EPS II: 
Estate Planning With Prototypes

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1 Introduction

This paper discusses our preliminary research into the possibility of developing a true legal planning system. To date, almost all legal expert systems have been legal analysis systems [8], but, in many domains, legal planning prior to taking an action is much more important than analyzing the legal consequences of an action after the fact. For example, the principal activity of business and tax attorneys is not litigation, but rather assisting clients in planning their affairs so as to avoid litigation in the future.

In a previous paper [17], one of the authors (DAS) presented an estate planning expert system, EPS. Following the traditional expert systems approach, EPS used heuristic rules formulated by an estate planning expert to “diagnose” a testamentary estate plan for a client. It did not contain a “deep model” of the legal domain from which it could derive its estate plan. In this paper, we will present a much more ambitious design for EPS II, which will include an explicit representation of the relevant provisions of the Internal Revenue Code and the associated Treasury Regulations, and which will use this representation of the law to construct a set of estate plans that satisfy a client’s goals. We wish to emphasize that EPS II is just a design at this point, not an implemented system. However, we will present our ideas in computational terms, and we will illustrate them with specific examples. We believe that our design is realistic, and we will report on the progress of our implementation in future papers.

In principle, estate planning can be formulated as a classical AI planning problem [14, chapters 7-8]: Given a client’s initial situation and goals, search the space of all possible estate plans to identify a plan that satisfies the goals while minimizing the tax consequences. However, classical AI planning is intractable even in the “blocks world” [2], and it would be impossible in the world of trusts and estates. Instead, human estate planners work with prototypes, matching a client to a prototypical plan and then modifying the plan as needed. We will attempt to mimic this technique in EPS II. In Section 2, we will analyze the human estate planning process and demonstrate the central role of prototypes, based on the experience of one of the authors (DAS) as an estate planning attorney. Then, in Section 3, we will show how to model this process computationally, using primarily a Language for Legal Discourse (LLD) [10], which was developed by the second author (LTM). Our particular representation of prototypes is based on the ideas presented in [12, 11], which have also been incorporated into LLD. In Section 4, we will compare the design of EPS II to related work, both in planning generally and estate planning in particular.
2 The Estate Planning Process

As pointed out in [17], estate planning is a complex problem that requires substantial legal knowledge from a number of different areas (e.g., tax, probate, corporate). In order to limit the domain, we have decided to consider the estate planning of inter vivos gifts, that is, gifts made during the client’s lifetime. In particular, we will consider inter vivos gifts to a trust for the benefit of a client’s children and/or grandchildren. This portion of the estate planning problem was chosen for several reasons: First, the relevant law consists of statutes, regulations, and cases, so it is representative in its degree of complexity. Second, there is a practitioner’s treatise on estate planning under California law [1] which contains a good explanation of the various prototype plans for making gifts to trusts, and this has helped us articulate and test our initial ideas. Finally, the sections of the Internal Revenue Code dealing with the income and estate taxation of trusts have been amended in the past few years. We have thus been able to study how the prototypes that worked well under one statute must be modified when the rules are changed.

In the following sections, we will present an account of the estate planning process based on the experience of one of the authors (DAS) as an estate planning attorney.

2.1 Collecting Initial Client Data

The first task of an estate planner is to collect initial data about the client’s family situation, assets, and liabilities. During this process, it is also important to determine the client’s goals. For the examples in this paper, we will assume that the following facts about the client are true: (1) the client is male, single, a U.S. citizen, and a California resident; (2) the client has several children, some of whom are married and/or have children of their own; (3) the client has a net worth in excess of $600,000, all of which is located in California; (4) the client has certain assets which he expects to appreciate greatly; (5) the client has taxable income in excess of $43,150; and (6) to reduce the death taxes (state and federal) attributable to owning the assets at the date of the client’s death.

Note that these goals fall into three main categories: (i) providing for beneficiaries, while (ii) retaining control over assets and (iii) avoiding taxes as much as possible.

2.2 Retrieving a Prototype Plan

Generally, an estate planning attorney accumulates a number of prototypical estate plans (usually represented by form documents) as a result of her work for other clients, and her reading in the estate planning literature. The ability to use prototype plans stems from several factors: First, it appears that the factual situations and goals of clients fall into a small number of distinct classes. Thus, it is possible to think in terms of prototypical clients. Second, there are only a limited number of estate plans that will achieve one or more of the prototypical clients’ goals, all legal constraints considered. Finally, most clients are not willing to pay for an attorney to “recreate the wheel” by researching the legal consequences of new estate plans. Thus, attorneys have a tendency to direct their clients toward plans (and documents) that have already been thoroughly researched and tested.

Accordingly, the second major step in the estate planning process is to retrieve a prototype plan that satisfies at least some of the client’s goals. To illustrate, we will consider an artificial example, an estate plan that satisfies goals (1)-(3) of the prototypical client from Section 2.1. Our plan contemplates that the client will transfer his assets to a trust containing the following language:

(A) During the Trustor’s lifetime, the Trustee may pay to or apply for the benefit of the Trustor and the Trustor’s issue (or any other person or entity) such amounts of income and principal of the trust estate and in such proportion as the Trustee in the Trustee’s

1To simplify the natural language syntax of this paper, we will use the male pronoun for clients and the female pronoun for lawyers.
absolute discretion shall determine. Any income not distributed shall be accumulated and added to principal. On the Trustor’s death, the Trustee shall distribute the trust estate to such one or more persons and entities, outright or in trust, as the Trustor shall appoint by will expressly referring to and exercising this general power of appointment. Any portion of the trust estate not effectively appointed as herein provided shall be distributed to the Trustor’s then living issue, by right of representation.

(B) At any time during the Trustor’s lifetime, he may amend this trust agreement or revoke this trust. Upon revocation, the Trustee shall distribute the trust estate to the Trustor, free of trust.

(C) The Trustee shall be the Trustor.

Since this trust gives a maximum amount of control to the grantor, we will refer to it as the client’s “pipe dream” trust. Unfortunately, it does not have very good tax consequences, as we will see.

2.3 Using Legal Knowledge to Critique the Prototype Plan

Although the “pipe dream” prototype satisfies some of our client’s goals, we will now assume that the client is willing to pay for the legal research necessary to determine if the plan satisfies his tax goals as well.

One of the main purposes of transferring assets to a trust is to remove them from the client’s gross estate, thus reducing federal estate taxes. But various provisions of the Internal Revenue Code stipulate that certain categories of property remain within the gross estate despite the client’s purported transfer. For example, §2033 provides that the value of the gross estate includes

\[ \text{the value of all property to the extent of the interest therein of the decedent at the time of his death.} \]

This provision would not cover the assets in the “pipe dream” trust, since our client would not have a direct interest in these assets at the time of his death. However, §2038 provides that the value of the gross estate includes

\[ \text{the value of all property \ldots to the extent of any interest therein of which the decedent has at any time made a transfer (except in case of a bona fide sale for an adequate and full consideration in money or money’s worth), by trust or otherwise, where the enjoyment thereof was subject at the date of his death to any change through the exercise of a power (in whatever capacity exercisable) by the decedent alone or by the decedent in conjunction with any other person (without regard to when or from what source the decedent acquired such power), to alter, amend, revoke, or terminate, or where any such power is relinquished during the 3-year period ending on the date of the decedent’s death. } \text{§2038(a)(1).} \]

Thus, if our client were to transfer assets to the “pipe dream” trust, as suggested in Section 2.2, these assets would be included in his gross estate as §2038 property since (i) the transfer would not be a bona fide sale, (ii) the transfer would be by trust, and (iii) the enjoyment of the assets would be subject at the date of the client’s death to a change through the exercise of a power by the client to revoke. Thus the goal of reducing federal estate taxes fails.

There are other problems with the “pipe dream” trust: For example, the income of the trust would be taxed to the client by §674. But, for purposes of illustration, we will focus our attention here on the §2038 problem.

2.4 Creating a New Prototype Plan

The Internal Revenue Code not only identifies the failure of a prototype plan to satisfy a client’s goal. It also suggests how the goal failure might be corrected. An estate planning attorney who knows her way through the provisions of the code can often use these provisions to “debug” a failed plan, and construct a new prototype.

In our illustration, there were three conjunctive conditions that led us to conclude that the assets in the “pipe dream” trust qualified as §2038 property. The second condition would apply to any transfer to a trust, and thus could not be negated. Would it be possible to negate the first condition, by setting up the transfer as a bona fide sale? To qualify as a bona fide sale, the decedent must receive “an adequate and full consideration in money or money’s worth,” but in this case the sale proceeds would be included in the client’s gross estate under §2033. As a result, the modified plan would not solve the goal failure. Note, however, that this analysis ignores the fact that the property sold to the trust might appreciate faster than the assets received in exchange, and an alert estate planning attorney might wish to save this example as a useful prototype for some future situation. But see §2036(c).

The only remaining alternative is to negate the third condition in the definition of §2038 property. This re-
quires several steps: First, it is necessary to specifically remove the client’s power in paragraph (B) to revoke the trust. Since a trust is revocable under California law unless otherwise stated, the trust agreement must specifically state that it cannot be amended. Thus, paragraph (B) should be rewritten as follows:

(B) Neither the Trustor nor any other person shall have the power to alter, amend, revoke, or terminate this trust, except for distributions set forth herein.

Second, the client’s powers as trustee in the first sentence of paragraph (A) constitute the power to “alter” the enjoyment of the trust property. One possible solution to this problem is to exclude the client from acting as trustee by changing paragraph (C) to read:

(C) The Trustor shall not be the Trustee.

There are several additional problems, including the fact that the grantor is a permissible beneficiary, see §2036(a)(1), and the fact that the grantor has a general power of appointment, see §2041. But each of these problems can be solved by an appropriate modification of the language in paragraph (A).

The end result of this process is a trust whose assets would be excluded from the client’s gross estate, thus satisfying goal (6) in Section 2.1 above. However, the resulting plan no longer satisfies goals (2) and (3). It is apparent at this point that these goals cannot all be satisfied simultaneously, and the estate planning attorney must now search for compromise solutions to goals (2) and (3) that do not violate the constraints of goal (6). As this process continues, the various modified plans would be presented to the client for his consideration and possible adoption, and the more successful plans would be filed away as prototypes for future use.

In the following section, we will outline our design for a computer program that automates portions of this process.

3 Towards an Estate Planning System

EPS II has been designed using a Language for Legal Discourse (LLD), which is described in [10] and which is based on prior work in [6, 7]. The representation of prototypes in EPS II is based on the ideas presented in [12, 11], which have also been incorporated into LLD. In Section 3.1, we will show how to represent the terms of a trust in LLD, and in Section 3.2 we will show how to represent the rules of the Internal Revenue Code. We will then discuss the process of constructing and modifying prototypes in Section 3.3. Finally, in Section 3.4, we will consider the available techniques for optimizing estate plans.

3.1 Representing Trusts

Most of the relevant facts concerning the client’s initial situation are easy to represent in a Language for Legal Discourse: There are objects (e.g., persons, assets, jurisdictions) and relationships (e.g., “x is a parent of y,” “x owns p,” “x is a resident of California”). These relationships change over time, and the changes are usually brought about by the actions of individuals. The concept of “property” is particularly important here. We treat every property interest as a mass term (see §2036(a)(1)) with various numerical measures attached to it. For example, a partnership interest in an office building could be described as a “25% share” with a “fair market value” of $1,500,000. We would expect the “25% share” to remain constant unless some specific action changes it, but we would expect the fair market value to fluctuate over time. In addition, we assume that every asset generates a stream of income: We represent this by a spontaneous action that creates new property (usually, cash) at periodic intervals. Various numerical measures can be attached to the income stream: dollars, percentages, probabilities, etc. Thus, if we wish to apply the techniques of numerical optimization to our domain (see Section 3.4 below), we will have the necessary data to do so.

The basic task for the client is to choose a disposition of his or her assets, that is, to designate who gets the principal and the income, and under what conditions. Thus, many of the client’s goals can be represented by stating a desired future event, e.g., “all the partnership income is to be transferred to my youngest son.” The natural way to effectuate this goal is to create an agent who is obligated to carry out the desired action. In other words, using pseudo-code from LLD:

(Obligation -
  {condition
   ‘‘P generates N dollars of income’’
  }
  {action
   ‘‘A transfers N dollars to client’s youngest son B’’
  }).

But this is just the legal device of a trust. The legal ownership of the property is transferred to a trustee, and the trust instrument creates an obligation on the part of the trustee to transfer all the income in the specified manner. More complicated trust provisions can be represented in similar ways. For example, the client
might reserve a *power* to alter the trustee's obligation to distribute partnership income in the event that the youngest son fails to enroll in college by a certain date. This would be represented in *LLD* by creating a *permission* for the trustor to bring about the *action* of changing the trustee's obligation if the stated *condition* becomes true. This use of dynamic permissions and obligations is discussed extensively in [6, 7].

As a further example, consider the terms of the “pipe dream” trust in Section 2.2. The first major provision of paragraph (A) gives the Trustee permission to distribute an unspecified percentage of the income generated by the trust property to the Trustor, or to the Trustor’s issue, or to anyone else, and then requires him to add the remainder of the income to the principal. Suppose we have defined the action $\alpha_1 = \"distribute N1 dollars to a set of beneficiaries\"$, and the action $\alpha_2 = \"add N2 dollars to the principal\"$. We could then state that the joint action $\alpha_1 \land \alpha_2$ is obligatory:

(Obligation -
{condition
   \"P generates N dollars of income\"
and
   \"N = N1 + N2\"
}{action
   \"Trustee distributes N1 dollars to a set of beneficiaries\"
and
   \"Trustee adds N2 dollars to the Principal\"}),

while stating that the action $\alpha_1$ is permitted in the free choice sense:

(Permission -
{condition
   \"P generates N dollars of income\"
and
   \"N1 =< N\"
}{action
   \"Trustee distributes N1 dollars to a set of beneficiaries\"}).

Of course, the action $\alpha_1$ would be defined in such a way that a “beneficiary” could be either the Trustor, or the Trustor’s issue, or any other person, and the percentage distributed to each beneficiary would be entirely unconstrained. The rule of free choice permission would thus leave these decisions entirely within the discretion of the Trustee, as the drafter of the “pipe dream” trust intended.

The provisions of paragraph (B) could also be represented as a free choice permission plus a conditional obligation. The power to amend or revoke could be stated as follows:

(Permission -
{condition
   \"Trustor is alive\"
}{action
   \"Trustor amends trust\"
or
   \"Trustor revokes trust\"),

and the conditional obligation would be:

(Obligation -
{condition
   \"Trustor revokes trust\"
}{action
   \"Trustee transfers Principal to Trustor\"}).

This representation may seem rather sparse. For the purpose of applying California trust law, of course, it would be necessary to define the actions “amend” and “revoke” in greater detail, and to specify more precisely the permitted and obligatory actions for both the Trustor and the Trustee. But for the purpose of applying the Internal Revenue Code to the “pipe dream” trust, this abstract characterization is sufficient. We will discuss this point further in Section 3.2.

Finally, paragraph (C) states that the Trustee and the Trustor shall be the same person. This provision could also be represented as an obligation, but in this case the obligation would constrain the actions of every agent to preserve the state of identity between the Trustee and the Trustor. We thus have an example of a situation, discussed in [7], in which an “ought to be” rule is represented by a generalized “ought to do” rule.

### 3.2 Representing the Internal Revenue Code

The Internal Revenue Code is a complex mixture of arithmetical expressions and conceptual rules. For example, §2001 provides, in essence, that

$$\text{EstateTax} = \text{TaxRate} \times [\text{Value}(\text{GrossEstate}) - \text{Deductions}] - \text{Credits}.$$  

and various provisions then define the *GrossEstate*, and specify what qualifies as a *Deduction* and a *Credit*. In particular, §§2033-2046 collectively define the property that must be included in the gross estate, §2055 defines the transfers that qualify for a “charitable deduction,” and §2056 defines the kinds of bequests that qualify for a “marital deduction.”

Some of these rules are strict, and some have substantial areas of “open texture.” §2033, for example, which
was cited in Section 2.3 above, can be implemented directly as a deductive rule. But §2038, which was also cited in Section 2.3, contains the following language:

...where the enjoyment thereof was subject ... to any change through the exercise of a power ... to alter, amend, revoke, or terminate ...

This clause has been the subject of Treasury Regulations and numerous cases through the years, without ever acquiring a clear definition. Our approach in this situation is to represent the rule by the subrules that classify cases as clearly included or clearly not included in the open-textured concept. In effect, we are defining the concept in terms of positive and negative prototypes [12, 11], without worrying about the classification of the nonprototypical cases. We believe that this approach is sufficient for most estate planning purposes, since human estate planners do not intentionally plan their clients into a law suit. Instead, they avoid the hard questions of law unless there is a definite benefit in confronting them.

We will illustrate this approach by considering a fragment of our representation of §2038. One central issue is the representation of a power. Following [6, 7], we will say that an agent has the power to change a legal relationship if there exists a permitted course of action for the agent that results in the desired change of state. This is equivalent to saying that the state change is not forbidden. We can thus represent part of §2038 as follows:

\[
\text{(NotForbidden -}
\begin{array}{l}
\{\text{condition NIL}\}
\{\text{action}
\begin{array}{l}
\text{``Trustor amends trust''}
\text{or}
\text{``Trustor revokes trust''}
\text{or}
\text{``Trustor terminates trust''}
\end{array}
\end{array}
\}
\)\]

It then follows immediately by a deduction in the deontic language that the “pipe dream” trust falls within §2038. In more realistic cases, of course, the deduction would not be so immediate, and it would be necessary to apply a definition of the actions “amend” and “revoke” and “terminate” to the specific provisions of the trust instrument to see if the rule was satisfied. In such cases, the positive and negative prototypes would become important.

Although the power to amend or revoke is not always clearly defined, the power to alter the enjoyment of the property in the trust is a classic example of an “open-textured” concept. Abstractly, we could represent this as a change in the interest of some beneficiary in the trust principal, where an interest is a bundle of rights that in some way benefits a particular individual. A trust provision falls within §2038 if it grants the Trustor a power to create such an interest:

\[
\begin{array}{l}
\{\text{NotForbidden -}
\begin{array}{l}
\{\text{condition NIL}\}
\{\text{action}
\begin{array}{l}
\text{\{(Action -}
\begin{array}{l}
\text{\{agent (Trustor T)}
\{event}
\begin{array}{l}
\text{\{(StateChange -}
\begin{array}{l}
\text{\{relation1 NIL\}
\{relation2
\begin{array}{l}
\text{\{(Interest -}
\begin{array}{l}
\text{\{subject (Actor B)}
\{object (Property P))}}})}
\end{array}
\end{array}
\end{array}
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\end{array}
\]
\]

or the power to destroy such an interest. However, not every newly created or newly destroyed permission or obligation has been held to satisfy this definition. For example, the power to pay principal to an income beneficiary falls within §2038, Lober v. U.S., 346 U.S. 335 (1953), whereas the power to transfer additional assets to the trust does not, Central Trust Co. (Est. Baur) v. U.S., 167 F.2d 133 (6th Cir. 1948). We would thus represent these two situations as positive and negative prototypes, respectively.

The identity of the Trustee is also an important factor in the interpretation of §2038. If the Trustee and the Trustor are identical, as they are in the “pipe dream” trust, then it follows by a simple deduction in the deontic language that any power of the Trustee is also a power of the Trustor. Moreover, if the Trustor has the power to remove the Trustee and appoint himself instead, then the powers of the Trustee are also attributable to the Trustor. This rule is supported by Treasury Regulation §20.2038-1(a)(3) and by the cases, Est. Loughridge, 11 T.C. 968 (1948), aff’d 183 F.2d 294 (10th Cir. 1950), cert. den. 340 U.S. 830 (1950), and it can be justified by a deduction in the deontic language as well. For if there exists a permitted course of action whereby the Trustor can become the Trustee, then there exists a permitted course of action whereby the Trustor can effectuate any change in the state of the world that could have originally been effectuated by the Trustee. Less clearcut is the position taken by the Internal Revenue Service in Revenue Ruling 79-353, 1979-2 C.B. 325, that the power to remove and replace a Trustee without cause falls within §2038, even though the Trustor himself is forbidden to become the Trustee. Although this Ruling has not yet been tested in the courts, estate planners are generally advised to follow it. We thus treat Revenue Ruling 79-353 as a positive prototype in the planning context, even though it is, in
fact, an arguable case.

This strategy helps us solve many difficult representational issues, simply by avoiding them. For example, under §2041, property in a trust will be included in a client’s gross estate if he or she has a “general power of appointment” over the property, as in the “pipe dream” trust in Section 2.2, but a power of appointment which is limited by an “ascertainable standard relating to health, education, support, or maintenance” is not a general power of appointment. Although we can represent the concept of a “power of appointment” using the deontic machinery of LLD, the concept of an “ascertainable standard” seems to require a representation of the epistemic modalities that is far beyond our current capacities. Fortunately, the legal system has not been able to define this concept either, and it turns out to be unnecessary for most estate planning purposes. Treasury Regulation §20.2041-1(c)(2) gives several examples of an ascertainable standard: If the client has the power to require that trust assets be used for his “health, education, or support,” then he would not have a general power of appointment, but if the client has the power to require that trust assets be used for his “health, education, support, or comfort,” then the law is unclear. In this situation, a human estate planner would simply lift the language “health, education, or support” from the Treasury Regulation and not attempt to add the word “comfort.” Our system would do the same.

### 3.3 Constructing and Modifying Prototypes

The estate planning process described in Section 2 depends critically on the construction and modification of prototypes: An estate planning attorney starts with a prototypical estate plan, she debugs the plan by reference to the statute, and she eventually creates a new plan that is tailored to her particular client’s goals.

To capture the elements of this process in EPS II, we will use the theory of prototypes and deformations developed by one of the authors (LTM) in previous work on the TAXMAN project [12, 11]. In the TAXMAN II system, legal concepts are represented by a set of exemplars, some of which are designated as prototypical, and a set of transformations that express various relationships among the exemplars. Adapting this theory to the estate planning domain, the exemplars are particular estate plans, represented in LLD, and the transformations express various modifications in the estate plans that either preserve or defeat the goals of a particular client. All transformations are thus annotated by their effects on the major client goal categories: (i) providing for beneficiaries, (ii) retaining control over assets and (iii) reducing taxes. Sometimes, the effects of these transformations can be derived from our domain theory, using the conceptual model of a trust from Section 3.1 and the representation of the Internal Revenue Code from Section 3.2, and in these cases the derivations will be stored in the body of the transformation, as illustrated in [12, 11]. In other cases, the deepest annotation possible is simply the fact that the Internal Revenue Code treats two different situations differently.

As an illustration, we will show how the “pipe dream” trust would be modified to comply with §2038. Putting together the representation of paragraph (B) in Section 3.1 and the representation of §2038 in Section 3.2, it is apparent that the property in the trust would be included in the client’s gross estate, thus conflicting with goal category (iii). Part of the necessary modification is now obvious: The original paragraph (B) must be deleted. For the rest of the modification, we need a formal representation of California trust law, specifically, the rule that a trust is revocable unless explicitly stated otherwise. California Probate Code §15400. This is a default rule, and it must be blocked by stating that any amendment or revocation by the Trustor is forbidden. We thus arrive at a provision similar to revised paragraph (B) in Section 2.4. The transformation that deletes and adds these provisions would then be annotated by the derivation that shows compliance with §2038, plus an annotation that goal category (ii) has been weakened. Note that both of these annotations could be generated by a deduction in the deontic language.

The second major problem with the “pipe dream” trust arises from the interaction of paragraphs (A) and (C). By paragraph (C), the Trustor and the Trustee are identical, and by paragraph (A), the Trustee has an unconstrained power to distribute income or principal to a set of beneficiaries. Thus, again, the property in the trust would be included in the client’s gross estate by §2038. One modification that solves this problem is to delete paragraph (C) and replace it with a provision stating that it is forbidden for the Trustor and the Trustee to be identical. Would this be sufficient? There is a potential problem with Revenue Ruling 79-353, and here it is necessary to apply once again a formalization of California trust law. It turns out that a Trustor does not have a right in California to remove a Trustee without cause, unless specifically stated otherwise, and so the default rule produces the desired result in this case without any additional modifications. California Probate Code §15642(a). Paragraph (C) would thus be rewritten as shown in Section 2.4, and the transformation would be annotated accordingly.

The revision of paragraph (C) is not the only solution to the §2038 problem. It is permissible for the Trustor to serve as the Trustee as long as the Trustee does not himself have the power to alter the enjoyment of the
property. Here the rules concerning an “ascertainable standard” under Treasury Regulation §20.2041-1(c)(2) and the case law under §2038 become relevant. In particular, our system could modify paragraph (A) to insert the standard of “health, education, or support” as a constraint on the Trustee’s discretion. Although the concept of an “ascertainable standard” is indefinable in LLD, so that it is impossible to derive these conditions from more basic principles, we can nevertheless construct a prototypical estate plan which is guaranteed to fall outside of §2038 and §2041. In this case, the annotation would simply be a reference to Treasury Regulation §20.2041-1(c)(2) and the case law under §2038.

Notice that our view of estate planning as a process of constructing and modifying prototypes agrees nicely with our views on the representation of open-textured legal concepts. If a legal rule is just a set of positive and negative prototypes, as suggested in Section 3.2, then the Internal Revenue Code is just a vast collection of particular estate plans that have been categorized in various ways according to their tax consequences. Such a system would be totally unmanageable, of course, unless the transformations imposed some degree of conceptual coherence on the domain. From a theoretical point of view, this notion of conceptual coherence has been one of the main concerns of the TAXMAN project [12, 11]. See also [9]. From a practical point of view, the conceptual coherence of the Internal Revenue Code is essential for the routine practice of estate planning, either by people or by machines.

When the Internal Revenue Code is amended, the planning problem is not so routine. But even here, the idea of prototypes and deformations is helpful. For example, prior to the Tax Reform Act of 1986, estate planners would often recommend the creation of a Clifford Trust, i.e., a trust for a child’s benefit that lasted more than 10 years. If the trust were properly drafted under §673, the income from the assets would be taxed to the child rather than the parent. The Clifford Trust thus became one of the prototypical estate plans for a client who wanted to provide for his child’s education, but did not want to transfer assets permanently to the child. However, the Tax Reform Act of 1986 changed the law in several respects. First, the income of a trust is now taxed to the grantor (i.e., the client) if he retains a reversionary interest in the trust of more than 5% of its value. See §673(a). Also, the income of a child under the age of 14 is now taxed at the parent’s marginal rate. See §1(i). Together, these provisions have completely eliminated the Clifford Trust as a viable technique for financing a college education. But this was precisely the legislative intent: to shift the Clifford Trust prototype from one tax category to another.

In our proposed design, EPS II would be able to check whether a prototype estate plan still satisfied the legal constraints under the amended statute, and, if not, it would create a new prototype estate plan. For example, EPS II should be able to discover that the Clifford Trust prototype no longer satisfied the client’s goals because of the change in §673(a). EPS II could then “debug” the plan failure as follows: If the term of the trust were extended so that the client had a reversionary interest of 5% or less, then the income would still be taxed to the child. (For this example, ignore the amendment to §1(i).) Assuming that EPS II contained the Internal Revenue Service’s actuarial tables, it could determine the trust’s term in years based on the client’s age. The program could then propose the new plan as a prototype. Most clients who would have used a Clifford Trust, however, would probably not want to use this new prototype, since they would not recover their principal for much more than 10 years.

While certain changes to the Internal Revenue Code, such as the amendment to §673(a), might be handled adequately by EPS II, it is clear that EPS II will not be able to debug existing prototypes and create new ones for all changes in the law. For example, even human expert estate planners do not know how the addition and subsequent amendment to §2036(c) will affect existing estate plans. We have no hope that EPS II will be able to perform tasks that human experts cannot perform.

### 3.4 Optimizing the Plan

In our description of the estate planning process in Section 2, we showed how to construct prototypical plans that satisfied one of the client’s goals at a time. Our initial design for EPS II is likewise limited to the satisfaction of only one goal at a time. It is possible to do more, however. For example, we might try to minimize the net expected present value of all future income and estate taxes. Or, using the techniques of [15] to elicit the client’s overall “utility function,” we might try to compute the estate plan that maximizes his total “expected utility.” To do this, we would have to integrate the techniques of symbolic computation with the appropriate numerical techniques from the field of operations research. An interesting example of such an integrated system is the Constraint Logic Programming language (CLP) of Lassez, et al. [5], which has been applied to the problem of options trading [4]. We are currently investigating the possibility of incorporating the ideas of CLP into LLD.

Although there are several commercial software systems that provide help with the numerical aspects of estate planning, these systems have not been widely used to optimize estate plans since it is often difficult (and time consuming) to collect the necessary data. Instead, human estate planners generally use crude “rules
of thumb” to select estate plans when their client’s goals are in conflict. Perhaps this situation would change if the conceptual analysis and the numerical analysis could be smoothly integrated into a single system.

4 Related Work

In this section, we will compare the design of EPS II to two existing estate planning systems, EPS by Schlobohm and Waterman [17] and TaxAdvisor by Michaelsen [13], and two recent examples of planning in the AI literature, SIPE by Wilkins [18] and CHEF by Hammond [3].

EPS and TaxAdvisor create estate plans for clients using heuristic rules formulated by expert estate planners. These heuristic rules have some similarities to the prototype estate plans proposed in this paper. For example, EPS contains rules in which the antecedents represent a prototypical client factual situation, and the conclusion is essentially a pointer to the text of the document that would implement the plan. The rules, however, do not contain any representation of the goals that the prototype plan would satisfy. Furthermore, EPS does not contain any knowledge about how the rules were obtained; their justification relies solely on textual material supplied by the author. As a result, human experts would have to modify the heuristic rules whenever the law changes, and the entire system containing the new rules would then have to be debugged. Finally, EPS and TaxAdvisor would be of little use to expert estate planners, since experts only need assistance when the law changes or when dealing with a novel client situation.

Our proposal for EPS II should correct at least some of these deficiencies. As argued above, since EPS II would maintain a deep representation of the law governing estate planning, it should be possible for the system to generate explanations and justifications of its estate plans in terms of the underlying legal rules. Also, since we believe that the law in some respects governs the creation of prototype plans, EPS II should be able to create new prototype plans when the law changes, or at least point out the flaws in the old plans. Finally, by providing EPS II with deep knowledge of the estate planning domain, we should be able to avoid some of the brittleness which traditional expert systems experience when fact situations approach the limits of the system’s knowledge.

In many ways, the SIPE program [18] represents the state of the art in classical AI planning systems. For example, SIPE is able to perform planning at different levels of abstraction (hierarchical planning), and it constructs nonlinear plans (possibly using parallel actions).

See also [16]. SIPE also has the ability to revise a plan after the occurrence of an unexpected event, and then to continue using the modified plan, which is similar to what we expect to accomplish by the use of prototypes and deformations in EPS II. The underlying representation language in SIPE is similar to LDL in its reliance on logical formalisms, of course, and this causes inevitable problems of computational complexity. Our use of prototypes to solve (or avoid) these complexity problems resembles the “case-based planning” approach of Hammond in CHEF [3], except that there is no deep model of the Szechwan cooking domain comparable to our model of the estate planning domain. In a sense, we are attempting to combine the ideas of SIPE and CHEF into a single system. We do not believe that this can be done in a domain-independent fashion, however, and our design of EPS II depends on a number of peculiar features of the estate planning process.

References


