An Implementation of Eisner v. Macomber

L. Thorne McCarty
Rutgers University
New Brunswick, New Jersey 08903
mccarty@cs.rutgers.edu

Abstract

Eisner v. Macomber, 252 U.S. 189 (1920), a corporate tax case, was the principal illustration of a theory of legal reasoning and legal argumentation proposed more than ten years ago. Although the theory was described in some detail, using the vocabulary of *prototypes* and *deformations*, it was never fully implemented. There were two main problems: (1) the knowledge representation languages available at the time were not sufficiently expressive, and (2) as a result, the central concept of a prototype was never sufficiently formalized. These problems have been remedied by subsequent work, and the present paper describes an implementation (in PROLOG) of the original theory. A study of the implemented system provides a rational reconstruction of the arguments of Justice Pitney and Justice Brandeis in this seminal corporate tax case.

1 Introduction

Eisner v. Macomber, 252 U.S. 189 (1920), is one of the seminal cases of United States tax law — "the most celebrated case in the annals of federal income taxation," according to one authority [5]. The first, and still the only case in which the United States Supreme Court has held that a federal tax statute was invalid under the Sixteenth Amendment to the Constitution, *Eisner v. Macomber* is mandatory reading for every American law student who takes a basic course in taxation. One can find in the majority opinion of Justice Pitney and the dissenting opinion of Justice Brandeis many of the issues that have bedeviled tax law, and especially corporate tax law, for decades. It is not surprising that William Andrews, in his casebook on *Federal Income Taxation* [1], adds the following note at the end of the case:

> [T]he opinions are reproduced here in full because the issue dividing them runs deep. What is it? Do the Pitney and Brandeis opinions differ in their concepts of income? or realization? or of the nature of a stock dividend? or a corporation? or a constitution? or a concept?

More than ten years ago, in joint work with N.S. Sridharan, I attempted to answer Professor Andrews' questions in computational terms. Taking *Eisner v. Macomber* as the principal illustration of our theory of legal reasoning, we presented a hand simulation of the arguments between Justice Pitney and Justice Brandeis on the proper interpretation of the concept of taxable income [19, 20]. Although I still believe that this theory — called the *TAXMAN II* theory — was qualitatively correct, it was never fully implemented, and it has been criticized on this account. In the present paper, I will attempt to remedy this deficiency.

The *TAXMAN II* theory began by emphasizing the following three points, which should be familiar to most lawyers:

1. Legal concepts cannot be adequately represented by definitions that state necessary and sufficient conditions. Instead, legal concepts are incurably "open-textured".

2. Legal rules are not static, but dynamic. As they are applied to new situations, they are constantly modified to "fit" the new "facts". Thus the important

process in legal reasoning is not theory application, but theory construction.

3. In this process of theory construction, there is no single "right answer". However, there are plausible arguments, of varying degrees of persuasiveness, for each alternative version of the rule in each new factual situation.

The first of these points has been thoroughly discussed by Anne Gardner [9], and seems to be generally accepted by researchers in AI and Law. The second point is less common, but it is related to the constructive approach to legal decisions proposed by Herbert Fiedler [8] and Tom Gordon [10], and to the rule-based representation of open-texture in law proposed by Trevor Bench-Capon and Marek Sergot [4]. The third point has been thoroughly debated by legal philosophers for many years as part of the response to Ronald Dworkin's thesis [7]. Sridharan and I adopted this third point primarily as a methodological guideline: Since lawyers are more likely to agree on what counts as a plausible argument in a case than to agree on the appropriate outcome, we decided that it would be more fruitful to develop a theory of legal argument than to develop a theory of correct legal decisions.

This was the framework in which we worked. The specific theory we proposed was based on a representation of legal concepts by means of *prototypes and deformations*. Legal concepts have three components, we suggested: (1) an (optional) invariant component providing necessary conditions; (2) a set of exemplars providing sufficient conditions; and (3) a set of transformations that express various relationships among the exemplars. These three components are then refined further, for most concepts, so that one or more of the exemplars is designated as a prototype and the remaining exemplars are represented by a set of transformations, or deformations, of the prototypes. In this model, the transformations induce a partial order on the set of exemplars corresponding to the typicality gradient observed by psychologists in the study of human categorization [23, 25], and the application of a concept to a new factual situation automatically modifies the definition of the concept itself, as required by Levi's classical account of legal reasoning [12]. This was our response to the first two points noted above. In response to the third point, as stated above, we offered a hand simulation of the arguments between Justice Pitney and Justice Brandeis in *Eisner v. Macomber*.

We did not attempt a full implementation of our theory in 1982 because of two main problems. First, the theory makes enormous demands on our knowledge representation language. To see this, it is sufficient to note that a transformation is a *syntactic* operation, and for such an operation to be meaningful it must correspond to the significant *semantic* relationships in the legal domain. However, the knowledge representation languages available in 1982 were simply not expressive enough to model the corporate tax domain with the degree of semantic detail that we needed. The second problem involves the theory of prototypes and deformations itself. What determines the choice of a prototype? What are the criteria for constructing transformations? It became increasingly clear, as we worked on the arguments in *Eisner v. Macomber*, that the concept of a prototype was much more complex than we had originally thought.

In the intervening years, I have devoted a great deal of thought to the knowledge representation problem, sometimes wandering far afield, but always motivated by the problems that arise in legal domains. Some of my theoretical work has been presented in [13, 14, 21, 17]; the practical applications are embodied in my *Language for Legal Discourse (LLD)*, which was presented in [15]. It is now possible to apply this work on knowledge representation to the implementation of my original theory of legal argument, as I will show in the present paper. Section 2 thus describes the facts of *Eisner v. Macomber*, and Section 3 describes my representation of the corporate tax domain in *LLD*. Section 4 presents a computational reconstruction of the arguments of Justice Pitney and Justice Brandeis, based on a fully implemented system. The system is written in PROLOG, and it was developed using LPA's MacProlog32 on a Macintosh Powerbook 180.

One caveat: I do not claim that this system runs autonomously, or that it is capable of generating arguments in arbitrary corporate tax cases without human intervention. It would be straightforward to write an autonomous system that generates exactly the arguments observed in *Eisner v. Macomber*, but this would not provide any additional insight. The claim, instead, is that each component of the argument is represented by a well-defined computational task, and that there exists an implemented procedure that performs each step required to carry out these tasks. In other words, the top level control structure is still a hand simulation.

2 The Case

Here are the facts of *Eisner v. Macomber*: On January 1, 1916, the Standard Oil Company of California had outstanding roughly 500,000 shares of common stock, at a par value of $100 per share. On that date, Standard Oil carried in its corporate accounts a record of surplus and undivided profits amounting to about $45,000,000, of which about $20,000,000 had been earned prior to March 1, 1913, the effective date of the income tax law. Since the undivided profits had been reinvested internally in the company's business, the board of directors of Standard Oil decided in January, 1916, to readjust

the corporation's capital structure, transferring some of these reinvested funds from the surplus account to the capital stock account. To do this, they issued a stock dividend. Each stockholder would receive additional shares of stock amounting to 50% of the number of shares currently owned, and the total par value of this new stock would be subtracted from the surplus account and added to the capital stock account on the corporation's books. Myrtle H. Macomber, the plaintiff in the case, was the owner of 2,200 shares of the original Standard Oil stock, and so she received a distribution of stock certificates representing 1,100 additional shares, at a par value again of $100 per share. The question: Was this distribution of stock taxable?

The Revenue Act of 1916 stated clearly that a distribution by a corporation was taxable, whether it was paid "in cash or in stock of the corporation, ...which stock dividend shall be considered income, to the amount of its cash value," Ch. 463, sec 2(a), 39 Stat. 756. Applying the statute, the Collector of Internal Revenue determined that 18.07% or 198.77 shares of Mrs. Macomber's dividend represented surplus earned by the corporation since March 1, 1913, and imposed a tax on this amount computed at its par value, $19,877. Mrs. Macomber paid the tax under protest, and brought an action against the Collector to recover the amount paid, claiming that the imposition of this tax was unconstitutional since her stock dividend was not "income" within the meaning of the Sixteenth Amendment to the United States Constitution. The District Court agreed and granted final judgment to Mrs. Macomber, and the Collector of Internal Revenue, a man named Eisner, brought a writ of error to the Supreme Court.

To understand this case, it is necessary to understand some of the constitutional background. The original United States Constitution had strictly limited the power of the federal government to levy taxes. Article 1, §2, cl. 3 and Article 1, §9, cl. 4 of the Constitution provided that direct taxes on property could only be levied by the federal government if they were apportioned according to the population of the various states, which turned out to be politically impossible. In *Pollock v. Farmers' Loan & Trust Co.*, 157 U.S. 429 (1895), the Supreme Court had held that taxes upon the rents and profits of real estate, and taxes upon the returns from investments of personal property, were in effect direct taxes upon the property from which such income arose, and must therefore be apportioned among the states as to population. As a practical matter, this meant that an income tax, too, was an impossibility. The Sixteenth Amendment to the Constitution reversed this decision. The language is as follows:

> The Congress shall have power to lay and collect taxes on incomes, from whatever source derived, without apportionment among the several states, and without regard to any census or enumeration.

Thus the Supreme Court in *Macomber* had to decide whether a tax on a stock dividend was a tax on "capital" under the original Constitutional provision, or a tax on "income" under the Sixteenth Amendment.

There were very few precedents in 1920 that could conceivably be cited as relevant to this question. In fact, for our purposes, there were only two: *Lynch v. Hornby*, 247 U.S. 339 (1918), and *Peabody v. Eisner*, 247 U.S. 347 (1918). In *Hornby*, the Cloquet Lumber Company distributed to its common stockholders $650,000 in cash, which was a substantial percentage of the total par value of its common stock. In *Peabody*, the Union Pacific Corporation owned two large blocks of common and preferred stock issued by the Baltimore & Ohio Corporation, and distributed both of them to its common stockholders. In each case, these distributions were held to be taxable.

We will return to consider the arguments in this case in Section 4.

3 The Program

I will assume that the reader is generally familiar with my *Language for Legal Discourse (LLD)*, as described in [15]. *LLD* has facilities for the representation of *states*, *events*, *actions* and various modalities over actions, such as *permission* and *obligation*. It also provides a systematic treatment of *sorts* and *subsorts* (e.g., an 'Actor' can be a 'Person' or a 'Corporation'), and it includes both *count terms* and *mass terms* (e.g., 'Person' is a count term and 'Stock' is a mass term). For both technical and philosophical reasons, the language is based on *intuitionistic logic* rather than classical logic. I have argued elsewhere [13, 14] that intuitionistic logic provides the correct semantics for a logic programming language in which implications appear as goals (i.e., when the class of Horn clauses is extended to the class of "embedded implications"), as they often do in legal discourse. The arguments for the application of intuitionistic logic are extended to the action language and the deontic language in [21, 17], which the reader should consult for the technical details.

Figure 1 shows a representation of the facts of *Eisner v. Macomber* in *LLD*. This representation uses the "internal" syntax of *LLD*, rather than the "external" syntax in which the slots for the arguments are explicitly named. For example, the `own` relationship in Figure 1 would be written in external syntax with slots labelled `subject`, `object` and `time`, and `stock0` would be written as the `objectof` a `measure` with slots labelled `unit` and `quantity`. The reader should consult [15] for a clarification of these syntactic conventions. Actually,

```
(start - (time t1))
(before - (time t1) (time t2))
(person macomber)
(corporation standard_oil)
(surplus - (corporation standard_oil)
           (number 45000000)
           (time t1))
(class stock0)
(common - (class stock0))
(issued - (corporation standard_oil)
          (stock0 - (measure - (share ?u)
                               (number 500000)))
          (time t1))
(parvalue - (share ?u) (dollar 1) (number 100))
(own - (person macomber)
       (stock0 - (measure - (share ?u) (number 2200)))
       (time t1))
(issue - (corporation standard_oil)
         (stock0 ?s (measure ?m (share ?u)
                                (number 250000)))
         (time t1)
         (time t2))
(distribute_to - (corporation standard_oil)
                 (stock0 ?s (measure ?m (share ?u)
                                        (number 250000)))
                 (number 0.5)
                 (class stock0)
                 (time t1)
                 (time t2))
```

Figure 1: The Facts of *Eisner v. Macomber*

the true internal representation of the own relationship in the PROLOG implementation of *LLD* is the following PROLOG term:

```
own(sk154, term([actor, person], macomber, []),
           term([property, security, stock, stock0],
                sk153,
                [measure(sk152, term([unit, share],
                                     sk151,
                                     []),
                                number(2200))]),
           time(t1))
```

Since Figure 1 represents an assertion of facts, the variables in this expression have been interpreted as existentials, and have been skolemized. The corresponding PROLOG representation of an uninstantiated own relationship is the following:

```
own(_, term([actor| _], A, _),
       term([property| _],
            P,
            [measure(_, term([unit| _], U, _),
                        number(N))]),
       time(T))
```

In this encoding, the upward path through the sort hierarchy (which is assumed to be a *meet semilattice*) has been explicitly written into each sorted term. This is a standard PROLOG coding trick which allows us to use ordinary PROLOG unification to simulate unification in an order-sorted logic. Also, the term structure shown here allows us to write *variable sorts*, a second-order feature which has proven to be extremely useful in the representation of the corporate tax domain. The translation from the "internal" *LLD* syntax to the true internal PROLOG syntax is straightforward, and fully automatic.

Figure 2 shows the representation in *LLD* of a deontic rule, specifically, the rule that permits a corporation to distribute quarterly cash dividends to its common stockholders. Space limitations preclude a discussion of most of the knowledge representation issues raised by this example. Obviously, we need facilities to handle time and number, quantity and class, etc. Most of this is taken care of automatically in *LLD*, behind the scenes. The relationship between *states* and *events* requires some comment, however, since these categories play an important role in our analysis of corporate tax law. Abstract events in *LLD*, such as distribute, are usually defined in terms of more basic events, and the basic events are usually defined in terms of changes in the state of the world. The theory underlying this representation is discussed in [21]. In this example, distribute is defined by the event own_minus, which is a basic event, plus the event distribute_to, which is an embedded implication asserting the fact that every owner of the property ?stock is the subject of the event own_plus, which is itself a basic event. The events own_minus and own_plus are, in turn, defined by changes in the own relationship between time ?t1 and time ?t2. When the deontic modalities — permit, forbid, oblige — are applied to these events, they assert that a particular actor is permitted (or forbidden, or obligated) to carry out a particular event, and it may be necessary to analyze the definition of the event in some detail to determine exactly what the actor is permitted (or forbidden, or obligated) to do. The theory underlying these deontic inferences is discussed in [17].

In my implementation of *Eisner v. Macomber*, most of the background theory of corporate law is stated using deontic rules such as the one shown in Figure 2. For example, in addition to saying that a corporation *has* issued stock or *has* distributed property, we need to say how and when and under what conditions such actions are permitted (or forbidden, or obligatory). We also need to state the "rights" of stockholders and bondholders. For common stockholders, these rights usually include: (1) the right to receive dividends, which is partially expressed by the rule in Figure 2; (2) the right to receive a distribution of net assets if the corporation is liquidated; and (3) the right to vote.[1] Preferred stockholders have a priority over common stockholders, and the various rights are reformulated accordingly. Finally,

[1] The voting right is only crudely represented in my system at present.

```
(permit -
   (distribute - (corporation ?c)
                 (cash - (measure - (dollar 1)
                                    (number ?n2)))
                 (number ?r2)
                 (class ?stock)
                 (time ?t1)
                 (time ?t2))
   (corporation ?c))

<=

[
(day - (time ?t1) (time ?t2))
(quarter - (time ?t1) (time -))
(issued - (corporation ?c)
          (?stock - (measure - (share -) (number ?d2)))
          (time ?t1))
(fraction - (number ?r2) (number ?n2) (number ?d2))
(surplus - (corporation ?c) (number ?e2) (time ?t1))
(lessthaneq - (number ?n2) (number ?e2))
]
```

Figure 2: Permitted Distributions to Common Stockholders

the corporation has a direct obligation to pay the principal and interest on outstanding bonds, which means that the rights of bondholders are sharply distinguishable from the rights of the various classes of stockholders. We will see in the following section the importance of this background theory of corporate law for the arguments of *Eisner v. Macomber*.

In a recent paper [18], I articulated a theory about the concept of "ownership" which also plays an important role in the arguments of *Eisner v. Macomber*. In its most general form, the theory makes a claim about alternative modes of conceptual definition, namely, that there are two types of definitions commonly used in AI systems, but neither is adequate for the definition of ownership. The first type is the classical definition *per genus et differentia*, in which an existing class of objects is specialized by stipulating additional conditions that the object must satisfy. For example, we might define a `small_business_corporation ?c` as a `corporation ?c` in which `?c` also satisfies the conditions of Internal Revenue Code §1371. (This is sometimes referred to as the *terminological* component in a knowledge representation system.) Since the variable `?c` appears here in both the *definiens* and the *definiendum*, there are no new objects created by this definition, only the specification of a subclass of existing objects. The second type of definition also operates on existing objects, but it creates a new relationship between them. For example, the concept of `control` is defined in Internal Revenue Code §368(c) as a relationship between an `actor ?a` and a `corporation ?c` that holds (roughly) when `?a` owns 80% of the common stock of `?c`. (This is sometimes referred to as the *assertional* component in a knowledge representation system.) However, as I have argued in [18], neither type of definition can represent what it means to `own property`, or, in particular, to `own stock`. Instead, we need a new mode of *contextual definition*, which creates a new object, called `stock`, and gives the meaning of the relations `own stock` and `issued stock` *hypothetically* in terms of the bundle of "rights" that would hold between the `actor ?a` and the `corporation ?c` if these relations were assumed to exist. The reader should consult [18] for a thorough discussion of these ideas, but I will also present a specific example of this mode of definition in the next section of the paper.

So far, the discussion in this section of the paper has emphasized the static features of my representation of the corporate tax domain. However, to reconstruct the arguments in *Eisner v. Macomber*, we obviously need to do some computation over these static structures. Here are the main computational modules of my current implementation:

1. The system includes an inference module, called `prove`, with several variations, all written as PROLOG meta-interpreters. This is the module that applies rules to facts, and also determines what facts would be necesary to establish the conclusion of a particular rule. It works not only with Horn clauses and embedded implications, but also with deontic rules and action definitions.

2. The system includes several procedures for comparing conjunctive logical expressions. For example, `intensional_difference` returns a list of the differences among the relations and sorts that appear in two logical expressions, and `extensional_difference` returns a list of the differences among instances. The converse of these operations is `transform`, which constructs a variant of a logical expression according to a given list of differences. However, for these operations to be useful, it is essential that the input be *focused* enough so that the two expressions share a common overall structure.

3. To provide the necessary focus, the system includes two procedures: `generate_facts` and `generate_map`. The procedure `generate_facts` takes a set of facts and a logical expression that is known to be provable from these facts, and computes a hypothetical set of facts that would be just sufficient to prove the input expression, in the same way. (The main idea here is based on my implementation of *explanation-based generalization* in [11].) The procedure `generate_map` takes the facts of two different cases and an abstract logical expression that is known to be provable from the

first case, and computes (i) a hypothetical version of the facts in the second case that would be just sufficient to prove the input expression, in the same way it was proven in the first case, whether or not it would be provable from the actual facts of the second case, and (ii) a *map* showing the correspondence between the two hypothetical cases thus generated. These procedures work not only with Horn clauses and embedded implications, but also with deontic rules and action definitions.

4. The system includes a simple *version space learning algorithm*, based on standard ideas in the literature [22]. This algorithm uses the sort hierarchy to compute generalizations over a small set of logical expressions, once they have been focused by the procedures described above.

5. The system includes a simple *planning* module to generate alternative transaction patterns. There is no "intelligence" in this planning module whatsoever. In my current implementation it does an exhaustive search, but it only has to examine a small number of rules specifying possible transactions, and it is always given a carefully focused planning problem to work with.

We will see how the total system works in the following section.

4 The Arguments

This section presents a computational reconstruction of the opinions of Justice Pitney and Justice Brandeis in *Eisner v. Macomber*, 252 U.S. 189 (1920).

Note, first, that both opinions articulate a theory of the corporation. Justice Pitney carefully describes the practice of corporate accounting, the relationship between surplus account and capital stock account, and the legal rights and economic expectations of common stockholders. Justice Brandeis describes in detail the alternative mechanisms for raising corporate capital, issuing stocks and bonds, and distributing dividends. Neither opinion disputes this background theory. We thus conclude (i) that a theory of the corporation is essential for the construction of the legal arguments in this case, and (ii) that the basic outline of such a theory is noncontroversial. This shows the necessity of providing a detailed model of corporate law as an input to our program.

To initiate the legal argument, we need to represent the fundamental dichotomy between "capital" and "income" created by the Sixteenth Amendment. These are open-textured concepts, of course, and they are initially understood only vaguely and metaphorically. Justice Pitney writes:

```
(own - (actor ?a)
       (property ?p (measure - (unit ?u) (number ?n)))
       (time ?t))
```

Figure 3: NonTaxable Pattern

```
(precedes - (time ?t1) (time ?t2))
(own - (actor ?a)
       (?property - (measure - (?unit ?u) (number ?n1)))
       (time ?t1))
(own - (actor ?a)
       (?property - (measure - (?unit ?u) (number ?n2)))
       (time ?t2))
(lessthan - (number ?n1) (number ?n2))
```

Figure 4: Taxable Pattern

> The fundamental relation of "capital" to "income" has been much discussed by economists, the former being likened to the tree or the land, the latter to the fruit or the crop; the former depicted as a reservoir supplied from springs, the latter as the outlet stream, to be measured by its flow during a period of time. 252 U.S. 189, 206 (1920).

As a computational formulation of this vague idea, let us start with the two expressions in Figures 3 and 4. The *nontaxable pattern* simply represents the ownership of some fixed quantity of property at some particular point in time. Clearly, under Article 1, §2, cl. 3 and Article 1, §9, cl. 4 of the Constitution, any tax imposed on the basis of this pattern alone would be subject to apportionment according to the population of the states. The *taxable pattern*, on the other hand, represents a positive change in the quantity of property owned between time `t1` and time `t2`. (An alternative representation of the same idea would consist of the elementary event `own_plus` occurring over the interval from `t1` to `t2`. These two expressions are interchangeable in *LLD*, however, each one being computable from the other.) Clearly, in order to be taxable as income under the Sixteenth Amendment, an event would have to be characterized by the pattern in Figure 4.

Note that the pattern in Figure 4 (and also in Figure 3) corresponds to the first component in my previous theory of prototypical definitions, i.e., it is "an (optional) invariant component providing necessary conditions" for the definition of a legal concept. But it can also serve as the starting point for the representation of an open-textured concept, since `?property` is an abstract mass term with a contextual definition. This means that we have enormous flexibility in the way we actually define a particular property interest in any particular situation. We will see, below, how this flexibility plays a role in Justice Pitney's argument.

The first thing we do with the taxable pattern, however, is to use it in the *prima facie* argument of Justice Brandeis. The prove metainterpreter succeeds immediately in inferring the taxable pattern in Figure 4 from the facts in Figure 1. It also succeeds in inferring the taxable pattern in Figure 4 from the facts in *Lynch v. Hornby* and *Peabody v. Eisner*. In fact, it succeeds twice in *Peabody v. Eisner*, once for the distribution of common stock and once for the distribution of preferred stock. Moreover, when we apply generate_map to the patterns inferred in these precedent cases, the only intensional difference between *Hornby* and *Macomber* and between *Peabody* and *Macomber* arises from the identity of the property distributed. Thus, a simple *version space* algorithm [22], applied to a very small training set, constructs a generalization that supports Justice Brandeis' position. It simply classifies as taxable the distribution by a corporation to its stockholders of any property whatsoever.

On the other hand, the version space algorithm cannot construct a generalization that supports Justice Pitney's position, as long as it is confined to the inferred taxable pattern in Figure 4, or the facts of the case that are associated with this pattern by generate_facts. This is because *Peabody* involves the distribution of common stock, just like *Macomber*, and thus there is no node in the generalization hierarchy that can distinguish the *prima facie* taxable patterns in these two cases. This is not to say that there are no factual differences between *Peabody* and *Macomber*. For example, the common stock in *Peabody* was issued by a corporation distinct from the corporation that distributed it, whereas the corporation in *Macomber* distributed its own common stock. But why would this distinction be relevant? Clearly, we do not want to search randomly through the facts of a case to identify all such distinctions. Instead, we need a theory to guide our search. Let us see how this works in the construction of Justice Pitney's main argument.

The strongest argument for Justice Pitney's position arises from an attempt to force the nontaxable pattern in Figure 3 to match the facts in *Macomber* at both time t1 and time t2, thus precluding the application of the pattern in Figure 4. This is done by redefining the property interest in question. In computational terms, we take the inferred ownership pattern at time t1, transform it into an ownership pattern at time t2 that is identical in all other respects, and then ask whether this new pattern can account for the facts of the case. Recall our contextual definition of stock ownership. In a shorthand notation, we might write this as follows:

```
                              <=  own
                              <=  issued
[ modalities over actions     <=  conditions ]
```

```
permit(_,
       [
       own_minus(_, term([actor, corporation],
                         standard_oil,
                         []),
                    term([property, cash| _],
                         _,
                         [measure(_,
                                  term([unit, dollar| _],
                                       _,
                                       []),
                                  number(A))]),
                    time(t1),
                    time(B)),
       own_plus(_, term([actor, person], macomber, []),
                    term([property, cash| _],
                         _,
                        [measure(_,
                                  term([unit, dollar| _],
                                       _,
                                       []),
                                  number(C))]),
                    time(t1),
                    time(B))
       ],
       term([actor, corporation], standard_oil, []))

<=

[
fraction(_, number(D), number(C), number(2200)),
fraction(_, number(D), number(A), number(500000)),
surplus(_, term([actor, corporation], standard_oil, []),
           number(45000000),
           time(t1)),
lessthaneq(_, number(A), number(45000000))
]
```

Figure 5: Contextual Definition of own stock at time t1 ...

```
[
fraction(_, number(E), number(C), number(3300)),
fraction(_, number(E), number(A), number(750000)),
surplus(_, term([actor, corporation], standard_oil, []),
           number(20000000),
           time(t2)),
lessthaneq(_, number(A), number(20000000))
]
```

Figure 6: ...and at time t2

Interpreting the italicized implication as a goal to be proven, this means:

> If we assume an own relation, and if we assume an issued relation, under what conditions can we conclude that the various elementary actions available to the corporation are permitted, forbidden, obligatory, etc.?

Asked this question about the inferred ownership pattern at time t1, prove returns the implication shown in

Figure 5 using the deontic rule from Figure 2, and similarly for the other deontic rules not shown. Since this is a "free choice" permission, it says that `standard_oil` is permitted to choose either the number `A` in `own_minus` or the number `C` in `own_plus` in distributing a cash dividend at time `t1`. Similarly, given the inferred ownership pattern at time `t2`, `prove` returns exactly the same free choice permission, but with the condition shown in Figure 6. The permission at time `t2` is therefore exactly the same (modulo the arithmetic operations) as the permission at time `t1`, except for the amount of surplus stated in the condition. Ignoring for the moment this minor difference (and Justice Pitney has a separate argument to explain the difference away), this means that we can force the ownership pattern at time `t1` to account for all of the modalities in effect at time `t2` as long as we also force the issued pattern in the same way. But this, in turn, means that the *nontaxable* pattern in Figure 3 can account for the facts of *Eisner v. Macomber* continuously from time `t1` to time `t2`, simply by redefining the `property ?p` accordingly. A federal tax levied on such a situation without apportionment according to the population of the states would, of course, be unconstitutional. In Justice Pitney's words:

> Having regard to the very truth of the matter, to substance and not to form, [the stockholder] has received nothing that answers the definition of income within the meaning of the Sixteenth Amendment. 252 U.S. 189, 211 (1920).

Although most commentators agree that this analysis of stock ownership in terms of the underlying deontic modalities is Justice Pitney's strongest argument, it does not by itself provide a workable test for taxability. Thus, much of the balance of Justice Pitney's opinion is devoted to alternative characterizations of the Macomber facts, at a level closer to the original description, in an attempt to articulate a simple verbal rule for the disposition of the case. And here, unfortunately, Justice Pitney gets into trouble, providing openings for the counter arguments from Justice Brandeis. For example, one suggestion is that the stock dividend "does not ...increase the intrinsic value of [the stockholder's] holding .... The new certificates simply increase the number of shares, with consequent dilution of the value of each share." 252 U.S. 189, 211 (1920). But this test, a measure of "constant value" before and after the transaction, applies also to the cash distribution in *Lynch v. Hornby* and the stock distributions in *Peabody v. Eisner*, a fact that the commentators were quick to point out. A better suggestion is that the stock dividend "does not alter the pre-existing proportionate interest of any stockholder," 252 U.S. 189, 211 (1920), a verbal test that survives and appears frequently in subsequent decisions. Space limitations preclude a full discussion of these proposed tests in computational terms, but we will consider one important example. Justice Pitney puts it as follows:

> The essential and controlling fact is that the stockholder has received nothing out of the company's assets for his separate use and benefit; on the contrary, every dollar of his original investment, together with whatever accretions and accumulations have resulted from employment of his money and that of the other stockholders in the business of the company, still remains the property of the company, and subject to business risks which may result in wiping out the entire investment. 252 U.S. 189, 211 (1920).

Let us call this the "no-transfers-out-of-assets" test, and see how it is constructed — and attacked — in our computational simulation.

We start with the results of our prior analysis. We know that the `issued` relation must be considered along with the `own` relation in order to preserve the stockholder's dividend (and other) rights between time `t1` and time `t2`. So we ask: What facts in the description of the case are responsible for changing these relationships in tandem in this way? The obvious answer, computed by `generate_facts`, is that these changes are the result of the events `issue` and `distribute_to`. But now we want to know: Is this just a spurious concurrence of two events, or are these two events likely to reoccur in other situations? It should be clear that *only in the latter case could we use these facts to construct a test of nontaxability*. Since this is a question about causation, or obligation, or (at a minimum) expectation, we search our knowledge base of modalities over actions to find some likely candidates. As it turns out, `issue` and `distribute_to` are intimately connected, since this is one of several ways that a corporation is permitted to make distributions to stockholders. We now apply `generate_map` to compare the deontic structure we have located in the *Macomber* case with the facts of *Hornby* and *Peabody*. In each case, following the link from the ownership pattern to the `distribute_to` event to the deontic modality, `generate_map` finds an intensional difference that distinguishes *Eisner v. Macomber*. Although `distribute_to` is paired with `issue` in the *Macomber* case, it is paired with `own_minus` in *Hornby* and *Peabody*. This is the genesis, I claim, of the "no-transfers-out-of-assets" test.

We have now developed enough of the structure of Justice Pitney's argument to appreciate the counter arguments of Justice Brandeis. Since Justice Brandeis is writing a dissenting opinion, his main job is to attack the distinctions set forth by Justice Pitney. He does this by constructing an array of hypothetical cases, each one slightly different from the one before, and asking how

Justice Pitney's analysis stacks up against them. (This opinion was a major impetus in my original development of the theory of prototypes and deformations.) To appreciate the flavor of the argument, consider the following passage:

> A dividend received by a stockholder from a corporation may be either in distribution of capital assets or in distribution of profits. Whether it is the one or the other is in no way affected by the medium in which it is paid, nor by the method or means through which the particular thing distributed as a dividend was procured. If the dividend is declared payable in cash, the money with which to pay it is ordinarily taken from surplus cash in the treasury. But ...the company may raise the money by discounting negotiable paper; or by selling bonds, scrip or stock of another corporation then in the treasury; or by selling its own bonds, scrip or stock then in the treasury; or by selling its own bonds, scrip or stock issued expressly for that purpose. How the money shall be raised is wholly a matter of financial management. The manner in which it is raised in no way affects the question whether the dividend received by the stockholder is income or capital; nor can it conceivably affect the question whether it is taxable as income. 252 U.S. 189, 226-227.

The overall strategy in this passage is to show: (i) that the tests proposed in Justice Pitney's opinion fail to make the distinction he really wants; and, a much stronger claim: (ii) that the distinction itself is incoherent. I will discuss the first claim in the remainder of this section, and discuss the second claim in my concluding remarks.

Although the rhetorical effect of Justice Brandeis' argument should be intuitively clear, its origin seems mysterious. How can we account for the construction of these hypothetical cases, in computational terms? I suggest that there are two interacting stages in the computation: first, a *planning* stage, in which minor variations are constructed on a small set of facts; and second, a *mapping* and *evaluation* stage, in which minimal factual differences are identified and analyzed. A crucial assumption, at each stage, is that the set of facts under consideration has been sharply delimited and focused by the mechanisms previously discussed.

Let us see how this works with Justice Pitney's "no-transfers-out-of-assets" test. We have formalized this test by contrasting the pair of events `issue` and `distribute_to` with the pair of events `own_minus` and `distribute_to`. Suppose we wanted to blur this distinction by constructing a sequence of hypothetical cases leading from one pair of events to the other, and suppose we have the focused facts of *Macomber*, *Hornby* and *Peabody* to work with. We might ask: Is there a way to modify the events in *Peabody* so that the Union Pacific corporation distributes cash, as in *Hornby*? Our planning module solves this problem by selling Union Pacific's shares of Baltimore & Ohio common stock (or preferred stock) on the open market in exchange for cash, and then distributing the cash. We might then ask: Is there a way to modify the events in *Macomber* so that the Standard Oil corporation sells stock on the open market and then distributes cash, as in the hypothetical *Peabody* cases? Our planning module solves this problem by having Standard Oil issue common stock (or preferred stock) into its own treasury account, and then selling it. (It does not notice that the corporation issuing the stock in this hypothetical is the same as the corporation that owns it.) Finally, comparing this hypothetical variation of *Macomber* with the facts of the original *Hornby* case, our planning module is able to simplify the way that Standard Oil acquires cash by having the corporation issue its common stock (or preferred stock) directly on the open market. Of course, each of these events was previously encoded in our domain theory, either explicitly or implicitly, as one of the permitted corporate transactions. But that information is part of the necessary background in corporate law, and it was surely available to Justice Brandeis as well.

In this way, we have obtained the full sequence of hypothetical cases that appears in the passage quoted above from Justice Brandeis' opinion. The second stage of the computation compares these hypothetical cases with the cases from which they were derived to see if there would be any difference in tax treatment under Justice Pitney's analysis. Since each case was derived by replacing the distribution of a security with the distribution of cash, this becomes the main difference to analyze. Justice Brandeis' opinion on this point continues as follows:

> Likewise whether a dividend declared payable from profits shall be paid in cash or in some other medium is also wholly a matter of financial management. If some other medium is decided upon, it is also wholly a question of financial management whether the distribution shall be, for instance, in bonds, scrip or stock of another corporation or in issues of its own. And if the dividend is paid in its own issues, why should there be a difference in result dependent upon whether the distribution was made from such securities then in the treasury or from others to be created and issued by the company expressly for that purpose? So far as the distribution may be made from its own issues of bonds, or preferred stock cre-

> ated expressly for the purpose, it clearly would make no difference in the decision of the question whether the dividend was a distribution of profits, that the securities had to be created expressly for the purpose of distribution. If a dividend paid in securities of that nature represents a distribution of profits Congress may, of course, tax it as income of the stockholder. Is the result different where the security distributed is common stock? 252 U.S. 189, 227.

Justice Brandeis has now closed the circle, and the case under consideration at the end of this passage is, of course, *Eisner v. Macomber*. Notice, incidentally, how the hypothetical case in which a corporation issues preferred stock and then distributes it to its own common stockholders was originally suggested by a variation on the facts of *Peabody v. Eisner*. From this case, it is just a small step up and down the sort hierarchy to the hypothetical case in which a corporation issues bonds and distributes them to its own common stockholders. These two cases play a pivotal role in the argument, as we will now see.

Recall that Justice Pitney's strongest point depended on the fact that the stock distribution in *Macomber* did not alter, in substance, the deontic rules that define the relationship between a corporation and its stockholders. But consider the distribution of preferred stock, or the distribution of bonds. Applying the same computational analysis to the ownership of bonds[2] at time `t2` that we applied to the ownership of stock at times `t1` and `t2` in the original *Macomber* case, we obtain, not the contextual definition shown in Figures 5 and 6, but the contextual definition shown in Figure 7. This is an unconditional obligation to pay a fixed amount of cash at a fixed interval of time. (For specificity, we have assumed that the bond pays interest monthly at a 6% annual rate.) Thus, any attempt to redefine the `property ?p` in figure 3 in such a way as to force the nontaxable pattern to match the facts in this hypothetical case would fail. On the other hand, Justice Pitney's "no-transfers-out-of-assets" test would succeed on these facts, since the `distribute_to` event is paired with an `issue` event rather than an `own_minus` event. Justice Brandeis states the dilemma succinctly in the following passage:

> The argument which appears to be most strongly urged for the stockholders is, that when a stock dividend is made, no portion of the assets of the company is thereby segregated for the stockholder. But does the issue of new bonds or of preferred stock created for use as a dividend result in any segregation of assests for the stockholder? 252 U.S. 189, 229.

[2] The analysis of preferred stock is somewhat more complex, but similar.

```
oblige(_,
       [
       own_minus(_, term([actor, corporation],
                         standard_oil,
                         []),
                    term([property, cash| _],
                         _,
                         [measure(_,
                                  term([unit, dollar| _],
                                       _,
                                       []),
                                  number(125000))]),
                    time(t2),
                    time(A)),
       own_plus(_, term([actor, person], macomber, []),
                    term([property, cash| _],
                         _,
                         [measure(_,
                                  term([unit, dollar| _],
                                       _,
                                       []),
                                  number(550))]),
                    time(t2),
                    time(A))
       ],
       term([actor, corporation], standard_oil, []))
```

Figure 7: Contextual Definition of `own bond` at time `t2`

The answer, of course, is: No.

We have thus shown, at a minimum, that the primary test proposed in Justice Pitney's opinion fails to make the distinction he wants to make. This is a powerful argument for the dissent.

5 Discussion

Although we have seen how Justice Brandeis is able to attack the specific tests proposed by Justice Pitney, we have not yet seen how it is possible to make the stronger argument: namely, that Justice Pitney's decision itself is wrong. It seems as if the taxable prototype and the nontaxable prototype might simply coexist, without one being able to dominate the other. What is it about the sequence of hypothetical cases in Justice Brandeis' opinion that tends to persuade us, not only that Justice Pitney has the wrong test, but also the wrong result?

The answer, I believe, depends on a theory of *coherence*. The task for a lawyer or a judge in a "hard case" is to construct a theory of the disputed legal rules that produces the desired legal result, and then to persuade the relevant audience that this theory is preferable to any theories offered by an opponent. Empirically, legal theories seem to have a *prototype-plus-deformation* structure, as in *Eisner v. Macomber*, and one important component of a persuasive argument is an appeal to the coherence of the theory thus constructed. To obtain a deeper understanding of the phenomenon of legal argument, therefore, we need to explain, in computational

terms, why one theory based on prototypes and deformations is more (or less) coherent than another. I have not addressed this question in the present paper, but I will in future papers. (I will also compare my work to the work of others, e.g., [2], [3] and [24], which is omitted here because of a lack of space.)

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