Models of Legal Decisionmaking

D. A. Waterman and Mark A. Peterson

Research Design and Methods
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The Institute for Civil Justice

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Foreword

This is the first in a series of Institute reports designed to describe new analytic methods and techniques that are being developed to make possible new kinds of research and analysis in the civil justice field. These documents will not ordinarily convey major research findings. Rather, they will present the new or adapted tools of research that are in development and show promise, whether the work is being done at the Institute or elsewhere. In addition, they will discuss examples of the research and policy questions that seem to be susceptible to use of the tool being presented.

The need addressed by the analytic instrument described in this report is one of the most pressing—and most difficult—in the field. Every student of the civil justice system knows that courtroom proceedings involve only a tiny fraction of the flow of claims and disputes. Most claims do not reach court. Even many cases that are tried are settled before verdict. Yet, almost all nonproprietary research on the system is limited to the tiny fraction that do reach verdict, because both data and analytic instruments suitable for examining the out-of-court elements of the system are in desperately short supply. It follows that ways of examining this hidden mainstream of system activity rank high on the priority agenda of the Institute for Civil Justice and others interested in rigorous inquiry in this field.

This report describes a promising attempt to use rule-based computer modeling to replicate key elements in the bargaining and decisionmaking process that leads to settlement. Beginning with information from seasoned professionals about how they actually operate at each stage of the process, the computer model translates these methods of operation into decision rules which, taken together, determine how far the case goes along the bargaining sequence leading to the courtroom, and at what dollar amount (if any) the matter is settled. The rules are many, reflecting the complexity of the law and the economic considerations that weigh on the parties. They are arrayed in decision trees that represent, to the degree possible, the "if-then" rela-
Summary

Despite the attention given to courts and trials, out-of-court settlements are the primary way in which civil justice is rendered in this country. Almost all lawsuits and claims that could become lawsuits are settled between the parties, rather than by a judge or jury verdict. To understand how the American civil justice system works, how it changes when legal rules or procedures change, and how it might be improved, we must understand how litigators go about settling cases. We must understand how settlement decisions are affected by different legal rules and procedures, by parties' characteristics, by the nature of injuries, and so forth.

We still know very little about how settlements are reached, partly because settlements are so complicated—many considerations can influence a settlement and these considerations vary greatly among cases —and partly because there are few records about settlements.

This report describes how the application of rule-based computer models might provide valuable information about the settlement process in civil litigation. Complex computer models that describe the settlement process for typical cases could be developed using a simple and straightforward research method. The models would be developed by asking lawyers and insurance company claims adjusters to describe how they try to settle specific cases. During repeated interviews, litigators would describe the actions they would take for a series of hypothetical civil claims and their reasons for those actions. By incorporating data on a broadly representative range of hypothetical cases, researchers could systematically explore the reasons for litigators' actions.

These reasons can then be translated into a series of "if-then" rules. That is, each rule would describe a part of the litigator's decision as an interim conclusion that is reached for a given set of premises, or "if" conditions. The entire reasoning process that leads to a litigator's action would be represented as a chain of these "if-then" rules, with the conclusions of some rules serving as premises for subsequent rules. The
rules would be incorporated in a computer program to form a rule-based model that attempts to reproduce litigators' reasoning processes. For example, when litigators consider a particular case, they use only a small number of the many possible rules that might be involved. Likewise, the computer model will select only a small number of the programmed rules that might be relevant to the case. The specific facts of a case determine the rules that are used; if a material fact is changed, the chain of rules for that case also changes.

To refine the rule-based model, litigators would be asked to review specific cases and the chain of rules that the model followed to reach its conclusion. The rules could then be modified or elaborated on the basis of the reviewers' comments. Finally, the model could be validated by comparing rule-based models of settlement decisions with actual settlements, taken from closed-claim files.

This report describes a limited prototype that we have developed to explore the feasibility of constructing rule-based models. The prototype indicates that at least some aspects of the settlement process can be described by such rule-based models, although further research will be needed to develop more comprehensive models and to address the technical issues that will arise in extending the current work.

Future research should focus first on how litigators decide about the value of a civil claim, a decision that is central to all other actions in presenting or defending against a civil claim. After initial models of case worth are developed, subsequent research could use those models to explore other decisions, such as whether to take a case, offers and demands, and the range of settlements that a litigator would accept.

The models could also serve as a basis for a laboratory of civil litigation, where negotiating could be studied through gaming research and where possible changes in settlements that might result from changes in legal rules or procedures could be analyzed.
Acknowledgments

During the past 18 months, many colleagues have taken an interest in, encouraged, and helpfully criticized our attempt to apply rule-based modeling as a research tool for studying legal settlements. Their support and criticism have both been invaluable in helping us to refine our approach. In particular, we would like to thank Stephen Carroll, David Seidman, Frederick Hayes-Roth, and Gary Martins for their continuing support and frequent suggestions. David Seidman and Philip Klahr reviewed several drafts of this report, providing suggestions about both the report and our basic approach. Edward Feigenbaum provided useful suggestions about developing and utilizing rule-based models of litigators' decisions. Finally, we wish to thank the Institute for Civil Justice, the Institute's director Gustave Shubert, and deputy director Charles Nelson for their confidence in and support for our work in developing a new technology for studying the process of civil litigation.
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I. INTRODUCTION

The American civil justice system operates principally through the extrajudicial behavior of litigators.1 The vast majority of civil claims are settled out of court, and the outcomes for most of these are entirely determined by negotiations among plaintiffs' and defendants' lawyers or insurance company claims adjusters.2 Even when a settlement is not reached, the arguments, decisions, and negotiations made during the settlement process influence the nature of the formal trial.

Despite the importance of this process, we know very little about how lawyers and adjusters go about settling cases. Past research provides a general description of settlement practices but almost no information about how litigators pursue or respond to civil claims, or about how their actions affect the outcomes of settlements. Nor do we have good information on the effects of changes in legal rules or procedures on litigators' behavior and settlement outcomes. Traditional methods of research have provided neither the complex data that are needed to understand litigators' behavior nor the means to analyze even the limited existing data about settlements.

In this report we describe how an innovative research method, the development of rule-based computer models, might be used to obtain and organize comprehensive information about the actions of lawyers and claims adjusters in settling cases. Interviews used to develop rule-based models would provide data about experts' decisions, and the models would provide a method for systematically analyzing these data.

We begin, in Section II, with a theoretical overview of the settlement process and the role that litigators' decisions play within that process. This overview serves both as a summary of our existing knowl-

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1 Throughout this report, we use the term "litigation" broadly, to include all acts in evaluating, negotiating, advancing, or defending against a claim, whether or not the claim results in the filing of a lawsuit. The term "litigators" includes all professionals who conduct litigation—insurance company claims adjusters as well as lawyers.

2 This report focuses on settlements in personal injury claims. In California, 97 percent of the claims arising from automobile accidents are settled without a lawsuit being filed; only 0.4 percent of such claims go to trial (California Citizens Committee on Tort Reform, 1977, p. 53). Over 80 percent of the closed product-liability insurance claims surveyed by the Insurance Services Office (ISO) in a national study were settled before a lawsuit was filed; and over 95 percent of the claims (representing 81 percent of the payments for bodily injury and 89 percent of the claims for property damage) were settled before trial (Insurance Services Office, 1977, pp. 95-96). Settlements are also the primary means for disposing of other types of legal disputes, including divorce (Friedman and Percival, 1976) and medical malpractice (Danzon, 1979).
edge and as a background for the discussion of how rule-based models might contribute to research on settlements.

Section III describes the method of rule-based computer modeling, its past use in analyzing decisionmaking in different areas of expertise, and the application of the model to the study of settlement decisions. We then discuss a prototype rule-based model that we have developed to examine initial technical questions about models of legal decisions. This preliminary work indicates that it is technically feasible to develop simple rule-based models of litigants' settlement decisions, and that exploration of more comprehensive models is warranted.

Section IV describes empirical research that will permit development of a more comprehensive model and presents some of the technical issues that must be addressed in developing such a model.

Section V describes proposed further research using the comprehensive models, including (1) tests of the validity and generality of the models, (2) research on multiparty strategies and negotiations, and (3) research on the effects of changes in legal rules and procedures on litigators' decisions. Finally, Section V summarizes the conclusions derived from our current work.
II. AN OVERVIEW OF THE SETTLEMENT PROCESS

A thorough understanding of settlement practices requires consideration of the effects of procedures, legal rules, and parties' characteristics, stakes, and interests on those practices (Mnookin and Kornhauser, 1979; Eisenberg, 1976). This section provides a framework within which these aspects of the settlement process can be discussed. We begin by examining prior empirical and theoretical considerations of settlement behaviors. We then present a number of hypotheses about settlement behaviors and describe the limitations of existing research methods for exploring these hypotheses.

Because settlement practices are complex and heterogeneous, it would be unrealistic to attempt to develop a detailed description of all civil settlements. Therefore, we shall focus on the settlement of tort claims, which constitute a major proportion of civil disputes. Tort law raises interesting and pressing issues about how settlement behaviors are affected by changes in legal procedures and rules (e.g., bases of liability, impacts of contributory negligence, constrictions of the rule).^3

THE ROLE OF CASE WORTH IN SETTLEMENT

Decisions to settle liability claims are the result of both private behaviors (decisions by each party) and multiparty behaviors (communications and negotiations that influence those private decisions).^4 Figure 1 shows a schema of the private decisionmaking process of litigators. It summarizes the theoretical assumptions about decisions that each litigator must make, the relationships among these private

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^3 Since there is great variation in legal rules, strategies, and party interests even among tort cases, our description of rule-based models in later sections of this report will focus even more narrowly on product-liability cases.

^4 Friedman and Percival (1976) found that in two California counties, tort cases constituted 27 percent and 19 percent of all 1970 civil court filings, and 56 percent and 50 percent of all non-family cases. Of course, most tort claims are settled without a filing of a civil claim.

^5 California Citizens' Commission on Tort Reform, 1977.

^6 To simplify the modeling task, we assume that the interests and decisions made by litigators correspond to those of their clients. This assumption is clearly a simplification, particularly for plaintiffs (cf. Rosenthal, 1974). In future work, we expect to include consideration of the various interests and decisions made by both the litigators and their clients.
decisions, and the relationships between these decisions and the settlement of a claim.\(^7\)

Trial lawyers and claims adjusters report that they routinely make private evaluations of the "worth" of civil claims with which they are involved. These evaluations are apparently related to the litigators' expectations of the verdict for the case if it were tried. Presumably, they reflect the litigators' assessments of the facts of the case in light of (1) formal legal rules; (2) informal rules that guide interpretations of indefinite legal terms, e.g., general principles that suggest whether or not an act was reasonable or undertaken with "ordinary care"; (3) informal rules for calculating the value of damages, e.g., valuing pain and suffering at some multiple of medical expenses; and (4) expectations about jurors' or a judge's affective response to the facts or parties, e.g., their reactions to sensational injuries, or how they may be influenced by the age, race, sex, demeanor, and sympathetic quality of the parties.

Legal practitioners seem able to make these evaluations of worth without considering adversarial factors, since they must make them at the beginning of cases when little or no knowledge of the opposing party or of the likely trier of fact is available.

We assume that evaluations of worth are central to litigators' other decisions and behavior. As the first step in pursuing a liability claim, at time T1 in Fig. 1, a plaintiff's lawyer decides whether or not to accept a case by estimating the worth of the claim and comparing the estimated worth with some minimum value for taking a case. The lawyer will also consider the costs of pursuing the claim. If after these costs are subtracted the estimated worth still exceeds the minimum for accepting the case (as shown in Fig. 1), the plaintiff's lawyer will file a claim, forcing the defendant's lawyer or an insurance company claims adjuster to also estimate the worth of the case (at time T2).

In addition to deciding the worth of cases, both litigators must decide upon the range of settlements they would accept. This decision is based upon the estimated worth of the case and the litigator's anticipation of the costs that will arise from further litigation. Because a settlement avoids additional litigation costs, the parties are usually willing to accept a settlement that is less favorable to them than their estimated worth of the case (Danzon, 1980).* The plaintiff will accept

\(^7\) The schema is based in part on Posner (1977) and Danzon (1980).

* The costs of further litigation include uncertainties about sustaining an unfavorable verdict. The risks of further litigation differ for parties and insurance companies. Insurance companies defend most claims, and their risks of losing a verdict can be offset against the verdicts that they win. In contrast, a plaintiff has one claim and can hedge against the possibility of an unfavorable verdict only by settling (Ross, 1970; Galanter, 1974). On the other hand, insurance companies face the risk that some adverse verdicts might serve as a stronger precedent than a settlement would. An insurance company may face numerous actual and potential claims similar to the one being litigated. An adverse
Fig. 1—Schema of settlement process
settlements below his estimate, and the defendant will accept settlements above his estimate. In Fig. 1, the defendant rejected the plaintiff's claim because it exceeded the defendant's acceptable range.

Finally, each party must decide what case value it will communicate to its adversary. As a part of its bargaining strategy, each side will make a demand or offer that is more favorable to it than its estimate of case worth (cf. the description of plea bargaining in Nagel and Neff, 1976). At various points in the case, a lawyer or adjuster will involve himself with legal procedures, collect further information (sometimes investing substantially), and communicate with the other party. As a result of any of these activities, a litigant may change his decisions about worth, acceptable range, and offer/demand. One of the principal purposes of the rule-based modeling effort described in this study is to examine the effects of these activities and information on such decisions. However, for this overview, the effects of such developments are represented simply in Fig. 1, with developments between times T2 and T3 producing changes in litigators' decisions.

At time T3, the acceptable ranges of settlements for the two parties overlap. The plaintiff will accept an offer that is, in fact, below the maximum demand to which the defendant will agree. If either party makes an offer or demand within this overlap, the parties will agree and settle the case. However, at time T3, neither party has indicated a willingness to settle at a value within this acceptable range; therefore, no settlement occurs. At time T4, the parties still hold to the

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9 Initial offers and demands must leave litigators with sufficient room for bargaining up to the time of a trial verdict. Unless new developments occur in a case, it is difficult for parties to take a more extreme position later in negotiations (Ross, 1972).

10 The demands/offers may be particularly extreme in cases where a litigator is uncertain about case worth — to avoid “giving the case away.” Extreme demands/offers might also indicate an inexperienced litigator who can not easily value the case. (W.L.F. Feltiner, personal communication).

11 We have shown both estimates moderating, because uncertainty has been reduced. Additional information could move both estimates up, e.g., injuries are greater than previously believed, or down, e.g., injuries are less severe.

12 As the result of developments between T2 and T3, the plaintiff might increase his acceptable range and demand, even if new information causes him to reduce his estimate of case worth. Ross (1970) argues that a party who has undertaken a substantial investment between T2 and T3 will increase his demand and the minimum settlement he will accept. At time T2, a settlement would have avoided this substantial expense; however at T3, the plaintiff will expect compensation for this expense. If the expense is greater than the reduction in the estimate of the case worth, the plaintiff will demand and accept a higher settlement at T3 than he would have at T2, even though he valued the case more highly at T2.

13 One of the objectives of third-party mediators is to discover undisclosed overlaps in acceptable settlements.
same judgments about worth and acceptable ranges, but one of the parties has made an offer/demand that falls within the overlap of acceptable ranges. The other party finds the offer/demand acceptable and the case is settled.\footnote{The parties do not have to agree on the value of the case. Since each side will accept a settlement less favorable to it than its estimate of case worth, it is sufficient that the parties' acceptable ranges overlap and that one party proposes a settlement within this overlap.}

SETTLEMENT STRATEGIES, COMMUNICATIONS, AND PROCEDURES

Figure 1 is intended merely to show the relationships among litigators' decisions and the settlement of a case; therefore, it does not indicate the potentially intricate strategies, communications, and procedures that occur within negotiations (Engel and Steele, 1979). It also does not indicate that litigators' actions and the resulting changes in their decisions will most likely occur in a few important periods. Because litigators' multiple caseloads prevent their constant attention to any one case, they will consider cases only periodically, depending upon procedural demands, actions by their adversary, developments in information, client demands, and so forth.

For most cases, strategies, communications, and procedures are probably not very intricate. Drawing on interviews with claims adjusters and plaintiffs' lawyers and also on observations of adjusters' settlements of automobile accident cases, Ross (1970) found that even when a claimant was represented by a lawyer, few cases involved anything beyond the simplest negotiations. Our preliminary examination of correspondence in closed insurance claims files supports this. We found that most communications between parties simply conveyed information necessary for evaluating the case, e.g., copies of doctors' reports or laboratory reports, or emphasized a particular chain of reasoning that was either rejected by the other party as irrelevant or accepted by both parties. Communications frequently appealed to norms that served as standard bases for evaluating cases, e.g., a tacit agreement that pain and suffering is worth n times medical expenses (Ross, 1970).\footnote{The simplified interactions among litigators found in Ross's research and our preliminary work closely resemble Matheny's (1980) theoretical description of plea-bargaining practices. Matheny describes plea negotiation as "uncertainty reduction rather than convergence through simple haggling and bluffing in a sentence marketplace" (1980, p. 277). Since the tasks and problems faced by civil and criminal litigators are very similar, the behavior of both kinds of litigators should be similar (Engel and Steele, 1979).}
Ross’s study suggests that these generally accepted norms or rules for deciding cases are the bases both for litigators’ private decisions about cases and for negotiations among the parties. Ross found that litigators’ decisions ignored fine points of law. Adjusters and plaintiffs’ lawyers both evaluate the facts of a claim in terms of a simplified set of operating rules to determine whether the claim should be settled with payment and, if so, approximately how much the payment should be. Our preliminary interviews corroborated this finding. The lawyers and adjusters we interviewed also reported using simplified rules for analyzing case worth. Moreover, rules used by different litigators addressed similar factors (e.g., extent of medical expenses, characteristics of the parties, past and future lost wages). As a result, the adversaries usually agreed about the worth of a case. In short, the simplified rules have resulted in a routinized claims settlement process. In many cases, the application of legal rules is so clear that there is no question about whether or not liability exists. And even where liability is not clear, negotiations are usually based on simple rules that ignore the complexities of the formal law.

Ross concluded that this simplification results from litigators’ attempts to satisfy conflicting objectives. Faced with the large volume of claims and the bureaucratic structure of insurance companies, adjusters must try to expeditiously settle cases and achieve equitable results, while minimizing payments. Plaintiffs’ lawyers also face a conflict between expeditious settlement and maximizing payments. The simple rules provide expeditious and roughly just bases for settling the bulk of cases.

Matheny (1980) argues that the considerable uncertainty of litigation might also contribute to this simplification. Because it is difficult for parties to evaluate cases in the face of this uncertainty, parties can exploit the ambiguity. To protect themselves from exploitation, litigants may have developed norms for providing each other with information. These simple rules also permit parties to dispose of cases without requiring precise, unambiguous information.

RESEARCH QUESTIONS AND HYPOTHESES

This overview raises many general questions about litigators’ behavior in resolving liability claims: How do litigators evaluate case worth? Are their decisions based on the settlement amounts of other, similar cases (cf. Matheny, 1980)? Are litigators’ decisions about case worth based on the verdicts they would expect if the cases went to trial (Danzon, 1980)? Are those decisions based on some intrinsic consider-
ation of just or appropriate compensation (Ross, 1970)? To what degree do litigators in the same jurisdiction use common rules or norms to evaluate cases? Do plaintiffs' lawyers differ systematically from defense lawyers and claims adjusters in the way they evaluate case worth? How are judgments about clients' characteristics and appeal considered in litigators' evaluations of case worth? How do legal rules affect decisions about case worth? Do litigators base their decisions on a general assessment of whether liability is certain or uncertain and not on refined considerations of legal doctrine? Do fine points of law become more important as the facts or legal issues become clearer?

How are decisions about the acceptable range related to decisions about case worth? Do litigators adjust case worth by their estimates of further litigation costs, so that in cases where costs are greater they will accept settlements that are further away from their estimates of the case's worth (cf. Danzon, 1980)? What other matters influence decisions about an acceptable settlement?

How are decisions about demands/offers related to decisions about case worth or the acceptable range of settlements? Do litigators use patterns of demands/offers to communicate relative willingness to settle (cf. Ross, 1970)? If so, how are these patterns interpreted? Do demands/offers usually tend to converge as a case proceeds? In what circumstances will a plaintiff's lawyer increase his demand or a defendant decrease his offer? Does such intransigence occur only when a party receives new facts or does it also occur in the absence of new facts?

Previous research and our own preliminary review suggest a number of hypotheses about the effects of particular facts, legal doctrines, litigator characteristics, and strategies upon litigators' behavior. For illustration, we shall briefly discuss the hypotheses that neither the adoption of strict liability nor the adoption of comparative negligence will change settlement practices in product-liability cases.

Schwartz (1979) and others argue that the adoption of strict liability would have little effect on the resolution of product-liability claims, because juries do not decide cases tried under negligence differently from cases decided under strict liability. In theory, negligence and strict liability differ. Negligence requires a finding of an unreasonable act attributable to a defendant—the theory focuses on the defendant's acts and requires a finding that the risks from those actions outweigh their benefits. Strict liability focuses on the product, requiring a finding that a product was defective, which appears to involve only a consideration of risk.

However, in practice there may be little difference between the two bases of liability. If a product is claimed to be defective because of an unsafe design or inadequate warning, the determination of a defect requires a balancing of the risks and benefits of at least some attributes
of products. Also, in most states, the defect must make a product unreasonably dangerous; again, the determination of unreasonableness seems to retain a balancing of risks and benefits. Moreover, negligence has been extended to permit liability without finding that a defendant acted unreasonably. The doctrine of res ipsa loquitur permits a jury to infer negligence on the basis of the product defect, without any direct evidence concerning the defendant's behavior. Doctrines of vicarious liability hold manufacturers accountable for negligence by employees, suppliers, and subsequent fabricators.

If litigators base their decisions about the worth of cases on expected jury verdicts and if they (as well as commentators) believe that juries would decide cases similarly under either theory, the availability of a theory of strict liability should have no impact on settlements. However, if litigators' decisions about case worth are based on considerations other than case worth or if they believe that juries would decide product-liability cases differently under the two theories, then the adoption of strict liability might change settlements. Litigators may expect verdicts under strict liability to be more favorable to defendants, since jurors sometimes fail to understand or agree with the assumption of negligence under res ipsa loquitur. Also, if strict liability reduces the plaintiff's costs in pursuing a product-liability claim, plaintiffs may demand higher settlements when that doctrine becomes available.

Untested hypotheses also exist about the effects of the adoption of the legal theory of comparative negligence. Under the traditional, contributory negligence doctrine, a plaintiff was not entitled to recover a verdict from a negligent defendant if the plaintiff's own carelessness contributed to his injury. Under the newer doctrine of comparative negligence, a careless plaintiff can recover a verdict, but the verdict amount will be reduced in an amount proportional to his own responsibility for his injury. Ross (1970) argues that comparative negligence will have little impact on settlements, a view that seems to be broadly held. He found that litigators were providing settlement payments to negligent plaintiffs who should have been barred from recovery under the doctrine of contributory negligence. Ross attributed these settlements to adjusters' judgments that it is unfair to bar recovery where a defendant's greater negligence was principally responsible for the plaintiff's injury; in these cases, adjusters applied a de facto comparative negligence rule.

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16 Restatement (second) of Torts 402a. But California requires only that a product be dangerous, not unreasonably dangerous (Schwartz, 1979).
18 Sole reliance on strict liability might, ironically, reduce the worth of cases. Some lawyers expect larger verdicts for cases tried under a theory of negligence, since a central issue presented to the jury under that theory is the defendant's alleged insensitivity to the risks he was imposing. See Cotchett and Cartwright, 1977.
As an alternative hypothesis, settlements under comparative negligence might increase if previous payments to negligent plaintiffs were based on litigants' expectations about potential jury verdicts for the case. This hypothesis would imply that adjusters (or defense lawyers) settle under contributory negligence because they are not certain that a jury would find the plaintiff to have been negligent. Many juries in contributory negligence jurisdictions avoid the unpopular harshness of that doctrine by applying their own lay form of comparative negligence. Rather than barring recovery by careless plaintiffs by finding them to be negligent, these juries reduce the plaintiffs' awards to reflect their carelessness. Thus, adjusters may agree to settle claims by careless plaintiffs because they expect that a jury would award them some damages anyway.

If juries award larger verdicts to careless plaintiffs under contributory negligence or, more precisely, if litigators expect that juries would do so, then settlements should increase under that rule. However, verdicts and settlements might decrease. Juries might be more likely to find a plaintiff negligent under comparative negligence, because they would not need to avoid the harshness of the contributory negligence rule. Thus, a change to comparative negligence could have an uncertain effect upon verdicts, by increasing the probability of finding a plaintiff negligent, but also by increasing the amount of damages awarded if such negligence is found. In turn, the effect of comparative negligence on settlements would depend upon litigators' perceptions of how these two theories will affect jury verdicts.

RESEARCH ON LITIGANT BEHAVIOR

No past research has examined litigator behavior in sufficient detail to address either the general questions or the specific hypotheses considered above. Ross's work attempts to provide a description of the general settlement process, rather than a detailed analysis of settlements of individual cases. Similarly, analyses of closed-claims files (Danzon, 1980; Insurance Services Office, 1977) and studies using retrospective interviews with attorneys or parties (Civil Litigation Research Project, 1979) have not attempted to describe systematically the operating rules that determine settlements of civil liability claims.

It seems unlikely that existing methods used by Ross or other

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10 Ross provided descriptions of some of the simplified operating rules, but even these rules may have changed with important recent changes in the tort law. Thus, Ross's work may be too dated to be useful for examining current issues about legal policy.
researchers can provide data sufficiently detailed or objective to permit a systematic description of litigators' behaviors. Even the most complete closed-claim file or retrospective interview can provide only limited information about the legal, factual, and strategic issues that arise in different cases. The data would not include details needed to describe how claims adjusters and attorneys decide those cases or to examine how various legal doctrines combine to determine settlements. Also, the integrity of these types of data must be seriously questioned. Material in closed-claim files that is relevant to legal or other rules may be biased by the litigators' tendency to "build a file" to support the outcome that they feel is appropriate (Ross, 1970). Retrospective interviews also suffer from the bias of interviewees toward presenting material in the best light, as well as from memory losses and other biases. Further, neither closed-claim studies nor retrospective analyses of claims pursued can deal with the issue of access to representation. Both sources provide information only for actual claims. Finally, the great factual variation among claims and the complexity of legal issues that might pertain to any case limit the utility of standard statistical procedures for analyzing data about settlements.

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20 Retrospective interviews can examine plaintiffs' lawyers' reasons for not taking cases, but they can probably provide only limited information about characteristics of unrepresented cases.
III. RULE-BASED COMPUTER MODELING OF LITIGANTS’ DECISIONS

Rule-based computer modeling combines a method that can be used to extract thorough and detailed information about litigators’ settlement decisions with a means for systematically exploring and organizing that information. The rule-based model provides a sophisticated means for exploring these decisions and behaviors, formulating hypotheses about them, and testing those hypotheses quickly. In turn, the modeling results can be elaborated and tested through other research, some of which is described in Section V.

In this section we will first briefly consider uses of rule-based and other computer models to study legal processes. We will then describe in more detail features of rule-based models of settlement decisions, illustrating these features by a simple prototype rule-based model that we have developed.

COMPUTER MODELING OF LEGAL DECISIONS

The use of computer modeling techniques to study legal decision-making processes is not new. Some progress has been made in creating a language for expressing legal concepts (Stamper, 1976; Jones, et al., 1979), analyzing cases on the basis of legal doctrine (Meldman, 1977; Popp and Schlink, 1975), investigating the tax consequences of corporate transactions (McCarty, 1980; McCarty and Sridharan, 1980), automating the assembly of formal legal documents (Sprowl, 1979), and performing knowledge-based legal information retrieval (Hafner, 1980). However, rule-based modeling differs from this more conventional approach by developing a structure for both analyzing and explaining the reasoning processes of litigators.

Rule-based models have not been used to study legal decisions, but they have been used successfully to describe other complicated expert decision processes, such as those involved in the analyses of molecular structures (Buchanan, et al., 1976; Nii and Feigenbaum, 1978; Carhart, 1979), medical diagnoses (Weiss and Kulikowski, 1979; Pople, 1977; Shortliffe, 1976), mineral exploration (Duda, et al., 1979; Duda, et al., 1978), electrical circuit design (Sussman, 1977), and international terrorism (Waterman and Jenkins, 1979). These models have been used
to construct "expert systems," computer programs that embody expertise and knowledge supplied by human experts and that use artificial intelligence techniques to provide inferences for the people who will work with the information these expert systems produce (Feigenbaum, 1977).

In developing an expert system, researchers (typically computer scientists with some knowledge of the area of expertise) "pick the brains" of a small number of experts. To do this, they present an expert with a hypothetical case requiring a decision. The expert then indicates what decisions should be made and why. The researchers can systematically explore the decision process by varying facts presented to the expert and noting how changes in facts change both the decision and the chain of reasoning supporting that decision.

The researchers will usually describe the decision process revealed through this experimental approach in terms of a set of heuristics or "rules of thumb," each of which describes a portion of the decision process. If the heuristics are stated in the form of "if-then" rules, the result is a rule-based model of expertise.

The model is a collection of rules, each of which has the form: if <conditions> then <conclusions>. That is, if a given set of conditions exist, then the experts reach the following intermediate conclusions. The data or "facts" that match the "if" part (the premises) of a rule are often provided by the conclusion of one or more other rules. In this way, individual rules are chained together to describe the decision process. Complicated decisions such as those found in legal analyses can be represented by long or complex chains of rules.

Rule-based models of litigators' decisions would be generally similar to those developed for other applications, although new technical issues are raised by the adversarial quality of litigators' decisions and the nature of legal rules, i.e., their dependence upon normative judgments, real or hypothetical statements of the parties, past knowledge, and so on (see pp. 25-27).

A PROTOTYPE RULE-BASED MODEL

To explore the feasibility of modeling litigators' settlement decisions, we developed a simple prototype rule-based model that describes how litigators decide about the value of product-liability cases. In constructing the prototype, we were concerned principally with determining whether legal and other rules involved in settlements could be transformed into the precise and unambiguous syntax needed for a computer program of the model or whether features of legal rules (e.g.,
concepts of time, intent, or foreseeability) created particular transformational or programming problems.\textsuperscript{21} We also used the prototype to see how a full rule-based model might look and to develop initial means by which lawyers and claims adjusters could interact with the model.

Because we were concerned principally with the technical feasibility of the model, we did not conduct the substantial research that would be necessary to develop a full model of litigators' decisions about the value of cases. The rules included within the prototype model were primarily formalized statements of the California legal doctrine for product liability as stated in statutes, court opinions, and legal treatises. These doctrines present an appropriate test of our ability to formalize legal concepts as statements in a computer program. The prototype also included rules for calculating damages that were suggested by interviews with claims adjusters and plaintiffs' lawyers, by Commerce Clearing House and other professional guides to product-liability practice, and by closed product-liability insurance claims that we examined. Our development of the prototype permitted us to examine the feasibility of transforming some bases of settlements into a rule-based model but did not provide us with a complete or necessarily accurate representation of product-liability law and practice. The prototype also provides a simple example of the basic features of rule-based models of settlement decisions.

Each rule of the prototype model explicitly describes a relationship between some facts of a case, inferences (i.e., conclusions) from other rules, and the conclusion that litigators would reach, based on these premises. Legal principles, such as the theory of strict liability, practitioners' strategies, and bases for calculating damages, can all be thought of as ways of organizing facts and intermediate conclusions into rules. Within the prototype model, we have formalized only rules that describe legal principles and bases for calculating damages. We assume that other bases of litigators' decisions can also be organized into rules, but that effort was beyond the limited purposes of the prototype.

The rule defining the theory of strict liability is given in Fig. 2 to illustrate how the rules are formalized. Like all the rules in the model, it is in the form of "if-then" statements, with the premises joined by conjunctions or disjunctions of terms. The premises are a mixture of facts (e.g., the loss is a personal injury) and intermediate conclusions from other rules within the model (e.g., the incidental-sale defense is not applicable).

\textsuperscript{21} Our prototype legal decisionmaking system, LDS, is implemented in ROSIE (Waterman, et al., 1979), a rule-oriented language designed to facilitate the development of large expert systems using English-like syntax. For an example of a typical ROSIE rule, see Fig. 1. ROSIE is a direct descendant of RITA (Anderson and Gillogly, 1976; Waterman, 1976), and more distantly of MYCIN (Shortliffe, 1976).
The model reproduces practitioners' inference processes by chaining individual rules together. The conclusion of one rule or a number of rules produces intermediate conclusions that match the premises for other rules, thus producing the model's inference chains. For example, the model examines rules that determine whether the defendant was responsible for the use of the product (see Rule 1, Appendix A) and whether the incidental-sale defense is applicable (see Rule 2, Appendix A) to determine whether or not the premises of the rule defining strict liability are satisfied.

Just as other rules or chains of rules provide conclusions that match the premises for the rule defining strict liability, the conclusion of this rule, i.e., that the defendant is liable under the theory, will match the premises of other rules within the model, such as a rule that states the impact of the plaintiff's possible negligence upon the amount of the settlement (Rule 7, Appendix A).

In short, rules link together facts and conclusions, and the rules
themselves are linked together through chains that represent the inference process. The facts of each case determine the sequence of rules involved in the chain; as a result, the inference chain will differ among cases presenting different facts. For each case, the inference chain continues until it reaches a final conclusion about the likely worth of the case.

CASE ANALYSIS WITH THE PROTOTYPE RULE-BASED MODEL

The operation and use of the prototype rule-based model can be illustrated by the analysis of a hypothetical case. The case described below is similar to one in our sample of closed-case insurance claims. The description includes only a small part of the information that was considered by the model:

On the afternoon of August 2, 1978, the plaintiff, Mr. Samuel Willis, was cleaning a bathtub drain with a liquid cleaner in an apartment complex located in Flagstaff, Arizona, and owned and managed by Harvey Craton. During this process, the cleaner exploded out of the drain and onto the left arm and hand of the plaintiff, causing extensive injury in the form of burns and permanent scarring. The plaintiff was employed by Mr. Craton to effect minor repairs in the apartment and was doing so at the time of the accident. Medical expenses for the plaintiff were $6000. 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 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 the label did not give a satisfactory description of means to avoid chemical reactions. The plaintiff was not familiar with the product. The plaintiff did not know what had been placed in the drain before he used the cleaner and he did not flush out the drain before using the cleaner. The amount of the claim was $60,000.

The inference process performed by our model on the drain-cleaner case suggests that litigators would probably evaluate the worth of the
case at between $35,000 and $41,000. Figure 3 shows a portion of the inference chain involved in considering this case. The rules were not invoked in one sequential chain; rather, they form a decision tree in which several chains of rules come together as premises that lead to the use of a single rule.

Seven conditions were needed to reach a conclusion that the defendant was liable under strict liability (Rule 4). Although Fig. 3 shows only four of the conditions, all were satisfied. Some were satisfied by simple facts, e.g., the plaintiff was injured by the product, but most conditions required processing of other rules (or would require such processing in a fully developed model). For example, the strict liability rule (Rule 4) requires a premise that the defendant was responsible for the product’s use. This premise is satisfied by the conclusion of Rule 1. In turn, the conclusion of Rule 1 was reached because that rule’s two premises were satisfied, i.e., the product was used in a reasonable and proper manner and its use was foreseeable. A fully developed model would include rules that define “reasonable and proper” and “foreseeable” as used in this context. The derivation of rules to describe such imprecise terms would be among the more technically difficult tasks in developing a comprehensive rule-based model (see p. 26).

Other rules determine that the plaintiff was not negligent in his use of the product and calculate the special damages for the case. Together, these three separate chains of rules lead to the conclusion that the defendant is liable for the total amount of the plaintiff’s injuries.

As we indicated, the facts presented to the model determine the inference chain that will be applied to the case. If the facts in this example are changed to indicate that the plaintiff had a means for protecting himself from the danger but did not do so, the model then uses a different chain of rules (see Fig. 4). The model uses Rule 5 to conclude that a user of the product who is an adult, who knows its hazards, and who fails to use available precautions against those hazards failed to use due care in the use of the product. This conclusion then matches a premise in Rule 6, so that that rule now leads to the conclusion that the plaintiff was negligent in his use of the product.

Both conclusions—that the defendant is liable under a theory of strict liability (a conclusion resulting from the same chain of reasoning as in the first example) and that the plaintiff was negligent in his use of the product—become premises in a comparative negligence rule. Since the other five premises of this rule are satisfied, the rule determines that the defendant is responsible for only a portion of the plain-

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23 The figure does not trace the inference process all the way to the facts of the case; it omits some rules that lead to conclusions listed at the left margin, as well as other rules that provided premises for those shown in the figure.
Fig. 3—Representation of computer output for drain-cleaner case
Fig. 4—Representation of computer output for drain-cleaner case with changed facts
tiff's loss. Because of the limited objectives of the prototype model, we have not attempted to develop a rule that calculates the degrees of comparative liability of the plaintiff and of the defendant. Under an assumption that the plaintiff is responsible for 30 to 40 percent of his injury, the model determines that the case should settle for between $21,000 and $29,000.
IV. DEVELOPMENT OF COMPREHENSIVE RULE-BASED MODELS

Our development of a prototype model indicates that it is technically feasible to develop simple rule-based computer models that describe some bases of decisions made by litigators in civil liability claim settlements. Some elements of the decisions can be described in terms of "if-then" rules, using a limited number of terms that can be precisely described. These rules can be chained together by the model to provide a reasonable, simple description of settlement decisions. Our initial success with the prototype warrants further work to see whether a broader range of determinants of settlement decisions can be successfully described by more elaborate rule-based models.

In this section we describe how rule-based models of case worth could serve as a central focus of research on settlement practices. We describe the empirical research that would be needed to develop comprehensive models of litigators' evaluations and then consider a number of technical issues that would have to be addressed during the development of such comprehensive models.

RULE-BASED MODELS OF THE WORTH OF LIABILITY CLAIMS

As described in Section II, litigators must make a number of decisions in pressing or responding to a civil liability claim. These include decisions about the worth of a claim, whether to represent a claimant, the acceptable range for settlement, offers or demands, communications with other parties, and the use of legal procedures. Litigators' decisions about case worth seem central to their other decisions and actions; therefore, research to develop models of case worth should provide a convenient and appropriate initial step toward evaluation of this complex series of decisions and actions.

Focusing on this one type of decision would simplify the initial research and would, at the same time, provide information that is critical for understanding other aspects of the settlement process. Lawyers' and adjusters' decisions about case worth are closely related to other decisions such as whether to accept a plaintiff's case, what offers or demands the parties will make, and what settlements they will find
acceptable. Although these related decisions are interesting and important, research on them would best be deferred until models of case worth have been developed and studied.

By themselves, models of case worth would address many of the research questions raised in Section II. Work on developing the models would reveal how litigators consider legal doctrine in evaluating cases. It would examine the hypothesis that in evaluating cases, litigators avoid detailed consideration of legal issues and consider only whether liability is certain or uncertain. It would examine the alternative hypotheses that (1) decisions about worth are based on litigators’ perceptions of expected jury verdicts; (2) they are based on general patterns of settlements; and (3) they are guided, in part, by litigators’ abstract considerations of just or appropriate compensation. This research could also provide information on whether litigators’ decisions about case worth differ markedly among individuals; whether they differ among plaintiffs’ lawyers, defense lawyers, and claims adjusters; and whether they differ among jurisdictions.

In addition to being of central importance, decisions about case worth are most readily modeled. Rule-based models would be developed primarily through repeated interviews and experiments with a small number of lawyers and claims adjusters, who would decide the value of hypothetical cases and describe the bases for their decisions. We expect that litigators should be able to perform this research task readily, since they routinely evaluate the worth of civil claims, often on the basis of limited and even hypothetical information.24

In contrast, interviews based on hypothetical cases may not provide a sufficient method for examining negotiating and bargaining strategies, where a lawyer or adjuster must respond to and anticipate actions by an adversary. Strategic issues involving negotiations, decisions about offers and demands, or the use of alternative legal procedures might be examined more effectively through simulated gaming situations, where lawyers and adjusters play against each other or a programmed opponent. Such gaming research could build upon our proposed models of case worth. By knowing a litigator’s estimate of a case’s worth and the basis for that estimate, we could more effectively structure research questions about negotiations.

Initial models of case worth could be supplemented by later research that is based, in part, on the initial models. Rule-based models can be developed in an incremental fashion, because the results of subsequent research can be incorporated as additional rules in the

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24 Also, because the Socratic method of legal education relies heavily on varying hypothetical cases, this experimental approach seems particularly appropriate for analyzing the decisions of legal experts.
inference chains that drive the models. In Section V, we shall describe further research for elaborating initial models of case worth.

RESEARCH METHODS FOR DEVELOPING THE MODELS

As stated above, data needed to develop the initial models would be obtained through intensive interviews with plaintiffs' lawyers, defense lawyers, and claims adjusters. Each interview would center on a number of hypothetical cases. The litigator would consider one hypothetical case at a time and indicate his decision about its worth. The interviewer would then ask the expert to explain why he decided on that value, probing to discover as much as possible about the decision. The interviewer would attempt to reformulate the expert's explanations into "if-then" rules of the type used in the model. The expert would then review the reformulations to verify that they accurately describe the basis for his decision and to obtain modifications of the rules.

As computer programs incorporating the models are developed, they would be used in the interviews. The interviewer would present the computer analysis of particular cases and determine whether the expert agrees with the model's conclusions and reasoning chains. In light of the experience of others who have developed rule-based models, we expect that this procedure will produce considerable refinement of the model.

The nature of the models will be determined by the litigators upon whose expertise they are based. Models derived from interviews with highly experienced and expert litigators will describe sophisticated settlement practice. Thus, in addition to providing research information, such models would be useful as teaching devices or as "expert systems" that less-skilled litigators could draw upon for advice. Issues of variations in the quality of legal services could be studied by comparison of sophisticated models derived from expert litigators with models derived from litigators who are not specialists in the studied legal area.

Rule-based models can also be used to explore the similarity of decisions among litigators. We would expect to find systematic differences between plaintiffs' lawyers and defense lawyers or claims adjusters and between professionals practicing in different jurisdictions.

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25 The modeling research will not attempt to produce statistical analyses providing probability statements about litigators' decisions or behavior in handling liability claims. Rather, it is a procedure that should permit us to explore those decisions and develop models that can be tested in other research.
However, we also expect to find common bases among litigators in evaluating the worth of cases. The great frequency of communications among lawyers and adjusters, their use of common professional guides, and the high rate of settlement all suggest that there are common approaches among litigators in how they evaluate cases. Common models could be developed if many of the same rules could be used to describe decisions, at least for litigators representing the same side in the same jurisdiction.

On the other hand, if the research should show marked differences in decisions made by particular types of litigants, the method could be used to develop individual models of their decisions. Further work with the individual models could then attempt to account for these differences and could examine negotiations by using gaming techniques.

TECHNICAL ISSUES IN DEVELOPING THE MODELS

Although rule-based modeling has been used to describe expert decisions in other areas, several technical problems must be addressed in developing a large rule-based system dealing with legal settlements.

A model of settlement decisions should be complete enough to make useful predictions yet small enough to be a manageable computer program. Our experience with representing product-liability law and associated legal practices in rule form suggests that a model for a narrow domain of inquiry (e.g., automobile accidents that raise issues of product liability) might require up to several thousand rules. A model of this size presents special problems not encountered in the development of a smaller prototype, centering mostly on efficient access to rules and data. It would be premature to propose a solution to this difficult problem at this time, but a possible approach might be to use data structures with explicit links to the rules for fast access, and to partition the data and rules to minimize the need for large, time-consuming searches.

The model should also incorporate a facility for explaining why a conclusion was reached, preferably by graphically displaying the inference chain. Our prototype model provided such explanations (see Appendix B) but did not provide an accompanying graphic display. A sophisticated explanation facility would be useful both during model development and during interviews, when it could show experts why the model reached a given conclusion.

The model should also include a facility for explaining why an expected conclusion was not reached. To determine why an expected answer was not obtained, the system must search for a way to obtain that answer, hypothesizing facts or intermediate conclusions that could
be used to arrive at it. The search should produce a list of facts or conditions that need to be true for the model to obtain the desired answer. This explanation facility would provide additional insights into the operation of the model.

The model should work toward reducing imprecise terms that occur in legal doctrines and other rules describing litigants' decisions. Interpretations of imprecise terms could be derived inferentially from instances of the terms used in past situations. The hypothetical cases used in the expert interviews will provide many instances in which the expert must decide, for example, if a jury is likely to find a particular act to be reasonable, undertaken with ordinary care, and so forth.

The model can use several methods to interpret imprecise terms. First, it can provide rules that describe how an imprecise term was used previously in particular contexts. Second, it can display brief descriptions of instances of prior use of the imprecise term and let the user decide whether or not the term applies in the current instance. Third, the model can ask a series of questions to elicit information about the specific case in which the imprecise term is at issue, compare the answers with prior cases in which the term applied, and provide a numeric rating that indicates the certainty that the rule defining the term applies presently. Fourth, the model might use a system of "gradual refinement" by query to determine whether or not a term applies. To do this it would ask a series of increasingly specific questions. Each of these might have imprecise terms that would be further refined by even more specific query lists.

Finally, since settlements are affected by litigators' uncertainties about proving factual issues and applicable legal doctrine, the models must incorporate methods for dealing with these uncertainties. Our prototype model has no provision for such uncertainty; rather, it uses a binary approach in which facts are classified as present or absent.

Discussions about the preferred approach to this issue will necessarily await further work, since the model's treatment of uncertainty should represent how practitioners actually deal with uncertainties. Lawyers and adjusters may treat uncertainties as additional premises within operating rules used to reach decisions. Presumably, this could be incorporated within the overall approach of the model. Alternatively, practitioners might consider a case independently of matters of uncertainty, reach a tentative conclusion, and then adjust that conclusion by some probabilistic factor that represents their overall uncertainty about the case. This would suggest that uncertainties should not be incorporated as premises within each rule but should be treated as a separate rule that is applied after other rules have been considered. A third approach to this issue might be the use of certainty factors (Shortliffe, 1976). Here, numbers representing the expert's confidence
in the accuracy of the data and rules might be incorporated into the model to provide a more accurate reflection of his decision processes.
V. TESTS AND USES OF THE MODELS

Once the models of case worth are developed, they must be validated by testing their performance on well-understood problems. Then they can be used to study interesting and complex issues such as the use of multiparty strategies in negotiations and the effect of changes in legal rules on litigators' decisions.

VALIDATION OF THE MODELS

Like all models, rule-based models tend to oversimplify. The research method of presenting hypothetical cases to litigators may be ineffective for studying some matters that influence litigators' decisions, such as how actively a client participates (Rosenthal, 1974) and how lawyers' and adjusters' decisions are affected by their own characteristics, i.e., their experience, ability, and economic motivation.

Experiments or survey questionnaires based on the models could examine the models' generality and more thoroughly examine differences in decisionmaking among litigators. For example, hypothetical cases could be presented to groups of practitioners not involved in the models' development. The practitioners would be asked to decide the value of these cases and describe the bases for their decisions. The models' outcomes and inference processes could then be compared with those of the test group to examine whether the models are representative of decisions made by the relevant group of practitioners (e.g., plaintiffs' lawyers in the jurisdiction covered by the model), how the model might be unrepresentative, and what types of practitioners might reach conclusions significantly different from those of the model.

The models might also be tested by comparing the processes described in them with patterns of actual settlements as revealed in analyses of other data. For example, models of the worth of product-liability cases could be tested through analysis of data from the Insurance Services Office (ISO) survey of closed product-liability cases. The ISO survey is based on detailed information from 23 property insurance companies about all product-liability claims closed between July 1, 1976, and March 15, 1977 (Insurance Services Office, 1977). The file contains detailed information on the type and extent of bodily injuries, medical expenses, lost wages, and other direct economic costs for 24,452 claims.
The ISO data do not provide simple criteria for determining whether models of case worth are valid. Nor do they include information about some matters that are likely to be relevant to litigators' decisions (e.g., characteristics of the parties, information about defenses). Also, as a closed-claim study, the ISO data present problems of biased reporting, and the ISO sampling plan oversamples recent cases that were settled quickly. Moreover, the ISO data provide information about actual settlements, while models would describe decisions made by each side.

Nevertheless, analyses of the ISO data can provide independent tests of some hypotheses derived from the rule-based models. Particularly, if both plaintiffs' lawyers and claims adjusters regard a certain issue as having the same impact on case value, then analyses of the ISO data should reveal that the issue has a predicted impact on settlements. Some issues influencing litigators' decisions might be present in every case (e.g., larger settlements for claimants who suffer greater losses in future income); for these we would predict statistical main effects across all cases. Other issues would operate differently for particular cases (e.g., negligence by the injured party might be less important in a case where that party was killed); for these we would predict statistical interactions or effects for only selected cases.

A "LABORATORY" FOR STUDYING CIVIL LITIGATION

Models of case worth can be used in further research to examine the complicated set of behaviors that occur in resolving claims and to explore how those behaviors are affected by changes in legal rules, procedures, and litigators' strategies. The models could be used as a first step in a "laboratory" that examines other decisions made by litigators, negotiations, the effects of negotiations on litigators' decisions, and the effects of changes in legal doctrines on decisions and behavior.

Other decisions made by litigators can be studied, in part, through further interviews with experts who participated in developing the models of case worth. These interviews would ask only limited questions about the worth of the cases, primarily to confirm existing models. Most questions would examine decisions about acceptable settlements, decisions about offers/demands, and the relationship among these decisions and decisions about case worth. The interviews might then be used to develop models of these other decisions.
RESEARCH ON NEGOTIATIONS THROUGH GAMING

The use of rule-based models in gaming research provides a powerful means for conducting controlled research on negotiations, for organizing the complex information involved, and for testing hypotheses. In the gaming situation, plaintiffs' lawyers and claims adjusters not only make decisions about a hypothetical case, they also negotiate with an adversary. The adversary can be either another litigator participating in the research or a computer program.

Models of litigators' decisions about case worth, possibly supplemented by models of acceptable range and of initial offer/demand, would provide an excellent basis for gaming research. Rule-based models could be used to describe each litigator's position at the beginning of negotiations, informing researchers of the important decisions made by each litigator and the bases for those decisions. Negotiations would then alternate between the two parties. Each party would provide current decisions about case worth, the acceptable range, and their next step, based on their own prior actions and those of the adversary. The parties would have opportunities for making offers or demands and otherwise communicating with each other. A party's involvement in legal procedures or its research on legal or factual issues could be simulated as events involving costs but possibly producing useful information. The litigators would be asked to discuss their actions and strategies and the actions of their adversaries, indicating why the actions were taken, what was expected as a result, how they interpreted the adversary's actions, and so on.

Gaming research can extend the rule-based model in two ways. First, it can provide a basis for developing rules to describe the broader range of decisions and behaviors that occur during negotiations. Second, actions by the adversary could be added as premises in the rules describing litigators' decisions. By comparing the rule-based models at successive points, we could see how a litigator's own actions and those of his adversary affect his decisions. The gaming method also provides an opportunity for testing models as they are being developed. Models could be used to predict a party's next action, and the resulting prediction could then be compared with the action actually taken by the party.

THE EFFECTS OF CHANGES IN THE LAW

Rule-based models can be used to examine how litigators' decisions and behaviors might be affected by changes in legal doctrine or proce-

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26 Because of these advantages, Rand is currently using rule-based models in research on international negotiations and defense strategies.
dures. The effects of legal changes are difficult to predict, particularly since the effects of any single change often depend upon other legal rules and strategies operating within the settlement process. For example, the expansion of liability in products cases that would result from adoption of a comparative negligence rule depends upon whether the jurisdiction applies the doctrine to strict liability cases. To appreciate the significance of a change in doctrine, it is necessary to consider the influence of legal rules, strategies, and characteristics of the legal system on the magnitude and direction of the change. Because these determinants of settlements are complex and numerous, a computer model provides a unique and powerful basis for analyzing potential changes.

To examine the effects of legal changes, we would begin by modifying one or more rules within the model. Changing one rule may change the entire inference process for many cases. As an example drawn from our prototype model, we could change the legal rule defining strict liability (Fig. 2), adding a requirement that the defendant will be strictly liable only if, in addition to the other conditions, the product was unreasonably dangerous when sold. Figure 5 shows how the inference process changes for the case used previously as an illustration.

Throughout our earlier discussion, the drain-cleaner case included the fact that the product was not unreasonably dangerous, a fact not previously used in any rule. Because we have now added to the rule defining strict liability (Rule 4) the premise requiring that a product be unreasonably dangerous, the presence of this fact now prevents the application of that rule. Further, since the defendant is no longer strictly liable, the inference chain no longer includes Rule 7 (the comparative negligence rule) or Rule 18, which determines a likely settlement amount for the case. Instead, Rules 10 and 20 were applied to obtain the result that the defendant was not liable. The calculation regarding the value of the loss was unchanged, although no settlement is made under the revised definition of strict liability. Of course this example, based on the formal law, is obvious. But it illustrates how changes in one rule can affect the chain of reasoning that a litigator uses to value a case.

Modifications to the model, by themselves, can represent only simple changes in the inference process, i.e., how settlements should change if part of the inference process changed and lawyers or claims adjusters did not adapt by modifying other parts of that process. However, we know that decisions about settlements are the result of complex behaviors. By changing one part of the decision process, we are

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27 Rule 20 is not included in Appendix A.
Fig. 5—Representation of computer output for drain-cleaner case with change in the definition of strict liability
likely to produce secondary changes in other parts of that process. For example, when a legal doctrine is changed, lawyers and claims adjusters may adapt their strategies, their interpretations of the law, or other practices to produce consequent changes in settlements that were not intended by the court or legislature that imposed the change.

The model can contribute to comprehensive research exploring these secondary changes. First, formal changes in the model can suggest hypotheses about where secondary changes in the inference process are likely to occur. Secondary change occurs because lawyers and claims adjusters do not accept the simple change that would occur from modifying a legal doctrine or a strategy. They make further changes in their decisions to ameliorate or take advantage of what was intended to be a simple change. By showing what the simple changes in the inference process would be, the model can suggest areas of tension where secondary changes are likely to occur.

Second, the model provides a tool for empirically examining secondary changes in the inference process. We can present hypothetical cases that include relevant changes in the law. Hypotheses about primary and secondary changes in the decision process can then be compared with lawyers' and adjusters' decisions for these cases. We can consider how a given change affected the experts' decisions about the worth of cases, their decisions to accept a case, decisions about acceptable settlements, offers, demands, and other negotiation strategies. We can also use these tests to explore the decisions resulting from unexpected secondary changes. By comparing the simple changes in the inference process suggested by the model with actual changes in lawyers' and claims adjusters' decisions we may gain some understanding of the more subtle ramifications of changing legal rules.

Third, we can use the rule-based model to represent a theory of secondary change in decision processes. Rules can be developed within the model to make secondary changes that reflect our understanding of how lawyers and claims adjusters adapt to new strategies or changes in legal rules. The rules we develop will then permit us to test and refine our theories of secondary change.

Research on the effects of changes in the law would be facilitated if models were developed in two jurisdictions. Changes could be studied by comparing decisions made by experts in each jurisdiction under different legal doctrines. Within each jurisdiction, experts would consider cases using laws that apply in their jurisdiction and the same set of cases using the law of the other jurisdiction. Using this strategy, we could study differences in decisions among jurisdictions and compare these differences with changes in decisions that experts indicate they would make if they were working with a different legal doctrine. The comparison of models across jurisdictions draws upon the experts' actu-
al knowledge derived from working with their own legal doctrine. By looking at the changes in practices for each expert, we can avoid having to analyze the competing explanations for differences in practices between jurisdictions.
VI. CONCLUSIONS

The U.S. system of civil justice operates primarily through the private decisions and actions of litigators—lawyers and, to an important extent, insurance company claims adjusters. Rule-based computer models offer a promising method for developing both a theoretical understanding of these settlement decisions and the empirical data needed to test those theories.

Rule-based modeling has several advantages for studying litigators' decisions. First, the model's use of rules captures the actual basis of those decisions. Legal decisions, including those involved in litigating claims, are based primarily on sets of rules. Most legal doctrine is stated as a set of rules that can be translated into the "if-then" statements of a rule-based model. Lawyers and claims adjusters typically use rules to describe their decisions, e.g., "if medical expenses are 'padded,' then pain and suffering should not be three times the medical expenses"; or "if the plaintiff is unattractive, then settle for a lower value." Because practitioners actually use rules in deciding about settlements, a model based on rules can describe those decisions. The common use of rules would also assure that lawyers and claims adjusters could understand and contribute to the model development.

Second, the modeling method can provide data about the litigators' decision processes through experimental variation of the hypothetical facts presented to them. Researchers who have developed rule-based models in other areas of expertise have found this experimental approach appealing to the experts whose decisions are modeled. In our preliminary interviews, we found that lawyers and adjusters will readily provide estimates of worth for hypothetical cases and that they regard making estimates for hypothetical cases a routine part of their work. Of course, the model derived through this experimental approach will be hypothetical, but its validity can be tested by comparing its results with decisions made by lawyers and claims adjusters in actual cases (see Section V).

Third, a rule-based model provides a particularly appropriate means for organizing the great number of factors that might influence litigators' decisions. Again, the analytic structure of rule-based modeling captures the structure of litigators' actual decisions. Those decisions are not made by applying the same fixed set of rules to all cases; rather, lawyers and claims adjusters draw from a large set of rules and apply only some of those rules in resolving any particular claim. Rule-based models are dynamic. Thus, the rules that are used to describe the
decision for a particular case are determined by the facts presented by the case. These rules will vary from case to case as the facts of the cases vary.

Fourth, the models provide a methodology for studying negotiating strategies and the effects of negotiations and legal procedures on the decisions of individual litigators (see Section V). By explicitly describing the decisions and strategies of a party going into a multiparty negotiation, we can refine rules that describe that party's strategies and add rules that describe his reactions to his opponents' strategies.

Fifth, rule-based models provide a convenient means to organize and study the effects of different legal rules and procedures on the settlement decisions made by litigators. The models can be used not only to identify changes in settlement practices that are likely to occur, but also to indicate why these changes are likely.
Appendix A

A REPRESENTATIVE SET OF RULES
FROM THE PROTOTYPE SYSTEM

The following rules are representative of the rules in the prototype legal decisionmaking system. These rules are more English-like than those illustrated in an earlier version of the system (see Appendix B).

[RULE1: RESPONSIBILITY FOR USE OF PRODUCT]
IF the use of (the product) at the time of the plaintiff’s loss
   is foreseeable
   and (that use is reasonable-and-proper
   or that use is an emergency
   or (there is a description by the defendant of that use
       and that description is improper)
   or there is not a description by the defendant of that use)
THEN assert the defendant is responsible for the use of the product.

[RULE2: INCIDENTAL SALE DEFENSE]
IF (manufacturing is the defendant’s business
   and the defense1 of the defendant is applicable)
   or (sales is the defendant’s business
       and the defense2 of the defendant is applicable)
   or (leasing is the defendant’s business
       and the defense3 of the defendant is applicable)
THEN assert the incidental-sale defense is applicable.

[RULE3: INCIDENTAL SALE DEFENSE]
IF (manufacturing is the defendant’s business
   and the defense1 of the defendant is not applicable)
   or (sales is the defendant’s business
       and the defense2 of the defendant is not applicable)
   or (leasing is the defendant’s business
       and the defense3 of the defendant is not applicable)
THEN assert the incidental-sale defense is not applicable.

1 Defense 1 is applicable if the defendant manufactured only a component part of the defective product and if the part manufactured by the defendant had nothing to do with the product being defective. Defense 2 is applicable if the defendant did not manufacture the defective product but was an occasional seller of that product and was not engaged in selling that product as part of his business. Defense 3 is applicable if the defendant did not manufacture or sell the defective product but was a casual lessor or renter of that product and was not engaged in leasing or renting as part of his business.
[RULE3.1: DEFINITION OF LOSS]
IF the type of the plaintiff's loss is 'injury'
THEN assert the plaintiff is injured by the product.

[RULE3.2: DEFINITION OF LOSS]
IF the type of the plaintiff's loss is 'decedent'
THEN assert the plaintiff does represent the decedent
and the decedent is killed by the product.

[RULE3.3: DEFINITION OF LOSS]
IF the type of the plaintiff's loss is 'property-damage'
THEN assert the plaintiff's property is damaged by the product.

[RULE4: STRICT LIABILITY DEFINITION]
IF (the plaintiff is injured by the product
    or (the plaintiff does represent the decedent
        and the decedent is killed by the product)
    or the plaintiff's property is damaged by the product)
    and the incidental-sale defense is not applicable
    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 defendant is responsible for the use of the product
    and (California is the jurisdiction of the case
        or the user of the product is the victim
        or the purchaser of the product is the victim)
    and the product is defective at the time of the sale
    and (the product is unchanged from the manufacture to the sale
        or (the defendant's expectation is 'the product is unchanged
            from the manufacture to the sale'
                and the defendant's expectation is reasonable-and-proper))
THEN assert the theory of strict-liability does apply
to the plaintiff's loss.

[RULE5: ORDINARY CARE DEFINITION]
IF the victim is an adult who does know the proper use of the product
and (the victim does know 'the product is defective'
    and the victim does continue the use of the product)
or ((the victim does know 'the product is dangerous'
    or the victim does know 'the product is defective')
    and (the victim is careless in the use of the product
        or the victim is inattentive in the use of the product))
or (the victim is improper in the use of the product
and ((there is a warning by the manufacturer
    and that warning does describe the improper use of the product)
or (there is a warning by the seller
    and that warning does describe the improper use of the product)))
or (the victim does know 'the victim is sensitive to the product'
and the victim does continue the use of the product)
or the victim does use poor-practices in the use of the product
or (there is a means for protection from the hazard of the product
and the victim does not use that means)
THEN assert the use of (the product) by the victim does not involve
ordinary-care.

[RULE5.1: LACK OF ORDINARY CARE]
IF the use of (the product) by the user does not involve ordinary-care
THEN create a lack of ordinary-care by the user.

[RULE5.2: LACK OF ORDINARY CARE]
IF there is a lack of ordinary-care by the user
THEN assert the danger does [not] cause that lack.

[RULE6: NEGLIGENCE DEFINITION]
IF (the product's user is not working in some area of some possible
danger
and the use of (the product) by the user
does not involve ordinary-care)
or (the product's user is working in some area
of some possible danger (d)
and the use of (the product) by the user
does not involve ordinary-care
and the danger (d) does not cause the lack of ordinary-care
by the user)
or the victim does accept 'the product is dangerous'
THEN assert the use of (the product) by the user is negligent.

[RULE7: COMPARATIVE NEGLIGENCE-PARTIAL LIABILITY]
IF the theory of strict-liability does apply to the plaintiff's loss
and the product's user is the victim
and (California* is the jurisdiction of the case
or Arizona* is the jurisdiction of the case)
and the victim does know 'the product is dangerous'
and the victim does appreciate 'the product is dangerous'
and the use of (the product) by the user is negligent
and the user of the product does contribute to the plaintiff's loss
THEN assert the defendant is liable for the plaintiff's loss
and the liability of the defendant is partial
and 1 — the maximum proportion of the responsibility
for the plaintiff's loss
is the minimum proportion of the defendant's liability
and 1 — the minimum proportion of the responsibility
for the plaintiff's loss
is the maximum proportion of the defendant's liability.

*The identification of states is arbitrary.
[RULE8: COMPARATIVE NEGLIGENCE-TOTAL LIABILITY]

IF the theory of strict-liability does apply to the plaintiff's loss and (the use of (the product) by the user is not negligent or the product's user is not the victim)
THEN assert the defendant is liable for the plaintiff's loss and the liability of the defendant is total.

[RULE9: CONTRIBUTORY NEGLIGENCE]

IF the theory of strict-liability does apply to the plaintiff’s loss and the product's user is the victim and (Colorado* is the jurisdiction of the case or Delaware* is the jurisdiction of the case) and the use of (the product) by the user is negligent and the user of the product does contribute to the plaintiff’s loss and the maximum proportion of the responsibility for the plaintiff’s loss is greater than 0
THEN assert the defendant is not liable for the plaintiff’s loss and the theory of contributory-negligence does apply to the plaintiff’s loss.

[RULE10: NO LIABILITY]

IF the theory of strict-liability does not apply to the plaintiff’s loss
THEN assert the defendant is not liable for the plaintiff’s loss and display 10.

[RULE11: EXIT]
quit.
end law.

*The identification of states is arbitrary.
Appendix B
TRACE OF A USER INTERACTION
WITH THE原型 SYSTEM

The following is a trace of a user interacting with an earlier version of our prototype legal decisionmaking system. The user input is italicized to distinguish it from the models' response. The rules in this version are not as English-like as those in our most recent version (see Appendix A). The most recent version does not yet have an explanation facility, so the earlier version of ROSIE is shown here.

@rosie

This program demonstrates the use of a rule-based model for studying legal decisionmaking processes. It consists of a set of rules for processing product-liability cases. We have already entered some information about an actual case. Important aspects of the case are summarized below.

The program will process the case and present its conclusions. Then, by answering a series of program questions, you will be able to change certain key aspects of the case and rerun the model to see the effect of the changes.

On the afternoon of August 2, 1978, the plaintiff, Mr. Samuel Willis, was cleaning a bathtub drain with a liquid cleaner in an apartment complex located in Flagstaff, Arizona, and owned and managed by Harvey Craton. During this process, the cleaner exploded out of the drain and onto the left arm and hand of the plaintiff, causing extensive injury in the form of burns and permanent scarring. The plaintiff was employed by Mr. Craton to effect minor repairs in the apartment and was doing so at the time of the accident. Medical expenses for the plaintiff were $6,000. 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 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 the label did not give a satisfactory description of means to avoid chemical reactions. The plaintiff was not familiar with the product. The plaintiff did not know what had been placed in the drain before he used the cleaner and he did not flush out the drain before using the cleaner. The amount of the claim was $60,000.

The case is now being analyzed.

The defendant is liable under the theory of strict liability. The plaintiff is not responsible for his loss. The amount of defendant liability is between $35,000 and $41,000, which represents the value of the case.
You may now process the case again, changing a few of the key pieces of data describing the case. Or instead, you may examine the rules that led to the decisions just reached.

Would you like to process the case again?  

Would you like an explanation of the model's current decision-making process?  yes

What would you like explained?

a) defendant's liability  
b) product user's negligence  
c) victim's liability  
d) what rule led to a given deduction?  
e) why the rule was applicable?  
f) nothing  

? a

THE LIABILITY OF THE DEFENDANT WAS CALCULATED BECAUSE:

A: At cycle #394 RULE4 fired.  
The rule is:

[ STRICT LIABILITY DEFINITION ]
IF LIABILITY OF DEFENDANT IS NOT KNOWN
AND ( TYPE OF LOSS OF PLAINTIFF IS INJURY
OR TYPE OF LOSS OF PLAINTIFF IS PROPERTY-DAMAGE
OR TYPE OF LOSS OF PLAINTIFF IS DECEDEHNT )
AND PRODUCT OF DEFENDANT IS CAUSE OF LOSS OF PLAINTIFF
AND INCIDENTAL-SALE-DEFENSE OF DEFENDANT IS NOT-APPLICABLE
AND RESPONSIBILITY OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS DEFENDANT'S
AND ( JURISDICTION OF CASE IS CALIFORNIA
OR JURISDICTION OF CASE IS COLORADO
OR USER OF PRODUCT OF DEFENDANT IS NAME OF VICTIM
OR PURCHASER OF PRODUCT OF DEFENDANT IS NAME OF VICTIM )
AND STATUS-WHEN-SOLD OF PRODUCT OF DEFENDANT IS DEFECTIVE
AND ( SECONDARY-PROCESSING OF PRODUCT OF DEFENDANT IS NONEXISTENT
OR ( SECONDARY-PROCESSING-EXPECTATION OF DEFENDANT IS NO-REMOVAL-OF-DEFECTS
AND VALIDITY OF SECONDARY-PROCESSING-EXPECTATION OF DEFENDANT IS REASONABLE-AND-PROPER ) )
THEN SET LIABILITY OF DEFENDANT TO STRICT-LIABILITY ;
THIS RULE FIRED BECAUSE:

B.1: The LIABILITY of DEFENDANT was not known
B.2: The LOSS of PLAINPIFF was BURNS-AND-PERMANENT-SCARRING
B.3: The TYPE of BURNS-AND-PERMANENT-SCARRING was INJURY
B.4: The PRODUCT of DEFENDANT was DRAIN-CLEANER
B.5: The CAUSE of BURNS-AND-PERMANENT-SCARRING was
   DRAIN-CLEANER
B.6: The INCIDENTAL-SALE-DEFENSE of DEFENDANT was
   NOT-APPLICABLE
B.7: The ACTUAL-USE of DRAIN-CLEANER was CLEANING-DRAIN
B.8: The RESPONSIBILITY of CLEANING-DRAIN was DEFENDANT'S
B.9: The JURISDICTION of CASE was ARIZONA
B.10: The USER of DRAIN-CLEANER was SAMUEL-WILLIS
B.11: The NAME of VICTIM was SAMUEL-WILLIS
B.12: The STATUS-WHEN-SOLD of DRAIN-CLEANER was DEFECTIVE
B.13: The SECONDARY-PROCESSING of DRAIN-CLEANER was
   NONEXISTENT

What would you like explained?

  a) defendant's liability
  b) product user's negligence
  c) victim's liability
  d) what rule led to a given deduction?
  e) why the rule was applicable?
  f) nothing

? e

Why .8?

C: At cycle #291 RULE1 fired.
The rule is:
[ RESPONSIBILITY FOR USE OF PRODUCT ]
IF RESPONSIBILITY OF ACTUAL-USE OF PRODUCT OF DEFENDANT
   IS NOT KNOWN
AND ( NATURE OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS
   FORESEEABLE
AND ( ACT OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS
   REASONABLE-AND-PROPER
OR CIRCUMSTANCE OF ACTUAL-USE OF PRODUCT OF DEFENDANT
   IS FORESEEABLE-EMERGENCY
OR NATURE OF DESCRIPTION OF INTENDED-USE OF PRODUCT OF
   DEFENDANT IS IMPROPER
OR AUTHOR OF DESCRIPTION OF INTENDED-USE OF PRODUCT OF
   DEFENDANT IS NOT NAME OF DEFENDANT )
THEN SET RESPONSIBILITY OF ACTUAL-USE OF PRODUCT OF
   DEFENDANT TO DEFENDANT'S ;
THE RULE FIRED BECAUSE:

D.1: The PRODUCT of DEFENDANT was DRAIN-CLEANER
D.2: The ACTUAL-USE of DRAIN-CLEANER was CLEANING-DRAIN
D.3: The RESPONSIBILITY of CLEANING-DRAIN was not known
D.4: The NATURE of CLEANING-DRAIN was FORESEEABLE
D.5: The ACT of CLEANING-DRAIN was REASONABLE-AND-PROPER

What would you like explained?

a) defendant's liability
b) product user's negligence
c) victim's liability
d) what rule led to a given deduction?
e) why the rule was applicable?
f) nothing

? d

What set the degree of liability of defendant?

THE DEGREE OF LIABILITY OF DEFENDANT WAS SET BECAUSE:

I: At cycle #450 RULE8 fired.
The rule is:

[ COMPARATIVE NEGLIGENCE - TOTAL LIABILITY ]
IF LIABILITY OF DEFENDANT IS STRICT-LIABILITY
AND DEGREE OF LIABILITY OF DEFENDANT IS NOT KNOWN
AND ( METHOD OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS
NOT NEGLIGENT
OR USER OF PRODUCT OF DEFENDANT IS NOT NAME OF VICTIM )
THEN SET DEGREE OF LIABILITY OF DEFENDANT TO
TOTAL-LIABILITY ;

THE RULE FIRED BECAUSE:

J.1: The LIABILITY of DEFENDANT was STRICT-LIABILITY
J.2: The DEGREE of STRICT-LIABILITY was not known
J.3: The PRODUCT of DEFENDANT was DRAIN-CLEANER
J.4: The ACTUAL-USE of DRAIN-CLEANER was CLEANING-DRAIN
J.5: The METHOD of CLEANING-DRAIN was not known

What would you like explained?

a) defendant's liability
b) product user's negligence
c) victim's liability
d) what rule led to a given deduction?
e) why the rule was applicable?
f) nothing
Would you like to process the case again? yes

Please answer the following questions concerning the case. Respond with the letter that matches your answer. If you need help type a question-mark, if you don't know the answer just type a carriage-return.

What is the jurisdiction of the case?
   a) Arizona
   b) California
   c) Colorado
   d) Delaware

Was the victim either the user or purchaser of the product?
   a) Yes
   b) No

What was the status of the product when it was sold by the defendant?
   a) Defective
   b) Non-defective

Was the product modified after manufacture by parties other than the defendant?
   a) Yes
   b) No

Was the nature of the use of the product foreseeable?
   a) Yes
   b) No

What is the legal status of the victim?
   a) Adult
   b) Minor

Did the victim know the product was defective before he used it?
   a) Yes
   b) No
Did the victim continue using the product, even after he found it defective?
   a) Yes
   b) No

Did the victim have a means for protecting himself from the dangers of using the product?
   a) Yes
   b) No

Did the victim use this means to protect himself?
   a) Yes
   b) No

Did the victim know and appreciate the danger involved in the use of the product?
   a) Yes
   b) No

What were the medical expenses of the plaintiff?
   $6,000

The case is now being analyzed.

The defendant is liable under the theory of strict liability. The plaintiff is partially responsible for his loss under the theory of comparative negligence. The total amount of the loss is between $35,000 and $41,000. The amount of defendant liability is between $21,000 and $29,000.

Would you like to process the case again? no

Would you like an explanation of the model's current decision-making process? yes

What would you like explained?
   a) defendant's liability
   b) product user's negligence
   c) victim's liability
   d) what rule led to a given deduction?
   e) why the rule was applicable?
   f) nothing
THE LIABILITY OF THE DEFENDANT WAS CALCULATED BECAUSE:

K: At cycle #3482 RULE4 fired.
The rule is:

[ STRICT LIABILITY DEFINITION ]
IF LIABILITY OF DEFENDANT IS NOT KNOWN
AND ( TYPE OF LOSS OF PLAINTIFF IS INJURY
OR TYPE OF LOSS OF PLAINTIFF IS PROPERTY-DAMAGE
OR TYPE OF LOSS OF PLAINTIFF IS DECEASED )
AND PRODUCT OF DEFENDANT IS CAUSE OF LOSS OF PLAINTIFF
AND INCIDENTAL-SALE-DEFENSE OF DEFENDANT IS
NOT-APPLICABLE
AND RESPONSIBILITY OF ACTUAL-USE OF PRODUCT OF
DEFENDANT IS DEFENDANT'S
AND ( JURISDICTION OF CASE IS CALIFORNIA
OR JURISDICTION OF CASE IS COLORADO
OR USER OF PRODUCT OF DEFENDANT IS NAME OF VICTIM
OR PURCHASER OF PRODUCT OF DEFENDANT IS NAME OF VICTIM )
AND STATUS-WHEN-SOLD OF PRODUCT OF DEFENDANT IS
DEFECTIVE
AND ( SECONDARY-PROCESSING OF PRODUCT OF DEFENDANT IS
NONEXISTENT
OR ( SECONDARY-PROCESSING-EXPECTATION OF DEFENDANT IS
NO-REMOVAL-OF-DEFECTS
AND VALIDITY OF SECONDARY-PROCESSING-EXPECTATION OF
DEFENDANT IS
REASONABLE-AND-PROPER ) )
THEN SET LIABILITY OF DEFENDANT TO STRICT-LIABILITY ;

THIS RULE FIRED BECAUSE:

L.1: The LIABILITY of DEFENDANT was not known
L.2: The LOSS of PLAINTIFF was BURNS-AND-PERMANENT-SCARRING
L.3: The TYPE of BURNS-AND-PERMANENT-SCARRING was INJURY
L.4: The PRODUCT of DEFENDANT was DRAIN-CLEANER
L.5: The CAUSE of BURNS-AND-PERMANENT-SCARRING was
DRAIN-CLEANER
L.6: The INCIDENTAL-SALE-DEFENSE of DEFENDANT was
NOT-APPLICABLE
L.7: The ACTUAL-USE of DRAIN-CLEANER was CLEANING-DRAIN
L.8: The RESPONSIBILITY of CLEANING-DRAIN was DEFENDANT'S
L.9: The JURISDICTION of CASE was ARIZONA
L.10: The USER of DRAIN-CLEANER was SAMUEL-WILLIS
L.11: The NAME of VICTIM was SAMUEL-WILLIS
L.12: The STATUS-WHEN-SOLD of DRAIN-CLEANER was DEFECTIVE
L.13: The SECONDARY-PROCESSING of DRAIN-CLEANER was
NONEXISTENT
What would you like explained?

a) defendant's liability  
b) product user's negligence  
c) victim's liability  
d) what rule led to a given deduction?  
e) why the rule was applicable?  
f) nothing

? e

Why L.6?
M: At cycle #3430 RULE3 fired.  
The rule is:

[ INCIDENTAL SALE DEFENSE ]
IF INCIDENTAL-SALE-DEFENSE OF DEFENDANT IS NOT KNOWN  
AND ( ( TYPE OF BUSINESS OF DEFENDANT IS MANUFACTURING  
AND PRODUCT OF DEFENDANT IS OUTPUT OF BUSINESS OF  
DEFENDANT  
AND DEFENSE1 OF DEFENDANT IS NOT-APPLICABLE )  
OR ( TYPE OF BUSINESS OF DEFENDANT IS SALES  
AND PRODUCT OF DEFENDANT IS MERCHANDISE OF BUSINESS OF  
DEFENDANT  
AND DEFENSE2 OF DEFENDANT IS NOT-APPLICABLE )  
OR ( TYPE OF BUSINESS OF DEFENDANT IS LEASING  
AND PRODUCT OF DEFENDANT IS MERCHANDISE OF BUSINESS OF  
DEFENDANT  
AND DEFENSE3 OF DEFENDANT IS NOT-APPLICABLE )  
)  
THEN SET INCIDENTAL-SALE-DEFENSE OF DEFENDANT TO  
NOT-APPLICABLE ;

THE RULE FIRED BECAUSE:
N.1: The INCIDENTAL-SALE-DEFENSE of DEFENDANT was not known  
N.2: The BUSINESS of DEFENDANT was  
DRAIN-CLEANER-MANUFACTURING  
N.3: The TYPE of DRAIN-CLEANER-MANUFACTURING was  
MANUFACTURING  
N.4: The PRODUCT of DEFENDANT was DRAIN-CLEANER  
N.5: The OUTPUT of DRAIN-CLEANER-MANUFACTURING was  
DRAIN-CLEANER  
N.6: The DEFENSE1 of DEFENDANT was NOT-APPLICABLE

What would you like explained?

a) defendant's liability  
b) product user's negligence  
c) victim's liability  
d) what rule led to a given deduction?
e) why the rule was applicable?
f) nothing

? b

THE METHOD OF ACTUAL USE OF THE PRODUCT WAS CALCULATED BECAUSE:

O: At cycle #3589 RULE6 fired.
The rule is:

[ NEGLIGENCE DEFINITION ]
IF METHOD OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS NOT KNOWN
AND ( ( STATE OF LOCALE OF USER OF PRODUCT OF DEFENDANT IS NOT DANGEROUS
AND CAREFULNESS OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS NOT-ORDINARY-CARE )
OR ( STATE OF LOCALE OF USER OF PRODUCT OF DEFENDANT IS POSSIBLY-DANGEROUS
AND STYLE OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS CARELESS
AND CAUSE OF STYLE OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS STATE OF LOCALE OF USER OF PRODUCT OF DEFENDANT )
OR ( PRODUCT IS DANGEROUS IS IN ACCEPTANCE OF VICTIM )
THEN SET METHOD OF ACTUAL-USE OF PRODUCT OF DEFENDANT TO NEGLIGENT ;

THIS RULE FIRED BECAUSE:

P.1: The PRODUCT of DEFENDANT was DRAIN-CLEANER
P.2: The ACTUAL-USE of DRAIN-CLEANER was CLEANING-DRAIN
P.3: The METHOD of CLEANING-DRAIN was not known
P.4: The USER of DRAIN-CLEANER was SAMUEL-WILLIS
P.5: The LOCALE of SAMUEL-WILLIS was BATHTUB
P.6: The STATE of BATHTUB was SAFE
P.7: The CAREFULNESS of CLEANING-DRAIN was NOT-ORDINARY-CARE

What would you like explained?

a) defendant's liability
b) product user's negligence
c) victim's liability
d) what rule led to a given deduction?
e) why the rule was applicable?
f) nothing

? e

Why P.7?
Q: At cycle #3535 RULES fired.
The rule is:

[ ORDINARY CARE DEFINITION ]
IF CAREFULNESS OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS NOT KNOWN
AND ( LEGAL-STATUS OF VICTIM IS INFORMED-MINOR
  OR LEGAL-STATUS OF VICTIM IS ADULT )
AND (( PRODUCT-IS-DEFECTIVE IS IN KNOWLEDGE OF VICTIM
  AND STATUS OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS CONTINUED-USE )
  OR ( PRODUCT-IS-HAZARDOUS-OR-DEFECTIVE IS IN KNOWLEDGE OF VICTIM
  AND ( ATTENTIVENESS OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS INATTENTIVE
  OR STYLE OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS CARELESS ) )
  OR ( ACT OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS IMPROPER
  AND ( ( AUTHOR OF WARNING OF DANGERS OF IMPROPER-USE OF PRODUCT OF DEFENDANT IS MANUFACTURER OF PRODUCT OF DEFENDANT )
  OR ( AUTHOR OF WARNING OF DANGERS OF IMPROPER-USE OF PRODUCT OF DEFENDANT IS SELLER OF PRODUCT OF DEFENDANT ) )))
  OR ( SENSITIVE-TO-PRODUCT IS IN KNOWLEDGE OF VICTIM
  AND STATUS OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS CONTINUED-USE )
  OR ( MEANS OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS POOR-PRACTICES )
  OR ( THERE IS PROTECTION OF DANGERS OF ACTUAL-USE OF PRODUCT OF DEFENDANT
  AND STATUS OF PROTECTION OF DANGERS OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS UNUSED-BY-VICTIM ) )
THEN SET CAREFULNESS OF ACTUAL-USE OF PRODUCT OF DEFENDANT TO NOT-ORDINARY-CARE .

THE RULE FIRED BECAUSE:

R.1: The PRODUCT of DEFENDANT was DRAIN-CLEANER
R.2: The ACTUAL-USE of DRAIN-CLEANER was CLEANING-DRAIN
R.3: The CAREFULNESS of CLEANING-DRAIN was not known
R.4: The LEGAL-STATUS of VICTIM was ADULT
R.5: The KNOWLEDGE of VICTIM was (PRODUCT-IS-DANGEROUS PRODUCT-IS-DANGEROUS)
R.6: The MEANS of CLEANING-DRAIN was GOOD-PRACTICES
R.7: The DANGERS of CLEANING-DRAIN was EXPLODES-IN-WATER
R.8: The PROTECTION of EXPLODES-IN-WATER was COVER-DRAIN
R.9: The STATUS of COVER-DRAIN was UNUSED-BY-VICTIM

What would you like explained?

a) defendant's liability
b) product user's negligence
c) victim's liability
d) what rule led to a given deduction?
e) why the rule was applicable?
f) nothing

THE THEORY OF NEGLIGENCE WAS CALCULATED BECAUSE:

S: At cycle #3644 RULE7 fired.
The rule is:
[ COMPARATIVE NEGLIGENCE - PARTIAL LIABILITY ]
IF LIABILITY OF DEFENDANT IS STRICT-LIABILITY
AND DEGREE OF LIABILITY OF DEFENDANT IS NOT KNOWN
AND USER OF PRODUCT OF DEFENDANT IS NAME OF VICTIM
AND ( JURISDICTION OF CASE IS CALIFORNIA
OR JURISDICTION OF CASE IS ARIZONA )
AND PRODUCT-IS-DANGEROUS IS IN KNOWLEDGE OF VICTIM
AND PRODUCT-IS-DANGEROUS IS IN APPRECIATION OF VICTIM
AND METHOD OF ACTUAL-USE OF PRODUCT OF DEFENDANT IS
NEGLIGENT
AND CAUSE OF CONTRIBUTING-FACTORS OF LOSS OF PLAINTIFF IS
NAME OF VICTIM
THEN SET DEGREE OF LIABILITY OF DEFENDANT TO
PARTIAL-LIABILITY
AND SET MINIMUM-PROPORTION OF DEGREE OF LIABILITY OF
DEFENDANT TO 1 .
MAXIMUM-PROPORTIONATE-VICTIM-RESPONSIBILITY OF LOSS OF
PLAINTIFF
AND SET MAXIMUM-PROPORTION OF DEGREE OF LIABILITY OF
DEFENDANT TO 1 .
MINIMUM-PROPORTIONATE-VICTIM-RESPONSIBILITY OF LOSS OF
PLAINTIFF
AND SET THEORY OF NEGLIGENCE TO
COMPARATIVE-NEGligence ;

THIS RULE FIRED BECAUSE:

T.1: The LIABILITY of DEFENDANT was STRICT-LIABILITY
T.2: The DEGREE of STRICT-LIABILITY was not known
T.3: The PRODUCT of DEFENDANT was DRAIN-CLEANER
T.4: The USER of DRAIN-CLEANER was SAMUEL-WILLIS
T.5: The NAME of VICTIM was SAMUEL-WILLIS
T.6: The JURISDICTION of CASE was ARIZONA
T.7: The KNOWLEDGE of VICTIM was (PRODUCT-IS-DANGEROUS PRODUCT-IS-DANGEROUS)
T.8: The APPRECIATION of VICTIM was (PRODUCT-IS-DANGEROUS PRODUCT-IS-DANGEROUS)
T.9: The ACTUAL-USE of DRAIN-CLEANER was CLEANING-DRAIN
T.10: The METHOD of CLEANING-DRAIN was NEGLIGENT
T.11: The LOSS of PLAINTIFF was
   BURNS-AND-PERMANENT-SCARRING
T.12: The CONTRIBUTING-FACTORS of
   BURNS-AND-PERMANENT-SCARRING was
NO-USE-OF-DRAIN-LID
T.13: The CAUSE of NO-USE-OF-DRAIN-LID was SAMUEL-WILLIS

What would you like explained?

a) defendant's liability
b) product user's negligence
c) victim's liability
d) what rule led to a given deduction?
e) why the rule was applicable?
f) nothing

? f

Would you like to process the case again? no

Would you like an explanation of the model's current decision-making process? no

Finished
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Judicial Arbitration in California
The First Year
D. Hensler, A. Lipson, and E. Rolph
1981

A special bibliography (SB 1064) provides a list of other Rand publications in the civil justice area. To request the bibliography or to obtain more information about The Institute for Civil Justice, please write the Institute at this address: The Institute for Civil Justice, The Rand Corporation, 1700 Main Street, Santa Monica, California 90406, (213) 393-0411.