Annotating, Extracting, and Linking Legal Information

Adam Wyner
University of Aberdeen
Department of Computing Science

University of Edinburgh
Law School
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Outline

• Background, context, materials.
• Samples.
• Wider and deeper in content analysis.

Question for you:

How could you mix into legal informatics?
Background, Context, Materials
My Background – AI and Law since 2001

- Linguistics PhD (Cornell, 1994) and Computer Science PhD (King's College London 2008).
- Contract concepts in a logic and a computer program.
- Textual information extracted from legal cases, legislation, and regulations.
- Legal case ontologies.
- Legal argumentation in case law and judicial hierarchy.
- Policy-making support tools.
- LegalRuleML – machine readable mark up of the law.
Semantic Web of the Law

- Want to semantically annotate, extract, and link meaningful content in a corpus of legal documents, not just retrieve documents (a la Google).
- Use information to reason, e.g. input data to rules.
- Use information to link to other documents with related information, e.g. legislation on a certain topic or other web-based documents.
- Building services on top of annotated data for search, comparison, reuse, mash-ups....
State of Play – Lots of Change

- Internet.
- Government information needs (transparency, efficiency....).
- Open Data and Big Data.
- Making the law machine-readable (UK and USA).
- More powerful search and reasoning tools.
- Economic change in firms, billing, hiring.... (Susskind).
- Blogs: [http://legalinformatics.wordpress.com/](http://legalinformatics.wordpress.com/)
- List of projects (at end).
Other Projects/Links

- openlaws.eu (Radboud Winkels)
- Court of Cassation (Annie Foret)
- Text analysis for legal histories (Adam Wyner). Also see: Old Bailey, Trading Consequences, 1641 Depositions,....
- Text mining cases (Wyner, Ashley)
- IAAIL, JURIX, Journal of AI and Law
- Casetext, other legal-tech startups
- Harvard's Berkman Center H20 project
Set the Context

- Support tools for information extraction and decision support.
- Formal analysis of the law and legal system.
- Decompose problems; incrementally create partial solutions.
- Individual v Collaborative, Collective, distributed legal work.
- Not robot lawyers, or fully automated justice, or 3 Laws.

<table>
<thead>
<tr>
<th>Law Applied to Computers</th>
<th>Computers Applied to Law</th>
</tr>
</thead>
<tbody>
<tr>
<td>privacy, software patents, data management, copyright....</td>
<td>knowledge extraction, representation, management; reasoning; networks.</td>
</tr>
</tbody>
</table>
Materials

- Legislation, regulation, guidance, case law, bankruptcy notices, responses to policy making consultations, documents recording practice knowledge, ....
- A main reason for recent developments in legal informatics
  - internet/semantic web ideology
  - open legal data.
Samples
Various

- The Stationery Office's OpenUp Data Enrichment Service
- Google Scholar links case citations and legislation
- Annotating structure of law – UK Legislation
- Akoma Ntosa and LegalRuleML
- Google ngrams
- Networks of linked citations
- Oracle Policy Automation
The Stationery Office (TSO) Magic

- Pop some text into the website.
- Pick your output type (default semantic annotations, RDF, XML…).
- Get your output.
- A mash-up.
- How can we do the same for our data in our own way?
OpenUp Platform

The OpenUp platform is a collection of integrated services available as Software as a Service (SaaS) allowing fast deployment at a reasonable cost. Together, the services provide a highly scalable and resilient platform that allows you to store, retrieve, query and enrich your data. To find out more about any of these services or how they can be combined to create a managed data publishing service please email us at opendats@tso.co.uk

RDF Store for Linked Data
Data Harvesting
Data Enrichment Service
Professional Services
Web Hosting
Scalability and Resilience
Future Developments

Try the Data Enrichment Service

Experiment with open data

openup.tso.co.uk/openup-platform
Defiance Button Machine Company (Defiance-NY), a New York corporation, appeals from an order and judgment of the Southern District of New York, entered after a non-jury trial before Judge Gerard L. Goettel, dismissing its complaint under the Lanham Act, 15 U.S.C. Secs. 1051-1127 (1982), which seeks injunctive relief against defendants' use of its trademark DEFIANCE and trade name Defiance and damages. Plaintiff also appeals from the dismissal of its claim of alleged conversion of its customer lists and from the district court's refusal to permit it to amend its complaint to add a claim for conversion of its casting molds. The district court held that Defiance-NY abandoned its trademark when it sold the physical assets it used to produce goods under its trademark and name, even though the trademark and trade name were expressly excluded from the assets sold and there was evidence that the company, under new ownership, planned to use them in the production and sale of goods of substantially the same quality and nature as those produced under the mark. We reverse the dismissal of the claim based on unlawful use of plaintiffs' trademark and trade name. We affirm both the dismissal of the claim for conversion of the customer lists and the denial of leave to amend the complaint.
### Output For Your Text

Defiance Button Machine Company (Defiance-NY), a New York corporation, appeals from an order and judgment of the Southern District of New York, entered after a non-jury trial before Judge Gerard L. Goettel, dismissing its complaint under the Lanham Act, 15 U.S.C. Secs. 1051-1127 (1982), which seeks injunctive relief against defendants' use of its trademark DEFIANCE and trade name Defiance and damages. Plaintiff also appeals from the dismissal of its claim of alleged conversion of its customer lists and from the district court's refusal to permit it to amend its complaint to add a claim for conversion of its casting molds. The district court held that Defiance-NY abandoned its trademark when it sold the physical assets it used to produce goods under its trademark and name, even though the trademark and trade name were expressly excluded from the assets sold and there was evidence that the company, under new ownership, planned to use them in the production and sale of goods of substantially the same quality and nature as those produced under the mark. We reverse the dismissal of the claim based on unlawful use of plaintiffs' trademark and trade name. We affirm both the dismissal of the claim for conversion of the customer lists and the denial of leave to amend the complaint.

### Key

<table>
<thead>
<tr>
<th>Administrative Area</th>
<th>Date</th>
<th>Legislation</th>
<th>Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>York</td>
<td>1982</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lanham Act</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Judge Gerard L. Goettel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S.C. Secs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note that not all the above annotations may be listed below for conciseness (marked *). However they will still display in the left pane.

### Extracted Information

**Administrative Area**

- York
  - [http://data.ordnancesurvey.co.uk/id/7000000000025595](http://data.ordnancesurvey.co.uk/id/7000000000025595)

**Date**

- 1982

**Legislation**

- Lanham Act

**Person**

- Judge Gerard L. Goettel
- U.S.C. Secs

**Position**

- Judge

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**Named entity recognition**
Defiance Button Machine Company (Defiance-NY), a New York corporation, appeals from an order and judgment of the Southern District of New York, entered after a non-jury trial before Judge Gerard Goettel, dismissing its complaint under the Lanham Act, 15 U.S.C. § 1051-1127 (1982), which seeks injunctive relief against defendants' use of its trademark DEFIANCE and trade name Defiance and damages. Plaintiff also appeals from the dismissal of its claim of alleged conversion of its customer lists and from the district court's refusal to permit it to amend its complaint to add a claim for conversion of its casting molds. The district court held that Defiance-NY abandoned its trademark when it sold the physical assets it used to produce goods under its trademark and name, even though the trademark and trade name were expressly excluded from the assets sold and there was evidence that the company, under new ownership, planned to use them in the production and sale of goods of substantially the same quality and nature as those produced under the mark. We reverse the dismissal of the claim based on unlawful use of plaintiffs' trademark and trade name. We affirm both the dismissal of the claim for conversion of the customer lists and the denial of leave to amend the complaint.
The density of notices in the area:

Look Back To: Choose the time period

From: 2010-10-29 to: 2011-05-26

Boundary: District and Borough Ward

Ward Opacity: 1

<table>
<thead>
<tr>
<th>Notice Type</th>
<th>Num.</th>
<th>Legend Show</th>
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</thead>
<tbody>
<tr>
<td>Appointment of Administrators (notice code 2410)</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Members Appointment of Liquidators (Notice Code 2432)</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Appointment of Liquidator (Notice Code 2443)</td>
<td>89</td>
<td></td>
</tr>
<tr>
<td>Winding-Up Orders (Notice Code 2452)</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

Total: 128
Notice: 1352715 (Issue: 59775)

Date: 5 May 2011   Issue Number: 59775   Page number: 8433
Publication Date: Thursday, 5 May 2011
Notice Code: 2443
Appointment of Liquidators
Company Number: 05220154.
Name of Company: OMEGA PROJECTS (NW) LIMITED.
Nature of Business: Other Building Completion.
Type of Liquidation: Creditors.
Address of Registered Office: Hanover House Office 5.8, Hanover Street, Liverpool, Merseyside, L1 3DZ.
62a Bold Street, Liverpool, L1 4EU
Liquidators' Names and Address: Darren Terence Brookes and Colin Thomas Burke, both of Milner Boardman & Partners, The Old Bank, 187a Ashley Road, Hale, Cheshire, WA15 9SQ.
Office Holder Numbers: 009297 and 008803.
For further details contact: Email: office@milnerboardman.co.uk Tel: 0161 927 7788
Date of Appointment: 27 April 2011.
By whom Appointed: Members and Creditors.
(1352715)
Google's Searches in Case Law
Public Resource [https://public.resource.org/](https://public.resource.org/)

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Oaxaca v. Roscoe
841 F. 2d 386 - Court of Appeals, 5th Circuit, 1981 - Google Scholar
The suit of a former Internal Revenue Service employee who contends that the government discriminated against him based on his Mexican national origin was dismissed for lack of subject matter jurisdiction on the ground that the employee failed to bring his complaint to the attention of the Equal ... Cited by 116 - How cited - Related articles

Roscoe v. Roscoe
379 F. 2d 94, 126 US App. DC 317 - Court of Appeals, Dist. of ..., 1967 - Google Scholar
This appellant on August 31, 1963 was injured in a North Carolina automobile accident, allegedly caused by her husband's negligence. On June 15, 1965, she brought suit against her husband in the District Court of the District of Columbia. The record shows that on September 13, ... Cited by 52 - How cited - Related articles - All 2 versions

Steven v. Roscoe Turner Aeronautical Corporation
324 F. 2d 157 - Court of Appeals, 7th Circuit, 1963 - Google Scholar
Kathryn E. STEVEN, Administratrix of the Estate of George A. Steven, deceased, Plaintiff-Appellant, v. ROSCOE TURNER AERONAUTICAL CORPORATION, Defendant-Appellee. ... United States Court of Appeals Seventh Circuit. Cited by 172 - How cited - Related articles - All 3 versions

League of United Latin Am. Citizens v. ROSCOE ISD
119 F. 3d 1228 - Court of Appeals, 5th Circuit, 1997 - Google Scholar
LULAC requested the attorneys' fees at issue in this appeal in connection with a Section 5 enforcement action under the Voting Rights Act, 42 USC § 1973c. During the course of a Section 2 suit challenging Roscoe Independent School District's ("Roscoe ISD" or "the District") at-large election ... Cited by 74 - How cited - Related articles - All 2 versions
641 F.2d 386 (1981)

Juan Roberto OAXACA, Plaintiff-Appellant,

v.

Egger L. ROSCOE, Commissioner of Internal Revenue Service,
Defendant-Appellee.

No. 80-1196.

United States Court of Appeals, Fifth Circuit. Unit A

April 3, 1981.

*387 Thomas L. Kolker, Austin, Tex., for plaintiff-appellant.


*388 Before RUBIN and GARZA, Circuit Judges, and SUTTLE, District Judge.

ALVIN B. RUBIN, Circuit Judge:

The suit of a former Internal Revenue Service employee who contends that the government discriminated against him based on his Mexican national origin was dismissed for lack of subject matter jurisdiction on the ground that the employee failed to bring his complaint to the attention of the Equal Employment Opportunity [EEO] counselor within thirty calendar days as required by the federal nondiscrimination regulations. Concluding that the failure to give timely notice does not deprive the court of subject matter jurisdiction, but raises instead issues that the parties should be given an additional opportunity to address, we reverse the dismissal and remand for further proceedings.

In McArthur v. Southern Airways, Inc., 569 F.2d 276 (5th Cir. 1978) (en banc), we stated that the failure timely to file an administrative complaint with the Equal
Roscoe v. Roscoe, 379 F. 2d 94 - Court of Appeals, Dist. of Columbia Circuit 1967

How this document has been cited

“Where wife had gained right of action against husband under North Carolina law for injuries sustained in automobile accident, such right followed her to District of Columbia and, when husband died, the basis of doctrine of interspousal immunity from suit disappeared and District of Columbia court would apply law of North Carolina and permit wife to maintain suit.”

- in Modern Federal practice digest: all Federal cases law of the modern era and 5 similar citations

“Restatement (Second) of Conflict of Laws § 146. Third, waiver of sovereign immunity is the preferred modern rule.”

- in Fresh or hot pursuit: hearing before the Subcommittee on Government ... and 2 similar citations

“— refused to apply the District interspousal immunity rule, applying instead the law of North Carolina, the situs of the accident.”

- in Myers v. Gaither, 1967 and one similar citation

“An extension under Rule 8 (b), made either prior to the expiration of the ninety days or afterwards on a showing of excusable neglect, is allowed.”

- in Sinclair on federal civil practice and 2 similar citations

“In construing a contract where the laws of two jurisdictions are involved, the forum applies the law of the state which has the more substantial interest in the resolution of the issue.”

- in Fowler v. A & A COMPANY, 1970 and one similar citation

“A motion for reconsideration of order granting of summary judgment, filed the same day as entry of the judgment, tolls the time for appeal until it is disposed of.”

- in Federal rules digest and one similar citation

Cited by

- Bagalay v. Lahaina Restoration Foundation
  588 P. 2d 416 - Haw: Supreme Court 1978

  388 A. 2d 44 - DC: Court of Appeals 1978

- Semler v. Psychiatric Institute of Washington, DC
  575 F. 2d 922 - Court of Appeals, Dist. of Columbia Circuit 1978

- Blair v. Prudential Insurance Co. of America
  472 F. 2d 1356 - Court of Appeals, Dist. of Columbia Circuit 1972

- Edmunds v. Edmunds
  353 F. Supp. 287 - Dist. Court, Dist. of Columbia 1972

Related documents

- Williams v. Rawlings Truck Line, Inc.
  357 F. 2d 581 - Court of Appeals, Dist. of Columbia Circuit 1965

- Root v. Kaufman
  48 Misc. 2d 468 - NY: City Court, Civil Court 1965
How Cited

How this document has been cited

“—federal statute stripping property owner of right to pass interest by descent or devise constitutes taking under Fifth Amendment”
- in Boggs v. Boggs, 1997 and 70 similar citations

“Indeed, "[i]n one form or another, the right to pass on property-to one's family in particular-has been part of the Anglo-American legal system since feudal times."”
- in Rice v. Cayetano, 2000 and 108 similar citations
In sum, an annuity goes to Sandra, a surviving spouse; but otherwise Dorothy would remain free not only to have, but to bequeath, her share of the marital estate to her children. This reading of the relevant statutory provisions and purposes protects Sandra, limits ERISA's interference with basic state property and family law, and minimizes the extent to which ERISA would interfere with Dorothy's preexisting property. Cf. *Hodel v. Irving*, 481 U. S. 704, 717 (1987) (federal statute stripping property owner of right to pass interest by descent or devise constitutes taking under Fifth Amendment); *Babbitt v. Youpee*, 519 U. S. 234, 244-245 (1997) (statutory restriction on class of permissible heirs constitutes taking).

In Boggs v Boggs
PART I
BRITISH CITIZENSHIP

Acquisition after commencement

1 Acquisition by birth or adoption.

(1) A person born in the United Kingdom after commencement [F1, or in a qualifying territory on or after the appointed day,] shall be a British citizen if at the time of the birth his father or mother is—

(a) a British citizen; or

(b) settled in the United Kingdom [F2 or that territory].
Legislation – UK

Acquisition by birth or adoption (1)

A person born in the United Kingdom after commencement shall be a British citizen if at the time of the birth his father or mother is a British citizen.
(1) A person must not engage in a credit activity if the person does not hold a licence authorising the person to engage in the credit activity.

Civil penalty: 2,000 penalty units.

[...] Criminal penalty: 200 penalty units, or 2 years imprisonment, or both.
<lrml:PrescriptiveStatement key="ps2">
  <ruleml:Rule key=":rule2" closure="universal">
    <lrml:hasStrength>
      <lrml:Defeasible/>
    </lrml:hasStrength>
    <ruleml:if>
      <ruleml:Atom>
        <ruleml:Rel iri="#hasLicence"/>
        <ruleml:Var>X</ruleml:Var>
      </ruleml:Atom>
    </ruleml:if>
    <ruleml:then>
      <lrml:SuborderList>
        <lrml:Permission>
          <ruleml:Atom>
            <ruleml:Rel
              iri="#engageCreditActivity"/>
            <ruleml:Var>X</ruleml:Var>
          </ruleml:Atom>
        </lrml:Permission>
      </lrml:SuborderList>
    </ruleml:then>
  </ruleml:Rule>
</lrml:PrescriptiveStatement>
interstate commerce, railroad, right of way
Hoekstra, 2013. "A Network Analysis of Dutch Regulations"
Oracle Policy Automation

- Industrial scale applications with *Oracle Policy Automation*: Scope legislation and regulation, express policies and knowledge base in a "just enough" controlled natural language, served as web-based business/policy system.
  - Creating Rules in Oracle Policy Automation
  - UK DirectGov Benefits Calculator
- Rules representation and reasoning using web-based natural language interfaces.
- Why no similar open-source, academic tool?
Oracle Policy Automation

Human Resources Policy 100 – Maternity Leave

100.1. The employee is eligible for maternity leave if

a. The employee is female and 
b. Either
   i. The employee has given birth to a natural child or
   ii. The employee has taken legal custody of an adopted child and

c. The employee is a full time employee and
d. The employee has been employed for at least 12 months continuously
100.1. The employee is eligible for maternity leave if

   a. The employee is female and
   b. Either
      i. The employee has given birth to a natural child or
      ii. The employee has taken legal custody of an adopted child
    and
   c. The employee is a full time employee and
   d. The employee has been employed for at least 12 months continuously

Language is 'normalised', parsed, semantically represented for inference
Oracle Policy Automation

After completing the interview with these responses, OPA tells us that the employee is eligible for maternity leave. Now click on the Why? link after the result.
Wider and Deeper
Rule Extraction
Rule Extraction

- Want to extract rules from legislation and regulations to make rule books, process further (executables), linking rules to one another, linking rules to parties, external sources,....
- Uses GATE.
Rule Extraction – Blood Regulations

You may use human blood from a donor with a previous record of a reactive screening test for evidence of infection due to a communicable disease agent that is designated in paragraph a of this section, if:

(1) At the time of donation, the donor is shown to be suitable by a requalification method; and

(2) tests performed under paragraphs a are nonreactive.

Consequence, list structure, and conjuncts of the antecedent.

Except as specified in paragraphs c, you, an establishment that collects blood, must test each donation of human blood that is intended for use in preparing a product for evidence of infection due to the following communicable disease agents:

(1) Human immunodeficiency virus, type 1;

(2) Human T-lymphotropic virus, type 1; and

(3) Human T-lymphotropic virus, type II.

Exception, agent NP, deontic concept, active main verb, theme.
Collaborative Annotation for Legal Education
Collaborative Annotation for Legal Education

- LCBR - common law contexts, where lawyers argue for an decision in a current case on the basis of precedents (previous decisions), comparing and contrasting the cases in terms of the facts of the cases and the legal rules that are applied.

- Would like to annotate, extract, and link the various parts of the cases internally (links between cases or from cases to legislation) and externally (information outside the case base or legislation).
Students Annotating and Discussing Cases

- Create a gold standard corpus.
- Manually annotated with an online tool.
- Some components can already be automatically annotated.
- Grow corpus.
- Analyse components, e.g. what are the linguistic indicators legal fact, holding, rationale, decision, etc?
- Apply some Machine Learning (once we have the corpus).
Elements Annotated

713 F.2d 1174

ZOECON INDUSTRIES, a DIVISION OF ZOECON CORPORATION, Plaintiff-Appellee,
v.
The AMERICAN STOCKMAN TAG CO., Carolyn Reed and Nelda Poncik, Defendants-Appellants.

No. 82-1463.

United States Court of Appeals, Fifth Circuit.

Sept. 9, 1983.

Palmer, Palmer & Coffee, Philip I. Palmer, Jr., Dallas, Tex., for defendants-appellants.

Thompson & Knight, Schuyler B. Marshall, IV, Louise Ellen Teitz, Dallas, Tex., for plaintiff-appellee.

Appeal from the United States District Court for the Northern District of Texas.

Before WISDOM, TATE and GARWOOD, Circuit Judges.
AMERICAN CAN COMPANY, Plaintiff-Appellee,

v.

Ishwar MANSUKHANI, et al., Defendants-Appellants.

No. 82-2004.

United States Court of Appeals, Seventh Circuit.
Results of Annotation

• The annotators carry out their task and complete the project.
• Carry out inter-annotator agreement analysis.
• Curate the disagreements to create a Gold Standard corpus. Use this for machine learning.
• Search the annotations using an online tool, e.g. ANNIC.
Searching Annotations

{Legal Roles.Feature=="Plaintiff"}
Parsing and Logically Representing Legislation
Executable Rules and XML

- Natural language:
  - If a person satisfies the conditions then the secretary must register her.

- Logic (inference, consistency):
  - \( \forall x \exists y \left[ \text{person}(x) \land \text{the-conditions}(y) \land \text{satisfy}(x,y) \right] \rightarrow \text{register}(\text{the-secretary},x) \)

- Prolog (executable):
  - \( \text{register}(\text{the-secretary},X) \leftarrow \text{person}(X), \text{the-conditions}(Y), \text{satisfy}(X,Y). \)

- XML (transmittable, mutable), e.g. RuleML:
C&C/Boxer

- C&C/Boxer
- Groningen Meaning Bank
  - http://gmb.let.rug.nl/
C&C/Boxer

- Lexically given grammar (how words combine).
- Uses a statistical model to output the most likely parse.
- Successful wide-coverage (of the Penn Treebank corpus). Parses and semantically represents more than Attempto Controlled English.
- Translates to DRS (FOL).
- Nutcracker inference tool (textual entailment tool).
- Translation to RuleML.
- Highlights issues of interpretation.
C&C/Boxer Examples

- Cameron is a British citizen.
- If an application is made to register as a British citizen a person who is a British overseas territories citizen, the Secretary of State may, if he thinks fit, cause the person to be so registered.
Parse - Cameron is a British citizen
DRS - Cameron is a British citizen
FOL-XML - Cameron is a British citizen

First Order Logic

\[ \forall A : ( \text{per1cameron}(A) \land \exists B : \exists C : ( \text{a1british}(C) \land ( \text{n1citizen}(C) \land A = C ) ) ) \]

RuleML

```xml
<?xml version="1.0" standalone="no"?>
<!--
<xml-model
href="http://www.ruleml.org/1.0/relaxng/folog_relaxed.rnc"
/>
<xml-model
href="http://www.ruleml.org/1.0/xsd/folog.xsd" type="application/xml" schematypens="http://www.w3.org/2001/XMLSchema">
xsi:schemaLocation="http://ruleml.org/spec http://www.ruleml.org/1.0/xsd/folog.xsd">
  <!--
  <Var>A</Var>
  <And>
    <Atom>
      <Rel>per1cameron</Rel>
    </Atom>
    <Var>A</Var>
  </And>
</RuleML>
```
If an application is made to register as a British citizen a person who is a British overseas territories citizen, the Secretary of State may, if he thinks fit, cause the person to be so registered.
Output Analysis

First Antecedent
1. A person (x9) is identified as a British overseas citizen (see x14 in P10).
2. A making event (e7) has an application (x6) as Theme.
3. A registering event (e12) has the application (x6) as Agent and x9 as Theme.
4. The registering event (e12) is in the as relation with a British citizen (x13), which is distinct from x14.

This captures some interesting issues - the difference between different forms of predication, e.g. as a British Citizen and is a British Citizen, while leaving their exact interpretation aside. The proposition (p10) correctly predicates being a British overseas territory citizen of the person (x9) who wants to be a British citizen. There are two events - a making event and a registering event, where the theme of making (the application) is the agent of registering; this captures accurately the link between the passive and the subject of the infinitive. However, it makes an abstract noun the agent of registering, which is a conceptual ambiguity of the text. The agent of making is left unspecified, as it is in the source, though conceptually there ought to be one.
Modals

- Alethic (necessity, ....), Epistemic (know, ....), Temporal, Deontic (must, may, ....).

- Subclasses of modal operators and propositional attitudes with different inference properties. Why are these not relations rather than sentential operators?
  - Factive – know, saw, heard,...
  - Non-factive – believe, remember (?),...
  - Contrafactive – wish, imagine, ...
  - Epistemic-root interpretation – may, must, can,....
  - Scope issues with de re/de dicto.
Issues

• Legal rules are *defeasible* – what is the linguistic and formal representation of this?
Thanks for your attention!

• Contact:
  Adam Wyner, adam@wyner.info
  [http://wyner.info/LanguageLogicLawSoftware](http://wyner.info/LanguageLogicLawSoftware)

• Comments, questions, suggestions....