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## Legal Understanding in the Era of Expert Systems<sup>1</sup>

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*Language rests on consensus, but a consensus of action, not belief.*  
Ludwig Wittgenstein.

### 1. Introduction

This paper is an exercise based on a fusion of jurisprudential thinking and computer technology through the use of an Expert System<sup>2</sup>. In learning how to create this system it has become apparent that there exist many limitations on what we can do with computer technology. We believe however that as our understanding has grown, so too has our belief that the technology has much potential. In considering the logic of the program with the logic of modern jurisprudential theory, the paper has evolved into an exposition on the realization that we must, and that we can, develop new tools for explaining rationality in the Law.

The purpose of this paper is to consider the underlying rationality of the legal discourse through the process of developing an expert system. Through this process we believe that this rationalization of the law will present new challenges as to how we understand and teach law.

Thesis: *We cannot build an expert system dealing with hard cases without believing in an underlying structure of rationality.*<sup>3</sup>

We have divided the paper into two components. The first phase will deal with the methodological dependence on a jurisprudential theory of actions which will aid in the explanation of an underlying structure of rationality. In the second phase we consider the actual computational application of legal knowledge in connection with a "deep structured" approach. In doing so, we will apply the methodology developed in the first component so as to understand how legal knowledge is created.

We will emphasize expert systems in a jurisprudential context. We do not wish to confound the reader with technical concepts and jargon. Instead we will outline an approach which will justify our thinking that through building expert systems we-practitioners, theorists and students-can come to a better understanding of legal reality.

We will conclude that expert systems require a sound theoretical foundation. We argue that if an expert system in law is to be of practical value, it must be based on rationality. An action theory provides such a coherent basis upon which to develop models of reasoning within computer based systems. These models are based on a teleological approach which fuses creative understanding with the social and legal discourse.

## **2. The Methodology**

### **2.1 Application of an Actions Theory of Law**

The Law is the manifestation of social order. In practise we see two levels of discourse operating within it. One is that of the jurisprudential theorist who reflects upon and articulates the structure of the Law. The Law is examined for form, shape and purpose. The other discourse is that of the lawyer who takes these concepts, manifest through case law and, like a carpenter, pounds the facts like nails into wood, so as to achieve the objective of Law.

Law was at one time considered to be determined by the length of the Chancellor's foot. It is recognized that law is indeterminate. A modern sceptic might suggest that the task facing the lawyer is analogous to the deal of a hand of poker. While it is impossible to deny the Law's indeterminacy, we can structure the law within a framework which will create a certainty within the social construction. Without a basis for certainty, a methodology will prove to be of little value in the construction of a computer expert system. We need more than legal anarchism. We need a process which will allow us to construct a rational approach towards legal determination.

Legal Rationalism must come in the form of an epistemological<sup>4</sup> understanding of the underlying function of law. We must believe in a concept of true legal knowledge which we can use to make a rational structure upon which to base computer logic. We will apply in building our expert system a deep structure approach which will examine the rationality of process within the legal discourse.

By relying on a rational substratum the expert system will be effective in disclosing the social dimension within Law. We must infer from this that the "legal language" can be seen as a cultural artifact, an abstraction from reality. Expert systems incorporate this dimension but they are tied to the natural rationality of an agent. Therefore by building an expert system for hard cases, we must try to minimize the products of the social and cultural institutions.

To gain a more complete understanding of law, we must reduce the apparent effects of the representational practice. We eliminate this institutional product by reducing our dependence on the traditional legal discourse. Instead we focus on behaviour which is determinate upon our needs and goals.

The application of such practical reasoning is the essence of a theory of actions.<sup>5</sup> The reason for this is that the theory shows us the ultimate relation between law and practical rationality.<sup>6</sup> Actions lie at the bottom of Law. We must observe therefore that legal knowledge depends on the actions of the actor. The legal discourse should be concerned more about the fact that the process of how we get legal knowledge is dependant on the action itself. To fully comprehend the justification of the Law, the lawyer cannot shield itself with institutional doctrinal concepts within case based reasoning.

It is for this practical purpose that the legal discourse in Common Law also concern itself with the teleology of the law. If we accept this, then lawyers must focus on intent of law and not on its cultural artifact of doctrinal reasoning, for realizing legal knowledge.

## 2.2 Approaches to Expert System

The most effective form of legal case based reasoner is one which asks the user only factual questions, but utilizes an extensive case database to formulate a legal conclusion.<sup>7</sup> The task of the knowledge engineer is to ensure that the right category of facts is established to serve as match parameters with the database.

In considering how best to build a tool with which to assist the practitioner in her everyday struggle with the Law, we are forced to consider both the way in which the Law functions conceptually, and in terms of how the lawyer may utilize the body of case law to perform within the judicial system. We will break this down into two aspects. The first will be the Case Based Reasoner approach. The second will be the Rules Based approach.

The Case Base Reasoner is utilized through the construction of case profiles. The technique is to extract from the user a set of facts which are relevant in a given area of the Law. These facts are then used to derive or determine the conclusion for the user. Using these as the search parameters, the program will match the situation with the database Case profiles.

The program will incorporate weighting calculations which will approximate the degree of similarity, and therefore how "on point" the case is based upon the facts provided. This will be done against the entire data base. From this the system should be able to provide some measure of predictability and provide a list of relevant cases to the user.

We examine the facts in two senses. In one sense we derive the relevance of the legal facts to a specific domain. In doing this we then get the appropriate cases based on the matching facts within the database. In the second sense we use the facts as attributes which determine how we are to conclude the outcome. The logic is then able to compare these attributes to the fact-patterns within specific cases.

The shell of the system conceptualizes the legal reality through the responses the user provides. The questions therefore must create an impression of the factual reality which we are to consider in legal terms. The quality of the questions therefore are essential to this process of clarification. Because of this process of recognition from an external perspective to have a meaning within the legal discourse, it is imperative that the questions be constructed by those skilled in the process of conceptualization by analogy. Lawyers must be involved in designing questions for expert systems.

The rule-based approach incorporates the knowledge of the expert directly into the program shell. This system derives its conclusions, as is found in the shell of the case based reasoner, from *modus ponens* type structures that capture domain expertise. The difference is that in a rule based system, the conclusion is not derived through the cases themselves. The system may justify its conclusions by referring the user to relevantly similar cases in an associated database, but it does not "consult" the cases before reaching an outcome.<sup>8</sup>

We will be using a case data base to derive our user response. We have thereby adopted the case based reasoner methodology.

## 2.3 Critique of Rule Scepticism

"If we take in our hand any volume; of divinity or school metaphysics, for instance, let

us ask: Does it contain any abstract reasoning concerning quantity or number? No. Does it contain any experimental reasoning concerning matter of fact and existence? No. Commit it then to the flames: for it can contain nothing but sophistry and confusion."  
*Hume*

We wish to criticize the sceptics view on determinacy within the Law and its consequential effects on building expert systems. What we argue is that within legal language there exists a certainty of fixed meaning through the use of legal metaphor. The point we will make is that to build a coherent structure which will be relevant to legal reasoning through artificial intelligence, we must have a rational pattern in law upon which to base our computational logic. It is crucial that one takes the right approach when looking at the phenomenon of expert systems within Law.

It is apparent from many contemporary approaches to this phenomenon that an external perspective is required to understand the legal discourse.<sup>9</sup> We argue that we should not confuse the logic of the Law, with the logic of the Lawyer within the Law. We wish to suggest that an understanding of the legal discourse entails realization of the logical structure of both the process or function of Law itself and, the process or function of the lawyer itself. These two processes are entwined but distinct.

The first consideration in any investigation of the application of expert systems in law must be "What is to be expected from an expert system?" It would appear that expert systems can serve two functions. One aspect relates to the practise of law. It is concerned with the utilization of case law or doctrinal level of legal discourse. The other aspect is concerned with expert systems as a means of uncovering a coherent basis in the law.

The premise: "Before knowledge engineers can model legal reasoning they must first understand legal rules and how lawyers and judges fashion and utilize these rules."<sup>10</sup>, will lead us to rely on an inherently contradictory legal discourse in a case based reasoner. In order for the legal institution to function at all, there must be a non-contradictory epistemological fundament which is accepted by the legal profession.<sup>11</sup> Relying on how lawyers think leads us only to understand the process through which individuals interact with the Law, but not the Law itself. As a methodology for developing expert systems, we are left unable to develop useful computational structures which will reveal the rational function of legal rules. We are left to wonder how such an approach can lead to the development of useful applications of knowledge-based systems.

The second approach rests on the acceptance of a true belief or predictability within the Law. It is however, not only that we have true belief but that these beliefs are connected in complex on-going relations to one another. The relations are determined by a goal-ordering hierarchy which is the rational basis for social interactions. Within the body of Law we can see that this goal-orientation is reflected through a matrix.<sup>12</sup>

Agents are autonomous beings in the world. They operate to achieve independent goals. In a world of finite resources, these goals will inevitably conflict with the goals of other agents. Law represents the media through which the conflict of goal-values is resolved. The Law therefore must prioritize goal-values, and therefore protects one goal set over another. The rules and principles of the legal institutions reflect this goal ordering. To illustrate this point, we can consider the underlying rationale of defamation. Truth is more important than protection of reputation. The protection of reputation is more important than freedom of communication.<sup>13</sup>

The matrix then represents the ordering of these goal-values which appears to be the *gestalt* of law. Our understanding of law rests on seeing a connection between goals and actions. An expert in the particular domain will examine the case law so as to establish what factual determinants are inherent in the domain. This analysis represents the deep-structure of the domain. We propose that in building expert systems we must structure the algorithm incorporating the inherent logic flow of the deep-

structure.

## 2.4 The Pure Economic Loss Algorithm<sup>14</sup>

We must now consider how to implement the goal-hierarchy into a structured computer algorithm. We will show how the deep-structure presents the most practical methodology in the design of the logic-flow. By applying this technique, the resulting computer program will be more stable and coherent, and better reflect the jurisprudential reality.

The application of a deep structured programming technique reflects the fact that computer systems are tools. The expert system is a tool which we use to solve problems by machine rather than by human effort. At the present time we are restricted in developing such tools by our limited capacity to deal with natural language. Accordingly any application we develop must be one which deals primarily with concise logical structures rather than open-textured concepts.

Our task here is to construct a system to evaluate a case of purely economic loss<sup>15</sup> The expectations we will have of this system depend in part on the objective we hold for the expert system. We can develop the tool as a means of evaluating argument. That is to say we can use the Case Based Reasoner to examine doctrinal level arguments and create a scale of relevance to our existing fact situation. We do this by understanding the approach a good lawyer takes to evaluating the prospects of success, and then incorporating this in the Case Based Reasoner by adopting a numerical case evaluation scale.

We consider pure economic loss to be a concept independent of contract, negligence or Trust. In contract risk is allocated between the parties according to their preferences and intentions. When we speak of damages in contract they are to be considered in purely economic terms. We do not include these in the concept of Pure Economic Loss because the agents have already agreed how any breach is to be arbitrated. In negligence we are concerned with the restoration from injuries inflicted as a result of injury to property or person. We therefore attach liability to the injury itself. The law on Trusts has prescribed remedies based through the establishment of fiduciary obligations.

Pure Economic Loss is the loss of money which arises as a result of a legal breach from causes other than breach of contract or actual physical injury. In considering the validity of a claim for losses which are purely economic, we are concerned with questions of remoteness to physical injury, and of accepted extension of liability by the Court.

We believe the core of pure economic loss in non-legal terms can be described as the "relationship" between knowledge, the communication media, and the goals of the agent. This can also be considered as "justifiable" reliance by one agent on another. By media we refer to the body through which the goals of the agent are to be achieved. It is breach of obligation by the media in communication to the agent which results in a failure by the agent to fulfil its goals.

In the development of the Pure Economic Loss Advisor we have attempted to incorporate what we consider to be the a structured flow of the relevant case law with the necessity of building a tool which will access the relevant case law necessary for the practising lawyer.

We have determined from a review of relevant cases in the area of pure economic loss that case law is broken first into the area of remoteness; where the loss arises out of risk of physical injury and, second the area of extension; where the Court considers the loss to fall within a recognizable head of liability. In reviewing the area of extension we see an underlying logic which focuses on the concept of communication between the tort feisor and the plaintiff. This aspect reveals to us the underlying structure within the action theory.

In the area of pure economic loss, we must, like the lawyer, consider the inherent contradictions

which exist within case law at the doctrinal level. Of particular concern is the opposing conclusions between *Anns v. Merton London Borough Council* [1978] A.C. 728 (adopted in Canada in *Kamloops v. Nielsen* (1984) 2 S.C.R. 2) and the case of *Murphy v. Brentwood District Council* (1990) 3 W.L.R. 414.

*Anns* sets out economic loss as a prima facie duty of care where there is a foreseeable risk of harm. *Murphy* rejects this doctrine and restores the distinction between pure economic loss and physical damage, as set out in *Rivtow Marine Ltd. v. Washington Iron Works* [1974] S.C.R. 1189.

We start with the premise that Agents are autonomous beings who are free to fulfil their goals. The agent has free-will. From this we digress to incorporate a prima facie duty of care not to inflict physical harm on their fellow agents. The contradiction then arises where the free will of the agent conflicts with the effect of economic loss by another agent. In reviewing the matrix of goal-ordering, we see that free-will is valued higher than the suffering of economic loss. Accordingly we assign no prima facie duty of care to avoid pure economic loss. Money is merely an abstraction in an abstract world.

### 3. Creating Legal Reality within the Expert System

"When I use a word," Humpty Dumpty said, in a rather scornful tone, "it means just what I choose it to mean—neither more nor less."

"The question is," said Alice, "whether you *can* make words mean so many different things."

The question is," said Humpty Dumpty, "which is to be master—that's all."

- *Through the Looking Glass*

#### 3.1 Understanding Legal Reality

The use of a metaphor is an attempt to show reality by creating a new cultural meaning within a particular context. This is possible only because a metaphor can describe something different from what it really is. A metaphor can only function behind a network of language, in a certain "form of life."<sup>16</sup> It is the shift in culture that gives meaning to the practise of discourses. We recognize that words get their meaning from their use within the social practice and therefore, words express what it is we experience.<sup>17</sup>

We create legal concepts to explain the social phenomena of agent action. These legal concepts comprise reality within the legal discourse. This is the legal metaphor. When metaphors introduce new literal meaning into the legal practice, they become dead-metaphors. They are then not metaphors any more but instead they are institutional social constructions with a "certain" legal meaning.<sup>18</sup>

The objective of the system should be to provide the lawyer with a representation of the legal world in a form which she can use in arguing a set of facts. We cannot at present develop a system which is capable of duplicating the intellectual process of a human legal expert. We cannot duplicate the intellectual process because law is victimized by its own metaphor. Law requires that we understand experience through analogy. We can only create a computer logic which appears to simulate aspects of this process. We believe the term "Artificial Intelligence" to be a misnomer in that in a rule based structure there is no capacity to go beyond the existing domain.

Ten years ago the american pioneer in artificial intelligence, Roger Schank, proclaimed that computers in the near future would be able to have natural language capability. Time has proved this

to be wrong.

Natural language is not concerned with machines thinking like people but with thinking about applying interpretation of language computational-not the other way round.

Modern AI no longer tries to 'think' like a human -ie a lawyer-because thinking like a lawyer no longer gets us to the underlying rationality of what law is - it is a separate discourse which is outside the teleology of the law. We believe that emphasising the process of how lawyer's think in solving jurisprudential questions would be analogous to studying how physicists think for us to understand about quantum mechanics. What we are concerned with is giving the lawyer the capacity to make intelligent predictions of what the Law is based on the current legal doctrine.

### 3.2 The future of Law and AI

Law is a fuzzy concept. So it has always been. A recent approach in the sciences tries to challenge the traditional Aristotelian / Cartesian mathematical logic. It is an attempt to create a harmony between logic and human reasoning or "common sense". It is the science of imprecision which corresponds to how we use and understand language in the world.

Professor Zadeh<sup>19</sup> has made the claim that we are closer to natural language capability. By recognizing

that words quantify an element of truth about the world, rather than attempting to define the world in a pure objective system. Fuzzy Logic:

"..Provides a computational framework for representational framework for representing the meaning of propositions in a natural language which contain fuzzy quantifiers most propositions in a natural language do. This capability of fuzzy logic plays a particularly important role in the representation and inference from imprecise facts and rules in knowledge-based systems"<sup>20</sup>

Zadeh has provided a body of computational-orientated concepts and techniques for dealing with linguistic variables.<sup>21</sup> The basic idea is that precision and hence specificity carry a cost in terms of methodology and technology and should not be used unnecessarily. Fuzzy logic comes much closer to serving as a descriptive model of human reasoning than traditional logic systems. The guiding principle is *do not be more specific than is necessary*.

It is apparent that Law is a process of rationalizing linguistic variables. The problem for both the lawyer and the system programmer is applying the language to the real world experience. It is therefore apparent that any methodology which is premised on the reality of imprecision must be a more appropriate technique in dealing with natural language.

It is clear that the legal doctrine itself cannot overcome the ambiguity of its representation. What we can do however is to "defuzzify" the concepts for the purpose of the lawyer by using facts to describe the legal reality because facts themselves are "crisp". Zadeh is concerned in his thinking with creating a greater sense of certainty while recognizing that language itself is imprecise. The point to be taken is that we can achieve certainty within context, which in law would translate to the social practice of agents. We can take legal concepts and determine certainty because their meaning is derived from their use.

### 3.3 Limits in Building Expert Systems

No field in Law is static. This puts an inherent limit into the structure of computational process in

building expert systems. If the structure is too rigid the system will be unable to deal with slight modifications in factual situations or variation in law. If it is too flexible, then the system will be unable to provide specifically relevant information for the lawyer. The human knowledge must exist before expert systems can be built. We must know what the law is before we can build it.

The most obvious limitation is that of language. Since the legal profession is so heavily dependant on language, the difficulty in building expert systems in Law is obvious. We face serious obstacles in manipulating linguistic variables within the context of case based law. The processing of natural language must then be attached to the interpretation of legal concepts.

To deal with these problems the approach has been to develop systems which are conceptually "closed domains".<sup>22</sup> A closed domain is a self-contained representation of the legal doctrine. It is an area of the Law which is substantially "settled".

We need not be limited from building systems which deal with hard cases. We have stated in our thesis that what is required to construct an expert system in law, we must believe in an underlying structure of rationality. In law there is no consensus about what law is, nor about the true nature of legal reasoning, but it is nevertheless needed if legal rationality is to be self-conscious.<sup>23</sup>

The limits which exist in law are not to be confused with the indeterminacy of law as articulated earlier by Gardner. Instead we are confronted with the shift in culture which creates new metaphors and consequentially a new certainty. The limit on the expert system therefore is the ability of the system to adapt and incorporate this shift within its legal domain. It is precisely for this reason that legal experts are involved in the construction of expert systems because they are most able to conceptualize and incorporate legal metaphors in a dynamic framework.

#### **4. Legal Education**

The practice of law is the use of analogy. Analogy is used in law as a means of predetermining the content of the legal debate. It defines the parameters of the legal questions to be resolved. It transforms the facts of the external world to possess a legal meaning. It can do this because analogy resembles the real world.

This resemblance rests on the belief that you can compare that which exists in the external world to that which already exists in the legal reality. This represents the fusion of experience with legal knowledge. In this fusion we create likeness within the context of what we, the lawyers, already know.

This way of arguing reflects a circular picture, that is, a mirror of the world which is in its essence a reflection of the "legal self". The use of case law doctrine articulates a representational image that creates the basic meaning in law.

To teach in law would appear to be a matter of remaining loyal to the myth and the metaphors. Loyalty is established by severing legal reasoning from the contingency of culture. Legal concepts are being hypostatized and therefore neutralized. This fundamental confusion is vitalized as a way of keeping the wheel going.

Metaphor prescribes the language of the lawyer. True legal education then should be a matter of the student understanding the use of metaphor. In this sense we emphasize that the legal student should be more creative in her thinking. This critical approach to legal doctrine will reduce the prejudiced legal mind.

Expert Systems confront the student with the need for new approaches to legal reasoning. The

development of suitable algorithms to incorporate legal reasoning confounds the student with the circularity of traditional doctrinal reasoning. This process of recognition for the student demands that educators present an explanation of law in new contexts. We argue that the rationality of agents is one such method to go beyond the metaphoric and mythic dimension of law.

## 5. Conclusion

We have argued that by conceptualizing the Law as rational we can construct an expert system which can transcend the doctrinal legal discourse. This enables us to deal computationally with hard cases. If we do not accept this rational approach we limit the application of the computer technology to areas of the law which are settled. An expert system which deals only with an area of the Law which is settled will ultimately prove to be of limited practical use for the lawyer.

The main idea of this paper has been to show that it is crucial in the building of expert systems that we should develop the system based on a rational coherent structure upon which the common law is based. It would appear inevitable that we will not succeed in this task without examining the scope of practical reason within our legal domain.

The knowledge of practical rationality in Law is part of the "form of Life" of the legal reality. It is imperative that the expert system be constructed by those skilled in the process of conceptualization by analogy. Lawyers must be involved in designing questions for expert systems. This observation may appear obvious, but it is true.

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## Footnotes

1. Alexander Carnera, B.A, LL.B. University of Copenhagen, Denmark & Richard Edwards, B.A, LL.B, LL.M. (Cand.), Canada; Researchers at University of British Columbia, Faculty of Law, Artificial Intelligence Research Project (FLAIR) under the direction of Professor J.C. Smith. The authors would like to thank J.C. Smith and Daphne Gelbart of the FLAIR Institute for their advice and encouragement.

2. By the term "Expert System" we refer to the process of knowledge representation using computer technology. What this concept incorporates is that we can create a database which represents a structure of legal knowledge within a specific domain. Through the skill of an "expert" advisor *inter alia*, the lawyer, in the area, we can then develop computer programs which will manipulate the information within the domain in accordance with a set of facts provided by the user of the system. The system then merges the facts with the knowledge domain to create a "legal" response, or legal conclusion, which characterizes the given situation.

3. This approach is in contrast with the conclusions of Ann Gardner, in her Ph.D. Thesis, *An Artificial Approach to Legal Reasoning*, (1987). Stanford University Books, See also Yale Law Journal, 1989.

Ms. Gardner states that it is not possible to build an expert system which deals with "hard" cases. She derives this conclusion from the jurisprudential analysis of the Rules-Principle distinction debated by Dworkin and Hart. She concludes that computer logic is inadequate to resolve the use of legal principles.

We argue that we can go beyond the apparent indeterminacy of law by relying on a rational construction of legal reality. This construction is not an apology to contemporary jurisprudential thinking but rather, we believe it is the recognition of the consensus of action which is the

presupposition for legal certainty.

4. The term "epistemology" is commonly used to describe the branch of philosophy that Inquires into the nature and validity of knowledge. See Dancy;" Contemporary Epistemology" (2 rev. ed. 1988) (discussing the basic and classical concerns of epistemology)

5. We will refer to *Law and its Presuppositions*, J.C. Smith & S. Coval (1986), which appears to be one of the few jurisprudential works to have adopted this approach.

"The central strategy of our argument has been that all basic relevant considerations which appear In law (perhaps in morals as well) are either directly expansion of agency or justifiable by it.." (LP at p.37).

6. This jurisprudential fundament was already established in *Legal Obligations*. There Smith tries to explore the ontology of legal obligations. He exposes Law as a social discourse based on practical reason. See *Legal Obligations*, especially Chapter three.

7. *Toward a Comprehensive Legal Informafion Retlieval System*, Gelbart and Smith (1990)

8. *Building Expert Systems in Case-Based Law*, Smith, Gelbart and Graham, at p.2

9. The question whether we can have an external view of the world is an old debate within the philosophy of science. Philosophers like Popper, Feyerabend and Putnam has canvassed whether we can have an objective knowledge of normative phenomenon. See *Social Epistemology*, Fuller at pp.51-61 concerning a "third" world perspective by Popper. The hermeneutical approach taken by Dworkin especially stated in *Law's Empire* at pp.82-89, emphasizes that it is impossible to have an external perspective apart from the legal discourse. We are part of the legal paradigm or social world that we wish to interpret. The way we will apply the concept "external perspective" in this paper relates to how we are to picture the Legal Discourse. We believe we must go beyond the product of the traditional institutionalized legal discourse in order to deal with the Law in a structured, relevant manner. in other words we believe in a rational perspective of human reasoning with regards to the legal discourse.

10. "Obstacles to the Development of Logic-Based Models of Legal Reasoning", D. Berman and C. Hafner from the anthology *Computer Power and Legal Language*, at p.183

11. "To know the Law then requires a cognitive act for which the Law itself - through the descriptions it supplies - cannot provide closure. The cognitive contribution of the agent is a necessary condition for the completeness for any Law.", Smith and Coval (1986), at p.106

12. See Smith and Coval (1986), at p.102

13. See Smith and Coval (1986), at p.103

14. The authors undertook to create an operational expert system in Tort Law. The area chosen was "Pure Economic Loss". This area was selected because it is a relatively stable area of law, which straddled the boundaries of tort and contract law. As such it presents the opportunity to study certain "hard" cases. "Algorithm" is method of describing the structure of logic which is incorporated into the computer program.

15. For a thorough review of this area of the law, using a teleological approach, see J.C. Smith, *Liability in Negligence*, The Carswell Company, 1984, especially Chapters 4, 11.

16. See Wittgenstein, *Philosophical Investfgaitons* (1951).

17. Read for example §72 in Wittgenstein's *Philosophical investigations*.

18. Smith, J.C. (1976), p.75. See also Richard Rorty and Mary Hesse, *Unfamillar noises*, Proceedings of Aristotelian Society, 1987 Supplement 1, p.297 ff

19. "The Birth and Evolution of Fuzzy Logic", A Quarter Century of Fuzzy Systems, *International Journal of General Systems*, Vol 17, (1990) pp.95-105

20 Ibid, at 101

21 A variable whose values are words or sentences in a natural or synthetic language. For example if the word height is treated as a linguistic variable, its values may be expressed as tall, not tall, more or less tall etc.

22 For a good review on this subject see Kowaiski, *Case-Based Reasoning and the Deep Structure Approach to Knowledge Representation*, AI & Law (1991)

23 Conference 1987, Smith and Deedman; see also Susskind's *Expert systems in Law*, 1987

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