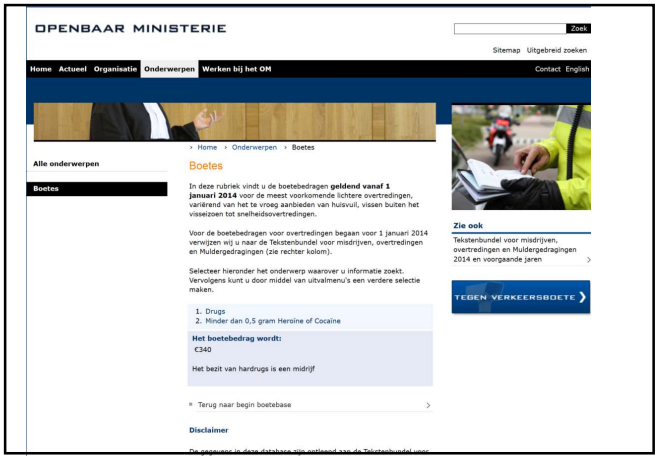


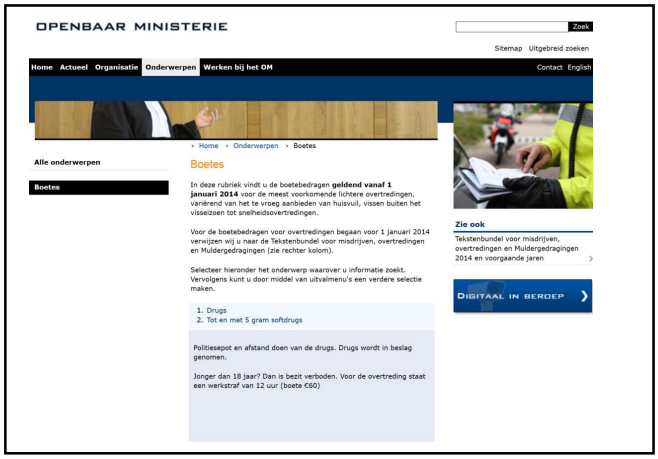
"Watson is almost certainly the most significant technology ever to come to law"

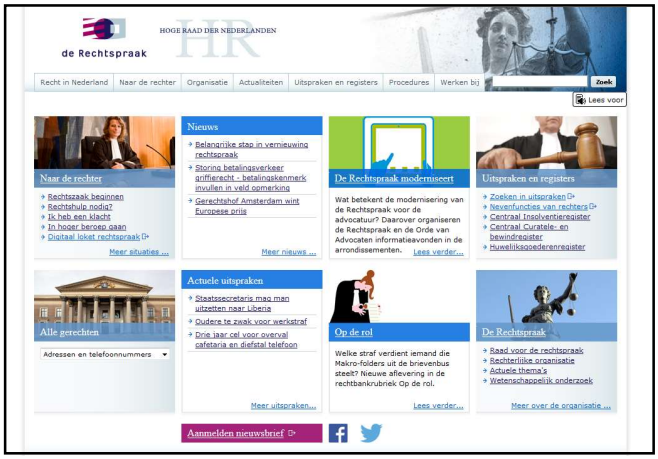
adviseHub
LawGives
legalzoom
PrioriLegal
NextGen Reporting
Wizdocs
PacerPro
effacts.
MyLawsuit.com
RocketLawyer
Lex Machina
supportpay
SimpleLegal
Court Listener
OTONOMOS

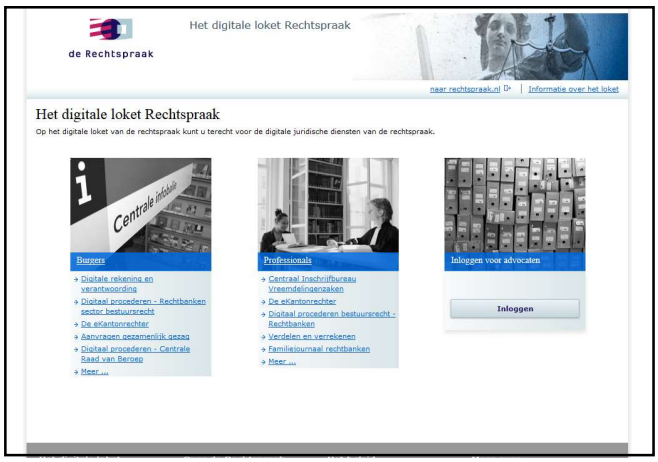
Legal tech exists



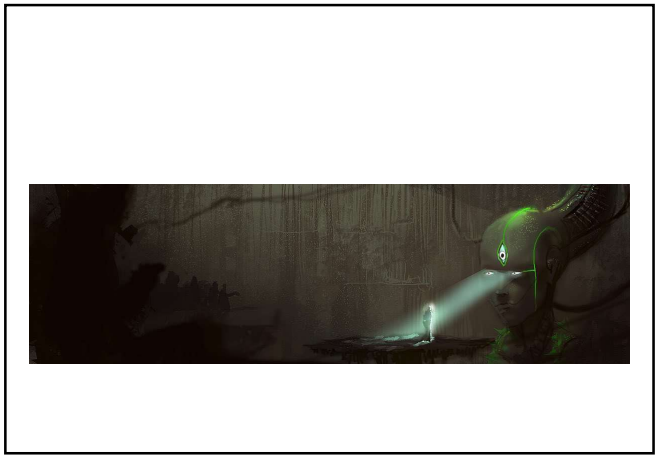


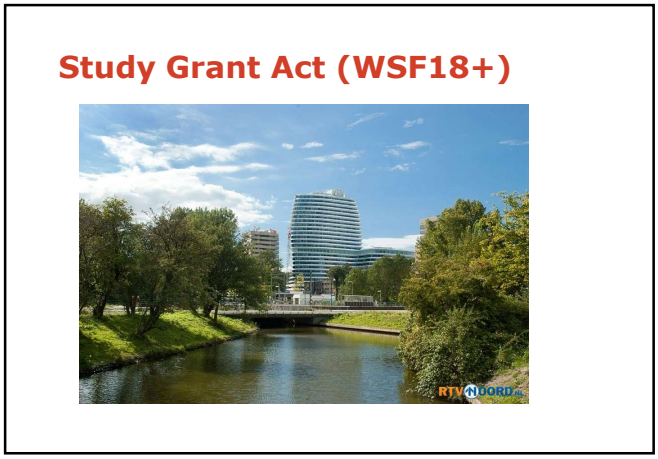

OPENBAAR MINISTERIE
Zoek
Sitemap Uitgebreid zoeken
Home Actueel Organisatie Onderwerpen Werken bij het OM Contact English
Home › Onderwerpen › Boetes
Alle onderwerpen
Boetes
Boetes
In deze rubriek vindt u de boetebedragen geldend vanaf 1 januari 2014 voor de meest voorkomende lichtere overtredingen, variërend van het te vroeg aanbieden van huisvuil, vissen buiten het visseizoen tot snelheidsovertredingen.
Voor de boetebedragen voor overtredingen begaan voor 1 januari 2014 verwijzen wij u naar de Tekstenbundel voor misdrijven, overtredingen en Muldergedragingen (zie rechter kolom).
Selecteer hieronder het onderwerp waarover u informatie zoekt. Vervolgens kunt u door middel van uitvalmenu's een verdere selectie maken.
1. Drugs
2. Tot en met 5 gram softdrugs
Politiesepot en afstand doen van de drugs. Drugs wordt in beslag genomen.
Jonger dan 18 jaar? Dan is bezit verboden. Voor de overtreding staat een werkstraf van 12 uur (boete €60)
Zie ook
Tekstenbundel voor misdrijven, overtredingen en Muldergedragingen 2014 en voorgaande jaren
DIGITAAL IN BEROEP


de Rechtspraak
HOGE RAAD DER NEDERLANDEN
Recht in Nederland
Naar de rechter
Organisatie
Actualiteiten
Uitspraken en registers
Procedures
Werken bij
Zoek
Lees voor
Naar de rechter
Rechtszaak beginnen
Rechtshulp nodig?
Ik heb een klacht
In hoger beroep gaan
Digitaal loket rechtspraak
Meer situaties ...
Nieuws
Belangrijke stap in vernieuwing rechtspraak
Storing betalingsverkeer griffierecht - betalingskenmerk invullen in veld opmerking
Gerechtshof Amsterdam wint Europese prijs
Meer nieuws ...
De Rechtspraak moderniseert
Wat betekent de modernisering van de Rechtspraak voor de advocatuur? Daarover organiseren de Rechtspraak en de Orde van Advocaten informatieavonden in de arrondissementen.
Lees verder...
Uitspraken en registers
Zoeken in uitspraken
Nevenfuncties van rechters
Centraal Insolventieregister
Centraal Curatele- en bewindregister
Huwelijksgoederenregister
Alle gerechten
Adressen en telefoonnummers
Actuele uitspraken
Staatssecretaris mag man uitzetten naar Liberia
Oudere te zwak voor werkstraf
Drie jaar cel voor overval cafetaria en diefstal telefoon
Meer uitspraken...
Op de rol
Welke straf verdient iemand die Makro-folders uit de brievenbus steelt? Nieuwe aflevering in de rechtbankrubriek Op de rol.
Lees verder...
De Rechtspraak
Raad voor de rechtspraak
Rechterlijke organisatie
Actuele thema's
Wetenschappelijk onderzoek
Meer over de organisatie ...
Aanmelden nieuwsbrief


de Rechtspraak
Het digitale loket Rechtspraak
naar rechtspraak.nl
Informatie over het loket
Het digitale loket Rechtspraak
Op het digitale loket van de rechtspraak kunt u terecht voor de digitale juridische diensten van de rechtspraak.
Centrale intake
Burgers
Digitale rekening en verantwoording
Digitaal procederen - Rechtbanken sector bestuursrecht
De eKantonrechter
Aanvragen gezamenlijk gezag
Digitaal procederen - Centrale Raad van Beroep
Meer ...
Professionals
Centraal Inschrijfbureau Vreemdelingenzaken
De eKantonrechter
Digitaal procederen bestuursrecht - Rechtbanken
Verdelen en verrekenen
Familiejournaal rechtbanken
Meer ...
Inloggen voor advocaten
Inloggen

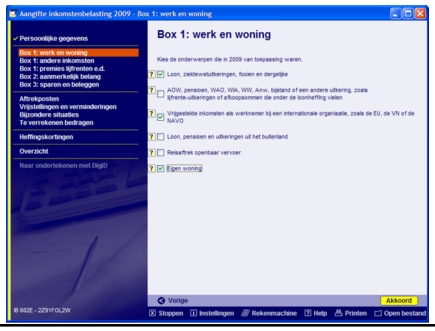

Legal tech exists,
but is it disruptive?
napster
WIKIPEDIA
The Free Encyclopedia
WhatsApp
UBER




Study Grant Act (WSF18+)
RTV NOORD

Belastingdienst.nl/aangifte

Leuker kunnen we 't niet maken. Wel makkelijker.



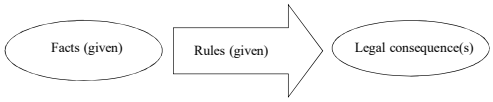
Hurdles

1. Legal reasoning is rule-guided, rather than rule-governed.
2. Legal terms are open textured.
3. Legal questions can have more than one answer, but a reasonable and timely answer must be given.
4. The answers to legal questions can change over time.

Rissland 1988 on Gardner 1987

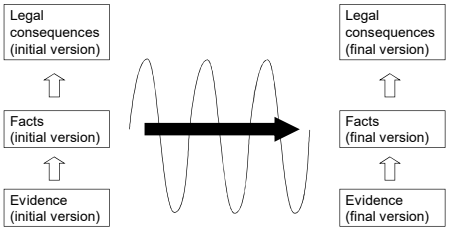
Harvard Journal of Law and Technology

The subsumption model



Montesquieu (1689-1755):
The judge as 'bouche de la loi'

The theory construction model



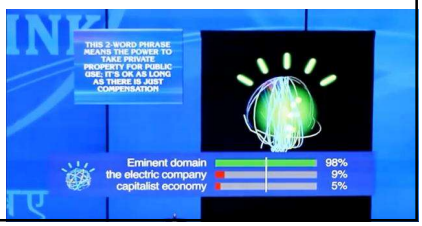
Before disruption is at all possible:

Information technology
will have to adapt to
legal information processing

Argumentation

This 2-word phrase means the power to take private property for public use; it's ok as long as there is just competition

Eminent domain



Netherlands Criminal Courts Prediction Machine

Predict

Netherlands Criminal Courts Prediction Machine

Predict *Let's push the button*

Netherlands Criminal Courts Prediction Machine

Predict *Let's push the button*

Netherlands Criminal Courts Prediction Machine

Predict

Prediction: *The suspect is guilty as charged*

Netherlands Criminal Courts Prediction Machine

Predict

Prediction: *The suspect is guilty as charged*

This machine provides correct predictions in 95% of all cases
(Cf. data collected by the Netherlands Bureau of Statistics)

Netherlands Criminal Courts Prediction Machine

The two faces of Artificial Intelligence

Expert systems	Adaptive systems
Business rules	Machine learning
Open data	Big data
IBM's Deep Blue	IBM's Watson
Complex structure	Adaptive structure
Knowledge tech	**Data tech**
Foundation: logic	Foundation: probability theory

The two faces of Artificial Intelligence

Argumentation technology

Expert systems	Adaptive s…
Business rules	Machi…
Open data	
IBM's Deep Blue	…s Watson
Knowle…	**Data tech**
Fou…	Foundation: probability theory

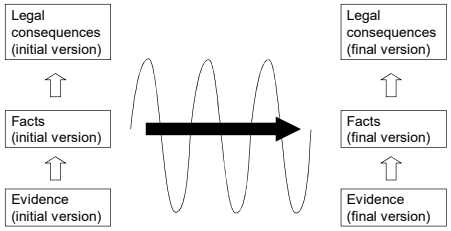
Law and artificial intelligence

The tension in the law between *legal security* on the one hand and *justice* on the other is related to the *gof-ai* vs. *new-ai* dichotomy.

The former are *top-down* and focus on *explicit knowledge* (rules, logic), the latter are *bottom-up* and use *implicit knowledge* (discretion, case analogy, learning, self-organisation).

The law has a long history of struggling with this tension and developed pragmatic approaches.

The theory construction model



Legal codes

Example:

Art. 300 of the Dutch Criminal Code

1. Inflicting bodily harm is punishable with up to two years of imprisonment or a fine of the fourth category.
2. When the fact causes grievous bodily harm, the accused is punished with up to four years of imprisonment or a fine of the fourth category.
3. []

Precedents

Example:

Supreme Court July 9, 2002, NJ 2002, 499

Theft requires the taking away of a good. Can one steal an already stolen car? The Supreme Court's answer is: yes.

Reasoning with rules and with cases

Rule-based reasoning:

Apply general rules

Example:

John is a thief. (There is a rule that) Thieves are punishable. THEREFORE: John is punishable.

Case-based reasoning:

Follow analogous cases

Example:

John is a thief. (There is a precedent in which) Peter was punishable as a thief. THEREFORE: John is punishable.

Overview

Legal decision making

Rule-based reasoning: rules & principles

Case-based reasoning: Hypo

Case-based reasoning: entangled dialectical arguments

Are case-based and rule-based reasoning logically different?

Reasoning with rules

d_1: x is a contract $\Rightarrow$ x only binds its parties

d_2: x is a lease of house y $\Rightarrow$ x binds all owners of y

d_3: x is a lease of house y $\wedge$ tenant has agreed in x that x only binds its parties $\Rightarrow$ x only binds its parties

contract lease of a house:

both d_1 and d_2 seem to apply; application of d_2 blocks d_1 (by a form of specificity defeat)

also tenant has agreed that only parties are bound:

application of rule d_3 blocks the application of rule d_2, hence the application of d_1 is no longer blocked

Prakken 1997

Reason-Based Logic

punishable: thief(x) $\Rightarrow$ punishable(x)
Thief(john)
THEREFORE
Applicable(thief(john) $\Rightarrow$ punishable(john))

This gives a reason that the rule ought to be applied.

If there are no reasons against the rule's application, this leads to the obligation to apply the rule.

Reasons are weighed, but not numerically.

Hage 1997

Dworkin (1978): rules versus principles

Legal *rules* seem to lead directly to their conclusion when they are applied.

Legal *principles* are not as direct, and merely give rise to a reason for their conclusion.

Dworkin (1978): rules versus principles

	Rule	Principle
Application	Conclusion	Reason
Conflict	Contradiction	Weighing
Other rules and principles	Independent	Dependent

Example

Mary's bike is stolen.
John buys the bike from the thief.
Who owns the bike?

Both Mary and John have a reasonable claim to the bike:
Ownership is not broken by theft.
Buying gives ownership.

The law provides rules to resolve conflicting principles *in a generic way instead of case by case*.

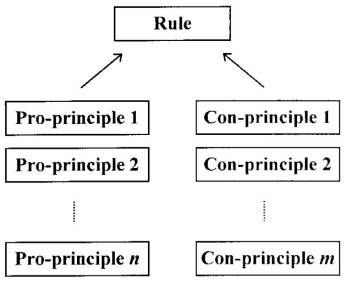
An integrated model of rules and principles

The differences between rules and principles are merely a matter of degree.

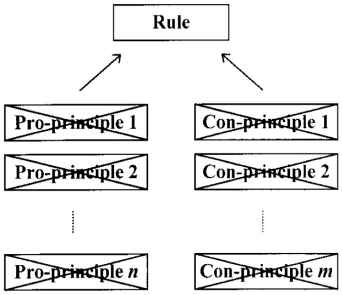
Rules and principles have the same logical structure, but have different behavior in actual reasoning.

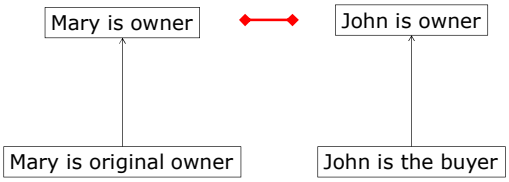
Verheij, B., Hage, J.C., & van den Herik, H.J. (1998). An Integrated View on Rules and Principles. *Artificial Intelligence and Law* 6 (1), 3-26.

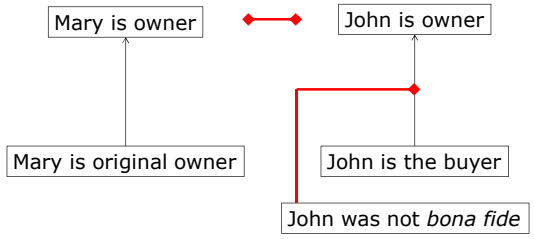
A rule and its underlying principles



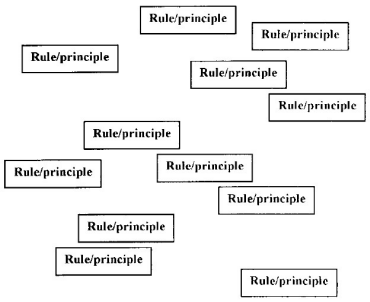
A rule replaces its underlying principles when it applies



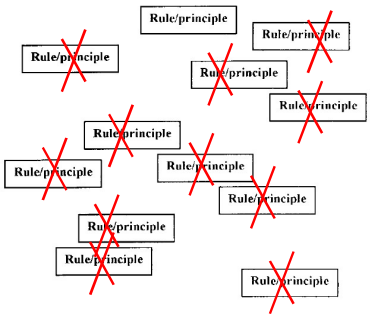




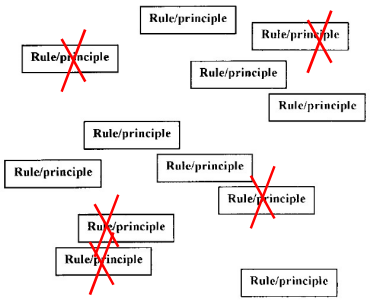
Interfering rules and principles



A typical rule applies



A typical principle applies



Case-based reasoning

Case-based reasoning is a common type of argumentation in the law, in which legal conclusions are drawn on the basis of previously decided cases.

If some decided case is sufficiently similar to the case at hand, then under the doctrine of *stare decisis* one should not depart from that decision, and the same conclusion should hold.

Case-based reasoning

Issue:
Can a dismissal be voided?

Precedent case:
+ The employee's behavior was always good
- There was a serious act of violence
Outcome: + (voided)

Current case:
+ The employee's behavior was always good
- There was a serious act of violence
+ The working atmosphere was not affected
Outcome: ?

Case-based reasoning

Issue:
Can a dismissal be voided?

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Outcome: + (voided)

Current case:
+ The employee's behavior was always good
- There was a serious act of violence
+ The working atmosphere was not affected
Outcome: + (voided)

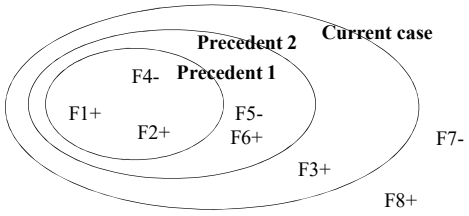
Ashley's HYPO (1990)

Factors are generalised facts pleading for or against an issue.

Cases are treated as sets of factors.

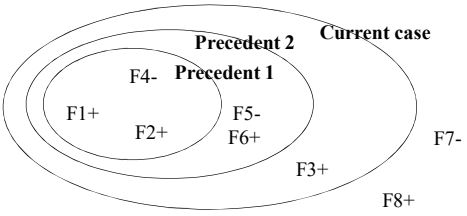
For precedent cases, the outcome is known.

HYPO



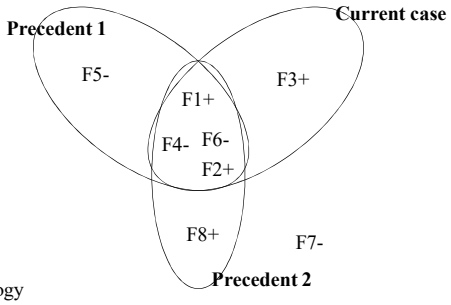
Precedent 1: -
Precedent 2: +
Current case? By analogy with precedent 2: +

HYPO



Precedent 1: -
Precedent 2: -
Current case? Undetermined on the basis of the precedents

HYPO



Precedent 1: +
Precedent 2: +
Current case?
+ by analogy with Precedent 1

Overview

Legal decision making
Rule-based reasoning: rules & principles
Case-based reasoning: Hypo
Case-based reasoning: entangled dialectical arguments
Are case-based and rule-based reasoning logically different?

Approaches to the modeling of case-based reasoning

Rule extraction method		**Case comparison method**	
(1) Extracting rules from decided cases (2) Showing that rule conditions are satisfied		(1) Selecting relevant case facts (2) Establishing an analogy between cases	
(3a) Applying extracted rules to the case at hand	(3b) Pointing out exceptions to extracted rules	(3a) Following decided cases in the case at hand	(3b) Distinguishing decided cases from the case at hand

Roth 2003

Approaches to the modeling of case-based reasoning

Models of case-based reasoning

either

focus on case comparison, but do not make explicit which conclusions could be drawn by following analogous cases

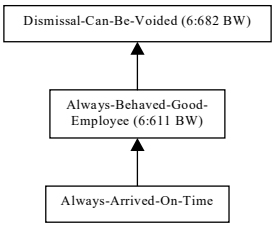
or

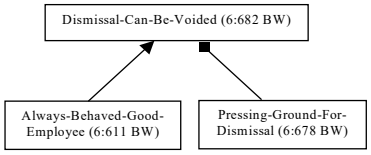
focus on rule extraction, thereby obscuring the role of case analogy.

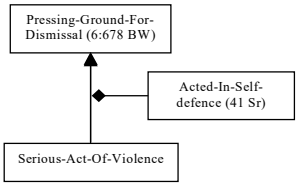
Dialectical arguments and case-based reasoning

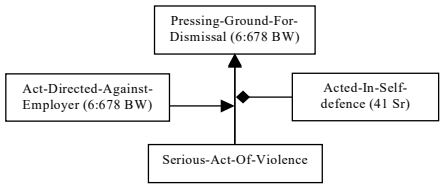
The present approach focuses on *case comparison* and makes explicit *which conclusions can be drawn* by following analogous cases.

Cases are compared in terms of the *dialectical arguments* that occur in them.









Entangled dialectical arguments

Dialectical arguments can contain both reasons for and reasons against conclusions (internal conflicts).

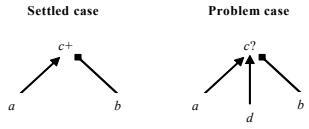
A statement can be supported or attacked by more than one reason (accrual).

It can be supported or attacked that a statement supports or attacks another statement (entanglement).

Cf. Verheij's DefLog (2003)

Case comparison in terms of dialectical arguments

c: Dismissal-Can-Be-Voided
a: Always-Behaved-Good-Employee
b: Serious-Act-Of-Violence
d: Working-Atmosphere-Not-Affected

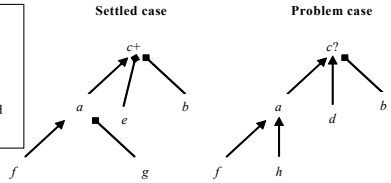


There is more dialectical support for *c* in the problem case, so c should follow by analogy with the settled case.

The same analysis can be done using Hypo's expressiveness.

Case comparison in terms of dialectical arguments

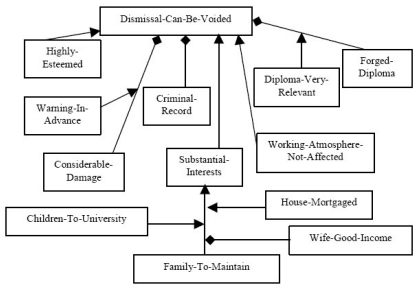
c: Dismissal-Can-Be-Voided
a: Always-Behaved-Good-Employee
f: Always-Arrived-On-Time
g: Once-Insulted-Superior
h: Always-Dressed-Properly
b: Serious-Act-Of-Violence
d: Working-Atmosphere-Not-Affected
e: Criminal-Record



There is more dialectical support for the statement *a* in the problem case. There is more dialectical support for conclusion *c* in the problem case, so c should follow by analogy. (Note that we do not need to know whether a or not in the settled case.)

This extends Hypo's expressiveness.

The entangled factor hierarchy

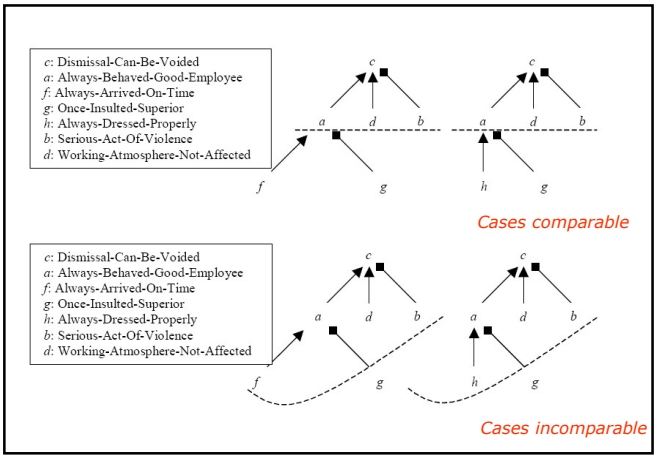


Roth 2003

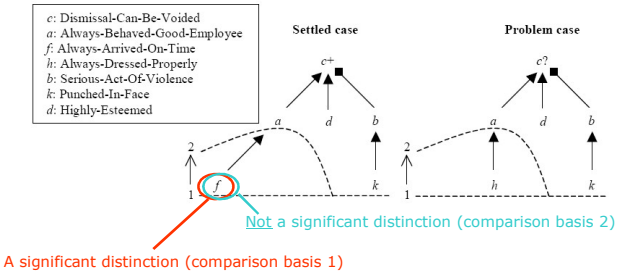
Factors and non-factors: the comparison basis

Comparison outcomes depend on the particular division made between factors and non-factors.

Arguing for a change of this division can downplay or emphasize distinctions.



Downplaying a distinction



Overview

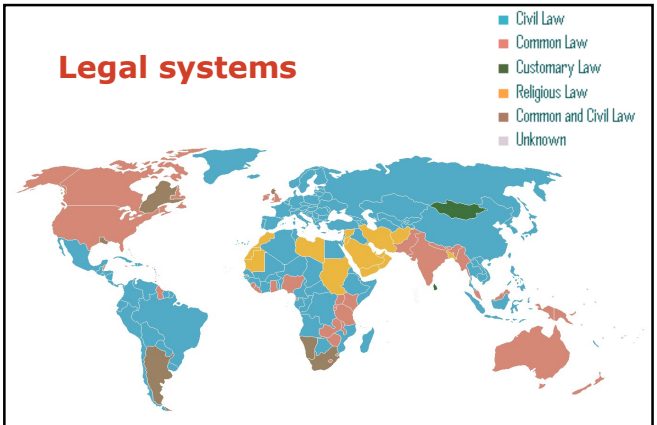
Legal decision making
Rule-based reasoning: rules & principles
Case-based reasoning: Hypo
Case-based reasoning: entangled dialectical arguments
Are case-based and rule-based reasoning logically different?

Rules and precedents

Rules and precedents as formal sources of law (Hart's rules of recognition)

Role depends on *jurisdictional sphere*

Legal systems



Rules and precedents

Comparative law research (MacCormick & Summers 1997):

- Rules and precedents are both significant sources
- This does not depend on whether precedents are officially considered to be formally binding

Logical differences?

To what extent are there logical differences between the role of rules and precedents when deciding cases?

Is deciding cases logically different in a legal system with only rules and in one with only precedents?

Existing formal models seem to take the logical distinction for granted.

Rule application

There is a rule with conditions A, B, C, ... and conclusion Z.
In the current case, the conditions A, B, C, ... are fulfilled.
THEREFORE
Conclusion Z follows.

Precedent adherence

There is a precedent with A, B, C, ... as relevant factors for conclusion Z.
The current case matches the relevant factors A, B, C, ... of the precedent.
THEREFORE
Conclusion Z follows.

Side comments

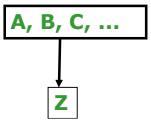
1. The technique used is that of semi-formal argumentation schemes
2. Schemes are defeasible
3. The schemes are not meant to be an absolutely correct/exact/unique representation
4. Scheme specification can be bent towards a context and goal

Verheij, B. (2003). Dialectical Argumentation with Argumentation Schemes: An Approach to Legal Logic. *Artificial Intelligence and Law* 11 (1-2), 167-195.

Logically, the basic patterns are equal

A, B, C, ... --> Z
A, B, C, ...

Z



Overview

Legal decision making
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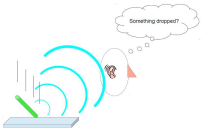
Before disruption is at all possible:

Information technology
will have to adapt to
legal information processing

Argumentation

Tech is disrupting the law.

The law is disrupting tech.



Lecture 1: Argumentation and Artificial Intelligence
An overview is given of how ideas from argumentation theory have been picked up in artificial intelligence. The focus will be more on general ideas and approaches, and less on formal detail.

Lecture 2: Argumentation in the law: case-based and rule-based
In the law, argumentation is central. Two kinds of argument-based reasoning are prominent. In the first kind, precedent cases are followed by analogy; in the second, rules are applied when their conditions are fulfilled.

Lecture 3: Argumentation and evidence: Combining arguments, scenarios and probabilities
For deciding about the facts in a criminal case, different normative frameworks aiming at the prevention of erroneous reasoning have been proposed: arguments, scenarios and probabilities. The normative frameworks are characterized and their relations investigated, for instance by discussing how arguments and scenarios can be studied using Bayesian networks.

http://www.ai.rug.nl/~verheij/ssa2016/

For more information on rules and principles, see:

Verheij, B., Hage, J.C., & van den Herik, H.J. (1998). An Integrated View on Rules and Principles. *Artificial Intelligence and Law* 6 (1), 3-26.

For more information on case-based reasoning with an entangled factor hierarchy, see:

Roth, B. (2003). *Case-based reasoning in the law. A formal theory of reasoning by case comparison.* Dissertation Universiteit Maastricht.

Roth, B., & Verheij, B. (2004). Cases and Dialectical Arguments - An Approach to Case-Based Reasoning. *On the Move to Meaningful Internet Systems 2004: Otm 2004 Workshops, Proceedings (Lecture Notes in Computer Science, Vol. 3292)*, 634-651.

Roth, B., & Verheij, B. (2004). Dialectical Arguments and Case Comparison. *Legal Knowledge and Information Systems. JURIX 2004: The Seventeenth Annual Conference* (ed. Gordon, T.F.), 99-108. Amsterdam: IOS Press.

For more information on the relation between rule-based and case-based reasoning, see:

Verheij, B. (2008). About the Logical Relations between Cases and Rules. *Legal Knowledge and Information Systems. JURIX 2008: The Twenty-First Annual Conference* (eds. Francesconi, E., Sartor, G., & Tiscornia, D.), 21-32. Amsterdam: IOS Press.