The Cop in the Backseat

Embedding Law in Everyday Life

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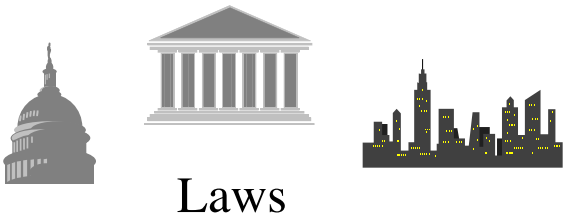
Abstract: Our daily lives subject to numerous, complex regulations from multiple jurisdictions. The result of this regulatory complexity is frequent lack of compliance, widespread inefficiency, and occasional disenchantment with the regulatory system. In this presentation, I argue that it is possible to mitigate these problems through the use of legal technology - specifically (1) Computational Law to mechanize certain aspects of legal analysis and (2) ubiquitous computing to make that analysis available to decision makers at the point of decision. Embedding law in the environment in this way could go a long way to dealing with the problems of regulatory complexity. Moreover, it could have significant impact on the way law functions in society, arguably constituting a major step in the evolution of our legal system.

You are in another state on business. You get up in your hotel, have breakfast, and head on off to visit your client. Driving on an unfamiliar road, you are unsure of the speed limit, and you cannot seem to find a sign. Is the car pool lane in effect at this time? Can you use your cell phone while driving in this state? You approach your destination. Can you make a U-turn on this street? Can you make a right turn on red? Can you park at this time? Back in your hotel later in the day, you decide to take care of some personal chores. Can you order your medications from that online Canadian pharmacy? Can you send that wine as a birthday gift to your aunt in Virginia? Checking on your medical bills. Under what conditions does your mother's health insurance cover her in-home nursing expenses? The law has answers to all of these questions. But the answers are not available when you need them, at least not without a lot of work on your part or the expense of hiring an expert.

Variety of Regulations



Laws

Business Rules

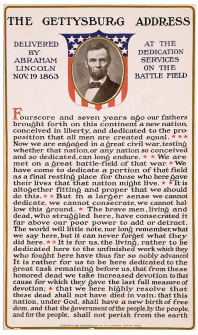
Personal Rules

Contracts

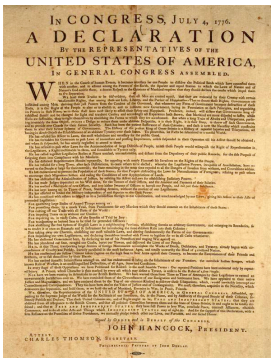
We live in a complex regulatory environment. As citizens, we are subject to governmental regulations from multiple jurisdictions - federal, state, and local. As members of organizations, we are subject to organizational policies and rules. As social beings, we are bound by contracts we make with others. As individuals, we are bound by personal rules of conduct.

Size of Regulations

66 Words



286 Words



1322 Words

26,911 Words

The sheer number and size of regulations can be daunting. We may all agree on a few general principles; but, at the same time, we may disagree on how those principles apply in specific situations. In order to minimize such disagreements, regulators are often forced to create numerous regulations or very large regulations, to deal with special cases. An article in the National Review made this case forcefully. "The Lord's Prayer is 66 words, the Gettysburg Address is 286 words, there are 1,322 words in the Declaration of Independence, but government regulations on the sale of cabbage total 26,911 words."

Complexity of Regulations

The University may terminate this lease when the Lessee, having made application and executed this lease in advance of enrollment, is not eligible to enroll or fails to enroll in the University or leaves the University at any time prior to the expiration of this lease, or for violation of any provisions of this lease, or for violation of any University regulation relative to resident Halls, or for health reasons, by providing the student with written notice of this termination 30 days prior to the effective date of termination; unless life, limb, or property would be jeopardized, the Lessee engages in the sales of purchase of controlled substances in violation of federal, state or local law, or the Lessee is no longer enrolled as a student, or the Lessee engages in the use or possession of firearms, explosives, inflammable liquids, fireworks, or other dangerous weapons within the building, or turns in a false alarm, in which cases a maximum of 24 hours notice would be sufficient.

Complicating the situation is the complexity of these regulations. Even small regulations can be very complex. While this complexity can sometimes be mitigated by careful drafting, such care is not always possible due to time constraints; moreover, once regulations are created, complexity often increases as the regulations are changed and then changed again.

A simple example of the problem of complexity is the Michigan Lease Termination Clause shown here. This case was first highlighted in a paper by Bob Kowalski to illustrate this very point. The rule itself is actually fairly simple. However, there are many conditions; there are conditions that modify other conditions; and so forth. Moreover, there are cases where the exceptions occur in other clauses. Typical in insurance contracts. In my homeowner's insurance contract, there is a statement on page 112 stating that the coverage on page 12 does not apply when various conditions exist." The upshot is a regulation that is difficult for most people to understand without specialized legal knowledge and a substantial amount of study.

Problems

Problems:

- Number of Regulations - multiple jurisdictions
- Size of Regulations
- Complexity of Regulations

Results:

- Lack of compliance
- Widespread inefficiency
- Frequent disenchantment with the legal system

These problems make it difficult for affected individuals to find and comply with applicable regulations. The result is occasional lack of compliance, widespread inefficiency, and frequent disenchantment with the regulatory system.

Information Problem

Fortunately, these problems are not insurmountable. To a large extent, they are information processing problems. As such, I believe that they can be mitigated by information technology.

Legal Technology

Information Technology
enhance the quality and efficiency of legal system
while decreasing the cost

Available to all
- Legal Professionals
- Monitors and Enforcers
- Regulators

Individuals finding and complying with regs

What is needed is appropriate "legal technology" - information technology applied to laws. Ideally, the technology should empower all parties in our legal system, not just the legal profession per se. It should help legal professionals find and understand relevant material; it should help enforcement organizations monitor and/or enforce compliance; and it should help regulatory bodies analyze proposed regulations for cost, overlap, inconsistency, etc. Most relevant to my subject today and most important in real life, the technology should help affected individuals find, understand, and comply with regulations.

Textual Representations of the Law

Most online legal information (e.g. cases, statutes, analysis) is encoded in the form of free-form text.

The *good news* is that such info can be stored cheaply and reliably and searched automatically.

Westlaw®
LexisNexis™
Global Legal Information Network

The *bad news* is that this does not provide adequate search and does not support automation.

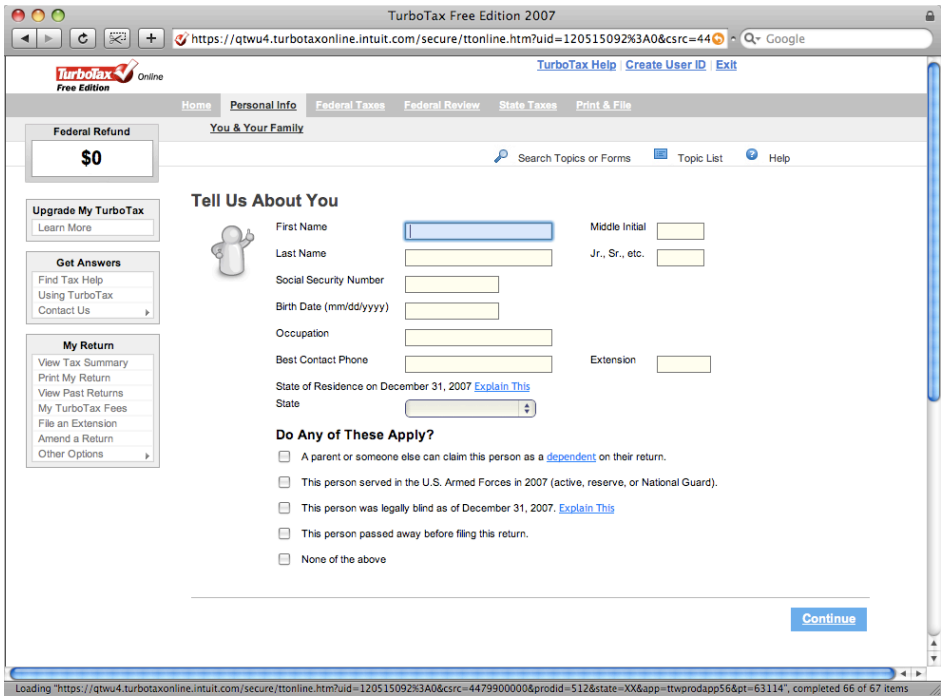
One step in this direction has already been taken. Today, the text of many legal documents (including statutes, regulations, cases, analysis) is available online. In some cases, the information is adorned with "semantic" tags / keywords to help in search. The good news is that these documents can be found using general search services, such as Google, or using services that specialize in legal information, e.g. those provided by companies like Westlaw and LexisNexis. Unfortunately, the quality of such search is limited; they often return too many documents and sometimes fail to find relevant information. Moreover, there is no automation; a specialist must still be there to read the documents and apply them to individual cases.

Computational Law

Computational Law is that branch of legal informatics concerned with the **mechanization** of legal reasoning.

An alternative is an extreme form of legal technology known as Computational Law. Computational Law is that branch of legal informatics concerned with the mechanization of legal reasoning. The focus of work in the field is the implementation and deployment of computer systems capable of doing useful legal calculations, such as compliance checking, legal planning, and so forth.

Turbotax



Turbotax is an example of an elementary computational law system. Millions use it each year to prepare their tax forms. Turbotax illustrates some of the key advantages of Computational Law for the individual. (1) It embodies tax regulations in its software in computable form. (2) It can explain its work to its user, providing pointers to applicable regulations for each quantity computed. (3) Most interesting, it does its work in a *situated* fashion, not in the abstract but rather in the context of a task the user would like to accomplish, thus exemplifying and even teaching the user about relevant regulations in real world setting.

Other Opportunities

Building Codes

Electronic Commerce (transportation, shipping,…)

Privacy (HIPAA, COPPA, etc.)

Labor Law

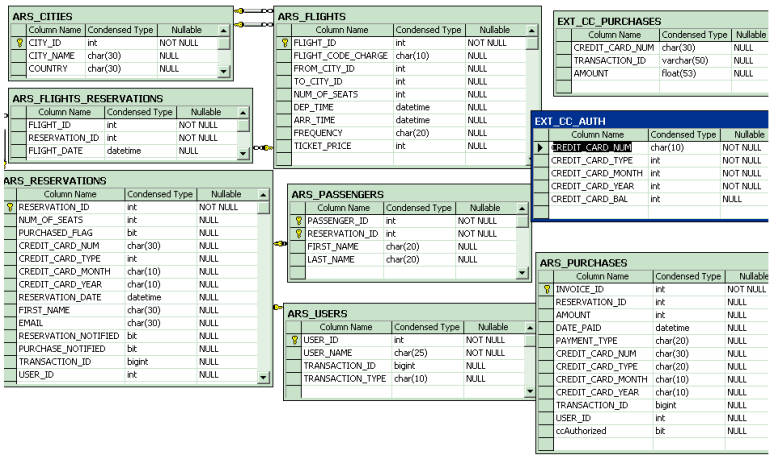
Financial Management (stocks, retirement funds)

Civil Procedures

Contracts

There are many other areas in dealing with privacy and security matters, in intellectual property rights management, in enterprise management (e.g. constraints on travel, expenditure, reporting), in assessing compliance of plans with building codes (affected by local, county, state, and federal safety requirements), in electronic commerce (e.g. import/export restrictions on technology, drugs, and so forth), in labor law (e.g. occupational safety regulations and health care benefits, notably cases where state regulations interact with federal provisions), and so forth.

Structured Data



ARS_CITIES

Column Name	Condensed Type	Nullable
CITY_ID	int	NOT NULL
CITY_NAME	char(30)	NULL
COUNTRY	char(30)	NULL

ARS_FLIGHTS

Column Name	Condensed Type	Nullable
FLIGHT_ID	int	NOT NULL
FLIGHT_CODE_CHARGE	char(10)	NULL
FROM_CITY_ID	int	NULL
TO_CITY_ID	int	NULL
NUM_OF_SEATS	int	NULL
DEP_TIME	datetime	NULL
ARR_TIME	datetime	NULL
FREQUENCY	char(20)	NULL
TICKET_PRICE	int	NULL

EXT_CC_PURCHASES

Column Name	Condensed Type	Nullable
CREDIT_CARD_NUM	char(30)	NULL
TRANSACTION_ID	varchar(50)	NULL
AMOUNT	float(53)	NULL

ARS_FLIGHTS_RESERVATIONS

Column Name	Condensed Type	Nullable
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RESERVATION_ID	int	NOT NULL
FLIGHT_DATE	datetime	NULL

EXT_CC_AUTH

Column Name	Condensed Type	Nullable
CREDIT_CARD_NUM	char(10)	NOT NULL
CREDIT_CARD_TYPE	int	NOT NULL
CREDIT_CARD_MONTH	int	NOT NULL
CREDIT_CARD_YEAR	int	NOT NULL
CREDIT_CARD_BAL	int	NULL

ARS_RESERVATIONS

Column Name	Condensed Type	Nullable
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NUM_OF_SEATS	int	NULL
PURCHASED_FLAG	bit	NULL
CREDIT_CARD_NUM	char(30)	NULL
CREDIT_CARD_TYPE	int	NULL
CREDIT_CARD_MONTH	char(10)	NULL
CREDIT_CARD_YEAR	char(10)	NULL
RESERVATION_DATE	datetime	NULL
FIRST_NAME	char(30)	NULL
EMAIL	char(30)	NULL
RESERVATION_NOTIFIED	bit	NULL
PURCHASE_NOTIFIED	bit	NULL
TRANSACTION_ID	bigint	NULL
USER_ID	int	NULL

ARS_PASSENGERS

Column Name	Condensed Type	Nullable
PASSENGER_ID	int	NOT NULL
RESERVATION_ID	int	NOT NULL
FIRST_NAME	char(20)	NULL
LAST_NAME	char(20)	NULL

ARS_USERS

Column Name	Condensed Type	Nullable
USER_ID	int	NOT NULL
USER_NAME	char(25)	NOT NULL
TRANSACTION_ID	bigint	NULL
TRANSACTION_TYPE	char(10)	NULL

ARS_PURCHASES

Column Name	Condensed Type	Nullable
INVOICE_ID	int	NOT NULL
RESERVATION_ID	int	NULL
AMOUNT	int	NULL
DATE_PAID	datetime	NULL
PAYMENT_TYPE	char(20)	NULL
CREDIT_CARD_NUM	char(30)	NULL
CREDIT_CARD_TYPE	char(20)	NULL
CREDIT_CARD_MONTH	char(10)	NULL
CREDIT_CARD_YEAR	char(10)	NULL
TRANSACTION_ID	bigint	NULL
USER_ID	int	NULL
ccAuthorized	bit	NULL

The technical basis for Computational Law is semantic technology. One component of semantic technology is the encoding of facts in the form of semantically-structured data, such as the tables in relational databases and XML files.

Computational Logic

Office mates are people who share an office.

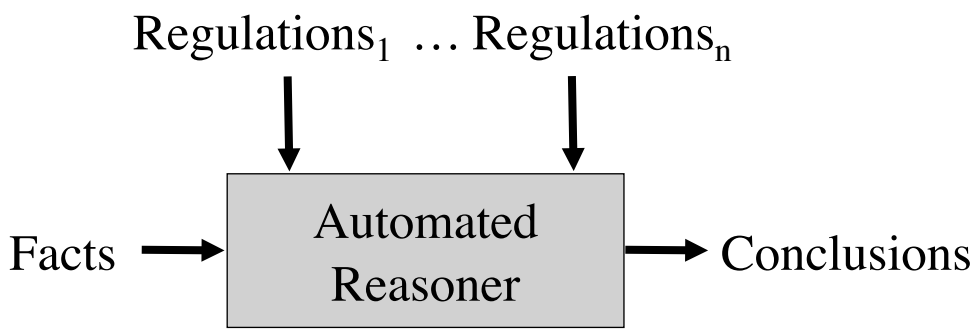
```
officemate(X,Y) :- office(X,Z) ∧ office(Y,Z)
```

Managers and subordinates may not be office mates.

```
illegal :- manages(X,Y) ∧ officemate(X,Y)
```

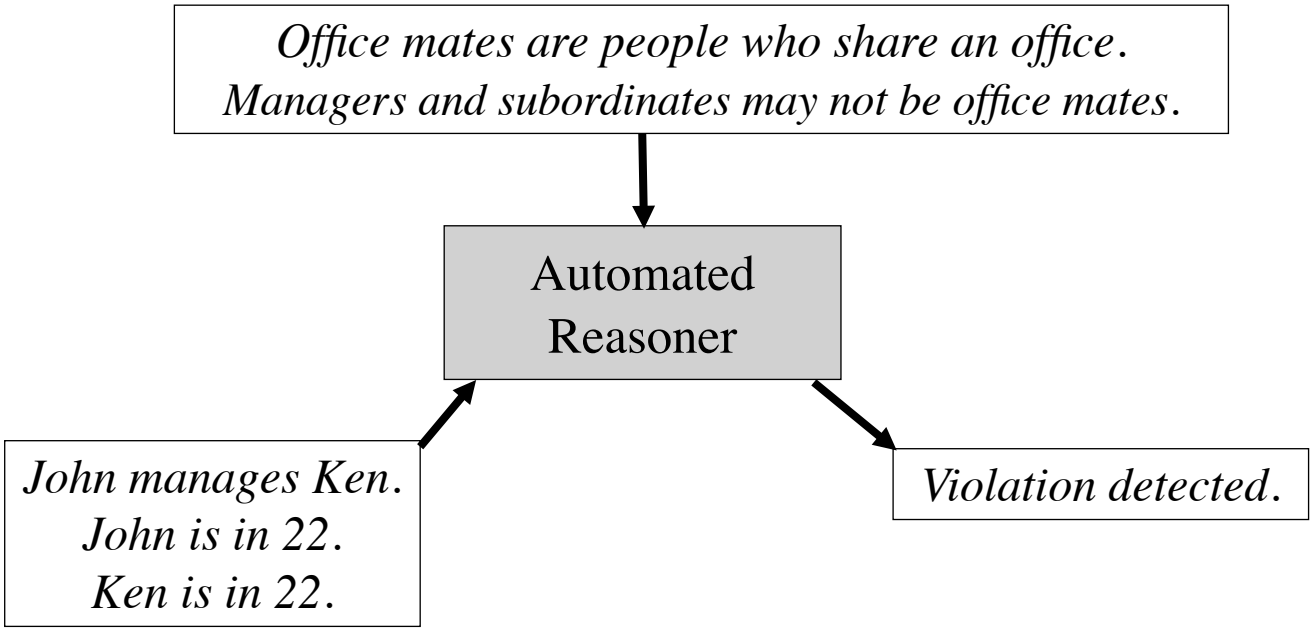

The second component is the representation of regulations as sentences in formal logic. A key feature of a logical representation of regulations is that it supports multiple functions - one set of rules can be used for legal analysis, compliance planning, explanation, and so forth.

Deductive Reasoning Systems



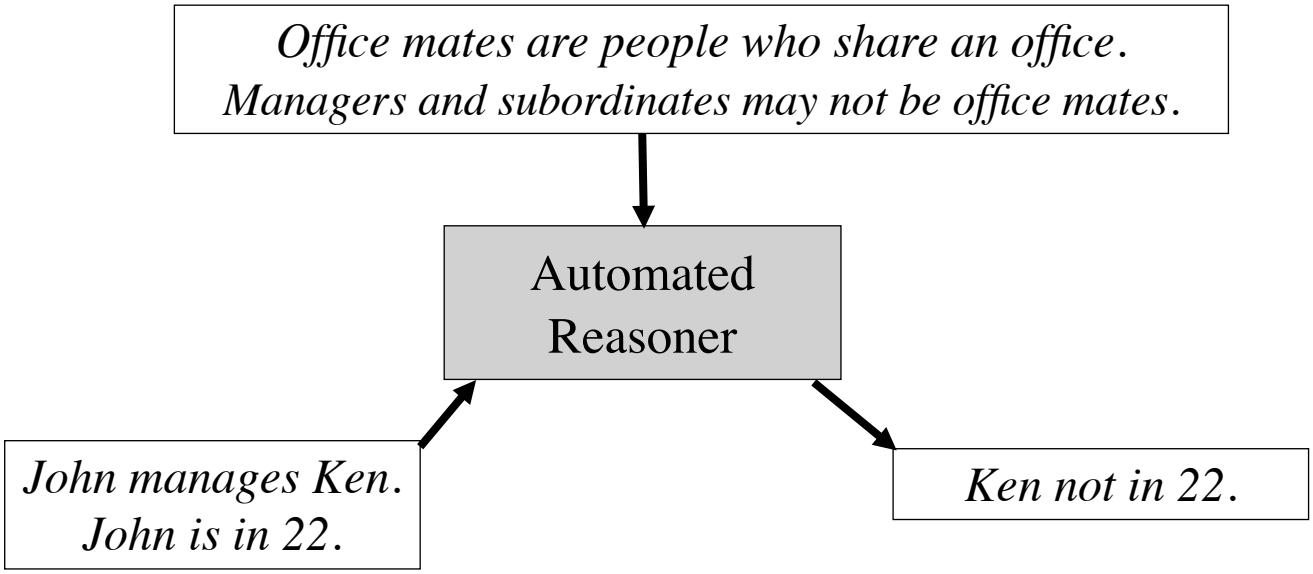
What makes Computational Law practical is the availability of automated reasoning programs that can be used to apply regulations (so represented) to facts (in the form of structured data) to derive logical conclusions.

Detecting Violations



For example, given a set of laws and a set of facts, such systems can detect violations.

Planning for Compliance



Such systems can also be used to generate legal plans.

Analyzing Regulations

All projects have managers and subordinates.
No manager may share an office with a subordinate.
All skunkworks personnel must be housed in a common room.

↓

Automated Reasoner

↓

Inconsistency detected.

And they can be used to detect inconsistencies, overlaps, and gaps in regulations.

Representational Challenges

Beliefs

… if the Secretary of State is satisfied that …

Defaults

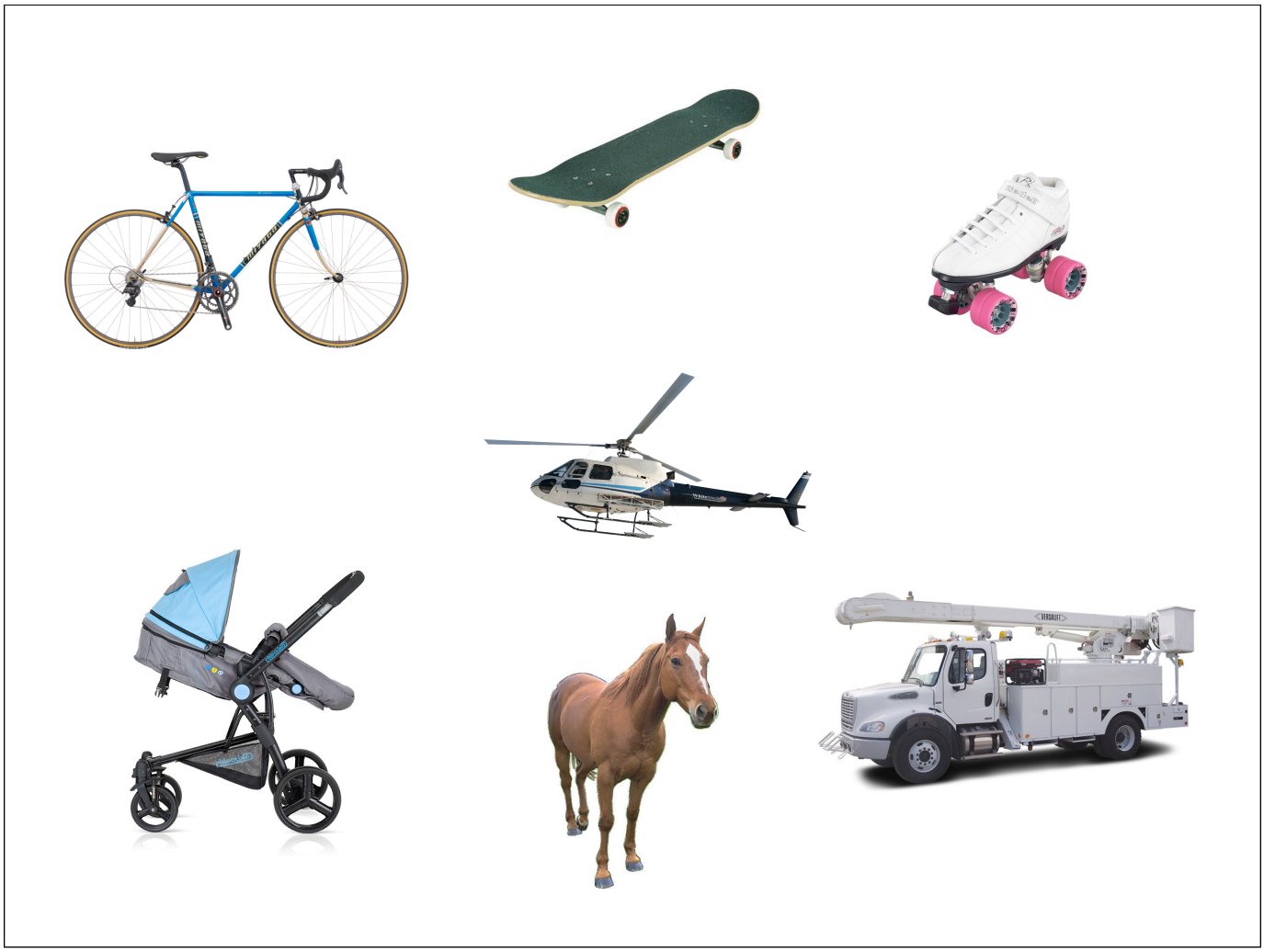
… unless the contrary is shown, …

Metalevel

… as defined in subsection (1) …

Of course, things are not perfect. There are some substantial problems that stand in the way of using Computational Logic in achieving the ideal Computational Law.

First of all, while the language of Logic is adequate for many types of regulations, there are others sorts of regulations that are more complicated. For example, some laws depend on people's beliefs about the facts (e.g. "... the Secretary of State is satisfied that ...). Some laws depend on "default conclusions" (e.g. "... unless the contrary is shown ..."). Some laws require the representation of metalevel information, i.e. references within the law to other parts of the law (e.g. "as defined in subsection (1) ...").



Another technical problem, familiar to many individual with legal training, is due to the open texture of natural language. Consider a municipal regulation stating “No vehicles in the park”. On first blush this is fine, but it is really quite problematic. Just what constitutes a vehicle? Is a bicycle a vehicle? What about a skateboard? How about roller skates? What about a baby stroller? A horse? A repair vehicle? For that matter, what is the park? At what altitude does it end? If a helicopter hovers at 10 feet, is that a violation? What if it flies over at 100 feet?

State

Federal

To make matters worse, regulations are not always well coordinated, arising, as they do, in different settings for different purposes. Sometimes, there are gaps, leaving important cases uncovered. More often, regulations overlap other regulations and in some instances are inconsistent with each other.

Analogical Reasoning

"Law is not a matter of simply applying rules to facts via Modus Ponens."

- Edwina Rissland

Many legal decisions are made through case-based / analogical reasoning, bypassing explicit reasoning about laws and statutes.

While there is research on analogical reasoning, there is no widely accepted standard for what constitutes a "correct" answer.

A different sort of challenge to Computational Law stems from the fact that not all legal reasoning is deductive. Edwina Rissland notes that, "Law is not a matter of simply applying rules to facts via modus ponens" [12], and when regarding the broad application of AI techniques to law, this is certainly true. The rules that apply to a real-world situation, as well as even the facts themselves, may be open to interpretation, and many legal decisions are made through case-based reasoning, bypassing explicit reasoning about laws and statutes. The general problem of open texture when interpreting rules, along with the parallel problem of running out of rules to apply when resolving terms, presents significant obstacles to implementable automated rule-based reasoning [17]. Also, in many legal domains, the facts of a situation themselves may be unclear or incomplete: human intervention and interpretation is necessary to make these facts available to a legal reasoning system so that it can even apply the rules. This further adversely affects usability and any notion of correctness. To combat these shortcomings, some rule-based systems have been hybridized with case-based systems, or augmented with meta-rules or with nonmonotonic, defeasible reasoning techniques, in order to make them more suitable for general applications in law [13, 15, 5].

The good news is that some of these problems have been addressed in the years since that article was written and can be handled by well-understood extensions to the techniques shown above. However, unlike the techniques described in the last section, these new techniques have not yet secured universal agreement. Moreover, we still have no way of dealing with the Open Texture problem.

Despite these problems, progress on semantic technologies has led to the development of web-based computer systems for managing the affairs of enterprises. Virtually all large corporations today utilize enterprise management software applications to run the operations of their businesses, such as accounting/finance, human capital management, supply chain & manufacturing, etc. Most large companies run dedicated enterprise management systems internally, while many small and medium-sized businesses use services that reside in the cloud. The development of such software and services has led to sizable businesses for companies like SAP, Oracle and IBM.

Other Opportunities

Building Codes

Electronic Commerce (transportation, shipping,…)

Privacy (HIPAA, COPPA, etc.)

Labor Law

Financial Management (stocks, retirement funds)

Civil Procedures

Contracts

My position is that these same technologies can be applied to the public sector, except with governmental rules and regulations in place of business rules. There are possibilities in dealing with privacy and security matters, in intellectual property rights management, in enterprise management (e.g. constraints on travel, expenditure, reporting), in assessing compliance of plans with building codes (affected by local, county, state, and federal safety requirements), in electronic commerce (e.g. import/export restrictions on technology, drugs, and so forth), in labor law (e.g. occupational safety regulations and health care benefits, notably cases where state regulations interact with federal provisions), and so forth.

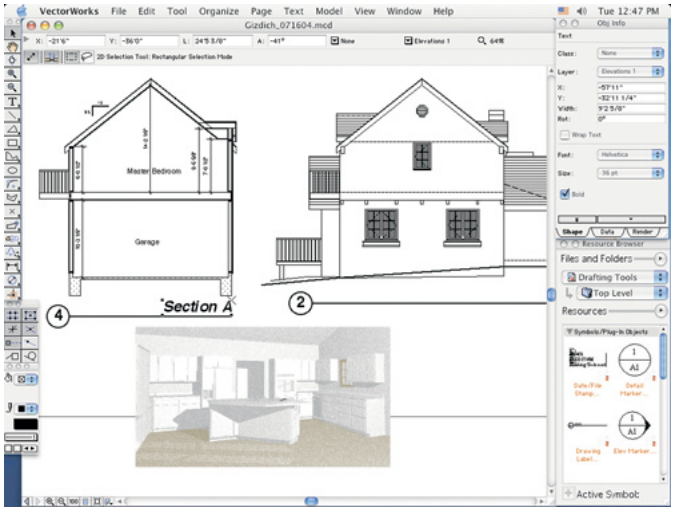
Computers and the Internet

One thing that makes this topic compelling today is the huge increase in **digitally mediated activity**, e.g. governmental websites, corporate intranets, electronic commerce.

Opportunity - ***Embedded Law***

What makes Computational Law especially interesting today is the dramatic increase in digitally mediated activity. Increasingly, our activities take place online. We routinely use the Internet to buy products, ship them, book travel, interact with government agencies, and so forth. This development is important because it means that the data necessary to do legal analysis are already in digital form. In some cases, these activities are managed by web services with the data and computational resources necessary to apply appropriate regulations. The opportunity here is that we can embed law in out computer systems - so that we can be aware of the legal status of our actions as we are performing them.

Building Code Compliance



Let's look at an example. Existing building construction projects are covered by numerous laws and regulations, including local building codes, federal environmental rules, and accessibility laws such as the Americans With Disabilities Act. Standard practice today id for architects to prepare their plans and then submit to municipalities for approval. This process can take weeks. Moreover, since there are so many different regulations in different municipalities, architects cannot know them all, and there are usually problems. Once the architect is informed of problems, the cycle repeats. It is a frustrating and inefficient process.

Project Calc was one of the first projects done in CodeX, under the direction of Harry Surden. The idea of the project was to embed compliance checking within the CAD systems used by architects and thus avoid such problems. CALC examined the degree to which existing laws governing the domain of building design can be modeled within computer systems and made to interact with systems currently used in the field. It examined whether computer systems could assist design professionals in knowing and complying with these rules. CALC also explored legal theoretical problems related to the representation of laws in computer systems and proposed principles for selecting and creating such laws. The project was never completed due to funding limitations, but it is a great example of embedded law.

Example

Of course, the idea is not restricted to deployment on traditional computers; we can also embed the technology in the our everyday environment via our cell phones and our Google Glasses - and in so doing we bring law to the *point of decision* so that we are informed of our legal responsibilities and our legal rights before we act and get ourselves into trouble and so that we know our legal rights.

Example

What is that flower?

Can I pick it?

You are in Massachusetts

Picking wild orchids is prohibited in Massachusetts

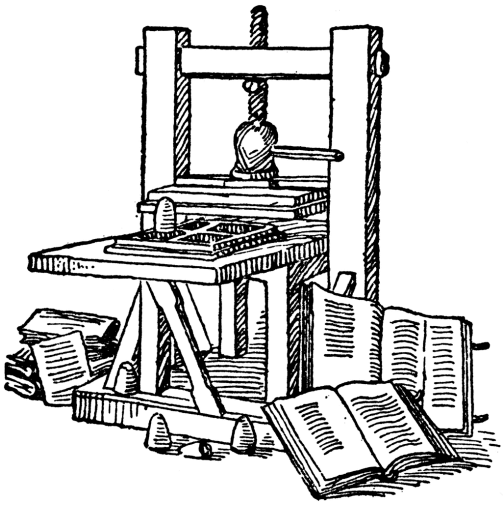
[Chapter 266 of the General Laws, Section 116A, 1935]

This makes lots of things possible. You are walking through the woods of Maine and see an attractive flower. You take a photo with your iPhone. Your plant app identifies it as a type of orchid and lets you know. At the same time, your legal app tells that, no, you may not pick it.

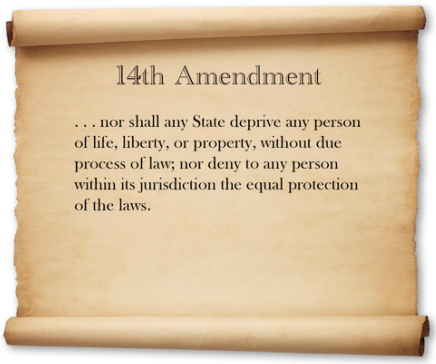
In thinking about this sort of Embedded Law, consider the metaphor of the Cop in the Backseat. Suppose that we had the benefit of a friendly policeman in the backseat of our car whenever we drove around (or perhaps an equivalent computer built into the dash panel of our car). The cop, real or computerized, could offer regulatory advice as we drove around - telling us speed limits, which roads are one-way, where U-turns are legal and illegal, where and when we can park, and so forth.

This already exists to limited extent in aviation, where where displays like this one provide feedback on restricted areas and areas with special requirements (these concentric circles).

Legal Evolution



In a sense, Embedded Computational Law is the natural next step in a progression that began millenia ago. Around 1750 BC, Hammurabi had the laws of the land encoded in written form (literally cast in stone) so that citizens could know what was expected of them and what would happen if they violated those expectations. Since then, it has been the norm to encode rules in written form and disseminate first via books and more recently via the Internet. However, with the proliferation of rules and regulations, just writing things down is not enough when the laws are voluminous and difficult to understand. In a way, Computational Law is the first significant bit of progress in this regard since the days of Hammurabi.



It is one of the greatest anomalies of modern times that the law, which exists as a public guide to conduct, has become such a recondite mystery that it is incomprehensible to the public and scarcely intelligible to its own votaries.

- Lee Loevinger 1949

Such progress is essential to the proper functioning of the law as a mechanism for achieving social good. One of the functions of the law is to help individuals predict the consequences of their actions. If we do not know what the law is, the law does not serve this function. The Constitution of the United States, in both the fifth and the fourteenth amendments, mandates "due process" for its citizens. Part of due process is the concept of notice. Citizens must receive notice of applicable regulations before they can be charged with violations. As many people have observed, the law today is far too complex for people to understand fully. Some of these scholars have argued that, when the law becomes so complex that citizens are unable to understand it, then they have not received adequate notice and cannot be charged.

The upshot should be a better legal system. It should be a better system, a more efficient system, and one that we all feel works for us.