RULE-BASED MODELS OF LEGAL EXPERTISE

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ABSTRACT

This paper describes a rule-based legal decisonmaking system (LDS) that embodies the skills and knowledge of an expert in product liability law. The system is being used to study the effect of changes in legal doctrine on settlement strategies and practices. LDS is implemented in ROSIE, a rule-oriented language designed to facilitate the development of large expert systems. The ROSIE language is briefly described and our approach to modeling legal expertise using a prototype version of LDS is presented.

I. INTRODUCTION

We are currently engaged in designing and building rule-based models of legal expertise. A rule-based model of expertise is a computer program organized as a collection of antecedent-consequent rules [1] that embodies the skills and knowledge of an expert in some domain. The primary goal of our work is to develop rule-based models of the decisionmaking processes of attorneys and claims adjusters involved in product liability litigation. We will use these models to study the effect of changes in legal doctrine on settlement strategies and practices.

Some progress has already been made in developing computer systems to perform legal analysis. The LEGOL Project [2] has been working for a number of years on the construction of a language for expressing legislation. In addition, systems have been developed for analyzing cases on the basis of legal doctrine [3,4], investigating the tax consequences of corporate transactions [5], automating the assembly of form legal documents [6], and performing knowledge-based legal information retrieval [7].

Our legal decisionmaking system (LDS) is being implemented in ROSIE, a rule-oriented language designed to facilitate the development of large expert systems. In section II the ROSIE language is briefly described. Section III discusses our approach to modeling legal expertise and describes the operation of our prototype version of LDS. The conclusions are presented in section IV.

II. METHODOLOGY

A rule-oriented system for implementing expertise (ROSIE) is currently under development to provide a tool for building expert systems in complex domains [8]. ROSIE is a direct descendant of RITA [9] and more distantly MYCIN [10] in that the models created are rule-based with data-directed control [11], and are expressed in an English-like syntax. In addition, the models use special language primitives and pattern matching routines that facilitate interaction with external computer systems. The ROSIE design also includes features not found in these successor systems, such as a hierarchical data structure capable of supporting abstraction and inheritance in a general way, partitioned rulesets that can be called as subroutines or functions, a clearer differentiation between rule antecedent matching and iterative control by permitting actions that involve looping through the data base, and a user support environment with extended facilities for editing and explanation.

In the latest version of ROSIE, the pattern-directed modules used to examine and modify the data structure are divided into the imperative knowledge or rules and the declarative knowledge or facts. Both rules and facts are represented as antecedent-consequent pairs, where the consequent is either an action to be executed (for rules) or a statement to be deduced (for facts). Rules operate via forward chaining and are of two basic types: existence-driven (IF-THEN) as in RITA, and event-driven (WHEN-THEN) as in ARS [12]. Facts, on the other hand, operate via backward chaining and are represented only as IF-THEN pairs. The facts in ROSIE are similar to RITA goals, but are more general since they are implicitly referenced by the rules and automatically executed whenever the rules need information the facts can supply. In effect, the information that can be inferred from the facts is a "virtual data base" or extension to the standard ROSIE data base.

The current ROSIE syntax is more English-like than that of RITA or earlier versions of ROSIE. It is intended to facilitate model creation, modification and explanation. This syntax is illustrated in Figure 1, which shows our definition of strict liability in the product liability domain.

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IF:   (the plaintiff is injured
         or the plaintiff is the representative of
              the plaintiff's decedent
         or the plaintiff's property is damaged)
      and the incidental-sale defense is not an
              applicable defense for the defendant
      and (the product is manufactured by the
              defendant
         or the product is sold by the defendant
         or the product is leased by the defendant)
      and (the product is a cause of injury to the
               plaintiff
         or the product is a cause of death to the
               decedent
         or the product is a cause of damage to the
                plaintiff's property)
      and the defendant is responsible for the use
               of the product
      and (the jurisdiction of the case is Calif
         or the plaintiff is a user of the product
         or the plaintiff is a purchaser of the
                product)
      and the product is defective at the time of
                the sale
      and (the product is defective
          and (the degree of the product's danger
                to the plaintiff is unreasonable
          or the degree of the product's danger
                to the plaintiff's  property is
                unreasonable)
         or the jurisdiction of the case is Calif)
      and the expected-change of the product at the
                time of the sale to the consumer is
                not substantial

THEN: assert the defendant is liable under the
      theory of strict-liability.
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FIGURE 1. Definition of Strict Liability in ROSIE

III. LEGAL MODEL

The model of legal decisionmaking we are building will contain five basic types of rules: those based on formal doctrine, informal principles, strategies, subjective considerations and secondary effects (see Figure 2). The formal doctrine evolves from court decisions and statutes, while the informal principles, strategies, etc. are shaped by example and experience. Sources for these rules include legal literature, case histories and interviews with experts. By separating the rules as described we can study both the relevant inference mechanisms and the influence of each type of knowledge on the decisionmaking process.

We are using our model of legal decisionmaking to systematically describe how legal practitioners reach settlement decisions and to test the effect of changes in the legal system on these decisions. Individual cases are analyzed by comparing the chains of reasoning (the chains of rules) that lead to the outcomes to similar chains in prototypical cases. This helps clarify the relationships existing between the formal doctrine, informal practices and strategies used in the decisionmaking. We are examining the effects of changes in legal doctrine, procedures and strategies on the processing of cases by modifying appropriate rules in the model and noting the effect on the operation of the model when applied to a body of selected test cases. This can provide insights that will suggest useful changes in legal doctrine and practices.

- o FORMAL DOCTRINE: rules used as the basis for legal judgements such as legislation and common law.
- o INFORMAL PRINCIPLES: rules that don't carry the weight of formal law but are generally agreed upon by legal practitioners. This includes ambiguous concepts (e.g., reasonable and proper) and generally accepted practices (e.g., pain and suffering = 3 * medical expenses).
- o STRATEGIES: methods used by legal practitioners to accomplish a goal, e.g., proving a product defective.
- o SUBJECTIVE CONSIDERATIONS: rules that anticipate the subjective responses of people involved in legal interactions, e.g., the effect of plaintiff attractiveness on the amount of money awarded, or the effects of extreme injuries on liability decisions.
- o SECONDARY EFFECTS: rules that describe the interactions between rules, e.g., a change in the law from contributory negligence to comparative negligence may change other rules such as strategies for settlement or anticipated behavior of juries.

FIGURE 2. Components of Legal Decisionmaking

Our current implementation of LDS is a small prototype model of legal decisionmaking containing rules representing negligence and liability laws. This prototype contains rules describing formal doctrine and informal principles in product liability. Future versions of the system will incorporate the other rule types shown in Figure 2. The model consists of approximately 90 rules, half of which represent legal doctrine and principles. Given a description of a product liability case the model attempts to determine what theory of liability applies, whether or not the defendant is liable, how much the case is worth, and what an equitable value for settlement would be. Once a decision is reached the user may ask for an explanation in terms of the rules used to reach the decision.

We will now describe the use of LDS to test the effect of a legislative change on a case outcome. The case is briefly summarized in Figure 3, while the operation of the model on this case is illustrated in Figure 4. The system was first applied using the definition of strict liability given in Figure 1. It was determined that the defendant was partially liable for damages under the theory of comparative negligence, with the amount of liability lying somewhere between $21,000 and

The plaintiff was cleaning a bathtub drain with a liquid cleaner when the cleaner exploded out of the drain causing severe burns and permanent scarring to his left arm. Medical expenses for the plaintiff were $6000, and he was unable to work for 200 working days, during which time his rate of pay was $47 per day.

The cleaner was manufactured and sold by the defendant, Stanway Chemical Company. The contents of the product were judged not to be defective by experts retained by the defendant. The product's label warned of potentially explosive chemical reactions from improper use of the product, but did not give a satisfactory description of means to avoid chemical reactions. The plaintiff was familiar with the product but did not flush out the drain before using the cleaner. The amount of the claim was $40,000.

FIGURE 3. Description of Drain cleaner Case (Note: the model actually used a much more detailed description of of the case than is shown here.)

$29,000. The case was valued between $35,000 and $41,000. After the definition of strict liability was modified to state that the product must be unreasonably dangerous for strict liability to apply, the defendant was found to be not liable. In this prototype implementation of LDS a somewhat more restrictive ROSIE rule syntax was used than is shown in Figure 1.

V. CONCLUSIONS

Our preliminary work with LDS has demonstrated the feasibility of applying rule-based modeling techniques to the product liability area. In spite of the inherent complexity of product liability law, the number of basic concepts manipulated by the rules is easily handled (in the hundreds), while the number of rules required to adequately represent legal doctrine and strategies is manageable (in the thousands).

The rules that represent legal doctrine in this area are basically declarative in nature.

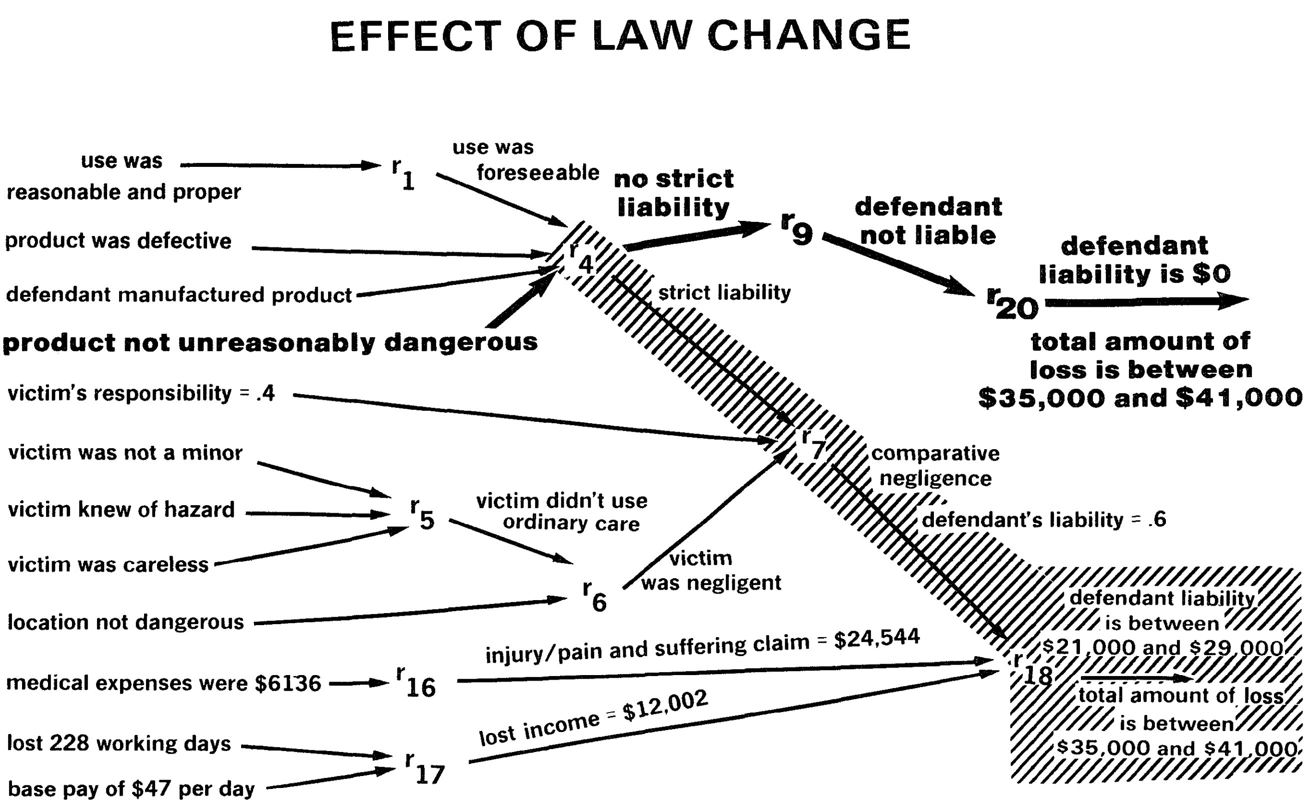

FIGURE 4. Inference Process for Drain Cleaner Case (Crosshatched area shows inference before law change)

Most of them are easily represented as definitions with complex antecedents and simple consequents that name the concept being defined. Rules of this sort can be organized as relatively unordered sets that are processed with a simple control scheme. Most of the action takes place in calls to other rule sets representing definitions of terms used by the initial set. This simple control structure facilitates rule modification and explanation.

In this application area improved methods are needed for dealing with vague or ambiguous concepts used in the rules. It is sometimes difficult to decide whether or not these concepts are applicable in a particular case, e.g., whether the use of the product was actually "reasonable and proper." Possibilities include gradual refinement: a query scheme involving presenting the user with increasingly specific sets of questions, each of which may have ambiguous terms that will be further refined by even more specific query lists, and analogy: displaying case histories involving similar prototypical concepts and having the user select the one closest to the term in question.

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