CASE-BASED REASONING AND THE DEEP STRUCTURE APPROACH TO KNOWLEDGE REPRESENTATION

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I. INTRODUCTION

Knowledge representation has been identified as the most important issue facing the field of AI and Law.[1] The nature of legal reasoning and decision making, in particular the way judges decide hard cases, have been important jurisprudential issues for many years. It is inescapable that a legal expert system which attempts to emulate the reasoning processes of a lawyer must embody a theory of legal reasoning.[2] Building a legal expert system is thus not just an exercise in computer programming, but requires solid and articulated jurisprudential foundations.

Case-based reasoning ("CBR") has much to offer for the construction of legal expert systems, particularly in case-based law. This paper will discuss how CBR legal expert systems are superior to purely rule-based systems.[3] It will be shown that an important advantage of CBR systems is that they are a more realistic portrayal of the reasoning processes of a lawyer. The issues of knowledge representation and legal reasoning therefore become paramount.

This paper will demonstrate that the deep structure approach to knowledge representation (together with its underlying assumptions about the nature of legal reasoning) and a relatively inexpensive commercially available shell can be used to build a CBR legal expert system in case-based law which:

(a) dynamically draws its conclusions from the case law in its database without the benefit of specific legal rules;
(b) adapts to most changes in the law simply by entering new cases in its database;
(c) adjusts its outcomes depending on the 'home' jurisdiction (country, state or province) selected by the user;
(d) overcomes the difficulties of representing legal knowledge at the doctrinal level; and
(e) operates at a high level of legal expertise.

The Malicious Prosecution Consultant[4] ("MPC") was built as an example of such a system. It is a frame-based CBR legal expert system operating in the domain of the tort of malicious prosecution. The shell used was Intelligence Compiler.[5] The MPC has a Database of 144 cases compiled with dBASE IV.[6] The text of the cases is stored in Intelligence Compiler's hypertext facility, enabling the user to view the brief or, in many cases, the full text of any case used by the MPC in its reasoning processes.[7] The MPC contains no specific legal rules about the tort of malicious prosecution. All of its legal conclusions and outcomes are dynamically directed by the case law in its Database at the time of the consultation.

II. THE DEEP STRUCTURE APPROACH TO KNOWLEDGE REPRESENTATION

The deep structure approach to knowledge representation was developed by Professor J.C. Smith and Cal Deedman during previous case-based legal expert system research at The University of British Columbia, Faculty of Law.[8] The following is only a brief explanation of their theories, but full details may be found in the references.

Legal principles are often expressed in contradictory pairs e.g. a lease versus a mere licence. This is a function of the adversarial system of justice whereby lawyers act not as impartial seekers of the truth but as 'hired guns' for their clients.[9] The practice of law is a highly ritualized contest regulated by rules and procedures centuries old. The importance of the contest cannot be over-emphasized. Every practising lawyer has experienced being on different sides of the fence at

different times. In one case a lawyer may act for the developer of a condominium project seeking planning approval and in another the lawyer may act for a group of local residents objecting to the development, and so on. This pattern repeats itself throughout legal practice. The language of the law, or law at the doctrinal level, is therefore necessarily 'elastic'.[10] This is a function not only of legal discourse between opposing lawyers but of judicial decision making. A judge decides a hard case by preferring one lawyer's formulation of the language of the law over another. Thus the apparently contradictory language of the law becomes embedded in legal decisions, thereby contributing to the criticism of law as fundamentally indeterminate. In many legal domains it is therefore a mistake to attempt to represent legal knowledge in the surface level language of the law. Legal expert systems which operate at the doctrinal level e.g. by asking questions like "Was there reasonable and probable cause for the prosecution?", are of little practical value to lawyers because they require the user to draw a legal conclusion. Alternative means of analyzing law and representing knowledge are required.

One such methodology is to search for deep structures or *fact* patterns underlying legal doctrine which account for and explain the decisions in the cases. Once these patterns have been identified a broadly stated meta-rule or principle may be formulated which explains the general direction of the case law in the domain independently of the "surface discourse" of law at the doctrinal level.[11] This theory postulates that judges and lawyers use deep structure fact patterns to decide cases and analyze problems. Whether they use the deep structure approach at a subconscious level, having unconsciously internalized it in the same way that a young child learns to speak her native tongue without knowing formal rules of grammar, or in the more overt goal-oriented manner described above where solving a client's problem or arriving at a correct legal decision are the primary concerns, is open to discussion. However, the fact remains that the deep structure approach successfully explains and accounts for legal decisions in areas of case-based law generally considered to be unstructured and indeterminate.[12]

The deep structure approach, by going beneath doctrinal law to the facts of cases, allows law to be analyzed and represented in 'concrete' terms which a computer is capable of processing. Facts become the unifying links between case law, the knowledge base of an expert system, database schemata (or case profiles) and the user's fact situation. Thus legal expert systems may be built which avoid the difficulties inherent in representing law at the doctrinal level. Facts may of course still be open to manipulation by lawyers skilled in the rules of evidence and the persuasion of juries. However, there is less room for 'manoeuvring' than with law at the doctrinal level. In other words, it is harder for a lawyer to argue that a will does not contravene the rule against perpetuities than to argue against the proposition that the testator signed the will in question.

III. CBR DESCRIBED

This paper is not an attempt to conclusively define CBR in legal expert systems but a description of a particular CBR system in case-based law embodying features which the author considers to be significant. Due to constraints of space, neither is this paper a review or comparison of previous work on CBR legal expert systems.[13] It is submitted that there are two important aspects to CBR legal expert systems.

First, the conclusions or outcomes of the expert system should be dynamically controlled by the cases so that simply entering new cases may change the outcome of the system and account for most changes to law.

Second, the cases should be ranked or ordered in a manner which allows some cases to be preferred over others in a way meaningful to lawyers. The most obvious method is the doctrine of *stare decisis* so that cases are ranked in accordance with their precedential value. The crux of this aspect of CBR is that some order should be imposed over cases retrieved from the database.

IV. THE CBR PROCESSES OF THE MPC

A. From Rules to CBR

Building the MPC was an evolutionary process. The MPC began as a purely rule-based system, although it was always planned to produce a CBR system. The rule-based stage was important because rules are, after all, in one sense or another the fundamental units of knowledge representation in law. When progressing from a rule-based to a CBR system, the highly specific legal rules are deleted

from the knowledgebase, but the more general rules on which the structure of the domain is founded are retained. In the MPC, these general rules govern the elements required to make out a cause of action and the ordering of questions asked of the user. The CBR rules which control case retrieval and display are then added. The CBR processes of the MPC were thus a natural progression from the rule-based version MPC and map onto the original rule-based structure.

Discarding specific legal rules in order to build a CBR system does not amount to removing the expertise from the expert system. The primary contribution of any expert to an expert system is the general structure within which problems may be solved. This structure is inevitably founded on a rule-based model of the domain, whether or not the rules are explicitly stated. Therefore, when specific legal rules are removed for CBR processes, it might be said that their 'ghosts' linger. Although their presence no longer has any direct effect on the outcome, which is now driven by the cases, their influence remains to 'haunt' the system.

B. The Structure of the Database and Case Representation Frames

The MPC's Database is a collection of 'profiles' of cases. A profile contains the formal descriptive details of a case and its factual attributes in terms of the deep structure analysis. In keeping with the deep structure approach, any reference to doctrinal law is avoided.

A case profile also contains eight "RES" (for result) slots. Each RES slot corresponds and maps onto one or more of the terminal node frames of the MPC. The RES slots form the heart of the CBR process. Their purpose is to represent the court's finding on a particular factual attribute. They may have a value of "passed" or "failed", depending upon the court's finding on the factual attribute associated with the RES slot in terms of satisfying the elements of a malicious prosecution action. They replace the specific legal rules of a rule-based system. Say, in a hypothetical criminal case, that a stay of proceedings was entered by the prosecutor. In a rule-based system, the knowledge engineer would draft a rule based on the case law specifying the effect of the entering of a stay. In the MPC, a factual attribute slot would be instantiated with the value "a stay was entered" and its corresponding RES slot would be instantiated with a value of passed or failed, depending upon the court's finding on the effect of entering a stay in terms of the element of termination of proceedings.

In practice, courts may often not explicitly state whether a factual attribute of a Plaintiff's case satisfies the requirements of a cause of action. By contrast, courts will almost always state when a factual attribute does not satisfy certain requirements. Therefore, a finding that a factual attribute satisfies certain requirements, if not explicitly stated, may be readily inferred in most circumstances from the absence of a contrary finding. If there is any doubt, the knowledge engineer may only assign a factual attribute to a slot and not assign any value to the corresponding RES slot. The factual attribute slot will still be used for factual pattern matching, but the absence of a value in its corresponding RES slot means the factual attribute will be excluded from the process of arriving at a legal conclusion. Uncertainty about factual interpretation may be similarly handled by creating a separate frame/record for each possible factual interpretation. Thus judicial and factual uncertainty in case-based law may be represented by this method.

D. Using Case Law to Direct the MPC's Conclusions (or Stage (a) of the CBR Process)

During a consultation, when a question at a terminal node level is asked of the user the Database is searched for:

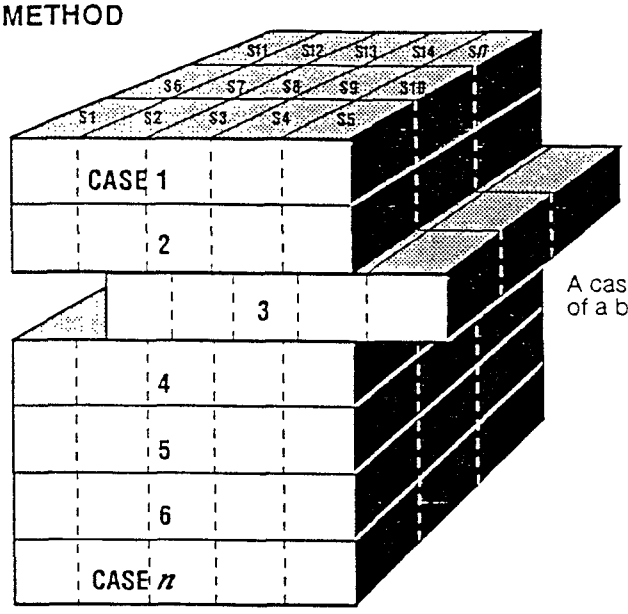
(a) all cases, irrespective of outcome, which contain the factual attribute suggested by the user's answer; and
(b) the value of the corresponding RES slot.

This process is called the "Vertical Search Method", which is shown in Figure 1,[14] and which may be illustrated by the following example.

Let us assume the user's answer to the question about the issue of malice is "The Defendant's primary interest in prosecuting the Plaintiff was to secure a financial or property advantage". The Database is searched for all records (cases) where the MALICE slot contains this answer. As each case is retrieved, the value of RES slot associated with the MALICE slot is noted. Depending on the value of the RES slot, the case name is stored in either

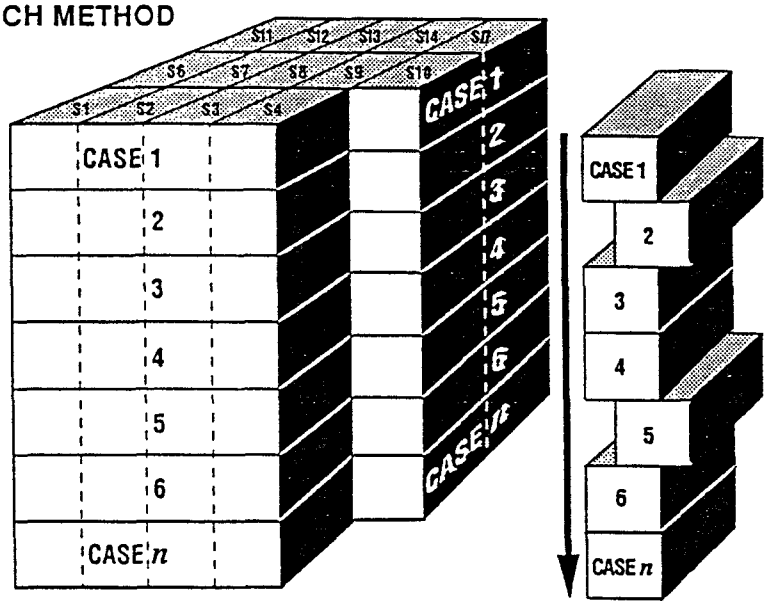
Figure 1

THE HORIZONTAL SEARCH METHOD



A case as a "slice" of a body of case law

THE VERTICAL SEARCH METHOD



Sample vertical search on slot 5 where cases 2 and 5 satisfy the search condition

CASE DATABASE (represented by cuboid)
S1 . . . *n* are the slots of case record frames
Cases 1 . . . *n* are cases in the database

the "MALICE passed list" or the "MALICE failed list". If, after all relevant cases have been retrieved, the MALICE failed list is empty, the consultation proceeds to the next stage. If the MALICE passed list is empty and the MALICE failed list contains cases, the consultation stops, the user is informed that no cause of action is available and reasons and supporting authority (the cases in the MALICE failed list) are displayed. If there are cases in both the passed and failed lists, the MPC recognizes the situation as one where conflicting authorities exist. The MPC refers the user to the conflicting authorities, explains the essence of the conflict and suggests which line of authority should be preferred. The MPC's choice of a preferred line of authority is based on an evaluation and ranking of the relative precedential value of the cases in each line. This process will be described shortly. If the MPC prefers the Defendant's line the consultation stops. If the Plaintiff's line is preferred the consultation proceeds to the next stage. This process occurs at each terminal node of the consultation. The various lists of passed and failed cases are retained for review at the end of the consultation.

E. The Weighing and Ranking of Cases (or Stage (b) of the CBR Process)

There are two aspects to this process.

The first aspect is the tallying of fact matches. At the end of a consultation the MPC compares the User Profile frame, which contains the user's answers from the consultation, to its Database. The total number of fact matches between each case in the Database and the User Profile frame is calculated so the cases closest to the user's fact situation, those with the greatest number of matching factual attributes, may be displayed. This is called the "Horizontal Search Method", whereby a case is treated as a 'slice' of a body of case law (see Figure 1). The cases may then be displayed in descending order of number of fact matches in two categories:

(a) where the court held for the Plaintiff; and
(b) where the court held for the Defendant.

This gives the user a preliminary indication of how authorities are 'stacked'.

The second aspect is the calculation of the relative precedential weight of cases.

Each case in the Database is assigned a point score, with a numeric range of 15 to 75 points. Point scores represent the relative precedential weights of cases. The system of calculating point scores and an example follow:[15]

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**************************
Calculating the point scores (weight)
            of cases

      Maximum of 75 points

Highest level court
(e.g. S.C. of Canada)    70
Appeal level court       50
Trial level court        30

Add 10 points for trial or appeal
level cases local to the selected
jurisdiction.

Deduct 15 points for cases outside
the selected jurisdiction, except
where the foreign jurisdiction is
England, then deduct 10 points.

Add points for recently decided cases
(assuming current year is 1990):
1990 + 5 points, 1989 + 4, 1988 + 3,
1987 + 2, 1986 + 1

      An example of calculating the
      weight of a case

Selected jurisdiction: British
Columbia

Case: Roy v Prior [1971] A.C. 470 (H.
of L.)
Highest level court              70
LESS for foreign
jurisdiction                     10
                                 --
            TOTAL WEIGHT         60
                                 --
           **************************
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The cases in the MPC's Database are ranked in accordance with this system from the greatest number of points (most authoritative) to the least number of points (least authoritative). Thus cases are always retrieved and displayed to the user in terms of this ranking. The system is not intended to be a comprehensive assessment of the precedential

value of each case, for this would be the province of another substantial expert system. It is a simple method of ranking cases based primarily on the level and jurisdiction of the court so a lawyer may readily identify the cases from the highest courts.[16] Practically speaking, this would be a lawyer's primary concern.

The assigning of weights to cases enables the MPC resolve a conflict of authorities by preferring one line of authority over another. The decision as to which line should be preferred is made by the following process:

(a) Find the case with the greatest number of points in each line of authority. Prefer the line which contains the case with the greatest number of points. If the two cases are of equal weight,
(b) compare the total weight of each line of authority. Prefer the line of authority with the higher total weight. If the lines are of equal weight,
(c) declare the authorities to be of equal force.

Again, this process is simple but effective. It represents a reality of legal practice that a lawyer would rather go into court with one case on point from the highest court in the land rather than a number of cases from lower courts.

As the explanation of the points system suggests, the MPC allows the user to select the jurisdiction for a consultation and it accordingly adjusts the weights of the cases in its Database.[17] Thus, given a suitable domain, this methodology allows a multi-jurisdictional system to be built where changing jurisdictions does not involve reprogramming of the knowledgebase by the knowledge engineer.

V. EVALUATING THE CBR METHODOLOGIES OF THE MPC

Compared to rule-based systems, CBR systems offer significant advantages. Complex networks of specific legal rules may be eliminated, thereby significantly reducing the amount of programming required.

Another advantage of CBR legal expert systems lies in the amount of maintenance required compared to a purely rule-based system. In a purely rule-based system, reflecting changes to the law in the knowledgebase may involve substantial reprogramming. A change to one node of the logic flowchart may require consequential changes to many other areas of the system. A purely rule-based system is thus a very brittle entity. By contrast, many changes to the law may be represented in a CBR system simply by adding new cases to its Database.

However, only those changes to the law which fall within the existing structure of the MPC's knowledgebase may be accounted for simply by entering new cases in its databases. More radical changes to the law, which require alteration of knowledge representation structures, would require more effort to implement. Say, a court decides that damages in malicious prosecution are no longer limited to the three recognized types (personal, property and reputation),[18] but any damage may form the basis of an action. To account for this change, the damages frames of the framebase, the Database schema and the questions to be asked of the user would have to be revised. Fortunately, common law tends to change and progress gradually on a case-by-case basis, so radical changes requiring substantial modifications occur infrequently.

An example of a gradual change which appears to be happening to the law of malicious prosecution concerns the traditional refusal of courts to allow malicious prosecution actions for civil proceedings other than bankruptcy or winding up proceedings.[19] This refusal is based on antiquated notions of the public perception of civil proceedings and the effect of civil proceedings on a person's reputation, and a commercially unrealistic view of legal costs in civil proceedings.[20] Some recent cases appear to have sidestepped the old rule and allowed malicious prosecution actions for civil proceedings other than the exceptions noted above.[21] The MPC's framebase has a frame for the type of proceedings issued and a slot value of that frame may be civil proceedings. Thus this change to the law may be accounted for simply by entering the new case into the MPC's Database. It should now be apparent that, when designing a CBR system, the knowledge engineer should bear in mind trends and possible changes to the law in the domain. It is not suggested that the knowledge engineer must have a crystal ball, but it is submitted that a legal domain expert should be aware of the general direction in which the law in the domain is heading. Thus, by comparison to a purely rule-based systems, a CBR system should probably have a wider conceptual

structure in order to accommodate changes to the law.

The process of weighing cases, ranking them and, where necessary, presenting them in terms of conflicting lines of authorities is a more meaningful method of knowledge representation for practicing lawyers than methods used in other legal expert systems, such as confidence factors. It is more consistent with the practice of law for a lawyer to present two sets of cases and state that the law derived from the cases is either *X* or *Y*, but probably *X*, rather than to state that there is a 75% possibility that the law is *X*, without referring to the possibility that it is *Y*. The problem with presenting legal conclusions with confidence factors is that the alternative(s), those with lesser confidence factors, are usually not displayed. Where uncertainty exists the expert system should present the lawyer with the alternative(s) and suggest the preferred alternative but allow the lawyer to make the final decision. To withhold alternative(s) from the lawyer may be misleading. The lawyer may, of course, take the alternative preferred by the expert system into the decision-making equation.

The Horizontal and Vertical Search Methods complement and supplement each other. The Horizontal method retrieves cases containing a collection of factual attributes, or slices of case law, which are similar to the user's overall fact situation. The cases are presented according to whether the Plaintiff or Defendant was successful. The Vertical Search Method retrieves all cases containing the factual attribute suggested by the user's answer, regardless of any other factual attributes which the cases may contain or the overall result of the case. These two methods of case retrieval offer the user a broad and deep model of legal research and reasoning.

VI. THE DEEP STRUCTURE OF THE TORT OF MALICIOUS PROSECUTION

Traditionally, there are five elements to a malicious prosecution action, all of which must be proven:

(1) Initiation of proceedings;
(2) Termination of the proceedings in the Plaintiff's favour, where the proceedings are capable of a favourable termination;
(3) Lack of reasonable and probable cause;
(4) Malice; and
(5) Damages.

The deep structure of malicious prosecution was developed in terms of these five elements. It happened to be the case in malicious prosecution that it was not necessary to look beyond these five elements for alternative structures because the case law may be accounted for in terms of analysis of the five elements. In other legal domains, traditional doctrinal classifications may be inappropriate to the building of a legal expert system and other structures may have to be implemented.

Elements (1), (2) and (3) are largely technical and procedural by nature and are not discussed in this paper. The lack of reasonable and probable cause and malice Elements are the most difficult and often closely related. They contain the true deep structure of the tort of malicious prosecution

A. Lack of Reasonable and Probable Cause

This is the most difficult element to prove in malicious prosecution because, aside from the difficult task of proving a negative, it is imprecise and abstract in its formulation. The use of the words 'reasonable' and 'probable' is a redundancy and merely a relic from old styles of pleadings.[22] Judicial definitions have not shed much light on the meaning of these words:

> "...an honest belief in the guilt of the accused based upon a full conviction, founded on reasonable grounds, of the existence of a state of circumstances which, assuming them to be true, would reasonably lead any ordinary prudent and cautious man, placed in the position of the accuser, to the conclusion that the person charged was probably guilty of the crime imputed."[23]

Authors have commented on the difficulties associated with analyzing reasonable and probable cause. Street states "it is impossible to enumerate all the factors which may be relevant",[24] and Fleming writes "we lack precise and universal criteria by which to measure the degree of caution and prudence that a reasonable person should observe in the evaluation of infinitely variable incriminating data."[25]

The deep structure or underlying fact pattern operating in this element concerns the acquisition of information about the prosecution. It

is about the manner in which the prosecutor and other parties involved in the prosecution informed themselves of the circumstances of the case against the Plaintiff and the manner in which the prosecution was conducted. Of particular importance is whether the Defendant sought legal advice and, if so, how the advice was obtained and acted upon. In general terms, if there was a thorough investigation of the circumstances of the case against the Plaintiff and the prosecution was properly conducted, it may be assumed there was reasonable and probable cause for the prosecution.

The MPC asks the following questions to establish whether there was lack of reasonable and probable cause:

```
Did the Defendant, before or
during the proceedings:

1. Receive advice about the
   proceedings?
2. Fabricate evidence?
3. Conceal, ignore or wilfully
   disregard relevant evidence?
   eg. An explanation by the
   Plaintiff.
4. Act carelessly in the
   investigation or conduct of the
   proceedings brought against the
   Plaintiff?
5. None of the above.

PLEASE NOTE: Question 3 does not
imply that the Defendant is
required to actively seek an
explanation from the Plaintiff or
to verify apparently accurate
information.
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Please select one of the following
statements concerning the advice
received by the Defendant.

1. The Defendant, before or during
   the proceedings, withheld or
   concealed relevant information
   from the advisor.
2. The advisor was not experienced
   or qualified to advise on the
   proceedings.
3. It should have been obvious to
   the Defendant that the advice
   of the advisor was incorrect.
4. The Defendant did not follow
   the advice.
5. None of the above.
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Analyzing the element of lack of reasonable and probable cause in terms of the factual attributes elicited by these questions accounts for the vast majority of malicious prosecution case law.

B. Malice

In malicious prosecution, the term malice has a wider meaning than the traditional meaning of spite or vindictiveness. A motive or purpose in bringing a prosecution other than a desire to further the course of justice, impartially enforce the law or similar constitutes malice. The element of malice is thus really an inquiry into the motive or purpose of the Defendant in prosecuting the Plaintiff. The deep structure approach to analyzing malice involves a consideration and enumeration of the factual scenarios which constitute proper and improper motives.

The MPC asks the following question about malice:

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By what sort of interest was the
Defendant primarily motivated in
bringing proceedings against the
Plaintiff?

1. Financial or property.
2. Personal satisfaction other
   than 4.
3. Strategic considerations.
4. A desire to enforce the law
   merely for the sake of doing
   so or to pave the way for
   further legal proceedings,
   and not for any of the
   ulterior motives listed in
   1. to 3.
5. Motive unknown.
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As with the element of lack of reasonable and probable cause, the factual attributes elicited by this question may be used to analyze and account for the vast majority of the case law.

The Malice Element may be satisfied by proving a dominant improper motive of the Plaintiff in prosecuting. However, a problem arises if the Plaintiff's motive is not identifiable. In this situation, malice may be inferred by showing that the circumstances of the case are such that the prosecution can only be explained by attributing a malicious motive to the Plaintiff.[26] Courts inevitably tend to use evidence about the lack of reasonable and probable cause for the prosecution in this regard.[27] It should, therefore, be possible to analyze this process of inference by a deep structure. It is planned to identify the cases where malice was inferred in this manner and then examine the courts' findings about lack of reasonable and probable cause in terms of the deep structure explained earlier. It is hoped to identify a pattern where malice is inferred from certain deep structure factual scenarios about lack of reasonable and probable cause. This would allow the MPC to be modified to deal with the situation when the motive of the Defendant is not known and to infer from the user's answers about reasonable and probable cause whether malice exists.

C. The Deep Structure Conclusions

The deep structure and policies embedded in the tort of malicious prosecution which protect prosecutors and the legal system may thus be expressed by the following meta rule:

> *If there are reasonable grounds for invoking the process of law then motive is irrelevant.*

The heart of the tort of malicious prosecution is, therefore, malice in that unsuccessful prosecutions remain unpunished, unless they are instituted maliciously. This allows people relative freedom and impunity to use the legal system, provided they do so for proper purposes.

VII. TESTING THE MALICIOUS PROSECUTION CONSULTANT

The MPC's performance was evaluated by running consultations with the facts of ten decided cases to establish whether the MPC would reach the same results as in the cases. A lawyer with no knowledge of the structure of the MPC was asked to read the cases and run a consultation for each case. Eleven consultations were run because one case had two defendants which necessitated a separate consultation for each defendant.

The ten cases were selected from the MPC's Database of 144 cases. Each case was removed from the Database before running a consultation so the MPC could not use the case to reach its conclusions. At the end of each consultation the case entered was reinstated in the Cases Database. Only those cases with malice and lack of reasonable and probable cause issues were eligible for selection. The cases were selected at random other than this initial screening. Since lack of reasonable and probable cause and malice are the most difficult elements to prove in a malicious prosecution action, it was thought that this approach would present the MPC with a challenge. In addition, these two elements are the last of the five elements required to be proved so the probability was quite high that most, if not all, of the first three elements would be present in the cases selected.

The MPC agreed with the decisions in ten out of eleven (90.9%) cases. A strong argument may be made that *Manning v Nickerson*, the one case where there was disagreement, was wrongly decided by the court.[28] In one of the cases tested, *Watters v Pacific Delivery Service et al*, the MPC disagreed with decision of the Supreme Court of British Columbia insofar as one of the defendants was concerned.[29] The defendant in question appealed to the British Columbia Court of Appeal and the court allowed the

appeal for basically the same reasons given by the MPC.

Thus the testing process revealed that the MPC is able to operate at a similar level of expertise as trial and appellate judges deciding malicious prosecution cases.

VIII. CONCLUSIONS

Previous research has shown how the deep structure approach to knowledge representation may be used to build rule-based legal expert systems in difficult areas of case-based law which operate with a high degree of accuracy and sophistication.[30] This paper demonstrates that the deep structure approach lends itself equally well to the construction of CBR legal expert systems in case-based law. The MPC operates at a high level of legal expertise in its domain. Its performance, case retrieval and 'longevity' are enhanced by its CBR methodologies, thereby demonstrating that CBR legal expert systems offer significant advantages over purely rule-based systems.

The future of CBR for legal expert systems appears promising, particularly if progress is made in the fields of natural language processing and intelligent database retrieval.[31] The future may hold the possibility of CBR legal expert systems sending search queries directly to large electronic legal databases. This would by-pass the step of 'profiling' cases which is currently the bottle-neck in the construction of CBR legal expert systems.

REFERENCES

* B.A., LL.B., LL.M. 389 Lonsdale Street, Melbourne 3000, Australia. Tel: + 61 3 670 6681. Fax: + 61 3 670 8503. The work on which this paper was based was undertaken at The University of British Columbia, Faculty of Law between August, 1989 and December, 1990. I gratefully acknowledge the assistance of Professor J.C. Smith and Cal Deedman.

1 McCarty, L. Thorne, "A.I. and Law: How to Get There from Here", presented at the International Conference on Expert Systems in Law" Bologna, Italy, May 3-5, 1990.

2 Susskind, Richard E., "Expert Systems in Law: A Jurisprudential Approach to Artificial Intelligence and Legal Reasoning", (1986) 49 Modern Law Review 168.

3 By "purely rule-based system" I mean a non-CBR system. I use the terms "purely rule-based system" and "CBR system" primarily to distinguish between the earlier rule-based non-CBR legal expert systems and later CBR legal expert systems. This terminology may not be entirely accurate because it is arguable that all legal systems to date, whether CBR or otherwise, are rule-based in one way or another.

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5 A product of IntelligenceWare, Inc., 9800 s. Sepulveda Blvd., Los Angeles, CA which retails for about $590 USD. The stand-alone version of the MPC occupies about 2.5 megabytes of disk space, including cases. It runs on a 286 or 386 IBM PC (or compatible) with a hard disk drive, 640K RAM and at least 1 megabyte of extended memory.

6 A product of Ashton-Tate Corporation.

7 Many of the cases are in full text and were retrieved and stored with the kind permission of QL Systems Limited.

8 Smith J.C., & Deedman, C., "The Application of Expert Systems Technology to Case-Based Reasoning", "Proceedings of 1st International Conference on Artificial Intelligence and Law", (Boston) A.C.M. Press, New York, 1987, p. 84; Deedman, C., "Building Rule-Based Expert Systems in Case-Based Law", LL.M. Thesis, University of British Columbia, Faculty of Law, 1987.

9 Deedman, Cal, "Exposing Some Myths About Law and Dispelling Some Myths About Computers." Unpublished.

10 For an interesting description of how law students studying torts are taught to "flip" legal arguments see Boyle, James, "Anatomy of a Torts Class", (1985) 34 American University Law Review 131.

11 Deedman, supra, note 9.

12 e.g. 'The Nervous Shock Advisor' by Professor J.C. Smith and Cal Deedman and 'The Hearsay Rule Advisor' by Professor M.T. MacCrimmon and Susan Blackman, The University of British Columbia, Faculty of Law.

13 Rissland, E.L. & Skalak, D.B., "Interpreting Statutory Predicates"; Branting, L.K., "Representing and Reusing Explanations of Legal Precedents"; Skalak, D.B., "Taking Advantage of Models for Legal Classification", "Proceedings of 2nd International Conference on Artificial Intelligence and Law", (Vancouver) A.C.M. Press, New York, 1989, pp. 46, 103, 234; Ashley, Kevin D., "Modelling Legal Arguments: Reasoning with Cases and Hypotheticals", M.I.T. Press, Cambridge, Mass., 1990 (in press).

14 It was Cal Deedman's idea to represent case law as a cuboid and Dorota Gertig prepared the sketches.

15 This system was developed in conjunction with A.I. and law personnel at The University of British Columbia, Faculty of Law.

16 Although a difficult factor to account for computationally, the reader will note that the date of the decision is also used in the weighing formula to a limited extent.

17 The user may choose from: the Australian states or territories, the Canadian provinces or territories, New Zealand and England.

18 Savile v Roberts (1698) 1 Ld Raym. 374; 91 E.R. 1147.

19 Wiffen v Bailey & Romford U.D.C. [1915] 1 K.B. 600. For another limited exception see Coleman v Buckingham's Ltd [1964] N.S.W.R. 363.

20 See Fleming, J.G, "The Law of Torts", 7th ed., 1987, p. 581; Rogers, W.H.V., "Winfield & Jolowicz on Tort", 13th. ed., 1989, p. 552.

21 Jervois Sulphates Ltd v Petrocarb (1974) 5 A.L.R. 1; Stoffman v Ontario Veterinary Assn. [1990] O.J. No. 1151, Action No. 542/85, Unreported (Ont. H.C.).

22 Winfield & Jolowicz, supra, note 20, p. 547.

23 Hicks v Faulkner (1878) 8 Q.B.D. 167 at 171 as approved by the House of Lords in Herniman v Smith [1938] A.C. 305 at 316.

24 Brazier, M.B., Street on Torts, 8th ed., 1988, p. 437.

25 Supra, note 20, p. 586, citing Herniman v Smith [1938] A.C. 305 at 317.

26 Brown v Hawkes [1891] 2 Q.B. 718 at 722; Carpenter v MacDonald (1979) 21 O.R. (2d) 165 at 184; Hawker v Hillsburgh [1942] 2 W.W.R. 488 at 489.

27 Sandison v Rybiak (1974), 1 O.R. (2d) 74.

28 [1927] 2 W.W.R. 623.

29 (1964) 45 D.L.R. 638

30 Smith, J.C. & Deedman, C., 'The Nervous Shock Advisor'.

31 eg. The 'Flexicon' project by The University of British Columbia Faculty of Law IBM (Canada) Law and Computer Centre.