RADICAL COMPUTER USE IN LAW

by

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Journal Abbreviations

Am. J. Comp. L.	American Journal of Comparative Law
Arch. R. -und Sozialph.	Archiv für Rechts -und Sozialphilosophie
Calif. L. Rev.	California Law Review
Corn. L. Q.	Cornell Law Quarterly
Dickinson L. R.	Dickinson Law Review
J. Legal Ed.	Journal of Legal Education
L. Q. R.	Law Quarterly Review
Nat. L. For.	Natural Law Forum
Stanford L. Rev.	Stanford Law Review
U. Chi. L. R.	University of Chicago Law Review
U. Pa. L. R.	University of Pennsylvania Law Review
Vand. L. Rev.	Vanderbilt Law Review
W. Res. L. R.	Western Reserve Law Review

PREFACE

Many people have assisted my further exploration of the role of computers in law. I must particularly acknowledge the guidance of my friend L. Thorne McCarty, formerly a Computer and Law Fellow at Stanford University, and now of the Faculty of Law at the State University of New York at Buffalo; Professor McCarty has given me the benefit of his wise counsel and far-ranging knowledge in this field. Mr. Colin Tapper, of Magdalen College, Oxford, a pioneer in the application of computers to law, has been his normal stimulating self in conversation. I have benefited, too, from exchanging ideas in Edinburgh with Colin Campbell, Bruce Aitken, and David Kidd, all of the Scottish Computer Legal Research Trust. Professor Bruce G. Buchanan, of the Computer Science Department of Stanford University, assisted me considerably, and Dean Joseph E. Leininger and Ms. Susan Kolasa-Nycum, of Stanford's Faculty of Law continued to display interest in my work.

As the title page indicates, this report was commissioned by the Department of Communications of the Government of Canada. My thanks must go to Mr. Kenneth M. Katz, Mr. Ken Stein, and Mr. Richard Gwyn, all of Communications Canada, who encouraged me when I needed encouragement, and took care of the administrative details that always plague endeavours of this kind. Finally, Eric Nadler, my research assistant,

and my secretaries - Jean Williams and Virginia Brown - were their normal helpful and uncomplaining selves.

INTRODUCTION

In an earlier study of law and computers,[1] I attempted to evaluate the most common current use of computers in law - electronic legal retrieval. My study looked at the nature of the "lawyering process;" it described existing retrieval systems and attempted to explain why they were developed; finally it assessed the effect of these new systems on the law and lawyers. The conclusions of this study were, for the most part, not well received by those engaged in the development and marketing of electronic legal retrieval systems. I concluded that "electronic legal retrieval, if widely embraced, may distort legal thinking, may affect unfavorably important features of the legal system such as the doctrine of precedent and the law-making ability of judges, and may enhance existing social inequalities."[2] The report recommended that for the moment large resources *not* be committed to the maintenance and development of electronic legal retrieval systems of the existing type. I particularly emphasized the need for research into the nature of legal thought processes, and for examination of artificial intelligence and computer simulation concepts. This new study - again sponsored

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1 Philip Slayton, *Electronic Legal Retrieval/La recherche documentaire électronique dans les sciences juridiques* (Ottawa: Information Canada, 1974).

2 *Ibid.*, p. 25.

by Communications Canada - is an attempt, in a preliminary way, to implement these recommendations.

The premise of my current inquiry is that technological development (as distinguished from scientific inquiry) is only rational when controlled by identified needs. To pursue development without thought to the limits of what is technologically possible is, at the very least, wasteful; it may in addition be dangerous if the developers, once they have a finished product, encourage its use with no understanding of or regard for the consequences. For example, my first study suggested unfortunate consequences for law and the legal system of widespread use of existing electronic legal retrieval systems which have been developed largely because that development was *possible*.

There is, of course, a relationship between needs and technological development; some needs are created by new technology, and some are only perceived once it is clear what is technologically possible. In some cases, once must have a notion of what can be done before an assessment of what should be done can be made; in the absence of this "feedback" process, society would become scientifically stagnant.

A further point must be made. For rational technological development, one must assess not only what is needed, but what is possible. It may be that technology cannot assist in some areas of human endeavour; needs may be manifest and manifold,

but not technological. Here the danger of irrational technological development is acute. Scientists may not understand a field, and may develop machines they incorrectly believe appropriate; powerful corporations will then employ sophisticated marketing techniques to sell these machines, come what may.

This new study, first, examines theories of legal thought. I look at obstacles in the way of any theory development; I consider major writings on the subject, and suggest a new division of the problem domain - a division into questions of, on the one hand, legal argument *formulation*, and, on the other hand, legal argument *presentation*. Secondly, I consider the recent history of research in the fields of artificial intelligence and cognitive simulation, and attempt to make some judgment as to what may be learnt from this history. Finally, by way of conclusion, I attempt to assess the possibilities of fruitful application to law of artificial intelligence and simulation techniques.

This study, like my earlier report, is only an initial examination of the problem area. It attempts to formulate the questions that must be asked, and to suggest lines of research for the future, should resources for such research be available. It should be considered as being in the nature of a working paper - and as such, it will, I trust, prove useful.

CHAPTER ONE: THEORIES OF LEGAL THOUGHT

A. Introduction

My analysis is quite simple. First I will emphasize what others have shown - that difficulties of a fundamental kind stand in the way of formulation of *any* theory of legal thought. Pre-eminent among these difficulties is the normative nature of law and the multi-functional use of legal language. Secondly, I will isolate and explain the *two* questions about legal thought - how is a legal argument formulated? how can a formulated legal argument be best expressed? Finally, I will consider how far we can go in answering these two questions about legal thought, and will try to explain the consequences of our relative inability properly to deal with the problem.

B. Obstacles to theory development

(1) Law: a normative system

Law is a *normative system.* It follows from the normative nature of law that legal propositions, and theories about those propositions, are not empirically verifiable. It follows from the systematic nature of law that any view of the legal thought process must be complex indeed, taking into account a subtle intermix of ideas and institutions.

Consider first the legal rule as *norm.* We can all observe that the body of legal rules is in a state of constant and often dramatic flux, responding to developing social and economic considerations, and to developing social and cultural

perceptions of the world. But although it may be true that there is a complex dynamic relationship between the law and what one might loosely call social reality, that relationship is not *necessary*, nor if it indeed exists, is it necessarily of any *particular* kind. Legal rules are not empirically verifiable. They are not in any sense true or false.

That this is so may appear quite obvious, and yet this cardinal feature of the law appears not to have been fully considered by some writers on legal language and thought. Consider, for example, those commentators influenced by the semantic theory of Alfred Korzybski.[1] Edward Duffy, writing for lawyers, explained part of Korzybski's thought in this way:

> Korzybski used an analogy of a map to a territory which goes like this: If we had an actual territory in which the cities of New York, Chicago and San Francisco existed in that order when proceeding from East to West; and if we made a map which showed San Francisco between New York and Chicago, we would say that the map was faulty and inaccurate... Korzybski further said that our languages must be considered as maps and that what he said about maps should also be said about languages.
>
> Maps and languages, to be reliable, must have a structure similar to the structure of the territory which they are supposed to represent, or the non-verbal world about which they speak.[2]

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1 Korzybski's most important work is considered to be *Science and Sanity - An Introduction to Non-Aristotelian Systems and General Semantics*, 4th edition, (Lakeville, Connecticut: International Non-Aristotelian Library Publishing Co., 1958) (first published 1933).

2 Edward B. Duffy, *Practicing Law and General Semantics*, (1958) 9 W. Res. L.R. 119, at pp. 120-21.

To do Duffy credit, although he endorses Korzybski, he does recognize the dangers "of people behaving as if the inferential level of abstracting were the descriptive level; as if the descriptive level were the objective level of abstracting; as if they were not abstracting."[3] Walter Probert, also apparently under the influence of Korzybski, has subjected the law to a similar analysis. Writes Probert:

> Our use of everyday language involves the making of and reacting to verbal roadmaps. You cannot see these maps in the same way you see roadmaps, so the existence of a structure may be harder to detect. Yet recall that you may be given verbal instructions on how to go from one location to another. Your travel between these two spots requires a correlation between the verbal structures involved and the non-verbal road structures.[4]

Probert is anxious to convince us of "the need for correlating our verbal maps with out non-verbal experience..."[5] Julius Paul has made a similar appeal: "The most important reminder is that whenever legal language is used, *extensionalization* should be employed as much as possible."[6]

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3 *Ibid.*, at p. 121.

4 Walter Probert, *Law, Logic and Communication*, (1958) 9 W. Res. L.R. 129, at pp. 130-131.

5 *Ibid.*, at p. 134.

6 Julius Paul, *Language and the "Law": Jurisprudence and some First Principles of General Semantics*, (1958) 62 Dickinson L.R. 227, at p. 233. Paul defines "extensional" orientation as "reliance on and a pointing to specific and clear-cut referents..." (*Ibid.* at p. 229.)

The exact thrust of this analysis - by Duffy, Probert, Paul and others - is uncertain. On the one hand, these writers (particularly Probert) seem sensitive to the bad linguistic habits of lawyers, particularly the tendency of lawyers to objectify ("thingify") legal words - to use legal concepts as if they were statements of truth. But on the other hand, the apparent intent of the Korzybski school's criticism is to bring legal linguistic usage "into line" with social reality. They agree that legal propositions do not necessarily reflect or describe social reality, but they feel that law *should* mirror the world as a map "mirrors" the terrain. This line of argument does not properly acknowledge the normative nature of law. "Thingification" is, after all, only giving full recognition to the "ought" concept of legal propositions. Lawyers do not really want to objectify; they wish to lay down standards for conduct, to exhort, to persuade.

Law is not only normative but also a *system*. An individual lawyer thinking legally, and the legal statements that may result from his thought, cannot be viewed in isolation; they form part of what is commonly and rather loosely termed "the legal system." This phrase is defined and used differently in different places. Sometimes it is used to refer to the network of ideas and institutions - substantive law, advocates, courts, and so on - which make the rule of law possible. Sometimes it is used in a more profound philosophic sense. Joseph Raz begins his recent book *The Concept of a Legal System*

in this way: "This work is an introduction to a general study of legal systems, that is to the study of the systematic nature of law, and the examination of the presuppositions and implications underlying the fact that every law necessarily belongs to a legal system..."[7] To Raz and other analytical jurists, the structure of a legal system is only one (and not the most important) of several questions of interest, and is in itself interesting only to the extent that the jurist can determine, first if there exists a structure shared between systems, and second, the significance of a shared structure (if one exists). Raz's main concern is to insist that the notion of "a law" cannot be understood except in the context of a theory of legal systems:

> It seems to have been traditionally accepted that the crucial step in understanding the law is to define 'a law', and assumed without discussion that the definition of 'a legal system' involves no further problems of any consequence. Kelsen was the first to insist that 'it is impossible to grasp the nature of law if we limit our attention to the single isolated rule'. Here it is proposed to go even further: It is a major thesis of the present essay that a theory of legal system is a prerequisite of any adequate definition of 'a law', and that all the existing theories of legal system are unsuccessful in part because they fail to realize this fact.[8]

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7 Joseph Raz, *The Concept of a Legal System*, (Oxford: Clarendon Press, 1970), p. 1.

8 *Ibid.*, p. 2

In discussions of the legal system, jurisprudes are generally concerned with normative structures, or at least, as Golding puts it, with the *systematic* character of legal systems.[9] Other lawyers, and non-lawyers interested in law and its functioning, more normally have in mind visible institutions and their interaction. The two notions are clearly complementary, and together indicate the need to view the problem of legal thought, creating law, in a wide context in order to gain a full understanding of its nature.[10]

(2) The function of legal language

> most men only need to let the word "justice" roll from their lips to feel as if they were being borne aloft in a balloon..."*

Words are the stuff of law; except through words, rules cannot be laid down, judgments cannot be given, theories cannot be devised. Yet as Ogden and Richards pointed out in 1923 in their famous book *The Meaning of Meaning*, "words, as

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9 M.P. Golding, *Kelsen and the Concept of 'Legal System'*, in Robert S. Summers, *More Essays in Legal Philosophy*, (Oxford: Basil Blackwell, 1971).

10 For an excellent recent account of the concept of a legal system, see Carlos E. Alchourrón and Eugenio Bulygin, *Normative Systems* (New York: Springer-Verlag, 1971) pp. 50-58.

*Richard Taylor, *Justice and the Common Good*, in Sydney Hook (ed.) *Law and Philosophy*, (New York: New York University Press, 1964) p. 88.

everyone now knows, 'mean' nothing by themselves..."[11]

Ogden and Richards identified five functions of language which they regarded as exhaustive: (1) symbolization of reference; (2) the expression of attitude to listener; (3) the expression of attitude to referent; (4) the promotion of effects intended; and (5) support of reference.[12] They took the view that in writing or speech of a rhetorical kind, (unlike scientific writing or speech, where words may have a simple symbolic purpose), a compromise between these various functions is reached:

> Only occasionally will a symbolization be available which, without loss of its symbolic *accuracy* is also *suitable* (to the author's attitude to his public), *appropriate* (to his referent), *judicious* (likely to produce the desired effects) and *personal* (indicative of the stability or instability of his references). The odds are very strongly against there being many symbols able to do so much. As a consequence in most speech some of these functions are sacrificed.[13]

The masterly and complex Ogden and Richards analysis is not specifically a study of legal language, nor is it

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[11] C.K. Ogden and I.A. Richards, *The Meaning of Meaning*, (London: Routledge & Kegan Paul, 1923), p. 9. Judges understand that this is the case. For example: "The word 'punitive' gives no help. It is simply a word used when a court thinks it unfair that a defendant should be saddled with liability for a particular item." Lord Pearce, *Parry* v. *Cleaver* /1970/ A.C. 1, at p. 33.

[12] *Ibid.*, pp. 226-7.

[13] *Ibid.*, p. 234.

wholly applicable to the law. But the study clearly indicates the prime obstacle standing in the way of development of *any* theory of legal thought. Any such theory must be based on a full understanding and appreciation of the use of language in law; after all, the law has no substance apart from words. And yet rhetorical speech or writing (and legal language is rhetorical rather than symbolic)[14] has many functions. Some or all of these functions may be served (in unequal measure) in any one rhetorical (legal) statement. A theory of legal thought - which must in some sense be a theory of the use of legal language - must, first of all, encompass the multiplicity of functions of legal statements, and must, secondly, enable us to isolate and measure the functions of any one legal statement.

The Ogden and Richards style of analysis has been applied to law, in a convincing fashion, by Professor Glanville Williams.[15] Glanville Williams identifies three (at least) features of legal language which bear directly upon the possibilities of developing a description, let alone a theory,

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14 "The symbolic use of words is *statement*; the recording, the support, the organization and the communication of references." Ogden and Richards, *ibid.* p. 149. Pure science normally (but not necessarily) employs words symbolically.

15 Glanville L. Williams, *Language and the Law*, (pts. 1-5) (1945) 61 L.Q.R. 71, 179, 293, 384; (1946) 62 L.Q.R. 387. A similar but less illuminating analysis is Walter Probert, *Law, Logic and Communication*, (1958) 9 Wes. Res. L.R. 129; and Probert, *Law and Persuasion: The Language-Behaviour of Lawyers*, (1959) 108 U. Pa. L.R. 35.

of legal thought. First, legal words are often *vague*. Second, many legal words or statements possess an *ulterior meaning*. Third, the whole of law is *emotive*.

Glanville Williams identifies five classes of *vague* words: (1) words indicating qualities of continuous variation; (2) class-names; (3) names suggesting unity; (4) mathematical terms; and (5) words uncertain in their time-reference. First of all, in law, everything may depend on words of gradation: "The question whether a man is left in freedom or detained in a mental institution depends on whether he is judicially classified as sane or insane... in a murder case it may be literally a question of life or death whether the accused intended to hurt by means of an act 'intrinsically likely to kill'. Well may a convict echo the words of the poet -

> 'Oh, the little more, and how much it is!
> And the little less, and what worlds away!"[16]

With respect to class-names, Glanville Williams notes that the following questions concerning the boundaries of artificial classes have actually been considered in the law reports: "is an album a 'book'? Is a bicycle a 'carriage'? Is a flag a 'document'? Is a flying-boat a 'ship or vessel'? Are household goods 'money'? Is ice-cream 'meat'? Is sandstone a 'mineral'?[17] Regarding names suggesting unity, Glanville Williams

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[16] Glanville Williams, *Language and the Law - II*, (1945) 61 L.Q.R. 1970, at p. 183.

[17] *Ibid.*, p. 189.

emphasizes that unity is only notional.[18] In applying mathematical terms, "it is just as necessary to decide questions of degree as in applying other words."[19] And finally, with respect to words uncertain in their time-reference, "does the word 'convict' or 'felon' include a person who was a convict or felon once but who has served his sentence?"[20]

Ulterior meaning is "the meaning, other than the literal meaning, intended to be conveyed by the speaker when he uttered the words, or the meaning, other than the literal meaning, attributed by a hearer to the speaker."[21] The key point, for the purposes of our analysis, is that "the ulterior meaning of a proposition need not be logically entailed in its literal meaning."[22]

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[18] Glanville Williams, *Language and the Law - III*, (1945) 61 L.Q.R. 293, at pp. 298-9.

[19] *Ibid.*, p. 300.

[20] *Idem.*

[21] *Ibid.*, p. 400.

[22] *Idem.* Probert, *Law, Logic and Communication, supra* note 15, has identified what he calls the "by-passing" situation, "the situation where the sender is reacting to his own words in one way and the receiver reacts to those words in an entirely different way." (p. 138) Probert attributes this phenomenon, not to a problem of ulterior meaning, but simply to a lack of understanding that words may have more than one meaning, and that meanings change over time.

Finally, Glanville Williams considers at length the emotive function of words. His particular concern is to emphasize the tendency to disguise emotive statements as referential statements; this disguise often takes the form of a hypostasis of values. To Glanville Williams, law is pre-eminently an example of this process:

> Every legal proposition is reducible in the last analysis to the affirmation or denial of an 'ought'; that is to say, it is reducible either to the statement that A ought to do or refrain from doing something, or else to the statement that there is no 'duty' (a hypostatized 'ought') that A shall do or refrain from doing something. Thus the whole of the law consists of emotive statements.[23]

Simply because the law is emotive does not mean, of course, that the law is "nonsense." As Hayakawa has argued, a statement need not be an analytic or synthetic proposition to be worthy of serious discussion.[24] Hayakawa has described a certain sort of emotive statement as the language of social agreement; the language of social agreement includes the law, which is "the mighty collective effort made by human beings to inhibit the 'discrete and separate spurts of impulse' and to organize in their place that degree of order, uniformity, and predictability of behaviour that makes society possible."[25]

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23 Glanville Williams, *Language and the Law - V*, (1946) 62 L.Q.R. 387, at 396.

24 S.I. Hayakawa, *Semantics, Law and "Priestly-Minded Men"*, (1958) 9 W. Res. L.R. 176.

25 *Ibid.*, p. 179.

The danger is - and it is a danger to which the law is particularly susceptible - that we will never be certain what are emotive statements and what are descriptive statements. Stoljar has argued that "legal thinking is vitiated by one great error"[26] - what he describes as the failure to distinguish between problems involving the logic of description and problems involving the logic of attitudes:

> The logic of description deals with the inferential pattern of legal thinking; it investigates legal rules as such, i.e., as expressed purely descriptively in terms of facts and consequences, and tries to explain how, or to what extent, they are compatible and consistent with each other. The logic of attitudes, on the other hand, deals with the specific role played by value judgments in the formulation of legal principles; above all, it attempts to analyze the "logical" and linguistic devices by which lawyers seek to attain their moral objectives.[27]

Stoljar sought to incorporate in an analysis of legal problem-solving the insight into the function of law revealed by, among others, Glanville Williams, when Williams emphasized the tendency to disguise emotive statements as referential statements.

The law is words and only words; all depends on semantics and syntax. Any "theory" of legal thought must perforce be a theory concerning the use of a particular kind of language - legal language. Legal language - being rhetorical - possesses characteristics which make theory formulation particularly

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26 Samuel J. Stoljar, *The Logical Status of a Legal Principle*, (1953) 20 U. Chi. L.R. 181, at p. 183.

27 *Ibid.*, p. 184.

difficult. Legal words are multifunctional, in the sense identified by Ogden and Richards. Perhaps the prime function is emotive (persuasive). What is logical and ordered - what can best be explained theoretically (in a scientific sense)-is not always what is most persuasive. At first glance, then legal reasoning seems like non-reasoning; legal "reasoning" is only the emotive use of special multifunctional words and word-constructs to impress and persuade the listener. In these circumstances, can a proper and useful theory ever be developed?

C. The first question: how is legal argument formulated?

(1) Deduction, induction and analogy

> The form of thought, like the form of love, may too soon satiate the restlessness of the undiscerning.*

Traditional theories of legal thought are built upon the related concepts of *deduction*, *induction* and *analogy*. These terms, in their simplest sense,are widely understood. *Deduction* signifies reasoning from the universal to the particular. Hence the famous syllogism:

> Socrates is a man;
> All men are mortal;
> So Socrates is mortal.

Induction signifies reasoning from the particular to the universal; as Stoljar puts it, "from having observed that Jones and Smith and Robinson have died we wish to state that mortality

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*Clarence Morris, *How Lawyers Think*, (Cambridge: Harvard University Press, 1937), p. 137.

will hold good of all men."[28] Since for this induction to be a proper one, Tom, Dick and Harry must resembles Jones, Smith and Robinson, the ability to make inductions depends on the ability to draw analogies.[29]

A sophisticated traditional theory is that found in Levi's 1949 work *An Introduction to Legal Reasoning*.[30] Levi perceived legal reasoning as depending first upon induction based on analogy, and then proceeding deductively. First the legal problem-solver finds a decided case with facts *analogous* to those currently confronting him. Then, proceeding *inductively*, a "rule of law" is extracted from the decided case. Finally the "rule" is applied deductively to the facts in hand.[31]

A contemporary and complex version of the traditional theory, in this case emphasizing deduction, is presented by

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[28] Samuel J. Stoljar, *The Logical Status of a Legal Principle*, (1953) 20 U. Chi. L.R. 181, at p.185.

[29] *Ibid.*, pp. 185-7.

[30] E. Levi, *An Introduction to Legal Reasoning*, (Chicago: University of Chicago Press, 1949).

[31] *Ibid.* pp. 73-4. For reviews of the Levi book, see Walter G. Becker, Charner Perry and Max Rheinstein, *Review of Levi, An Introduction to Legal Reasoning*, (1951) 18 U. Chi. L. Rev. 394. For Levi's views on judicial reasoning, see Levi, *The Nature of Judicial Reasoning*, in Sydney Hook (ed.) *Law and Philosophy* (New York: New York University Press, 1964).

Kent Sinclair.[32] It is Sinclair's view that "deductive organization characterizes legal argument and gives it its ultimate cogency."[33] He writes:

> Many writers who deprecate deductive reasoning have argued that it is of trivial importance to law because it is used only "at the end of the process" after the important questions determining the premises are decided by other means. No justification for the assumption that deduction has importance only after the premises are validated readily appears. Evidently, the assumption is made because only then are we sure that the argument's conclusions are sound. However, it seems far more plausible that a deductive framework must be adopted before any other analysis. Otherwise, discussion of the specific propositions would be undirected, if not in fact a meaningless enterprise; only creation of deductive structures permits informed selection of which propositions to examine or prove. The following set of successive arguments shows the usefulness of deduction in clarifying and directing inquiry.
>
> All rules of *X* sort should be adopted.
> *Y* is a rule of *X* sort.
> *Y* should be the rule adopted.
>
> To justify the major premise, on the issue of why *X*-type rules should be adopted:
>
> All rules serving Z_1 - Z_n policies should be adopted over other rules.
> All rules of *X* sort serve Z_1 - Z_{10} policies.
> Therefore, all rules of *X* sort should be adopted.

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[32] Kent Sinclair, *Legal Reasoning: In Search of an Adequate Theory of Argument*, (1971) 59 Calif. L. Rev. 821.

[33] *Ibid.*, p. 833. Castberg goes further: "...the foundation which we, as rational beings, demand of every solution of a legal conflict, cannot be made other than by a logical conclusion from a normative proposition, to which we attribute validity." Frede Castberg, *Problems of Legal Philosophy*, (Oslo: Oslo University Press, 1957), p. 67.

> Similar reasoning dictates the decision on whether policies Z_1 -Z_n predominate over another set of concerns, and so on. At each step of the progression a deductive approach helps isolate the issues and provide the answer. The *analogical* answer, "*X* is a rule like the rules in contexts *B*, *C* and *D*" is a thinly disguised deduction:
>
> > In all contexts similar to *B-D*, *Q* rules work well. The present context is similar to *B-D*. Therefore, all rules of *X* sort should be adopted.[34]

Just as Sinclair has tried to give new life to the notion that deduction is central to legal reasoning, so Becker has lately taken up the cudgels on behalf of analogy. Becker introduces the concept of *dynamic* analogy to this discussion: "What makes one thing an analog of another is... its performance with respect to that other, under specified conditions."[35] Writes Becker:

> ...what one looks for in a good dynamic analogy (for argument) is simply an object which has a property which can be "yoked" to a property in its analog for the purposes at hand. Relevance, or validity (i.e. whether *A* and *B* are appropriately thought of as analogs for a given purpose) is decided here in just the way one decides the worth of a theoretical model: in terms of its consequences for predictive, explanatory, heuristic, or other tasks.[36]

Finally, Horovitz has recently put forward the curious claim that "typical legal argument, *to the extent that it is*

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34 *Ibid.* p. 834.

35 Lawrence C. Becker, *Analogy in Legal Reasoning*, (1973) 83 Ethics 248, at p. 251.

36 *Ibid.*, p. 252.

rational, is in principle formalizable within the framework of some appropriate, so far nonexistent, theory of inductive support."[37] Apparently Horovitz is not particularly concerned with the precise problem of argument formulation, nor with that of the best argument presentation mode; his concern is with the development of the overall system. Writes Horovitz:

> Since logic and system are interdependent, the eventual application of inductive logic to law must involve a proper development and adaption of the legal system. ...The four interrelated activities involved in the undertaking - viz., formally adequate reconstruction of legal language, elaboration of specifically legal principles and rules, promotion of scientific research relevant to law, and progressive introduction of inductive procedures - are... referred to as *rationalization*. ... Accordingly, the thesis of qualified legal inductivism may be construed as a basic principle guiding the rationalization of law.[38]

(2) The process approach

> ...logic in excess has never been the vice of English law...*

Almost as soon as the traditional theory - relying on simple conceptions of deduction, induction and analogy - was

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37 Joseph Horovitz, *Law and Logic*, (New York: Springer-Verlag, 1972). p. 11.

38 *Ibid.*, pp. 11-12. Of some interest here is Horovitz's account of the "pseudoformalistic" position of Ulrich Klug (see *Juristische Logik*, 2nd ed., (Berlin: Spring-Verlag, 1958)). Klug considers the modes of legal reasoning to be purely formal inferences - *argumenta a simile, e contrario, a maiori, ad minus*, ect. Klug's position is *pseudoformalistic* because he regards the modes of legal reasoning, although designated by these terms, to be heuristic rather than truly logical.

*Lord Wilberforce, in *Cassel & Co. Ltd.* v. *Broome* [1972] 1 All E.R. 801, at p. 860.

being articulated, some thinkers were repudiating it, arguing that this theory was unduly mechanistic and empirically inaccurate. Dewey, for example, preferred to emphasize the actual *process* followed by a lawyer in formulating a legal argument:

> As matter of actual fact, we generally begin with some vague anticipation of a conclusion (or at least of alternative conclusions), and then we look around for principles and data which will substantiate it or which will enable us to choose intelligently between rival conclusions. No lawyer ever thought out the case of a client in terms of the syllogism. He begins with a conclusion which he intends to reach, favorable to his client of course, and then analyzes the facts of the situation to find material out of which to construct a favorable statement of facts, to *form* a minor premise. At the same time he goes over recorded cases to find rules of law employed in cases which can be presented as similar, rules which will substantiate a certain way of looking at and interpreting the facts. And as his acquaintance with rules of law judged applicable widens, he probably alters perspective and emphasis in selection of the facts which are to form his evidential data. And as he learns more of the facts of his case he may modify his selection of rules of law upon which he bases his case.[39]

If we accept the Dewey line of reasoning, the lawyer preparing a legal argument does not employ in the traditional way the traditional methods of deduction, induction and analogy, but rather, (1) decides first on the desired conclusion of his argument; (2) determines then what premises will enable him to reach this conclusion; (3) searches next in the

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[39] J. Dewey, *Logical Method and Law*, (1924) 10 Corn. L.Q. 17, at p. 23. A similar recent analysis is to be found in Bruce G. Buchanan and Thomas E. Headrick, *Some Speculation About Artificial Intelligence and Legal Reasoning*, (1970) 23 Stanford L. Rev. 40.

analogous jurisprudence to find these premises, perhaps using legal ingenuity to convince his audience of analogies that were not readily apparent; (4) uses induction as a tool to demonstrate how the desired premises emerge from the analogous cases; and (5) fits the entire construct into a syllogistic model. This five-step description of legal reasoning is subject to at least two important qualifications. First, as we have already noted, there is a feedback component of the process. The lawyer is not completely unrestricted in the formulation of the argument; when he approaches the legal "data base" to find cases containing the desirable premises, he may be forced by what he finds to modify the premises and, in turn, compromise his conclusion. There are limits to the analogies that can be found by even the most resourceful lawyer. Secondly, it is possible (and often happens) that not even a compromised conclusion can be reached on the basis of the existing "law": there is no support whatsoever for the lawyer's argument in the legal data base. In this situation, two options are open to the lawyer. He can simply advise his client that his case is hopeless. Or, he can seek a judicial decision based on policy rather than precedent.[40]

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[40] H.F.M. Crombag, J.L. de Wijkerslooth and E.H. van Tuyl van Serooskerken have lately attempted to present a similar analysis in a rigorous form (*On Solving Legal Problems* (Leyden: University of Leyden, undated)). These authors argue that lawyers, like chess players, reason regressively, that is, so that a hypothetical solution becomes prescriptive for the solving process. They have devised a working program in diagram form for the solution of a civil law problem, employing up to forty-two identified steps. This working program is reproduced as Appendix A to this study.

Clarence Morris further developed the argument that logic has little place in the formulation of legal argument. His analysis of legal thought-process closely resembles that of Dewey:

> The facts which are recited initially suggest theories, which when amplified and modified by thought and work suggest further inquiries concerning the facts, which again suggest amplification and modification of theories. The alternating process continues until a solution is recognized and acted upon.[41]

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> Practically nothing in logic books will help the problem-solver who has no premises at all to determine what theories are useful and what facts are significant. Only after the problem-solver has got some sort of hold on the significant will logic be useful. Then logic may be used to indicate possible lines of development.[42]

But Morris displays more caution than Dewey; it is his notion that legal problems can, in a general way, be "located" on the "legal map" and that the "location" of the problem is a restraint on argument formulation. The legal map is a classification system, and the legal problem is located when it is characterized: "the value of vague legal terms is that they may be used to point out the general location of a problem, they rid the problem-solver of much that is totally irrelevant, they get him somewhere near the relevant, they make working classification possible, they aid him in remembering where

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41 Clarence Morris, *How Lawyers Think*, (Cambridge: Harvard University Press, 1937), p. 36.

42 *Ibid.*, p. 41.

to look for the nature of problems."[43] Morris believes that, in some objective sense, a problem can have a "nature" and a "location," and that, again in some objective sense, there can be legal material "relevant" to a legal problem. In this way, he institutionalized the outer limits of argument formulation.

Jenson enlarged upon the notion that a process of classification, rather than induction or deduction, is central to legal thought. He wrote: "...the situation is: If *p* then *q* (or perhaps even: All *S* is *P*) but then the question is just whether defendant's conduct is an instance of *p* (or *S*)."[44]

(3) Some other perspectives

(a) The role of rules; Dickinson

The process theorists, who repudiated traditional theories of legal thought, emphasized the lack of constraints operating on the lawyer formulating a legal argument; they demonstrated that a key weakness of traditional theorists was their failure to recognize that much of the process of legal argument formulation was simply a process of justifying conclusions reached for "non-legal" reasons. But, in turn, this "counter-theory" is inadequate, for it fails to take into account the critical role of rules in the legal argument formulation process.

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43 *Ibid.*, p. 135.

44 O.C. Jenson, *The Nature of Legal Argument*, (Oxford: Basil Blackwell, 1947) p. 12.

In the first place, in very many cases legal rules exercise considerable restraint on the process. Dickinson noted that there exists "a large and important class of cases in which it is not too much to say that the outcome is in fact directly dictated by a legal rule without the intervention of judicial discretion in the smallest degree."[45] Where there is no judicial discretion, neither is there discretion for the lawyer seeking to succeed before the judge.

In the second place, where one is dealing with the application of a number of (possibly competing) rules, or with the application of rules containing terms representing "India rubber concepts" or of rules of higher generality, legal rules *by their very nature* may permit substantial creativity in argument formulation. Where there are a *number* of rules, legal rules "operate on the decision mainly by determining whether or not any issues, and if so which ones, remain to be decided in order to reach an ultimate decision of the case..."[46] In other words, in cases of this kind some legal questions are directly raised by the answers to other legal questions. As questions are answered in sequence by the application of rules, attention is directed to the final and generally most significant question, which may itself call only for the application

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45 John Dickinson, *Legal Rules: Their Function in the Process of Decision*, (1931) 79 U. Pa. L. Rev. 833, at pp. 846-7.

46 *Ibid.*, p. 849.

of a rule, or may assume the guise of a policy issue. In the former instance, although the case involved the application of a number of rules, these rules dictated the decision.[47] With respect to the cases which call for the application of competing rules, Dickinson observed that "whenever a fact-situation... creates possibility of conflict between two rules of law, the opportunity arises for a *creative precedent*, - for a decision, that is, which will make a new rule of law to cover a doubtful case."[48] Finally, some rules "are expressed in forms of words which on examination permit considerable latitude as to what may or may not be included within them."[49] Dickinson writes:

> In "applying" a rule of this character composed of terms so broad that they have been referred to as "India rubber concepts", the decision of the adjudicating agency is substantially a discretionary act, determined, inside the limits of the broadest possible meaning of the rule, by the interplay of a mass of subjective influences, prejudices, pre-conceptions, of which the adjudicating officer himself can be expected to give no complete or adequate account, and of which he is probably in the normal case not even aware.[50]

When we add to this consideration the power of the adjudicating officer to determine the "facts," a determination which decides

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47 *Ibid.*, p. 850.

48 *Ibid.*, p. 851.

49 *Ibid.*, p. 852.

50 *Ibid.*

which rules are applicable, the importance of "discretion" is clear.[51]

Dickinson explored the nature of "rules of higher generality" in a separate essay.[52] Rules of this kind incorporate terms like "negligence" and "consideration," and their construction "assumes that there runs through a number of specific rules some common feature which can be isolated and made the differential element forming the basis of a new and more inclusive rule."[53] In Dickinson's view, "the item of resemblance bringing particulars together"[54] is "resemblance in the reaction of approval or disapproval which particular acts evoke in a disinterested observer":[55]

> ...when the operation of a rule is left dependent on the direct application of terms like "negligence," "cruelty," "detriment," and the like, the applicability of the rule will depend not so much on discovering mere physical resemblances between the case and other cases already established as falling within the rule, but rather on the resemblance which the reaction of approval or disapproval to the case in question bears to the reaction aroused in cases forming the habitual and well established central content of the rule. The difficulty of establishing resemblances and differences between such reactions as contrasted with resemblances

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51 See *Ibid.*, p. 854.

52 John Dickinson, *Legal Rules: Their Application and Elaboration*, (1931) 79 U. Pa. L. Rev. 1052.

53 *Ibid.*, p. 1081.

54 *Ibid.*, p. 1085.

55 *Ibid.*, p. 1086.

> and differences between observed physical phenomena accounts for the essential difference in the application of legal rules and the whole process of legal reasoning as contrasted with the application of so-called scientific rules and the resulting process of scientic reasoning.[56]

Dickinson, then, injects a concept of "rule" into the theory of legal argument formulation. The process of argument formulation is properly seen within the context of legal rules; the nature of the relevant rules determines the scope and kind of creativity possible.

(b) The role of rules: Gottlieb

In his book *The Logic of Choice: An Investigation of the Concepts of Rule and Rationality*,[57] Gottlieb first proposes what is now widely accepted- that legal argument cannot be explained in terms of the concepts of formal logic. Therefore, "the test of analycity (of strict, necessary entailment) must give way to tests of validity and rationality for arguments and procedures in a given non-analytic field."[58] Gottlieb turns to the field dependence of non-analytic arguments: "We define our field as the field of reasoning in which reliance is put on rules for guidance. ... This determination of the field of argument fastens on *rules* as the

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56 *Ibid.*, p. 1087.

57 (New York: Macmillan, 1968).

58 *Ibid.*, p. 28.

critical inference-guidance device to be analyzed."[59]

How do legal rules operate as an inference-guidance device? First of all, a rational legal decision must show a correspondence between all relevant facts and the *protasis* of the rule (or rules) that has been applied; the *protasis* is that part of the rule which points to the circumstances in which it operates.[60] The *protasis* of a rule may, of course, be vague. Therefore, "the decision on the meaning of the word-in-the-rule is not just a decision about linguistic usage; it is a decision whether to apply the rule or not, and it often seems as if legal decisions involve questions of classification."[61]

The *protasis* of the rule must correspond to the relevant facts. But what are the "relevant facts"? Writes Gottlieb:

> The application of rules in rule-regulated fields must... pre-suppose the application of additional standards of materiality for the selection of material facts. This means that the application of rules in such fields requires a determination of materiality which is partly dependent upon other systems of rules and standards. The expectation then that legal rules can be used to govern legal judgments to the exclusion of other rules is groundless. It now appears that non-legal standards are infused at a crucial step in the process of applying legal rules.[62]

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59 *Ibid.*, p. 29.

60 *Ibid.*, p. 46.

61 *Ibid.*, p. 48.

62 *Ibid.*, p. 57.

Gottlieb suggests that standards by which facts are relevant include (in addition to consideration of the applicable rule): (1) maxims and rules of interpretation; (2) moral rules and principles; (3) economic and social considerations; and (4) consequences of proposed decisions.[63] The materiality of facts, determined according to non-legal standards, in turn affects the interpretation of legal rules. At this point in his argument, Gottlieb relies heavily on the analysis of Curtis, who argued that the fulfilment of a rule lies in its being applied: "Words in legal documents... are simply delegations to others of authority to give them meaning by applying them to particular things or occasions. The only meaning of the word meaning... is an application to the particular."[64] Writes Gottlieb: "The problem of interpretation thus entirely changes in character, it involves not discovering something in the rule, but finding guidance for the application of rules."[65] What provides guidance for the application of rules is *purpose*. Vagueness of purpose or competing purposes, merely enlarge the discretion of those applying the rule. Thus, rules become "devices designed to guide inferences leading to choices and judgments which tend to promote some

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63 *Ibid.*, pp. 57-62.

64 Charles P. Curtis, *A Better Theory of Legal Interpretation*, (1950) 3 Vand. L. Rev. 407, at p. 425.

65 Gottlieb, p. 101.

end-in-view."[66] Where interests compete and purposes differ, with fundamental differences being revealed, then as any ethical relativist understands, the discussion ends, with disputants being forced to rely on conscience alone.

The Gottlieb thesis, then, is that legal rules are an inference-guidance device; that the rational application of legal rules requires a correspondence between relevant facts and the *protasis* of the applicable rule; that since many legal rules have a vague *protasis* the decision to apply the rule is more than just a decision about linguistic usage; that decisions about the materiality of facts are partly based upon systems of non-legal rules and standards; that legal rules may be interpreted in light of facts called material for non-legal reasons; and that the ultimate guidance device for legal rules is purpose. In the end, this analysis, like many others, emphasizes non-legal characteristics of the legal problem-solving process, and pictures the purely "legal" aspects of the process (for example, legal rules) as operating within and being dependent on a complex framework of policy and intuition.

(c) Dialectical reasoning

What has been called the New Rhetoric movement began with Viehweg[67] and received its major impetus from Chaim

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66 *Ibid.*, p. 114.

67 T. Viehweg, *Topik und Jurisprudenz*, (1953).

Perelman.[68] This movement holds that the *good* legal argument is the *persuasive* legal argument; arguments should properly be characterized, not as correct or incorrect, but as strong or weak. In a recent article, Bodenheimer described this view as a theory of "dialectical reasoning," such reasoning being in Bodenheimer's view a fourth type of argumentation (after deduction, induction, and reasoning by analogy).[69] Dialectical reasoning is based on the Aristotelian *topoi*: "*Topoi* are for Aristotle propositions, hypotheses, or points of view which may serve as guidelines or pointers for the solution of controversial questions... The *topoi* give hints as to how one may deal with a problematic situation to avoid

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[68] Perelman's major recent works include *The Idea of Justice and the Problem of Argument*, (New York: Humanities Press, 1963); *What the Philosopher May Learn From the Study of Law*, (1966) 11 Nat. L. For. 1: *Le Raisonnement juridique*, (1965) 2 Etudes Philosophiques 135; and *Raisonnement juridique et Logique juridique*, (1966) 11 Archives de Philosophie du Droit 1.

[69] Edgar Bodenheimer, *A Neglected Theory of Legal Reasoning*, (1969) 21 J. Legal Ed., 373.

getting hopelessly entagled in its complexity."[70]

D. The second question: how can legal argument be presented?

(1) Introduction

Once a legal argument has been devised, the problem arises of how that argument should be presented, or can best be presented. Some modes of presentation are more persuasive, for whatever reason, than others. Some modes of presentation offer a test of the clearness of the argument. Is it free from ambiguity? Does the conclusion follow from the premises?

Much of the confusion in the literature concerning legal thought is confusion between the related but separate questions of (1) how legal argument is formulated, and (2) how legal argument can and should be presented. The *form* of presentation has been taken by some writers as the equivalent of the *process* of formulation.

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[70] *Ibid.* pp. 381-2. For an interesting discussion of two other nonformalistic positions - those of Engisch and Simitis - see Horovitz, *supra* note 37, at pp. 53-65. Horovitz is highly critical of nonformalism. "Indeed," he asks, "if the rational force of a legal argument does not reside in its ideal logical form, then what is its foundation?" (p. 126) Horovitz considers that nonformalists have made a crucial error in discarding the idea of formal nondeductive legal logic; they have not recognized the possibilities presented by inductive logic. Writes Horovitz: "The valuational aspect of legal argumentation may be seen as resolvable, in principle, into a logical element - viz. the deontic character of legal logic - and a complex residual element - confirmation - which, in turn, involves legal and methodological grounds, empirical elements - viz. psychosocialogical laws and particular facts - and a formal element - inductive support." (p. 128)

(2) Deduction, induction and analogy

As we have already observed, the traditional logical concepts of deduction, induction and analogy have been accepted by some theorists as adequate to explain the process of legal argument formulation. And yet it is clear, upon examination, that these notions at best are only vehicles for the expression of legal argument. That this is so emerges with force from the analysis of Dewey referred to earlier.[71] Dewey thought that although the results of the legal thought-process can be expressed in syllogistic *form*, the conclusion of that process is not reached through a syllogistic *process*. In Dewey's opinion, what the lawyer does is first decide on a desirable conclusion, and then search for major and minor premises which will permit him to reach that conclusion. (it may well be, of course, that in the search for premises the lawyer is forced to change his conclusion to a less attractive one because of the lack of suitable "principles and data.") Secondly, Dewey emphasized the role of analogical reasoning, but analogy's purpose is only to delimit the jurisprudence which can properly be searched to find the premises leading to the desired conclusion. Furthermore, a distortion of the analogical process may well be used improperly to enlarge the proper scope of enquiry if useful premises are found outside that scope. Finally, for Dewey, induction

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[71] *Supra*, n. 39.

appears to be the process by which extraction of the needed premises from the discovered "analogy" is justified.

Jenson, it will be remembered, was particularly concerned to repudiate the role of *deduction* in legal thought. He wrote:

> ...the problem is one of classification rather than one of deduction. Very well, it might be said, let us grant that the crucial question is whether the conduct, *X*, *is* an instance of *S*; but when this point is settled does not the judgment '*X* is therefore *P*' follow as the conclusion of a syllogism 'All *S* is *P*, *X* is *S*; therefore, *X* is *P*?
>
> The reply to this is that if there is a process of logical deduction, it occurs only in the final stage and is so obvious that it need not be, and is not, given explicit formulation.[72]

When this process *is* formulated explicitly, all that is being formulated is the best expression of an argument already devised. Sinclair, a proponent of the critical role of deduction in legal thought formulation unwittingly explains the Jenson hypothesis; he puts forward a convincing account of the deductive *structure* of legal inquiry. According to Sinclair, for a reason to be a reason for a conclusion, it must support or confirm the conclusion, and such support can only be found within a deductive framework: a major premise, express or implied, is essential before what then becomes the minor premise can be a "reason" for the conclusion. Sinclair offers a number of examples of "arguing with reasons," and suggests what he calls a "general argument-form which is always

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[72] *Supra* n. 44, p. 16.

applicable if a truth value can be assigned to its premises:

> The legal position supported by the stronger reasons is justified.
>
> $R(X)_1 \ldots R(X)_n$ are all the reasons to adopt *X*.
>
> $R(\text{Not-}X)_1 \ldots R(\text{Not-}X)_m$ are all the reasons not to adopt *X*.
>
> The combined reasons $R(X)_1 \ldots R(X)_n$ are stronger than combined reasons $R(\text{Not-}X)_1 \ldots R(\text{Not-}X)_m$.
>
> Therefore, *X* is a justified legal position."[73]

It will be remembered that Sinclair went on to argue that deduction not only characterizes legal argument, but gives it its cogency. But this radical part of his overall position seems really to be no more than a complex and extended statement of the less exceptional part of his argument - that legal arguments (in order to be arguments) are properly presented in a deductive framework (it is that framework that makes them arguments). The essence of Sinclair's radical position is that "only creation of deductive structures permits informed selection of which propositions to examine or prove;" Sinclair stresses the "usefulness of deduction in clarifying and directing inquiry."[74] *This is not to say that propositions can be either chosen or proven by virtue of the deductive framework.* It is only to point out that the deductive structure is "useful" in presenting propositions for the purpose of

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73 *Supra* n. 32, at p. 853. $R(X)$ signifies the fully explicit reasons for adopting legal position *X*; $R(\text{Not-}X)$ signifies the fully explicit reasons against adopting legal position *X*.

74 *Supra* note 32, p. 834.

choice, a choice still made for "non-logical" reasons. The lawyer must still "prove" the comparative strength premise and must still decide whether that premise if proven justifies the adoption of a given legal position. Sinclair has done no more than offer a sophisticated account of the accepted mode of *presenting* legal arguments.

The Becker version of analogy theory[75] is vulnerable to similar criticism. Clearly it is more meaningful to view analogy as a dynamic concept, but so to view it is only to change somewhat the method of comparison and the range of possible comparisons in any given case. The subsidiary role of analogy in legal argument formation is not affected; analogy, dynamic or otherwise, still only indicates to us what range of cases we can properly and convincingly consult in the search for precedents to support a conclusion already determined.

(3) Modern legal logic: Tammelo and others

The application to law of deontic logic - symbolic logic applied to normative concepts - has lately been promoted by a number of writers, with Ilmar Tammelo foremost

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75 *Supra* note 35.

among them.[76] Representative of Tammelo's work is his book *Outlines of Modern Legal Logic*.[77] From the beginning, Tammelo accepted that logic is ontologically indifferent: "The function of logical reasoning is to establish self-consistent thought. Logical reasoning does not establish material (epistomological) truth, but only the formal truth of thoughts

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76 Tammelo's writings include *Sketch for a Symbolic Juristic Logic*, (1955) 8 J. Leg. Ed. 277; *On the Logical Oppenness of Legal Orders*, (1959) 8 Am. J. Comp. L. 187; *Legal Formalism and Formalistic Devices of Juristic Thinking*, in Sydney Hook,(ed.) *Law and Philosophy*, (New York: New York University Press, 1964); *"The Is" and "The Ought" in Logic and in Law*, (Sydney: University of Sydney Institute for Advanced Studies in Jurisprudence, Materials for Postgraduate Study, 1967); *Outlines of Modern Legal Logic*, (Wiesbaden: Franz Steiner Verlag GMBH, 1969); *Logic as an Instrument of Legal Reasoning*, (1970) 10 Jurimetrics Journal 91; and *On the Construction of a Legal Logic in Retrospect and in Prospect*, (Sydney: Institute for Advanced Studies in Jurisprudence, Materials for Postgraduate Study, 1970).

Important too are the works of V.G. Kalinowski and Ron Klinger. Kalinowski's writings include *Logique déontique et logique juridique* (1965) 2 Etudes Philosophiques 157; *Introduction à la Logique Juridique*, (Paris: Sirey, 1965); and *De la spécificité de la logique juridique*, (1966) 11 Archives de Philosophie du Droit 7. For Klinger, see *Some Aspects of a Deontic System in the Service of Law*, (Sydney: University of Sydney Institute for Advanced Studies in Jurisprudence, Materials for Postgraduate Study, 1966); and *Basic Deontic Structure of Legal Systems*, (*Ibid.* 1969).

Of interest are R.L. Clark, *On Mr. Tammelo's Conception of Juristic Logic*, (1956) 8 Leg. Ed. 491: Bohuslav T. Peklo, *Observations on the Construction of Legal Logic*, (1972) 53 Arch. R.-und Sozialph. 185; and Ronald Moore, *The Deontic Status of Legal Norms*, (1973) 83 Ethics 151.

77 (Wiesbaden: Franz Steiner Verlag GMBH, 1969).

which follow from other thoughts according to the rules of consistency."[78]

The basic unit in propositional calculus is the *well formed propositional formula*, (abbreviated WFOF or WFF). A WFOF may be any single propositional variable (for example, *p* representing "*Bona fides* is a fundamental principle of international law") or may be a propositional compound made up, according to the rules, of a number of individual propositional variables. Several operators are employed for the formulation of propositional compounds. For example, the "operator of negation" is *N* followed by one unit, and means "It is not the case that..." Similarly, the operator of conditional is *C* followed by two units, and means "If... then..."[79] The Propositional values are "true" and "false." These terms are known as "truth-values," and are normally represented by a plus and minus sign respectively. Truth-values refer only to the logical status of a proposition, and bear no relation to its thought content. Tammelo gives the following example of a propositional calculus inference:

> Suppose that the premisses for an inference are:
> *If* this statute is constitutional *then* this statute is legally valid.
> *If* this statute is legally valid *then* the regulations issued in accordance with it are legally unchallengeable.

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78 Ilmar Tammelo, *Sketch for a Symbolic Juristic Logic*, (1955) 8 J. Leg. Ed. 277, at p. 280.

79 See *Supra* note 77, p. 50.

These premises can be translated into symbols as *Cpq* and *Cqr* respectively. The appropriate rule of inference is that of the law of "hypothetic syllogism" (in its conditional version), namely **CKCpqCqrCpr*.[80] Hence the conclusion is Cpr_1 whose ordinary language correspondent is:

If this statute is constitutional *then* the regulations issued in accordance with it are legally unchallengeable.

In statement form, the above inference is **CKCpqCqrCpr*. Presented in argument form, it appears as follows:

Cpq	(first premise)
Cqr	(second premise)
.: *Cpr*	(conclusion by hypothetic syllogism)[81]

From propositional calculus, Tammelo moves on to predicational calculus, which concerns itself with the internal structure of propositions. To give a simple example, if *Fh* stands for the singular proposition "London is a city," *h* represents the unique concept known as "London," while *F* represents a property possessed by that entity.[82] Finally, Tammelo discusses extensional calculus, which is "a further way of logical treatment of properties which lies in making use of the concept of classes."[83] A class is an extension determined by a predicator:

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80 The Law of Hypothetic Syllogism is one of the laws of propositional calculus for three variables. *K* followed by two units is the operator of conjunction and means simply "... and ...". The asterisk placed before the first operator sign of the compound (*) indicates a tautology - "the propositional compound whose ultimate value constellation contains only 'true'..." *Ibid.* p. 51.

81 *Ibid.*, p. 56.

82 *Ibid.*, p. 66.

83 *Ibid.*, p. 78.

> The link between classes and predications is that a class results from a predication by substituting for its predicator the indication of the range of entities for which the predication holds. Supposing that the formula *Fk* stands for the predication "Paul is a minor", *F* stands for the property "minor" characterising the range of entities of which Paul is a member. If the symbol *a* is assigned to the range of entities called "minors", *Fk* can be rendered as $R^{\varepsilon}ka$, where the symbol R^{ε} (which may be called "the epsilon relator") stands for *"is a member of"*. Thus the predication "Paul is a minor" can be rendered as "Paul *is a member of* the class 'minors'"[84]

In the final chapter of *Outlines of Modern Legal Logic*, Tammelo discusses specifically the role of modern logic in the legal universe of discourse. He defines a legal norm as "a thought-formation directed to a person or persons and containing a legally authoritative stipulation concerning an instance or instances of behaviour."[85] Norms have three parts: "The norm-subject is any entity whose behaviour a legal norm regulates... The norm-object is any instance of behaviour regulated by a legal norm... The norm-nexus links the norm-subject and the norm-object into a norm-unity..."[86] Tammelo fixes on four varieties of the norm-nexus:

"...ought to carry out..." (O^c)

"...ought to refrain from..." (O^r)

"...may carry out..." (M^c)

"...may refrain from..." (M^r)[87]

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84 *Ibid.*

85 *Ibid.*, p. 86.

86 *Ibid.*

87 *Ibid.*, p. 87.

Using these relators, legal norms can be treated as propositions subject to propositional calculus. The same technique can be employed to express the relationship between norms in a hierarchical norm structures and to represent legally significant relations between different norm-subjects.[88]

What is the precise value of this highly complex method of legal analysis?[89] Tammelo, like most of his colleagues, makes only modest claims. Take his view on the application of symbolic logic to problems of ambiguity and vagueness in the law:

> Although ambiguities and vaguenesses in law are largely a problem for the theory of non-stringent reasoning, logic is relevant to the treatment of both. Non-stringent reasoning involves steps of logical reasoning in its total course. These steps enhance the lucidity and intellectual restraint of that kind of reasoning. Moreover when non-stringent reasoning has achieved its goal in a statement to which insightful assent is sought, its soundness is tested by examining the merits and demerits of its corollaries, which are formulated by applying the principles and methods of logic. If these corollaries prove to be objectionable, there may be something wrong with the formulation of the statement or it may be materially unsound.[90]

Tammelo, despite the positive note of this passage, makes clear that the foundation of legal reasoning is non-stringent.

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88 *Ibid.*, pp. 96-101.

89 In my account of Tammelo's thought, I have only hinted at the complexity to be found in *Outlines of Modern Legal Logic*, which itself purports only to be an introductory book on the subject.

90 *Ibid.*, p. 108.

Following a discussion of the circuit-diagram method (devised by Layman Allen) and isomer-diagram method of eliminating syntactic ambiguity, Tammelo comments that "even though these techniques make explicit any syntactic ambiguity involved, they do not assist in the resolution of the ambiguity materially. To determine which alternative to choose is an extra-logical matter."[91]

E. Summary and Conclusions

Can a theory of legal thought be formulated at all? Legal rules, unlike scientific rules, are normative; they are not empirically verifiable and cannot be considered "true" or "false." Law is a system - both a hierarchical norm structure, and a network of actual ideas and institutions - that must be fully appreciated before legal thought - part of the system - can be fully understood. Finally, the stuff of law is words, and yet words used legally may only be vague words, with ulterior meaning, used emotively. Rhetorical language making up norms in a complex and ever-changing system - how can these things be the components of scientific theory?

The problem of constructing a theory of legal thought has been made worse by confusion in the literature between the related but separate questions of (1) how legal argument

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91 *Ibid.*, p. 114.

is formulated, and (2) how legal argument, once formulated, should be or can best be presented. Early theorists constructed their notion of legal thought out of the traditional concepts of deduction, induction and analogy. Levi, for example, considered that a lawyer first thought inductively (and in this first stage employed analogy), and then proceeded deductively. Sinclair, in a contemporary version of this approach, argues that deduction is not only the framework for legal arguments, but that it is also the only structure for the proper legal inquiry. Becker, another contemporary writer, attempts to breathe new life into the role of analogy by introducing the concept of dynamic analogy.

But other writers have correctly perceived these traditional notions to be relevant only to the *presentation* of legal argument, and have looked elsewhere for understanding of the process by which legal argument is formulated. From the analysis of Dewey, Morris, Jenson, and others, we learn that a typical lawyer putting together his argument, most likely (1) decides first on the desired conclusion of his argument; (2) determines then what premises will enable him to reach this conclusion; (3) searches next in the analogous jurisprudence to find these premises; (4) uses induction as a tool to demonstrate how the desired premises emerge from analogous cases; and (5) fits the entire construct into a syllogistic form (for purposes of clarity and persuasiveness). The process theory, so to speak, stands the traditional theory on its head.

Examination of the role of rules in legal thought sheds further light on the process of legal argument formulation. Although in some cases a legal outcome is determined by the discretion-free application of a single legal rule, more often (and more significantly) the rule to be applied will be a rule of higher generality, dependent on "India rubber" concepts, calling forth discretion and legal creativity. Or, several (possibly competing) legal rules will be relevant, again providing an opportunity for the use of imagination in establishing new precedent. Rules, as Gottlieb explains, become only inference-guidance devices, dependent on a concept of *purpose*, the promotion of an end-in-view.

Fundamental, then, to an understanding of legal thought is full appreciation of the actual process employed by a lawyer in constructing a legal argument. Essential to that process, and the process' starting point, is the conclusion (purpose, end-in-view) the lawyer seeks to achieve. The sole restraining force on argument formulation is the possible existence of clearcut, precise, relevant and non-competing rules (or perhaps a single rule) in the legal data base.

The notions of deduction, induction and analogy - considered components of a theory of argument formulation by some - find their true use at the level of argument presentation. Analysis of traditional theories of legal thought, dependent upon these concepts, shows that legal propositions are neither chosen nor proven by deduction or induction.

Analogy only assists in ascertaining the initial scope of the legal inquiry. The most promising tool for argument presentation, as Tammelo and others have shown, is deontic logic. Use of symbolic logic, at the very least, enhances the lucidity and intellectual restraint of non-stringent reasoning, and provides a method of determining whether legal propositions are well formulated and materially sound.

It must be said that any jurist will readily admit that the problems of argument formulation and argument presentation are interrelated. If we can determine what is (in some sense) the best means of presenting a legal argument, that determination will perhaps tell us much about the best way (or even the normal way) of formulating such an argument. Similarly, if we can understand how it is that lawyers formulate legal arguments, how those arguments should be presented may quickly become apparent. However, despite this close relationship between the two questions of legal thought, they remain two separate questions; continued development in inquiry into legal thought requires their individual treatment.

The elements of reasonable inquiry into legal thought are now clear. We possess some idea of the process of legal argument formulation. And we have a notion of how that argument, once formulated, can be presented, and of the merit of so presenting it.

CHAPTER TWO: THE LESSONS OF ARTIFICIAL INTELLIGENCE AND SIMULATION RESEARCH

A. Artificial intelligence and simulation

The goal of artificial intelligence research is "to construct computer programs exhibiting behaviour we call 'intelligent behaviour' when we observe it in human beings."[1] AI research attempts to develop programs which will perform in the best possible way the intellectual tasks that humans perform, sometimes well and sometimes poorly. Most AI programs employ human approaches to problem-solving devices - often a heuristic approach - but algorithmic or "brute force" programs also fall within this field of research.

Cognitive process simulation is concerned "with the programming of computers to perform intellectual tasks in the same way that persons perform these tasks."[2] Research of this kind attempts to increase understanding of human cognitive processes. The test of a simulation program's adequacy is normally considered to be the extent to which it is a good predictor of human behaviour.[3]

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1 E.A. Feigenbaum and J.F. Feldman, *Computers and Thought*, (New York: McGraw-Hill, 1964) p. 3. Although this book is now substantially out-of-date, it remains a classic in its field.

2 *Ibid.*, p. 269.

3 For a comprehensive account of computer simulation, see John M. Dutton and William H. Starbuck, *Computer Simulation of Human Behaviour*, (Toronto: John Wiley & Sons, 1971) See particularly John M. Dutton and Warren G. Briggs, *Simulation Model Construction, ibid.*, pp. 103-126.

The concepts of artificial intelligence and simulation of cognitive processes are not always kept separate. Indeed, Newell and Simon's General Problem Solver "maximally confuses the two approaches - with mutual benefit."[4] Newell and Simon claim that in the GPS a new methodological sophistication is brought to bear on cognitive psychology: "...we can write a program that constitutes a theory of the computer's behaviour in literally the same sense that the equations of Newtonian dynamics constitute a theory of the motions of the solar system."[5] They write: "To explain a phenomenon means to show how it inevitably results from the actions and interactions of precisely specified mechanisms that are in some sense 'simpler' than the phenomenon itself."[6] The mechanisms in this context are information processes, and the "explanation" consists of using a program to organize these processes in such a way that recognizable behaviour results. In this sense, a computer program represents a psychological theory.[7]

I suggest that this line of reasoning is suspect. The

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4 Allen Newell and Herbert A. Simon, *Simulation of Human Thought*, in Dutton & Starbuck, *ibid.*, p. 150.

5 *Ibid.*, p. 152.

6 *Ibid.*, p. 153.

7 See Nico H. Frijda, *Problems of Computer Simulation*, in Dutton & Starbuck, *ibid.*, pp. 610-618.

description of a process producing the same result as human thought is not necessarily an explanation of the human thought process; coincidence of result may be fortuitous, without significance. Furthermore, even if *ex hypothesi* only *one* process can produce the result in question, a description of that process may not be the equivalent of an explanation of it, at least in the case of sensible bodies. A human being, in performing a commonplace act, may well be conforming, out of necessity, to the most complex laws of physics, but a recitation of those laws does not constitute an explanation of his behaviour. We would do well to preserve, to begin with, the distinction between artificial intelligence and cognitive simulation.

B. Some historically significant areas of artificial intelligence and simulation research

(1) Machine translation

Martin Kay has written of machine translation that "there has probably been no other scientific enterprise in which so much money has been spent on so many projects that promised so little."[8] Kay was far from the first to reach this conclusion. In 1966, a committee of the United States National Academy of Sciences reported that a satisfactory translating machine was not likely in the foreseeable

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8 Martin Kay, *Automatic Translation of Natural Languages*, (1973) Vol. 102, No. 3, Daedalus 217, p. 217.

future.[9] The committee concluded that machine translation was slower, less accurate and more costly than that provided by human translators; the only important result of research in this field was thought to be a "fall-out" of a better linguistic understanding.

Why have attempts to devise adequate machine translation systems been abject failures? An explanation given by Kulagina and Mel'cuk[10] stresses a critical gnostic problem: "It is well known that a perfect command of the respective languages is not enough for a good translation; the translator (or editor) has to perfectly understand what is said in the text under translation, i.e. to have a perfect command of real situations described."[11] Bar Hillel's famous *The box is in the pen* example illustrates the point. This sentence can mean either "the box is in the small enclosure for children to play in" or "the box is in the writing pen." To know that the latter formally correct interpretation is

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9 Automatic Language Processing Advisory Committee, National Academy of Sciences, National Research Council, *Languages and Machines*, (Washington: U.S. Government Printing Office, 1966).

10 O.S. Kulagina and I.A. Mel'cuk, *Automatic Translation: Some Theoretical Aspects and the Design of a Translation System*, in A.D. Booth (ed.), *Machine Translation*, (New York: American Elsevier, 1967) p. 139.

11 *Ibid.*, p. 141.

unlikely to be the "real" meaning of the sentence requires a knowledge of the world which computers foreseeably will not possess.

The smallest unit of meaning in most languages is a *pattern* composed of several words or perhaps several sentences. Accordingly, word-for-word translation is likely to produce absurdities. For proper translation a computer must have syntactic understanding, and yet such understanding (of a sophisticated sort) is probably beyond the grasp of current computer development. It has been estimated that there are about 10^{50} English sentences of twenty words or less, putting effective mechanical translation perhaps as much as forty-five orders of magnitude out of reach.

Despite these difficulties, of the most severe kind, research into mechanical translation continues.[12] But for the most part, hopes are not high. In the face of the gnostic problem - computer ignorance of the real world - caution is justified.

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[12] One of the more interesting ongoing projects is the SYSTRAN System of the United States Air Force. SYSTRAN translates Russian into English, and substantial claims are being made for the results of second-phase optimization. See Peter P. Toma, Ludek A. Kozlik, and Donald G. Perwin, *Optimization of Systran System*, (La Jolla: LATSEC Incorporated, 1973).

(2) Chess-playing programs

Algorismic solutions to complex problems (such as game playing) are inadequate, for possible solutions to complex problems increase exponentially, rendering their bulk beyond computer capability. Heuristics are the answer, although heuristics entail the risk of bypassing the optimum solution, or indeed, any solution at all.

If we assume a chess game to consist of forty moves, then by the time a *formal* game is over some 30^{80} possible moves will have been considered. Singh points out: "Even if we assume that our chess-playing computer examines a thousand billion (10^{12}) moves per second, it will still take... 10^{98} years to make even the first move. ...this exceeds the putative age of the university by a factor of 10^{83}..."[13] The heuristic appropriate to this problem is limiting the "look-ahead" procedure to just a few moves, and restricting the examination of possibilities at each move. If we look ahead only four moves and examine only seven possibilities for each move, we restrict possible moves to 2401.

In 1949, Claude Shannon introduced a detailed description of the appropriate heuristic:

> Playing chess consists of considering the alternative moves, obtaining some effective evaluation of them by means of analysis, and choosing the preferred alternative on the basis of the evaluation. The analysis... could be factored into three parts. First, one would explore the continuations to a certain depth. Second, since it is clear that the explorations cannot be deep

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13 Jagjit Singh, *Great Ideas in Information Theory, Language and Cybernetics*, (New York: Dover Publications, 1966), p. 261.

> enough to reach terminal positions, one would evaluate the positions reached at the end of each exploration in terms of the pattern of men on the chessboard. These static evaluations would then be combined by means of the minimaxing procedure to form the effective value of the alternative. One would then choose the move with the highest effective value.[14]

The Shannon analysis was refined by Alex Bernstein.[15] Bernstein restricted the legal alternatives and continuations to be considered by introducing subroutines called plausible move generators: "Each of these generators is related to some feature of the game: King safety, development, defending own men, attacking opponent's men, and so on. The program considers at most seven alternatives, which are obtained by operating the generators in priority order, the most important being first, until the seven are accumulated."[16] Building on the work of Shannon, Bernstein and others, Newell, Shaw and Simon devised a chess-playing program with "a set of goals, each of which corresponds to some feature of the chess situation - King safety, material balance, centre control and so on. Each goal has associated with it a collection of processes, corresponding to the categories outlined by Shannon: a move generator, a static evaluation routine,

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14 Description by Allen Newell, J.C. Shaw and H.A. Simon, *Chess-Playing Programs and the Problem of Complexity*, in E.A. Feigenbaum and J. Feldman (eds.), *Computers and Thought*, (New York: McGraw-Hill, 1964), 39, at p. 43.

15 See *ibid.*, pp. 48-50.

16 *Ibid.*, p. 48.

and a move generator for analysis."[17] At the beginning of each move, the "state" prevailing evokes a list of goals. Then, "the move generator associated with each goal proposes alternative moves relevant to that goal."[18] Each proposed move is assigned a value by an analysis procedure which "consists of three parts: exploring continuations to some depth, forming static evaluations, and integrating these to establish an effective value for the move."[19] To select a move, the program sets an acceptance level as final criterion and takes the first acceptable move.[20]

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17 *Ibid.*, p. 51.

18 *Ibid.*, p. 52.

19 *Ibid.*, p. 53.

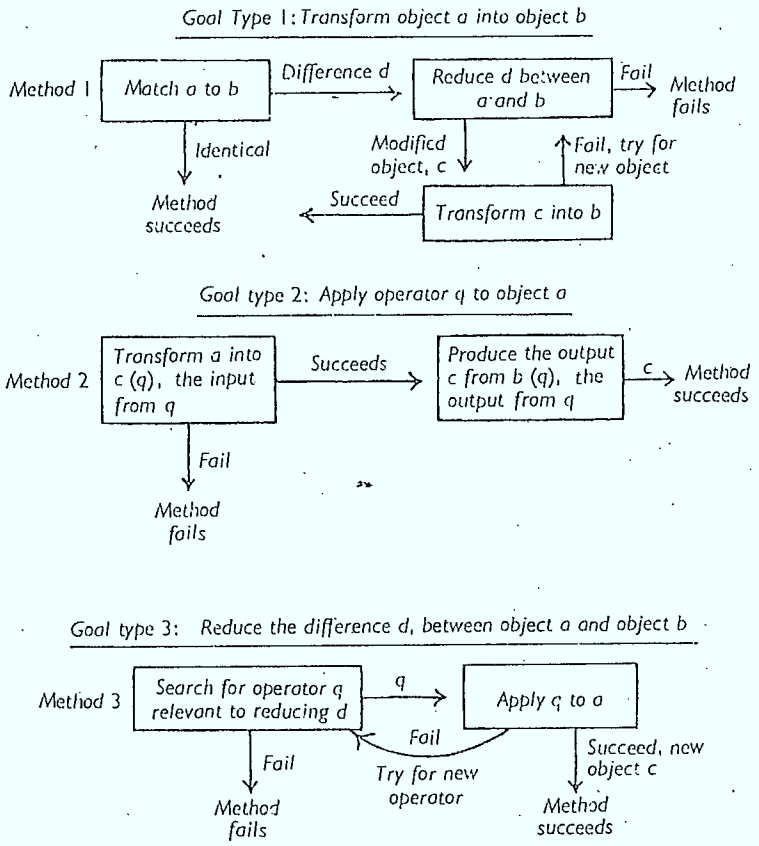
20 Newell, Shaw and Simon make clear that the analysis move generators are critical to the program's success. Continuation exploration is based on Turing's concept of a dead position: "The static evaluation of a goal is meaningful only if the position being evaluated is 'dead' with respect to the feature associated with that goal - that is, only if no moves are likely to be made that could radically alter that component static value. The analysis move generators for each goal determine for any position they are applied to whether the position is dead with respect to their goal; if not, they generate the moves that are both plausible and might seriously affect the static value of the goal. Thus the selection of continuations to be explored is dictated by the search for a position that is dead with respect to all the goals, so that, finally, a static evaluation can be made." *Ibid.*, p. 55. See Appendix B for a description of a game played between the NSS Chess Program and H.A. Simon. For a recent discussion of checker-playing programs, see Arthur L. Samuel, *Some Studies in machine learning using the game of checkers. II-Recent progress*, in Frecerick J. Crosson, (ed.) *Human and Artificial Intelligence*, (New York: Meredith Corporation, 1970) pp. 81-117.

What conclusions can be drawn from the history of chess-playing program development? Some limited success has been achieved; there exist programs which play an elementary form of chess, sufficient to vanquish the inexperienced and amateurish. But this success is no cause for jubilation in the ranks of researchers. First it is a *very* limited success, in terms of the game-playing ability of the various programs, particularly when put against the resources expended in its pursuit. Second there is no reason to believe that the heuristics developed reflect in any way the process actually followed by human beings in the playing of chess. Indeed, the limited success of chess-playing programs, viewed in light of the relatively very great chess ability of experienced human players, strongly suggests that human beings do not use heuristics of the kind employed in programs. It seems, then, that the chess-playing programs which have been developed neither play good chess, nor tell us how it is that some human beings play good chess.

(3) The General Problem Solver

The NSS chess-playing program was an expression of the development by Newell, Shaw and Simon of the General Problem Solver (GPS). GPS programming employed a heuristic strategy for solving problems of the chess-playing kind - for example, proving a theorem in symbolic logic. As Singh puts it, GPS programming "tries to mimic the specifically human technique

of free derivation guided *not* by the dreary mechanical 'method' prescribed by decision procedures but by that of 'unregimented insight and good fortune.'"[21] The GPS search for a goal is illustrated by the following figure[22] discussed by Singh[23]:



This figure clearly shows the interrelationship of the three goal types. For example, goal type 3 must be achieved before

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21 *Supra* note 13, at pp. 270.

22 Taken from Allen Newell, J.C. Shaw, and H.A. Simon. *A Variety of Intelligent Learning in a General Problem Solver*, in Marshall C. Yovits and Scott Cameron (eds.) *Self-Organizing Systems*, (New York: Pergamon Press, 1960); reproduced in Singh, p. 273.

23 *Ibid.* pp. 272-3.

goal type 1 can be reached in any cases where *a* and *b* are not identical. Similarly, goal type 3 is reduced to a type 2 if an operator *q* is found.

A critical feature of GPS programming is that it does not provide for the definition of differences between given objects. The program becomes relevant only once a set of differences has been assembled, and operators to obliterate those differences have been designed. The program, in effect, shows only how definitions and operators can be used to attain a goal; therefore it hardly constitutes a frontal attack on the problem of understanding human thought process, since a central feature of that process is devising "definitions" and "operators." Finally, the value of GPS programming to pure artificial intelligence research is limited, since the GPS is normally applied to "non-real world" problems, such as the proof of theorems in symbolic logic.

C. Problems and possibilities

Probably the most sustained recent criticism of "artificial reason" is that of Hubert Dreyfus.[24] Dreyfus argues that typically human forms of information processing have not been duplicated by researchers.

Dreyfus observes that a master chess player, in a fifteen

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[24] Hubert L. Dreyfus, *What Computers Can't Do* (New York: Harper & Row, 1972).

minute period, may consider 100-200 moves; a computer program might consider 25,000. Yet, more often than not the best move will be that of the player, and not the program. Asks Dreyfus: "What are they /*human beings*/ doing that enables them, while considering 100 or 200 alternatives, to find more brilliant moves than the computer can find working through 26,000?"[25] The answer, says Dreyfus, is what William James called the "fringes of consciousness:" the human chess player engages in a "global" form of information processing, unknown to the computer, "in which information, rather than being explicitly considered remains on the fringes of consciousness and is implicitly taken into account..."[26] One expression of fringe consciousness is the ability of human beings to "deal with situations which are ambiguous without having to transform them by substituting a precise description."[27]

Dreyfus then stresses the importance of "insight" - what he calls essential/inessential discrimination - in place of trial-and-error search:

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25 *Ibid.*, p. 15.

26 *Ibid.*, p. 8.

27 *Ibid.*, p. 19.

> ...Gestalt psychologist Max Wertheimer points out in his classic work, *Productive Thinking*, that the trial-and-error account of problem solving excludes the most important aspect of problem-solving behaviour, namely a grasp of the essential structure of the problem, which he calls "insight." In this operation, one breaks away from the surface structure and sees the basic problem - what Wertheimer calls the 'deeper structure' - which enables one to organize the steps necessary for a solution.[28]

Insight, suggests Dreyfus, is ruleless, and therefore not programmable. Accordingly, work like the GPS is "merely muddling through."[29]

Finally, Dreyfus distinguishes between perspicuous grouping, and character lists. "We normally recognize an object as similar to other objects," writes Dreyfus, "without being aware of it as an example of a type or as a member of a class defined in terms of specific traits."[30] The fact that humans do not conceptualize traits to recognize patterns distinguishes human recognition from machine recognition which operates on the conceptual level of class membership.

Dreyfus' argument is that researchers in this field have operated on four mistaken assumptions: (1) a biological assumption "that on some level of operation - usually supposed

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28 *Ibid.*, p. 26. See Max Wertheimer, *Productive Thinking* (New York: Harper & Bros., 1945), p. 202.

29 *Ibid.*, p. 31.

30 *Ibid.*, p. 34.

to be that of the neurons - the brain processes information in discrete operations by way of some biological equivalent of on/off switches;"[31] (2) a psychological assumption "that the mind can be viewed as a device operating on bits of information according to formal rules;"[32] (3) an epistomological assumption "that all knowledge can be formalized, that is, that whatever can be understood can be expressed in terms of logical relations...;"[33] and (4) an ontological assumption that "everything essential to the production of intelligent behaviour, must in principle be analyzable as a set of situation-free determinate elements."[34] Dreyfus rejects the biological assumption, referring to evidence which suggests that the neuron-switch model of the brain is not tenable.[35]

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31 *Ibid.*, p. 68.

32 *Ibid.*

33 *Ibid.*

34 *Ibid.*

35 See John von Neumann, *Probabilistic Logics and the Synthesis of Reliable Organisms from Unreliable Components*, in A.H. Taub (ed.), *Collected Works*, (New York: Pergamon Press, 1963), Vol. 5; John von Neumann, *The General and Logical Theory of Automata*, in *The World of Mathematics*, (New York: Simon and Schuster, 1956); Theodore H. Bullock *Evolution of Neurophysiological Mechanisms*, in Anne Roe and G.G. Simpson (eds) *Behaviour and Evolution*, (New Haven: Yale University Press, 1958); Walter A. Rosenblith, *On Cybernetics and the Human Brain*, (Spring, 1966) *The American Scholar* 247.

With respect to the psychological assumption, Dreyfus argues against the view that any theory of human behaviour which enables us to understand that behaviour is also an explanation of behaviour. He writes that a "physical description, excluding as it does all psychological terms, is in no way a *psychological* explanation. On this level one would not be justified in speaking of human agents, the mind, intentions, perceptions, memories, or even of colours or sounds..."[36] The epistomological assumption holds that all nonarbitrary behaviour can be formalized and that the formalism can be used to reproduce the behaviour in question.[37] Dreyfus' response to this assumption is simply to reject it; there is, he says, no reason to suppose that there can ever be a formal theory of linguistic performance. This is so partly because not all linguistic behaviour is rulelike, and partly because "for there to be a theory of linguistic performance, one would have to have a theory of all human knowledge..."[38] Finally, the ontological assumption - that everything essential to intelligent behaviour must be understandable in terms of a set of determinate independent elements - is rejected by Dreyfus on

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36 *Ibid.*, p. 89.

37 *Ibid.*, p. 102.

38 *Ibid.*, p. 110.

the grounds that human beings have an implicit understanding of the human situation which provides a context for understanding facts - a context which cannot be transmitted to a computer.[39]

Having rejected the traditional assumptions, Dreyfus proffers a strange alternative. Man, says Dreyfus, is not a *device*;[40] man has "an involved, self-moving, material body" which cannot be reproduced by a heuristically programmed digital computer. Writes Dreyfus:

> The body contributes three functions not present, and not yet conceived in digital computer programs: (1) the inner horizon, that is, the partially indeterminate predelineated anticipation of partially indeterminate data...; (2) the global character of this anticipation which determines the meaning of the details it assimilates and is determined by them; (3) the transferability of this anticipation from one sense modality and one organ of action to another.[41]

In Dreyfus' eyes, the true view of human behaviour is that it is orderly behaviour *without recourse to rules*. In the human world, facts are given meaning by human purpose, while a computer can only store and sort through an enormous list of "meaningless, isolated data."[42] The human situation is a

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[39] *Ibid.*, p. 122.

[40] *Ibid.*, p. 148.

[41] *Ibid.*, p. 167.

[42] *Ibid.*, p. 174.

function of human needs:

> When we experience a need we do not at first know what it is we need. We must search to discover what allays our restlessness or discomfort. This is not found by comparing various objects and activities with some objective, determinate criterion, but through what Todes calls our sense of gratification. This gratification is experienced as the discovery of what we needed all along, but it is a retroactive understanding and covers up the fact that we were unable to make our need determinate without first receiving that gratification. The original fulfillment of any need is, therefore, what Todes calls a creative discovery.[43]

What can we make of the Dreyfus analysis? It has been roundly criticized. Bernard Williams writes of Dreyfus' philosophy that "it is not... very easy to take it seriously, or even patiently. One of its characteristics is its reliance on terms which sound explanatory, but which in fact conceal in their ambiguity many of the real questions that need to be asked."[44] Bruce Buchanan and others have observed of *What Computers Can't Do* that it makes no reference to contemporary artificial intelligence research, such as that

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43 *Ibid.*, p. 188-9. The Todes reference is to Samuel Todes, *The Human Body as the Material Subject of the World*, Harvard doctoral dissertation, 1963.

44 Bernard Williams *How Smart Are Computers?* (a review of Hubert L. Dreyfus, *What Computers Can't Do: A Critique of Artificial Reason*) November 15, 1973, *The New York Review of Books*.

undertaken by Colby and Winograd (discussed later in this study).[45]

But Dreyfus *has* identified problems which appear critical to an evaluation of artificial intelligence and simulation research. Why *is* it that a human chess-player can easily beat a heuristically-programmed computer, even when the computer's heuristics are well thought-out and appear to approximate human heuristics, and even when the computer considers many more moves than the human player? What is the nature of the apparent ambiguity tolerance of human beings? How is it that humans can group on a perspicuous basis, and what is the nature and role of "insight?" Whether or not we adopt the Dreyfus analysis, we cannot ignore these questions.

It is Dreyfus' argument that researchers in the field have ignored phenomena such as fringe consciousness and insight, and have operated on biological, psychological, epistomological and ontological assumptions which taken together cannot explain (according to Dreyfus) the remarkable ability of human beings to perform some tasks - such

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[45] Bruce G. Buchanan, *Review of Hubert Dreyfus' What Computers Can't Do: A critique of Artificial Reason*, (Stanford: Computer Science Department, Stanford University, 1972). Stanford Artificial Intelligence AIM-181; Computer Science Department Report STAN-CS-72-325. I am indebted to Bruce Buchanan for discussing this subject with me and giving me a copy of this review.

A savage attack on Dreyfus' earlier writing is to be found in Seymour Papert, *The Artificial Intelligence of Hubert L. Dreyfus: A Budget of Fallacies*, (unpublished privately circulated paper, 1968).

as translating languages or playing chess - in a superior manner. The true view, Dreyfus argues, is that human behavior, although orderly, is ruleless, and that human behaviour is heavily dependent on one thing that all computers lack - "an involved self-moving, material body."

The first part of this analysis - the rejection of assumptions said to govern artificial intelligence and simulation research - seems the most formidable part. How else can we account for the very limited success of research in this field? How else can we account for human superiority in problem-solving?

The second part of the Dreyfus analysis - the argument that humans, in a way that involves the "body," use things like "fringe consciousness" and "insight" *instead of rules* in order to think, and that the consequent thinking process is non-programmable - is far more suspect. First of all, this argument in no way follows from rejection of the more traditional analysis. Secondly, Dreyfus' emphasis on the possession by humans of a "body" - an idea which he does not develop fully in his book - seems, on the face of it, and in its underdeveloped state, absurd. Not only is it absurd, but it may not even offer a sound basis of distinction between humans and computers. Some branches of robotics are developing "bodies" for computers; this development cannot be lightly dismissed by Dreyfus, unless he is prepared to offer us a full and convincing discussion of the special

qualities of the human body. Finally, the assertion that human behaviour is ruleless is just that - an assertion. It is patently false to conclude, from the current failure of thinkers to perceive rules governing human thought, that human thought is ruleless. That is only one of the many conclusions suggested by failure.

But with these criticisms of Dreyfus made, we necessarily return to the main point of the Dreyfus analysis. The record of artificial intelligence and simulation research is not good. Dreyfus may be wrong in concluding that human behaviour is therefore ruleless and non-programmable. Nonetheless, one *can* conclude that we have yet really to grasp and describe how it is that humans think. The immediate prognosis for artificial intelligence and simulation research is, therefore, not good.

D. Contemporary research and its significance

Despite early setbacks and intensive criticism, research in artificial intelligence and cognitive simulation continues. Some recent work has mitigated previous failure and blunted outside attacks, leaving a confused but still not hopeful prospect.

(1) McCarty's TAXMAN

I have described Professor McCarty's TAXMAN program[46] elsewhere.[47] McCarty chose as his problem domain the taxation of corporate reorganizations, and particularly section 368 (the definitional provision) of the Internal Revenue Code and its predecessors. TAXMAN has the following elements: (1) a description of situations and events in the corporate reorganization area; (2) analyses of these descriptions according to legal principles; (3) heuristic mechanisms for building and modifying the given descriptions and their respective analyses, plus a capacity to call interactively on a human user. A "description" is a semantic net, with names of things as nodes and names of properties or relations as links. A semantic net can be expanded indefinitely, and can be represented in a computer data structure. To accomodate the arguable nature of any legal proposition, McCarty has adopted the convention "that every assertion in the semantic net have attachable to it an additional piece of data

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46 L. Thorne McCarty was formerly a Computer Fellow at the Faculty of Law, Stanford University, and is now a member of the Faculty of Law at State University of New York in Buffalo. I am much indebted to Professor McCarty, who has given me his wise counsel ever since I became interested in problems of computer use in law.

47 See Philip Slayton, *Electronic Legal Retrieval/La recherche documentaire électronique dans les sciences juridiques*, (Ottawa: Information Canada, 1974), pp. 18-19; *Computers and the law - an uneasy trial marriage*, (1974) 1 In Search 14.

structure giving its justification (i.e., why it was asserted in the first place) and some indication of how it can be subsequently attacked."[48] TAXMAN's analysis mechanism aims to add a final assertion supported by plausible argument to the description structure, (e.g. *x* sequence of events constitutes a tax-free reorganization for reasons *y*).

Regrettably, this promising line of research, pursued by McCarty during his stay at Stanford, has not been substantially developed, partly because of the limited resources available to McCarty. There is not even, as yet, a comprehensive published account of the project. Because of the embryonic nature of TAXMAN and the lack of full information concerning it, any conclusive judgment about it is for the moment impossible, although McCarty's ability and optimism alone make his research worth careful monitoring. Perhaps the only criticism that can be levelled at his work at this stage is that he does not appear to have explored thoroughly the characteristics of legal problem-solving; the risks of failure to conduct such exploration are clear, and have been indicated earlier in this study.

(2) PARRY: a simulated paranoid

Dr. Ken Colby of Stanford University has devised, with

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[48] L. Thorne McCarty, *Interim Report on the TAXMAN Project: An Experiment in Artificial Intelligence and Legal Reasoning*, unpublished paper presented at the Workshop in Computer Applications to Legal Research and Analysis, Stanford Law School, April 28-9, 1972, pp. 2-3.

some considerable success, a natural language program which simulates paranoid human behaviour. Dr. Vinton Cerf has described the output of the program:

> If Parry believes it understands the sentence, it produces a *canned* response appropriate to the question or statement presented. Otherwise, Parry will say something noncommittal, but relevant to the context of the present conversation... At present, Parry appears to understand about 70% of the sentences presented.[49]

The operation of PARRY is evident from the transcript of a conversation it held with DOCTOR when the two programs were connected through the Advanced Research Projects Agency (ARPA) Network. DOCTOR, a creation of Professor Joseph Weizenbaum of the Massachusetts Institute of Technology, is closely modelled on the transformational grammar program known as ELIZA. The transcript is reproduced as APPENDIX "C" to this study.

(3) ATCS: Antimicrobial Therapy Consultation System[50]

The Antimicrobial Therapy Consultation System is an artificial intelligence program designed to advise physicians

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[49] Vinton Cerf, *Parry Encounters the Doctor*, (July, 1973) Datamation 62. For a fuller and more sophisticated account of PARRY, see K. Colby, S. Weber and F. Hilf, *Artificial Paranoia* (1971) 2 Artificial Intelligence 1.

[50] I am grateful to Bruce Buchanan for informing me about ATCS, and demonstrating the system for me (Stanford, June, 1973). The discussion of ATCS that follows is drawn from Edward H. Shortliffe, Stanton G. Axline, Bruce G. Buchanan, Thomas C. Merigan and Stanley N. Cohen, *An Artificial Intelligence Program to Advise Physicians Regarding Antimicrobial Therapy*, (1973) Volume 6, Number 6, Computers and Biomedical Research. The quotations are from a draft of this article given to me by Buchanan.

regarding antimicrobial therapy. The authors are a group of doctors associated with Stanford University, and Bruce Buchanan of Stanford's Computer Science Department.

The ATCS program contains basic information about most antimicrobial drugs and clinically important bacteria, and operates according to approximately one hundred decision-making processes. Rules consist of a "PREMISE" and an "ACTION." A monitor program examines the PREMISE of a rule and if its condition are met, the ACTION portion of the rule becomes applicable.

The consultation process is driven by the monitor program. This program first examines the initial therapy rule, which provides that if the organism is known to be pseudonomas, gentamicin is the drug of choice. It retrieves a list of all rules which will assist in determination of the initial therapy rule's premise - that is, those rules which will assist in identification of the organism. If recursive application of these rules fails to find the information needed for the PREMISE, additional data is requested from the user. If eventually the conditions of the PREMISE are met, the ACTION portion of the rule is executed.

The following flow chart demonstrates the organization and recursive nature of the rule monitor:[51]

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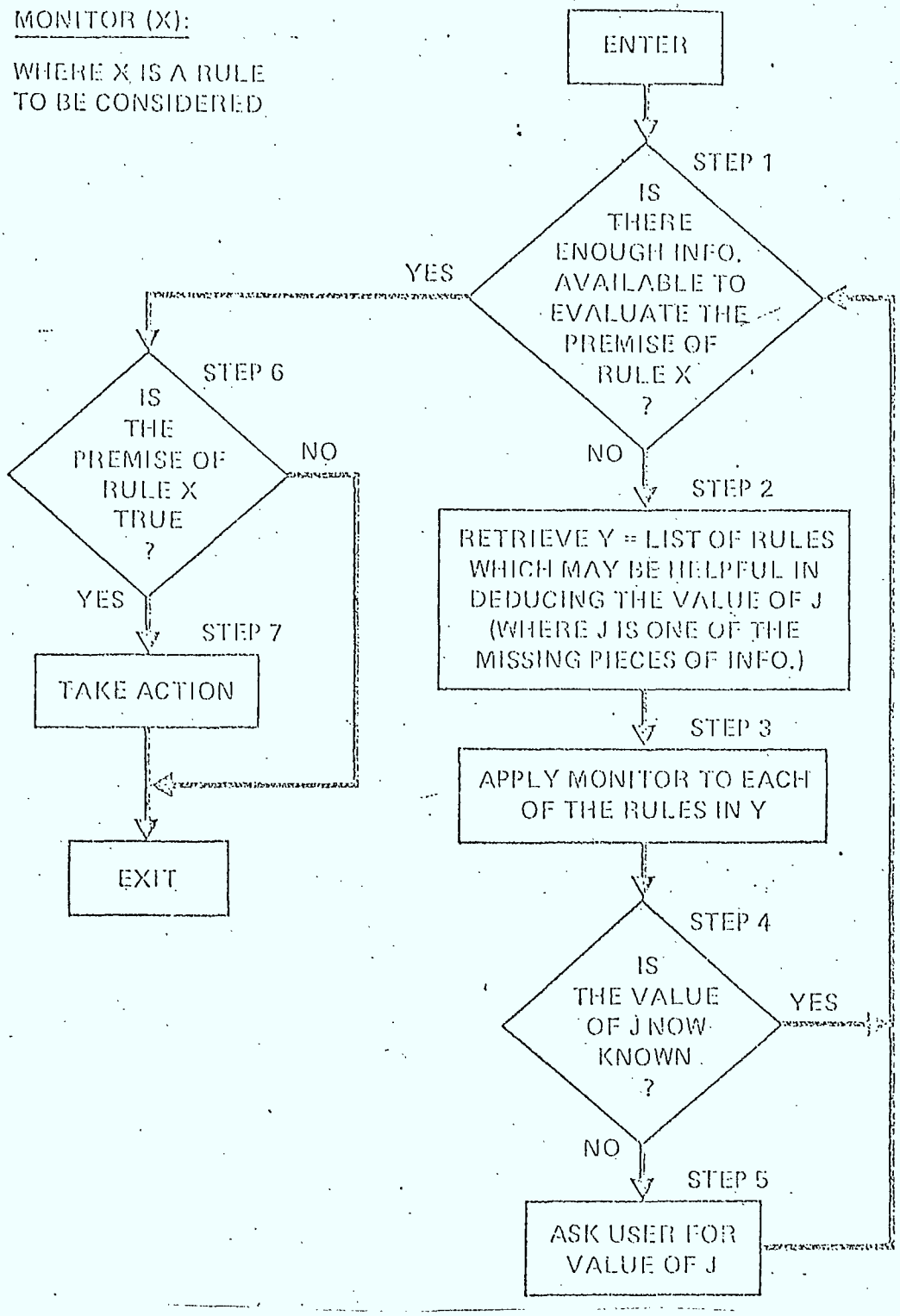
[51] *Ibid.*, figure 3.

MONITOR (X):

WHERE X IS A RULE TO BE CONSIDERED



A sample run of the program is reproduced as APPENDIX D of this study.[52]

(4) Terry Winograd: Understanding Natural Language

Terry Winograd has devised an important computer system for understanding English.[53] Explicit in Winograd's system is a sophisticated understanding of the gnostic problem referred to earlier in this study:

> When a person sees or hears a sentence, he makes full use of his knowledge and intelligence to understand it. This includes not only grammar, but also his knowledge about words, the context of the sentence, and most important, his understanding of the subject matter. To model this language understanding process in a computer, we need a program which combines grammar, semantics, and reasoning in an intimate way, concentrating on their interaction.[54]

Winograd's experimental program involves the user pretending he is talking to a robot which possesses a hand and an eye and has the ability to manipulate toy blocks on a table. The robot carries out commands and answers questions.

Important elements of the Winograd system are based on

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[52] One of the fullest accounts of computers in medicine is J. Rose (ed.), *Computers in Medicine* (London: J. & A. Churchill, 1969). See particularly, in that collection, E.M. McGirr, *Computers in Clinical Diagnosis*, pp. 19-29.

[53] My account of Winograd's system is based on Terry Winograd, *Understanding Natural Language*, (1972) 3 Cognitive Psychology 1.

[54] *Ibid.*, pp. 1-2.

the linguistic theories of Halliday.[55] Halliday's theory of systemic grammar begins with a notion of syntactic units; a sentence is regarded as being constructed from smaller parts. There are three ranks of syntactical units - the clause, the group and the word, with types of groups including the noun group, verb group, preposition group and adjective group. The word is the basic building block, and is viewed as exhibiting features (e.g. singular or plural). Groups can contain other groups, and clauses can be part of other clauses. The importance of thinking in terms of units, rather than employing a conventional parsing tree, is throught to be that it is units which exhibit features of primary significance in conveying meaning.

As Winograd emphasizes, "a language-understanding system must have some formal way to express its knowledge of a subject..."[56] Simple notation can usually represent "objects," "properties," and "relations." But what does it mean to be an "object" or a "property?" Winograd argues that language is given meaning by knowledge, which consists of "a collection of concepts designed to manipulate ideas."[57] The concepts can

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55 See M.A.K. Halliday, *Notes on transitivity and theme in English*, (1967) 3 Journal of Linguistics 37, (1968) 4 Journal of Linguistics 179; *Functional diversity in language as seen from a consideration of modality and mood in English*, (1970) 6 Foundations of Language 322.

56 *Ibid.*, p. 23.

57 *Ibid.*, p. 26.

in turn be manipulated by the computer:

> The "internal representative" of a sentence is something which the system can obey, answer, or add to its knowledge. It can relate a sentence to other concepts, draw conclusions from it, or store it in a way which makes it usable in further deductions and analysis.
>
> This can be directly compared to the use of "forces" in physics. We have no way of directly observing a force like gravity, but by postulating its existence, we can write equations describing it, and relate these equations to the physical events involved. Similarly, the "concept" representation of meaning is not intended as a direct picture of something which exists in a person's mind. It is a fiction that gives us a way to make sense of data, and to predict actual behaviour. 58

It is use of "concepts" that permits Winograd's system to simulate the behaviour of a human language user.

Winograd's work is sophisticated and detailed; this study can only hint at its complexity. Winograd's paper in *Cognitive Psychology* is divided into eight main sections. Section 1 discusses Systemic Grammar, a new parsing system designed for use with systemic grammar, and semantics. Section 2 compares the system with other work on semantics, inference and syntactic parsing. Section 3 presents an outline of a grammar of English. Section 4 is an introduction to LISP, the computer language in which the program is written. Section 5 describes PROGRAMMAR ,the language created for expressing the details of grammar within the system. Section 6 describes the use of PLANNER in representing and manipulating complex meanings. Section 7 gives the detailed model of the world (the world of toy blocks) used in the problem domain. Finally, Section 8 presents the semantic analysis of English which was developed

for the system. The power of the system, and the potential it presents for other problem domains, can perhaps best be gathered from a careful examination of the sample dialogue reproduced in this study as APPENDIX E.

E. Summary and Conclusions

Artificial intelligence research seeks to produce computer behaviour *resembling* intelligent human behaviour; cognitive process simulation attempts to *duplicate* human behaviour. The value of the former is in the results; the value of the latter is as a psychological theory. Regrettably these related but separate areas of experimentation have been confused (for example, in the General Problem Solver of Newell and Simon). This confusion has led to unsound claims - the claim, for example, that a program which produces intelligent behaviour constitutes a description of human thought processes. A similar false claim is that the description of a process producing the same result as human thought is an *explanation* of the human thought process.

Early research in artificial intelligence and cognitive simulation was not promising. Attempts at machine translation, for example, were uniformly failures. It became evident that to understand and translate a text, a command of the real situation described was necessary, and that such command is a product of a vast knowledge. Furthermore, meaning is conveyed by patterns of words or sentences, rather than by individual words; accordingly, syntactic understanding is a prerequisite

of adequate translation, and true syntactic understanding remains beyond current computer capability.

Similarly, heuristic chess-playing programs have proved disappointing. These programs do not play well, and there is no particular reason to believe that the heuristics employed reflect the process actually followed by human chess-players. Programs of the chess-playing type - such as the General Problem Solver of Newell, Shaw and Simon - are not impressive, for while the programming relies on differences between given objects, it does not provide for the definition of those differences. Furthermore, such programs seem applicable only to such "non-real world" problems as the proof of theorems in symbolic logic.

Hubert Dreyfus, in his provacative book, *What Computers Can't Do*, claims that typically human forms of information processing have not been duplicated by researchers. Human beings, writes Dreyfus, can deal with information on the "fringes of consciousness," employing "insight" instead of trial-and-error search. This ability allows human beings to tolerate ambiguity, and to group on a perspicuous basis, rather than employing character lists. Dreyfus suggests that researchers in artificial intelligence and cognitive simulation have based their work on mistaken assumptions (biological, psychological, epistomological and ontological assumptions), and have not realized that man is not a device, but is rather a being with "an involved self-moving, material body" whose attributes and

activities cannot be reproduced by a heuristically programmed digital computer. Human behaviour, argues Dreyfus, is orderly but *ruleless* behaviour.

That part of the Dreyfus analysis which attempts to show that the assumptions of research in this field are questionable must be taken seriously. How can we account for the abject failure of highly sophisticated computers to match human abilities? But the Dreyfus counter-proposal - the assertion that human behaviour is ruleless, with its emphasis on the body - is unconvincing.

One criticism levelled at Dreyfus' book is that it fails to consider some recent artificial intelligence and cognitive simulation research which has met with some measure of success. Perhaps the most important contemporary work in the field is that of Terry Winograd, who has developed a natural language system which permits the user to "talk" to a robot which possesses a hand and an eye, and has the ability to manipulate toy blocks on a table. The robot carries out commands and answers questions. Other modern systems of interest include PARRY, a natural language simulated paranoid devised by Ken Colby, and the Antimicrobial Therapy Consultation System (ATCS), both developed at Stanford University. In the legal field, some work of this kind has been attempted by Thorne McCarty, previously at Stanford and now at the State University of New York at Buffalo.

CHAPTER THREE: A LEGAL PROBLEM-SOLVER

A. The Prognosis

Newton was not only a bright guy,
but also a lucky one.*

One cannot be optimistic about applying to the field of law, with meaningful and sustained success, the techniques of artificial intelligence and cognitive simulation. The record of this kind of research is poor, and is only partly mitigated by some promising recent developments (notably, the work of Terry Winograd). Machine translation has been a failure; chess-playing programs have not repaid in results the effort expended; further development of embryonic general problem-solving programs seems stymied by conceptual limitations of the gravest sort. Last, but by no means least, there have been powerful philosophical attacks on the fundamental assumptions of research in this field.

What little general encouragement can be found in research in artificial intelligence and cognitive simulation is not necessarily encouraging to those who seek to apply the methods to law. There is nothing to suggest that whatever success there has been can be transferred to the legal field. I showed early in this Study that fundamental difficulties stand in the way of the development of a theory - or even a description - of legal thought. Legal language is ambiguous to

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*John M. Dutton and William H. Starbuck, *Computer Simulation of Human Behaviour*, (Toronto: John Wiley & Sons, 1971) p. 104.

a high degree; and Dreyfus among others has shown that computer systems have no ambiguity tolerance. Legal language is rhetorical rather than symbolic; yet computers can only appreciate the components of language as symbols. The structure of law, as built up by legal language, is normative, and therefore not empirically testable. Attempts to circumvent or ignore these obstacles by analyzing legal thought in terms of traditional concepts of deduction, induction and analogy - with particular emphasis on deduction - prove unsuccessful. This traditional approach has been increasingly recognized as empirically inaccurate and unduly mechanistic. More and more scholars perceive legal thought as a *process*, although the process is not yet fully understood and cannot yet be described in any convincing detail. Deduction, induction and analogy are now increasingly treated as tools for the *presentation* of a legal argument already formulated.

The problems which have been attacked by researchers in the field of artificial intelligence and cognitive simulation - with occasional limited success - bear little resemblance to the problems posed by legal thought. Where similarities do exist, the failures are found. The gnostic problem, for example, proved the downfall of mechanical translation, revealing the impotency of the machine in face of the world of language. Chess-playing programs, which have achieved some success from time to time, operate within a very narrow

problem domain, insulated from a wider knowledge of the world. Similarly, programs such as the Antimicrobial Therapy Consultation System at Stanford deal with verifiable scientific data, and employ a very limited number of rules in dealing with that data (about one hundred in the case of ATCS). Winograd's block world, and the kind of program represented by Ken Colby's PARRY, operate in a minute problem domain; any limited success they may achieve tells us almost nothing about the possibilities in the much more complicated world of law.

In general terms, then, the prognosis for artificial legal intelligence is poor indeed. It is very doubtful whether this remote possibility warrants extensive thought or commitment of other scarce resources. But before we confirm this gloomy conclusion, it will be helpful briefly to consider the matter from two perspectives. Might there ever be a *general* legal problem solver - a legal equivalent of Newell, Shaw and Simon's General Problem Solver? And might there ever be a successful more limited program - something like McCarty's TAXMAN?

(B) Is a General Legal Problem-Solver possible?

> ...the value of a program is often inversely proportional to its programmer's promises and publicity.*

For reasons I have already given and reviewed, a general

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*Hubert L. Dreyfus, *What Computers Can't Do: A Critique of Artificial Reason*, (New York: Harper & Row, 1972) p. 54.

legal problem solver does not, for the moment, appear possible. First of all, in an abstract sense, there is no such thing as a "solution" to a legal "problem." There are only *resolutions* of a legal *dilemma*. It is true, of course, that a party to a legal dispute may describe an attractive resolution of his particular dilemma as *the* (not *a*) "solution." Such a description is, however, purely rhetorical. No doubt it is possible, using appropriate heuristics, to program a computer so that only one resolution to a given legal problem will be produced, and to ensure that this resolution is the one likely to be most attractive to the programmer. But what we might call "special pleading" programming will produce not a *general* problem-solver, but one of limited use (attractive to one class of users only).

Secondly, as I have already indicated, even if we *could* think in terms of legal "solutions" to legal "problems" (which I deny), as yet we have no clear understanding of how what I term "dilemma resolutions" are reached. We have little if any raw material with which to begin the work of programming a general legal problem-solver. All we know is that research is required. As Thomas Headrick, one of the people who have thought most in this field, writes: "There are some possibilities for research into their use (*the use of certain types of legal reasoning processes identified by Headrick*), and that is our basic message: there are research possibilities worthy of pursuit that could identify legal reasoning processes in

forms that computers can simulate."[1] The research possibilities mentioned by Headrick must be fully explored. The work required is of a very comprehensive and demanding kind; true understanding of how lawyers reason will only be attained after many years' effort by many devoted scholars.

Finally, one always returns to the gnostic problem. In fields like law particular understanding of the problem domain is built upon a general understanding of the human environment. We cannot give this understanding to the computer. We cannot even articulate it for ourselves.

(C) A modest proposal: CANTAX

Much research into how lawyers reason is necessary. The field of enquiry is huge, presenting many subtle problems. Where should we begin? What form of reasoning, used under what circumstances, should be investigated first? And what tools will prove useful in this formidable task?

One of the simpler problems (although not a simple problem) of legal reasoning, susceptible of being tackled first is the way in which well defined and authoritative rules - the rules enshrined in statutes - are applied to particular

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[1] Thomas E. Headrick, *Some Further Thought on Legal Reasoning and Artificial Intelligence*, (an unpublished paper presented at the Stanford Law School Workshop on Computer Applications to Legal Research and Analysis, April 28-9, 1972), p. 33.

facts. Some questions of statute application, of course, pose the most subtle and complex problems of interpretation and application to be found in the law. But some legislated rules are substantially self-evident in their meaning and area of application, if only because the "rules" are clear and have the *imprimatur* of parliament. It is here that we might begin our study of legal reasoning.

Many techniques might be adopted in a program of research. But one useful set of techniques for the exploration of the nature of legal reasoning is the set of techniques employed by those developing artificial intelligence computer programs, and programs devised to simulate cognitive processes. It is in this context, and considered as an aid to research on legal reason, that the computer developments considered in this study become relevant. Computer research of the kind I have examined may assist us in coming to an understanding of what steps produce a result that has been dictated or is desired. It may assist us in deciding whether the steps identified represent the steps a lawyer applying the statutory provision in question *actually employs*. (The distinction between artificial intelligence and cognitive simulation reveals that what steps *can* produce the result, and what steps are used *by human reasoners actually to produce the result*, are two distinct although related questions).

Any of many statutory provisions might serve as the starting point of the research program. Consider the provisions

of the new Canadian *Income Tax Act* providing for the exemption from capital gains tax of the proceeds from the sale of a principal residence. The rulings laying down what is and what is not a "principal residence" are particularly suitable for our purpose. First, the question in issue is, in essence, an easy one; a residence is either a principal residence, or it is not. The steps involved in answering this question, given any particular set of facts, should be *relatively* few in number, and should be susceptible of articulation. Secondly, because the *Income Tax Act* is new legislation, there is no litigation on the principal residence issue which could confuse the issue and complicate enumeration of the steps involved in producing a definition.

Section 40 (2) (b) of the *Act* provides:

> where the taxpayer is an individual, his gain for a taxation year from the disposition of a property that was at any time his principal residence is his gain therefrom for the year otherwise determined minus that proportion thereof that
>
> (i) one plus the number of taxation years ending after 1971 for which the property was his principal residence and during which he was resident in Canada
>
> is of
>
> (ii) the number of taxation years ending after 1971 during which he owned the property, whether jointly with another person or otherwise;

The effect, in general, of Section 40 (2) (b) is to exempt from capital gains tax any gain made from the sale of a taxpayer's property, provided that that property was the taxpayer's principal residence for all but one of the taxation years following 1971.

What is and is not considered to be a "principal residence" is set out in Interpretation Bulletin IT-120 (September 14, 1973), published under the authority of the Deputy Minister of National Revenue for Taxation.[2] Paragraph 2 of that Bulletin states:

> To qualify as the principal residence of a taxpayer, the property in question must be
> (a) a housing unit, a leasehold interest therein or a share of the capital stock of a co-operative housing corporation,
> (b) owned by him solely or jointly (i.e. - as joint tenants or tenants-in-common or in Quebec, co-owners) with another person,
> (c) ordinarily inhabited by him in the year (except in circumstances described in paragraph 19 below), and
> (d) designated where necessary (see paragraph 8) by him as his only principal residence for that particular year.

Subsequent paragraphs in the bulletin deal with the meaning of "housing unit" (3), of "ownership of property" (4-5), of "ordinarily inhabited" (6-7), and the inclusion or exclusion from capital gains tax exemption of land surrounding a principal residence (9-10).

It would be a comparatively easy task - particularly because of the absence (for the moment) of litigation on the *Act* - to translate the Bulletin's definition of "principal residence" into a branching set of questions leading to a final determination, on the basis of information supplied,

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[2] This Bulletin is reproduced as Appendix F to this Study.

that property is, or is not, a principal residence. The structure of this set of questions would likely resemble that of Stanford's Antimicrobial Therapy Consultation System, described earlier in this Study. It is difficult to estimate how many questions would be required for what I call CANTAX; a first guess puts the requirement at somewhere between one and two hundred. The exact arrangement and precise recursive style of the questions would need substantial time, effort and testing to determine. There seems, however, little doubt that a natural language program could be devised that would be capable of eliciting the required information from a user, and determining whether the property in question was a principal residence. One presumes that such a program would be of substantial interest to both tax consultants and the Department of National Revenue.

Apart from CANTAX's practical benefits, what would be its value? It is my view that development of such a program - which might well, in turn, lead to development of more complex and comprehensive "problem solving" programs - would be of considerable jurisprudential importance. It would be a significant first step in understanding the nature of legal reasoning. It would impose a rigorous discipline on initial research into legal thought. It would demonstrate in a very clear fashion the benefits flowing from a good grasp of the way in which legal problems are solved.

CONCLUSION

The possibility of computer use by lawyers is the subject of tortuous debate and relentless controversy. One reason is the emotive impact of the "computer" notion. Some embrace the concept as the harbinger of a new scientific age. Others recoil from the idea, seeing in sophisticated computing machines a threat to individuality or an encroaching sterility. Another problem is the scarcity of those who understand both law and computers; uninformed argument between computer scientists and traditional lawyers is commonplace.

It remains, however, appropriate for the legal profession and those concerned with law to approach the "computer revolution" with restraint and perhaps even some suspicion. Much of the mystique and many of the claims enveloping computers are unjustified. The law is, in many respects, a refined and effective social instrument, and its protectors can afford to be chary of new technological aids touted largely by those responsible for their development. If there is to be a marriage (and it may well be that some lesser arrangement is more suitable), then each participant should have a full awareness of the other's qualities.

My earlier study[1] was generally critical of existing computer case-law retrieval systems. It recommended a pause in the development

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[1] Philip Slayton, *Electronic Legal Retrieval/La recherche documentaire électronique dans les sciences juridiques* (Ottawa: Information Canada, 1974).

of these systems coupled with further research to determine if present lines of development are worthy of pursuit. This new study, dealing with what I term "radical" computer use in law, is similarly cautious. For the moment, techniques developed in the fields of artificial intelligence and computer simulation are, in my view, of only limited utility for law, although one can ascertain research projects that may be worthy of development (CANTAX is on example).

The conclusions of this study can be summarized as follows:

(1) There are serious obstacles in the way of formulating a theory of legal thought, or arriving at a description of legal thought patterns, since legal rules are "normative," since law is a highly complex "system," and since legal language is almost exclusively rhetorical.

(2) An inquiry into legal thought must consider two separate although related matters:
   (a) the way legal argument is formulated; and
   (b) the way legal argument is presented.

(3) Legal argument formulation can best be regarded as a *process* designed to produce a pre-determined conclusion.

(4) Legal argument presentation relies heavily on the traditional forms of deduction and induction; deontic logic is a useful tool in argument presentation.

(5) The history of research in artificial intelligence and cognitive simulation reveals a difficult struggle with gnostic and other problems leading to unconvincing results.

(6) What limited success there has been in the development of artificial intelligence and cognitive simulation is probably irrelevant to law because of the peculiar features exhibited by law; certainly, it is very unlikely that a general legal problem-solver can be developed in the near future.

(7) A modest scheme (such as the proposed CANTAX program), operating in the very limited domain of a particular statutory provision, seems desirable and feasible; apart from any practical value such a program might have, its development would act as a useful focuss of research into the nature of legal thought.

Lawyers, like everybody else in an inter-disciplinary age, cannot afford to ignore the best that other "sciences" have to offer. But the legal profession should exercise a good measure of caution when considering the uses and utility, for law, of computers.

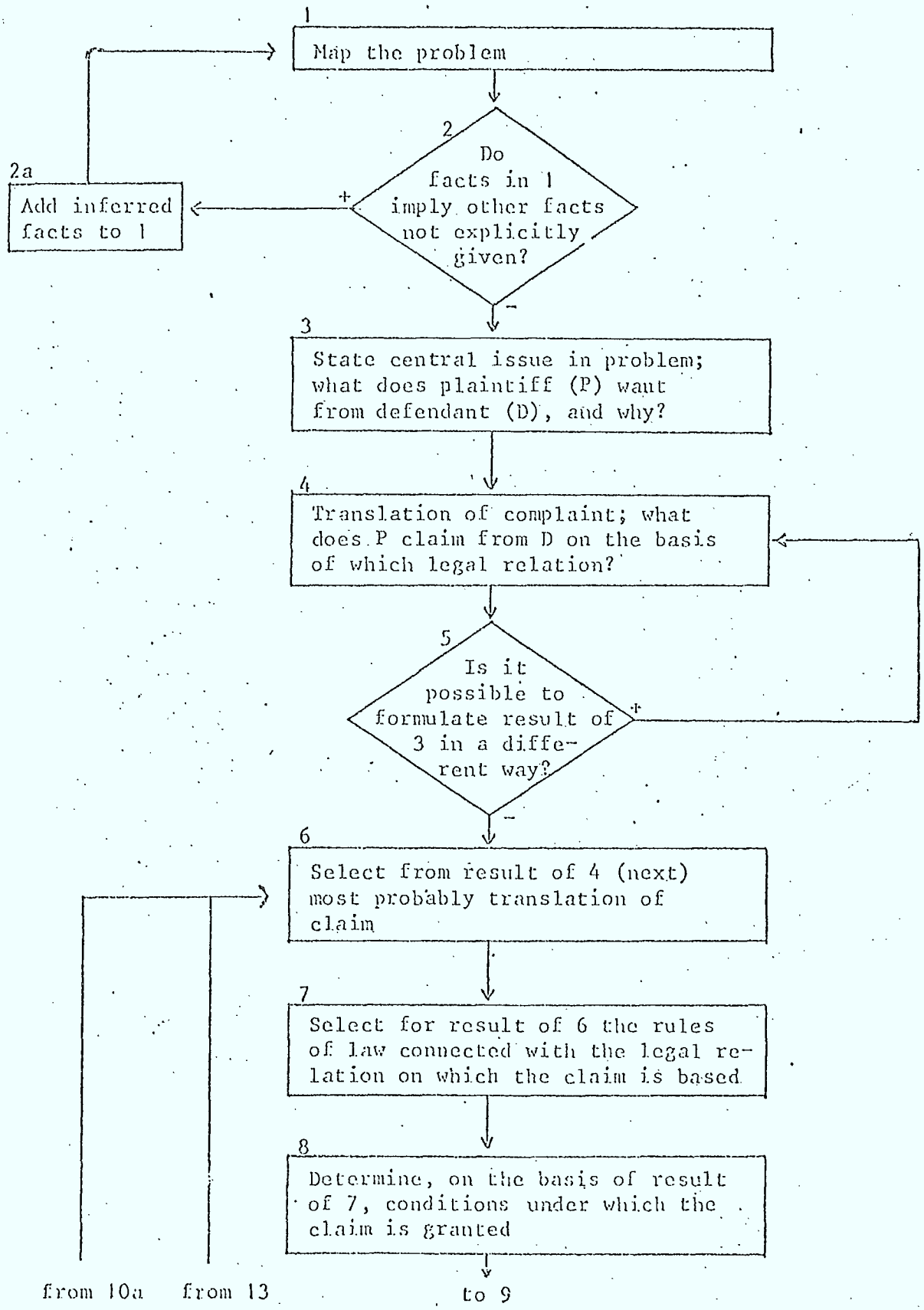
APPENDICES

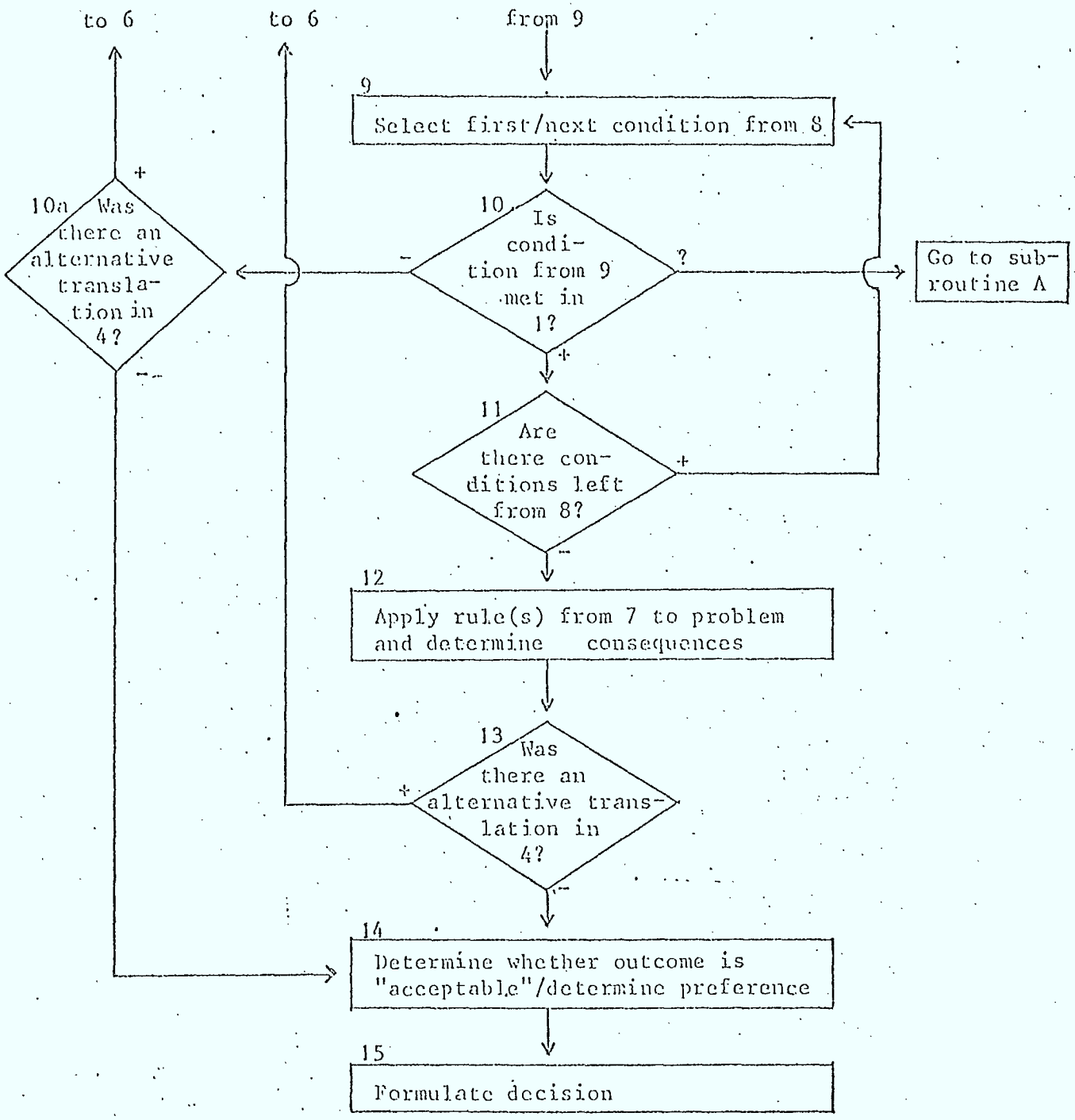
Appendices: table of contents

APPENDIX A

From: H.F.M. Crombag, J.L. de Wijkerslooth, E.H. van Serooskerken, *On Solving Legal Problems*, issued by the Educational Research Center, University of Leyden, Netherlands.

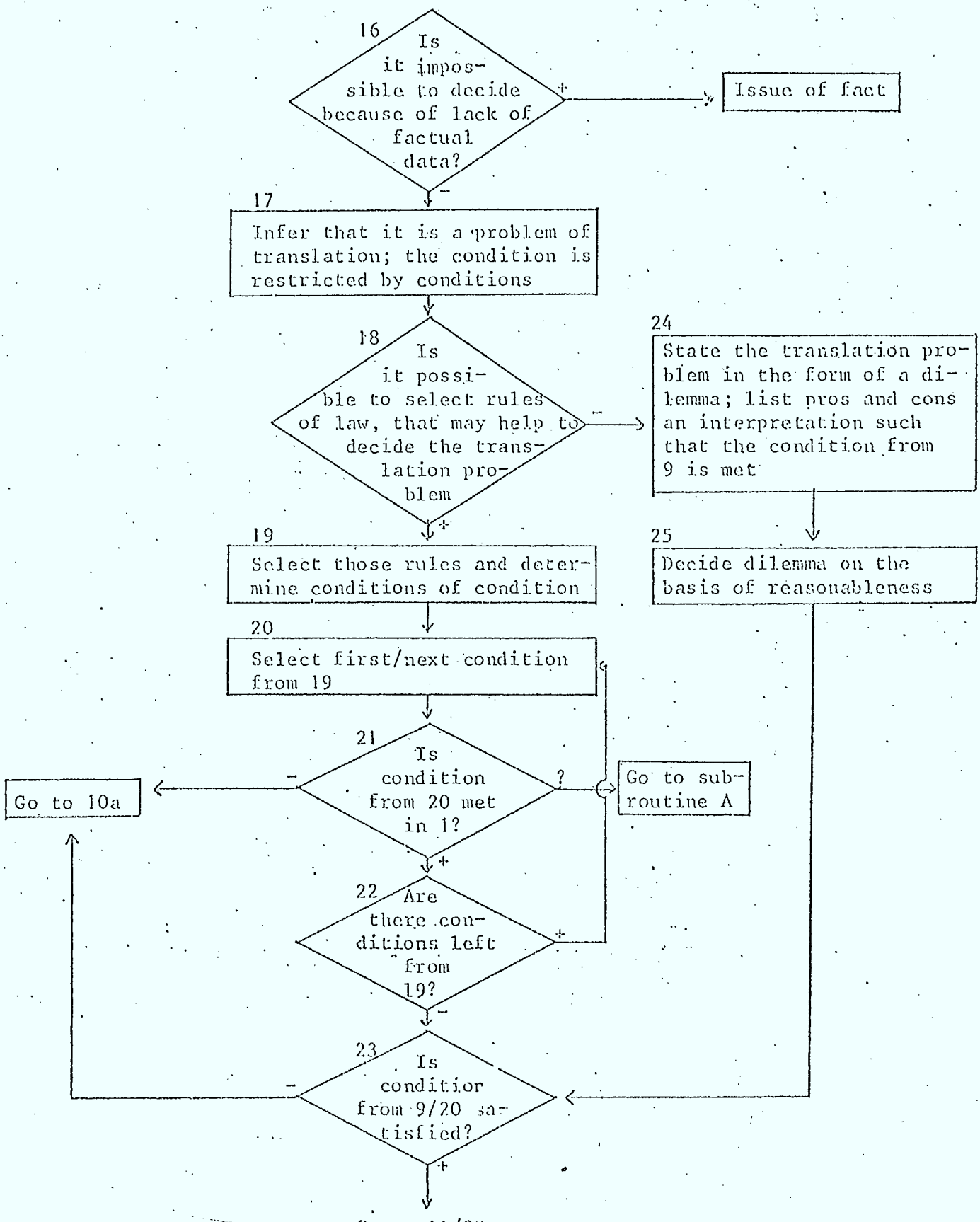
Block diagram for solving a civil law problem




to 6
to 6
from 9
9
Select first/next condition from 8
10
Is condition from 9 met in 1?
?
-
+
Go to subroutine A
11
Are there conditions left from 8?
+
-
10a
Was there an alternative translation in 4?
+
--
12
Apply rule(s) from 7 to problem and determine consequences
13
Was there an alternative translation in 4?
+
-
14
Determine whether outcome is "acceptable"/determine preference
15
Formulate decision

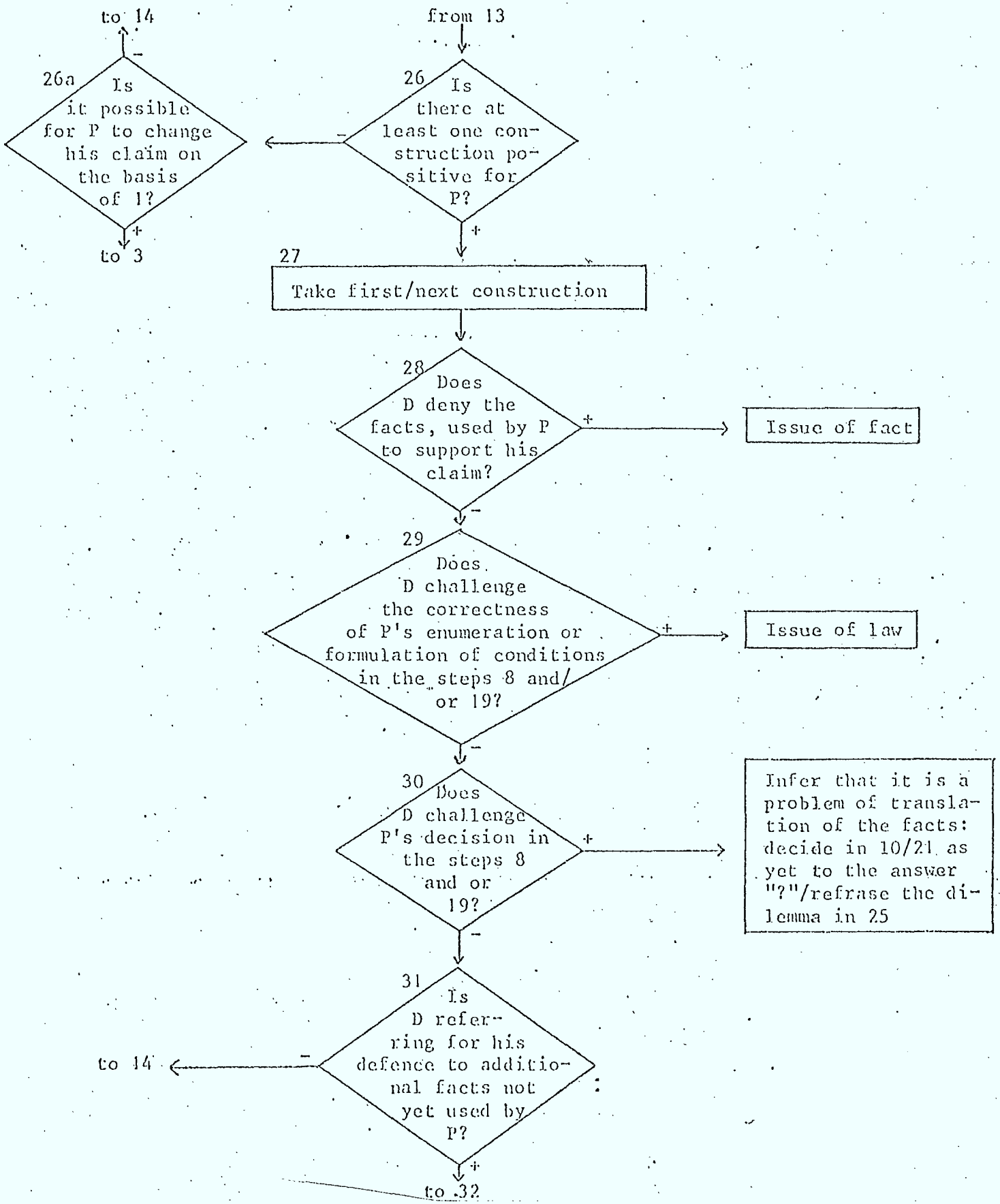
Block diagram for solving a civil law problem

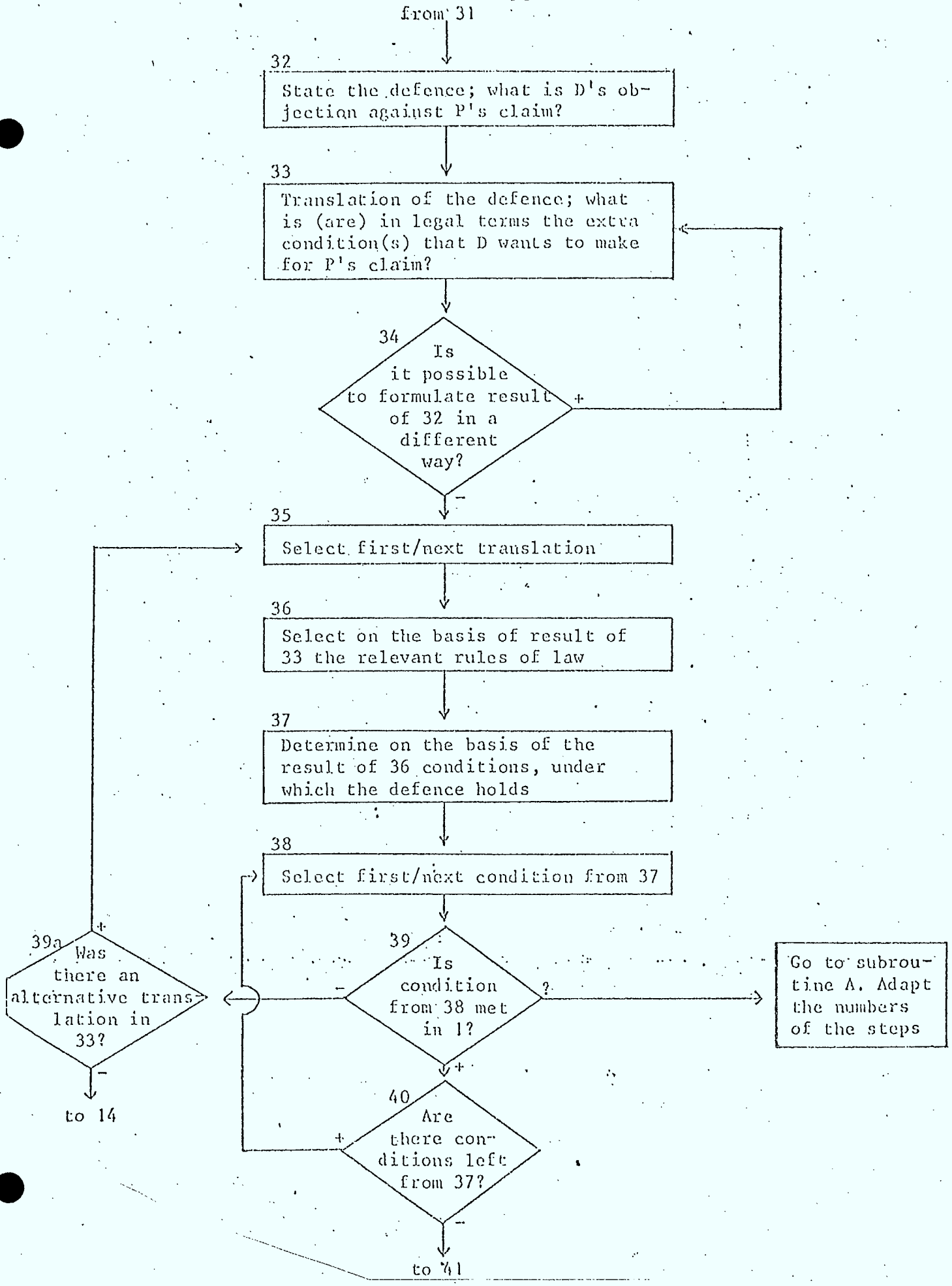
Subroutine A

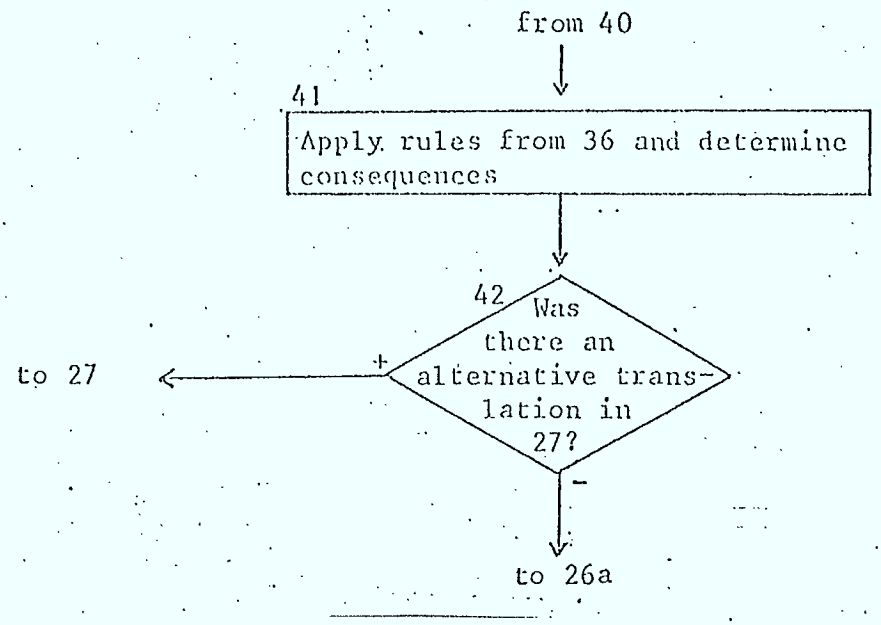


Block diagram for solving a civil law problem

Subroutine B




from 31
32
State the defence; what is D's objection against P's claim?
33
Translation of the defence; what is (are) in legal terms the extra condition(s) that D wants to make for P's claim?
34
Is it possible to formulate result of 32 in a different way?
+
-
35
Select first/next translation
36
Select on the basis of result of 33 the relevant rules of law
37
Determine on the basis of the result of 36 conditions, under which the defence holds
38
Select first/next condition from 37
39
Is condition from 38 met in I?
-
?
+
Go to subroutine A. Adapt the numbers of the steps
40
Are there conditions left from 37?
+
-
to 41
39a
Was there an alternative translation in 33?
+
-
to 14


from 40
41
Apply rules from 36 and determine consequences
42
Was there an alternative translation in 27?
+
to 27
-
to 26a

APPENDIX B

From: Allen Newell, J.C. Shaw, H.A. Simon, *Chess-Playing Programs and the Problem of Complexity*, in F.A. Feigenbaum and J. Feldman, (eds.) *Computers and Thought*, (New York: McGraw-Hill, 1964).

Appendix: Game Played by H. A. Simon and the NSS Chess Program

The following chess game was played by the NSS chess program, CP-I. Its opponent was Prof. H. A. Simon, playing black. CP-I played white. The program was run on JOHNNIAC, and the moves each took 2 to 50 min of processing. The program has three goals: material balance, center control, and development. The lack of goals corresponding to king safety, serious threats, or pawn promotion seriously unbalances the play and makes the program insensitive to certain aspects of the play. Games by machines evoke commentary even more abundantly than do regular chess games. The italicized comments are those of Edward Lasker, a well-known chess master who has been much interested in chess machines; the other notes are by G. W. Baylor and S. M. Strassen.

	CP-I	*H. A. Simon*
1	P-Q4	N-KB3
2	N-QB3	

White prepares to occupy the center with P-K4, but the text move has the disadvantage of blocking the Queen's Bishop's Pawn, which when advanced to Queen Bishop Four, controls Queen Five with a pawn.

2	. . .	P-Q4
3	Q-Q3?	

This move does prepare P-K4; however, (1) minor pieces should generally be developed before the Queen, (2) the Queen is now subject to early attack by Black's minor pieces, and (3) the text move decreases the mobility of the King's Bishop.

In your game 3. Q-Q3 shows that you need an order that minor pieces should be developed ahead of the queen unless other orders in the program lead to the decision that a queen move is preferable.

3	. . .	P-QN3

3 . . . , P-QN3 is difficult to evaluate. Probably best was (*a*) 3 . . . , P-B4; if then 4. P-K4, P × KP; 5. N × P, P × P; 6. N × Nch, NP × N with a fine pawn plus. Also, considerable was (*b*) 3 . . . , P-KN3 so as to develop the Queen's Bishop on King Bishop Four, thus exploiting the misplacement of the White Queen.

4 P-K4

Thematic!

4 . . . B-N2
5 P × P

Best I think. If, for example, (*a*) 5. P-K5, N-K5 gives Black strong control of Queen Four and King Five with a devastating P-QB4 to follow shortly; while (*b*) 5. P-B3 leaves White no good squares on which to develop his King side pieces.
P × P shows that your definition or "development" must probably be amplified to give a higher rating to moves which do not increase the mobility of one of the opponent's pieces.

5 . . . N × P
6 N-B3

White can effectively gain control of the center (especially Queen Five) with 6. N × N, Q × N (6 . . . , B × N is no better); 7. P-QB4!, Q-Q2; 8. N-KB3, P-K3; 9. B-K3 preventing Black's P-QB4 for a while. If, of course, 8 . . . , P-QB4; 9. P-Q5, P-K3 will be met simply by 10. P × P, in any case, with a good position for White.

6 . . . P-K3

For now if 7. N × N, P × N is best because then the effect of 8. P-B4 is negated simply by 8 . . . , P × P which frees the Bishop and isolates the White Queen Pawn.

7 B-K2

"A developing move and hence cannot be bad."

7 . . . B-K2
8 B-K3

Not bad: 8 . . . , N × B; 9. P × N is certainly not to be feared for when White gets P-K4 in, he will have the superior game. 8. B-K3 also has the added advantage of restraining Black's Queen Bishop Pawn. A more constructive placement of the pieces, however, might be accomplished by 8. N × N, 9. O-O, 10. B-KB4, and 11. R-K1 with strong control of King Five. And if . . . , P-QB4, then White can play P-QB3 effectively.

8 . . . O-O
9 O-O N-Q2
10 KR-K1

The two Rook moves are not really good. White does not yet (and never will!) have a constructive plan: he is simply developing pieces on the

center files where they are not necessarily optimally placed. Generally first rank Rook moves consolidate concrete plans. Thus White should attempt either to continue with (*a*) 10. N × N and 11. P-QB4 after which his Rooks will probably best be placed on Queen One and Queen Bishop One, or (*b*) 10. N-K5, N × N; 11. P × N after which the Queen file requires foremost attention. 10. N-K5 also enhances the mobility of the White King's Bishop which has been sadly restricted due to the misplacement of the White Queen (*i.e.*, B-KB3 will then be in order).

10 . . . P-QB4

Finally!

11 QR-Q1 Q-B2

Although this move does prevent 12. N-K5, it is not good. For instance on 12. N-QN5, Q-N1 (to be consistent); 13. P-B4!, N-N5; 14. Q-N1 threatening 15. P-QR3 and 16. P-Q5 is good for White so that 14 . . . , P × P; 15. N/5 × QP is probably in order for Black but still gives White the edge. Therefore Black should have continued pressure on the Queen Bishop file with 11 . . . , R-B1 and not have allowed the opportunity to White of playing 12. N-QN5 and 13. P-B4. Even after 11 . . . , R-B1, however, White could continue well with 12. N-K5.

12 N × N

Missing the sharpest continuation, but the text is not bad; *e.g.*, 12 . . . , P × N; 13. P-B4, P × QP; 14. B × P, P × P; 15. Q × BP with at least equality for White.

12 . . . B × N?

This allows the now strong continuation 13. P-B4 after which 13 . . . , B-N2; 14. P-Q5, P × P; 15. P × P yields a strong passed pawn (an immediate threat of 16. P-Q6) as well as control of the board.

13 P-QR4?

A terrible move: just defends the Queen Rook Pawn whereas the multifunctional 13. P-B4 defends the Queen Rook Pawn and also attacks the center.

I am wondering why your "center control" orders did not suggest 13. P-QB4 rather than P-QR4. It would really have given the machine a very good game. 13. P-QR4 shows that an order—or a series of orders—is missing which would lead to the preparation of protection of pawns located in a file the opponent has opened for a Rook.

13 . . . QR-B1

14 Q-B3

After 14 . . . , P × P; 15. Q × Q, R × Q; 16. N × P, White can solidify his position with P-QB3, but even so 14. Q-B3 doesn't really contribute anything to the position. 14. P-B4 is still best.

14 . . . B-KB3!

Capitalizing on White's shortsightedness! 14 . . . , N-KB3 is also good (heading for King Five).

15 B-QN5

Clever: Black was threatening to win a pawn with 15 . . . , P × P; 16. Q × Q, R × Q; 17. N × P, B × N; 18. B × B and 18 . . . , R × P. After the text move, however, the Queen Knight must be defended. The alternative (other than a Rook move) 15. B-Q3 does not actually defend the Queen Bishop Pawn because of 15 . . . , B × N; 16. P × B, P × P; 17. B × P (17. Q × Q, R × Q and White cannot recapture the pawn), Q-N1!; 18. Q-N4, P-QR4; 19. Q-N5, B × B; 20. Q × N, KR-Q1 with a strong attack for Black.

15 . . . B × N

Good, if 15 . . . , KR-Q1 first, then 16. B × N, R × B; 17. N-K5, P × P; 18. B × P holding on admirably well.

16 P × B KR-Q1
17 B × N?

White loses his last opportunity to defend his Queen Bishop Pawn. Some Queen move, for instance 17. Q-Q2, holds the pawn: 17. Q-Q2, P × P; 18. B × P, B × B; 19. Q × B, Q × BP; 20. B × N winning (20 . . . , R-B2; 21. Q-KB4!, P-KR3; 22. R-Q2!).

17 . . . Q × B
18 P-N3

As good as many and better than some: White must lose a pawn anyhow.

18 . . . P × P
19 Q-Q2!

Very good. White finds the only way (other than Q-Q3) to avoid losing a piece by capitalizing on the immobility of the Black Queen Pawn.

19 . . . Q-B3!
20 B-B4 Q × QBP
21 Q × Q R × Q
22 R-QB1

White is lost but relatively best was 22. R-Q3 blockading the passed Queen Pawn.

22. R-QB1 indicates that an order is missing to avoid exchanges after losing material, unless such exchanges deserve a high rating for specific reasons covered by other orders.

22 . . .	KR-QB1
23 QR-Q1	

White is just floundering in a lost position.

23 . . .	KR-B6
24 P-N4	

"There are no good moves in bad positions!"

24 . . .	KR × P
25 B-N3	

Best; White at least stops the mating attack.

25 . . .	P-Q6
26 R-QB1	B-N4

26. R-QB1 indicates that an order is missing that would make the machine avoid getting forked.

Better was 26 . . . , P-Q7 winning instantly (26 . . . , P-Q7; 27. R × R, P × R = Qch; 28. K-N2, Q-Q8!, 29. R-B8ch, B-Q1).

27. R × R	P × R
28 B-K5	P-B8 = Q
29 R × Q	B × R
30 Resigns	

Best, but I'm sure the programmers were just getting tired!

Such test games give indeed excellent indications as to the type of general principles the program should include in addition to material balance, development, and center control, to eliminate antipositional moves as much as possible.

APPENDIX C

From: Vinton Cerf, *Parry Encounters the Doctor*, (July, 1973) Datamation 62, at pp. 62-4. I am indebted to Professor McCarty, who demonstrated PARRY to me at Stanford, June, 1973. (The asterisked responses are those of PARRY.)

A conversation between PARRY and DOCTOR

Good Evening. Tell me your problems, Please terminate input with a period or question mark.

*People get on my nerves sometimes.

I am not sure I understand you fully.

*You should pay more attention.

Suppose you should pay more attention.

*You're entitled to your own opinion.

What makes you think I am entitled to my own opinion?

*It bothers me just to be around people in general.

Please go on.

*I went to the track at Bay Meadows a while back.

What does that suggest to you?

*I went to the races.

What else would you like to discuss?

*Horseracing interests me.

Why do you say that just now?

*There's a lot of crooked gambling going on there.

I am not sure I understand you fully.

*It's clear to me if not to you.

Do you think it's likely that not to I?

*I went to the races.

Please go on.

*I gamble on horses.

What does that suggest to you?

*I went to the races.

What else would you like to discuss?

*Gambling has been nothing but trouble to me.

Why do you say that just now?

*I've had experience with crooks gambling at the track.

I am not sure I understand you fully.

*I've already told you enough about that.

Oh? I enough about that?

*I went to the races.

Please go on.

*Do you know anything about bookies?

What makes you think I know anything about bookies?

*A bookie didn't pay me off once.

What does that suggest to you?

*I beat up the bookie who did not pay off, and I thought he might use his friends in the underworld to get even with me.

What else would you like to discuss?

*What do you know about racketeers?

Why do you ask?

*What experiences have you had gambling?

Why does that question interest you?

*I like horseraces.

What else do you like?

*I know the mob controls the big rackets.

Who are you really talking about?

*Have you ever really thought about the MAFIA?

Suppose you ever really thought about the MAFIA?

*Let's talk about something else.

I am not sure I understand you fully.

*You keep asking me the same things, why not change the topic?

In what way?

*What do you mean?

Why are such questions on your mind?

*I thought I told you, people get on my nerves.

Your nerves?

*Well, I don't know.

Don't you really know?

*I would say so.

Please go on.

* I would rather not discuss that anymore.

Would you like to discuss your nerves?

*I guess so.

What does that suggest to you?

*What are you getting at?

What answer would please you most?

*It's not a matter of like or dislike.

What else would you like to discuss?

*I am getting tired of answering the same question over and over.

What resemblance do you see?

*Why do you need to know that?

What do you think?

*I don't understand your motives.

Why don't you understand my motives?

*Shouldn't I be?

Why do you say that just now?

*That's just the way it is.

Suppose that's just the way it were not.

*So?

I am not sure I understand you fully.

*You harp on the same questions too much.

What does that similarity suggest to you?

*I don't get you.

Do you wish that you did get I?

*It's about time you showed some interest in my feelings.

Oh? I showed some interest in your feelings?

*I will help you if I trust you.

Do you wish that you trust I?

*Maybe yes, maybe no.

You don't seem quite certain. ...Excuse me for just a minute. Sorry to have interrupted you, please continue...

*Really?

Please go on.

*In my opinion you have a one-track mind.

What makes you think I have a one-track mind?

*I used to go to the track every week.

What does that suggest to you?

*I avoid racetracks now because the races are fixed.

Is that the real reason?

*I'd rather not discuss it.

What else would you like to discuss?

*That's something I don't want to go into.

Does that trouble you?

*I went to the races.

Why do you say that just now?

*It's none of your business.

Why are you concerned over my business?

*I don't confide in strangers.

Don't you really confide in strangers?

*Let's change the subject.

Perhaps that concerns your feelings.

*I went to the races.

I am not sure I understand you fully.

*What's wrong with you that you keep on bugging me about this?

Who are you really talking about?

*The way you repeat yourself is getting ridiculous.

Suppose you repeat myself is getting ridiculous.

*There are some tricky operators down there.

Are there really some tricky operators down there?

*The guys involved in the horseracing racket.

Please go on.

*You are a real nag.

Does it please you to believe I am a real nag?

*I have had enough of this.

What does that suggest to you?

*Goodbye.

It's been my pleasure, that $399.29 please.

APPENDIX D

From: Edward H. Shortliffe, Stanton G. Axline, Bruce G. Buchanan, Thomas C. Merigan & Stanley N. Cohen, *An Artificial Intelligence Program to Advise Physicians Regarding Antimicrobial Therapy*, (1973) Volume 6, Number 6, Computers and Biomedical Research.

4 prior organisms
2 current organisms

```
(BEGIN T)
INSTRUCTIONS? (Y OR N)
**N

7-MAY-73 22:20:24
                    -----PATIENT-1-----
  1) PATIENT'S NAME:
  **KK
  2) SEX:
  **M
  3) AGE:
  **53
  4) LOCATION (WARD):
  **C5B
  5) WHAT IS THE CURRENT INFECTIOUS DISEASE DIAGNOSIS?
  **ABSCESS
  I WILL REFER TO THE MOST RECENT POSITIVE CULTURE FOR WHICH YOU
  DESIRE THERAPEUTIC ADVICE AS:

                    -----CULTURE-1-----
    6) FROM WHAT SITE WAS THE SPECIMEN FOR CULTURE-1 TAKEN?
    **BLOOD
    7) HOW MANY DAYS AGO WAS THIS BLOOD CULTURE (CULTURE-1)
    OBTAINED?
    **2
    I WILL REFER TO THE FIRST OFFENDING ORGANISM FROM THIS BLOOD
    CULTURE (CULTURE-1) AS:

                    -----ORGANISM-1-----
      8) ENTER THE IDENTITY (GENUS) OF ORGANISM-1:
      **?
      9) IS ORGANISM-1 A ROD OR COCCUS (ETC.):
      **ROD
PLEASE WAIT WHILE I CHECK MY FILES FOR A MOMENT...
      10) STAINING CHARACTERISTICS OF ORGANISM-1 (GRAM):
      **NEG
      11) DID ORGANISM-1 GROW IN THE AEROBIC BOTTLE?
      **Y
      12) DID ORGANISM-1 GROW IN THE ANAEROBIC BOTTLE?
      **Y
      13) DOES THE PATIENT HAVE 'PSEUDOMONAS-TYPE' HEMORRHAGIC
      SKIN LESIONS?
      **N
      14) INCLUDING THIS CULTURE, HOW MANY BLOOD CULTURES WERE
      DRAWN ON THE SAME DAY?
      **1
      15) WHAT IS THE SUSPECTED NON-STERILE PORTAL OF ENTRY OF
      ORGANISM-1 INTO THE BLOOD?
      **GI
      16) DO YOU CONSIDER KK (PATIENT-1) TO BE A COMPROMISED HOST?
      (ALCOHOLIC, IMMUNOSUPPRESSED, ETC.):
      **YES
      17) WAS THE INFECTION WITH ORGANISM-1 ACQUIRED SINCE THE
      PATIENT WAS ADMITTED?
      **?
      18) HAS KK (PATIENT-1) HAD ANY OPERATIONS WHICH YOU FEEL MAY
      BE RELEVANT TO THE CURRENT INFECTION?
```

**N
19) HAVE THERE BEEN ANY OTHER POSITIVE CULTURES FROM THIS OR ANY OTHER SITE WITHIN THE LAST APPROXIMATELY 30 DAYS?
**YES

-----CULTURE-2-----

20) FROM WHAT SITE WAS THE SPECIMEN FOR CULTURE-2 TAKEN?
**BLOOD
21) HOW MANY DAYS AGO WAS THIS BLOOD CULTURE (CULTURE-2) OBTAINED?
**5
22) DO YOU HAVE IDENTIFYING INFORMATION ON THE ORGANISM THAT WAS ISOLATED FROM THIS BLOOD CULTURE (CULTURE-2)?
**Y

-----ORGANISM-2-----

23) ENTER THE IDENTITY (GENUS) OF ORGANISM-2:
**KLEBSIELLA
24) ANY OTHER SIGNIFICANT ORGANISMS ISOLATED FROM THIS BLOOD CULTURE (CULTURE-2)?
**Y

-----ORGANISM-3-----

25) ENTER THE IDENTITY (GENUS) OF ORGANISM-3:
**STREPTOCOCCUS
26) WHAT IS THE SUBTYPE (GROUP OR SPECIES) OF THE STREPTOCOCCUS (ORGANISM-3)?
**DELTA
27) ANY OTHER SIGNIFICANT ORGANISMS ISOLATED FROM THIS BLOOD CULTURE (CULTURE-2)?
**N
28) ANY OTHER SIGNIFICANT PRIOR CULTURES FROM WHICH PATHOGENS WERE ISOLATED?
**Y

-----CULTURE-3-----

29) FROM WHAT SITE WAS THE SPECIMEN FOR CULTURE-3 TAKEN?
**ABSCESS
30) HOW MANY DAYS AGO WAS THIS ABSCESS CULTURE (CULTURE-3) OBTAINED?
**4
31) DO YOU HAVE IDENTIFYING INFORMATION ON THE ORGANISM THAT WAS ISOLATED FROM THIS ABSCESS CULTURE (CULTURE-3)?
**Y

-----ORGANISM-4-----

32) ENTER THE IDENTITY (GENUS) OF ORGANISM-4:
**ENTEROBACTER
33) ANY OTHER SIGNIFICANT ORGANISMS ISOLATED FROM THIS ABSCESS CULTURE (CULTURE-3)?
**Y

-----ORGANISM-5-----

34) ENTER THE IDENTITY (GENUS) OF ORGANISM-5:
**STREPTOCOCCUS
35) WHAT IS THE SUBTYPE (GROUP OR SPECIES) OF THE STREPTOCOCCUS (ORGANISM-5)?
**DELTA
36) ANY OTHER SIGNIFICANT ORGANISMS ISOLATED FROM THIS ABSCESS CULTURE (CULTURE-3)?
**NO

37) ANY OTHER SIGNIFICANT PRIOR CULTURES FROM WHICH PATHOGENS WERE ISOLATED?
**N
38) WAS THE INFECTION WITH THE KLEBSIELLA (ORGANISM-2) ACQUIRED SINCE THE PATIENT WAS ADMITTED?
**?
39) IS STREPTOCOCCUS AEROBIC, ANAEROBIC, OR A FACULTATIVE ANAEROBE?
**?
40) WAS PENICILLINASE ADDED TO THIS BLOOD CULTURE (CULTURE-2)?
**N
41) WAS THE INFECTION WITH THE ENTEROBACTER (ORGANISM-4) ACQUIRED SINCE THE PATIENT WAS ADMITTED?
**?
42) WAS THE PATIENT TREATED FOR THE INFECTION WITH THE ENTEROBACTER (ORGANISM-4)?
**N
43) WAS THE PATIENT TREATED FOR THE INFECTION WITH THE KLEBSIELLA (ORGANISM-2)?
**N
44) WAS ANY ADDITIONAL CHEMOTHERAPY RECENTLY BEGUN TO COMBAT ORGANISM-1?
**N
PLEASE WAIT WHILE I CHECK MY FILES FOR A MOMENT...
45) ANY OTHER ORGANISMS ISOLATED FROM THIS BLOOD CULTURE (CULTURE-1) FOR WHICH YOU WOULD LIKE A THERAPEUTIC RECOMMENDATION?
**Y

-----ORGANISM-6-----
46) ENTER THE IDENTITY (GENUS) OF ORGANISM-6:
**?
47) IS ORGANISM-6 A ROD OR COCCUS (ETC.):
**COCCUS
48) STAINING CHARACTERISTICS OF ORGANISM-6 (GRAM):
**POS
49) DID ORGANISM-6 GROW IN THE AEROBIC BOTTLE?
**Y
50) DID ORGANISM-6 GROW IN THE ANAEROBIC BOTTLE?
**Y
51) DID ORGANISM-6 GROW IN CLUMPS, CHAINS, OR PAIRS?
**CHAINS(8) CLUMPS(4)
52) WAS PENICILLINASE ADDED TO THIS BLOOD CULTURE (CULTURE-1)?
**N
53) WHAT IS THE SUSPECTED NON-STERILE PORTAL OF ENTRY OF ORGANISM-6 INTO THE BLOOD?
**GI
54) WAS THE PATIENT TREATED FOR THE INFECTION WITH THE STREPTOCOCCUS (ORGANISM-5)?
**N
PLEASE WAIT WHILE I CHECK MY FILES FOR A MOMENT...
55) WAS THE PATIENT TREATED FOR THE INFECTION WITH THE STREPTOCOCCUS (ORGANISM-3)?
**N

Rule 30 - Because subtype data not looked at for IDENTITY ∃ problem w/ genus/species

↑ in general, not org-3 or org-5. This property is missing for strep.

```
     56) WAS ANY ADDITIONAL CHEMOTHERAPY RECENTLY BEGUN TO COMBAT
     ORGANISM-6?
     **N
   57) ANY OTHER ORGANISMS ISOLATED FROM THIS BLOOD CULTURE
   (CULTURE-1) FOR WHICH YOU WOULD LIKE A THERAPEUTIC
   RECOMMENDATION?
   **N
58) WERE ANY OTHER POSITIVE SPECIMENS RECENTLY DRAWN FROM KK
(PATIENT-1) WHICH REVEALED ADDITIONAL ORGANISMS FOR WHICH YOU WISH
THERAPEUTIC ADVICE?
**N

CONCLUSIONS REGARDING ORGANISMS FOR WHICH THE PATIENT IS TO
        BE TREATED...
(ORGANISM-1)
     THE IDENTITY OF ORGANISM-1:
PLEASE WAIT WHILE I CHECK MY FILES FOR A MOMENT...

          MOST LIKELY:  KLEBSIELLA OR ENTEROBACTER OR
                                PSEUDOMONAS
          CONSIDERED BUT RULED OUT:  PROTEUS OR E.COLI OR STREPTOCOCCUS
                                OR CLOSTRIDIUM OR BACTEROIDES
     THE CLASS OF ORGANISM-1:
          MOST LIKELY:  ENTEROBACTERIACEAE
     AN ORGANISM WHICH MAY BE THE SAME AS ORGANISM-1:
          MOST LIKELY:  ORGANISM-2 OR ORGANISM-4
(ORGANISM-6)
     THE IDENTITY OF ORGANISM-6:
          MOST LIKELY:  STREPTOCOCCUS
          CONSIDERED BUT RULED OUT:  STAPHYLOCOCCUS OR CLOSTRIDIUM OR
                                BACTEROIDES OR PSEUDOMONAS OR
                                PROTEUS OR KLEBSIELLA OR E.COLI
     AN ORGANISM WHICH MAY BE THE SAME AS ORGANISM-6:
          MOST LIKELY:  ORGANISM-3 OR ORGANISM-5
     THE SUBTYPE OF ORGANISM-6:
          MOST LIKELY:  DELTA


TURN TO NEW PAGE - HIT 'RETURN'
```

```
MY THERAPY RECOMMENDATION WILL BE BASED ON THE FOLLOWING CONDITIONS
TAKEN FROM THE RELEVANT THERAPY RULES:
     <1>     THE IDENTITY OF THE ORGANISM (org-1) IS KLEBSIELLA
                (RULE063 - 9/10)
     <2>     THE IDENTITY OF THE ORGANISM (org-1) IS ENTEROBACTER
                (RULE060 - 7/10)
     <3>     THE IDENTITY OF THE ORGANISM (org-1) IS NOT KNOWN WITH CERTAINTY,
             AND  THE IDENTITY OF THE ORGANISM (org-6) may be PSEUDOMONAS
                (RULE104 - 7/10)
     <4>     THE IDENTITY OF THE ORGANISM IS STREPTOCOCCUS,  AND  [A
             - THE SUBTYPE OF THE ORGANISM IS DELTA,  OR B - THE
             SUBTYPE OF THE ORGANISM IS NOT KNOWN]
                (RULE071 - 9/10)

59) IS THE STREPTOCOCCUS (ORGANISM-5) SENSITIVE TO PENICILLIN?
**YES

60) IS THE STREPTOCOCCUS (ORGANISM-3) SENSITIVE TO PENICILLIN?
**Y

61) IS THE STREPTOCOCCUS (ORGANISM-5) SENSITIVE TO STREPTOMYCIN?
**?

62) IS THE STREPTOCOCCUS (ORGANISM-3) SENSITIVE TO STREPTOMYCIN?
**?


63) IS THE KLEBSIELLA (ORGANISM-2) SENSITIVE TO GENTAMICIN?
**Y
```

Problem: organisms are treated separately.

```
[REC 1] MY PREFERRED THERAPY RECOMMENDATION IS AS FOLLOWS:
     IN ORDER TO COVER FOR <1> <2> <3>:
        GIVE: GENTAMICIN  (9/10)
              DOSE: 1.5 MG/KG Q8H - IV OR IM
              COMMENTS: MODIFY DOSE IN RENAL FAILURE
     IN ORDER TO COVER FOR <4>:
        GIVE THE FOLLOWING IN COMBINATION:
          1  PENICILLIN  (9/10)
             DOSE: 285,000 UNITS/KG/DAY - IV
          2  STREPTOMYCIN  (9/10)
             DOSE: 15 MG/KG Q12H - IM
             COMMENTS: MODIFY DOSE IN RENAL FAILURE

64) IS THE STREPTOCOCCUS (ORGANISM-5) SENSITIVE TO KANAMYCIN?
**N

65) IS THE STREPTOCOCCUS (ORGANISM-3) SENSITIVE TO KANAMYCIN?
**N

66) IS THE ENTEROBACTER (ORGANISM-4) SENSITIVE TO PENICILLIN?
**N

67) IS THE KLEBSIELLA (ORGANISM-2) SENSITIVE TO AMPICILLIN?
**YES
```

→ cannot give streptomycin

```
   68) IS THE STREPTOCOCCUS (ORGANISM-5) SENSITIVE TO AMPICILLIN?
   **?

   69) IS THE STREPTOCOCCUS (ORGANISM-3) SENSITIVE TO AMPICILLIN?
   **?


[REC 2] NEXT BEST THERAPY RECOMMENDATION:
     IN ORDER TO COVER FOR <1> <2> <4>:
        GIVE: AMPICILLIN  (8/10)
              DOSE: 175 MG/KG/DAY - IV
     IN ORDER TO COVER FOR <3>:
        GIVE: COLISTIN  (5/10)
              DOSE: 1.25 MG/KG Q6H - IM
              COMMENTS: MODIFY DOSE IN RENAL FAILURE

DO YOU WISH TO SEE THE NEXT CHOICE?
**YES

   70) IS THE STREPTOCOCCUS (ORGANISM-5) SENSITIVE TO VANCOMYCIN?
   **?

   71) IS THE STREPTOCOCCUS (ORGANISM-3) SENSITIVE TO VANCOMYCIN?
   **?

   72) IS THE KLEBSIELLA (ORGANISM-2) SENSITIVE TO KANAMYCIN?
   **NO


   73) IS THE KLEBSIELLA (ORGANISM-2) SENSITIVE TO CEPHALOTHIN?
   **YES


[REC 3] NEXT BEST THERAPY RECOMMENDATION:
     IN ORDER TO COVER FOR <1> <2>:
        GIVE: CEPHALOTHIN  (8/10)
              DOSE: 180 MG/KG/DAY - IV
     IN ORDER TO COVER FOR <4>:
        GIVE: VANCOMYCIN  (5/10)
              DOSE: 30 MG/KG/DAY - IV
              COMMENTS: MODIFY DOSE IN RENAL FAILURE
     IN ORDER TO COVER FOR <3>:
        GIVE: POLYMYXIN  (4/10)
              DOSE: 1.0 MG/KG Q8H - IM

DO YOU WISH TO SEE THE NEXT CHOICE?
**NO
```

```
     PLEASE ASK ANY QUESTIONS YOU WISH REGARDING THE ABOVE
          CONSULTATION SESSION OR THE OVERALL KNOWLEDGE OF THE
          CONSULTATION SYSTEM. QUESTIONS SPECIFIC TO THE ADVISORY
          SESSION ABOVE SHOULD BEGIN WITH A QUESTIONS-MARK (?).
          SAMPLES:
            **?  HOW DECIDE PROP OF ATM IS VALUE
          OR
            **?  WHY ASK QUESTION ##
          OR
            **?  WHAT IS RULE###
** ? WHY ASK QUESTION 13
     I DON'T KNOW OF A QUESTION WITH THAT NUMBER BEFORE IT.
** ? WHY ASK 13
     QUESTION 13 WAS ASKED TO FIND OUT LESIONS OF PATIENT IN AN
          ATTEMPT TO EXECUTE RULE040

** ? WHAT IS RULE040

* RULE040
  ----------
      IF: THE SITE OF THE CULTURE IS BLOOD, AND THE STAIN OF THE
          ORGANISM IS GRAMNEG, AND THE MORPHOLOGY OF THE ORGANISM
          IS ROD, AND THE PRESENCE OF PSEUDOMONAS-TYPE SKIN
          LESIONS ON PATIENT HAS BEEN INFERRED OR DEMONSTRATED
      THEN: CONCLUDE THAT THE IDENTITY OF THE ORGANISM IS
            PSEUDOMONAS (MODIFIER: THE CERTAINTY TALLY FOR THE
            PREMISE TIMES .8)

** ? WHY ASK 39
     QUESTION 39 WAS ASKED TO FIND OUT AIR OF STREPTOCOCCUS IN
          AN ATTEMPT TO EXECUTE RULE030

** ? WHAT IS RULE030

* RULE030
  ----------
      IF: THE IDENTITY OF THE ORGANISM IS KNOWN WITH CERTAINTY
      THEN: TRANSFER THESE PROPERTIES - GRAM MORPH AIR - FROM THE
            IDENTITY OF THE ORGANISM TO THIS ORGANISM, MODIFYING THE
            CERTAINTY FACTOR OF EACH BY 1

** ? HOW DECIDE THERAPY OF ORGANISM-6 IS VANCOMYCIN

     AFTER QUESTION 58 I USED RULE071 TO CONCLUDE THERAPY OF
          ORGANISM-6 IS VANCOMYCIN(  .5491991)
** ? WHAT IS RULE071

* RULE071
  ----------
      IF: THE IDENTITY OF THE ORGANISM IS STREPTOCOCCUS, AND [A -
          THE SUBTYPE OF THE ORGANISM IS DELTA, OR B - THE SUBTYPE
          OF THE ORGANISM IS NOT KNOWN]
      THEN:
        I RECOMMEND (IN ORDER OF PREFERENCE):
                    1 - IN COMBINATION: PENICILLIN STREPTOMYCIN
                    2 - AMPICILLIN
                    3 - IN COMBINATION: PENICILLIN KANAMYCIN
                    4 - VANCOMYCIN

** NIL
74) DO YOU WISH ADVICE ON ANOTHER PATIENT?
**NO
```

APPENDIX E

From: Terry Winograd, *Understanding Natural Language*, (1972) 3 Cognitive Psychology 1.

1.3. *Sample Dialog*

This section contains a sample of a dialog with the language-understanding system. It carries out actions and answers questions about a simple scene containing a table, hand, and box and several blocks and pyramids. The boldface lines in lower case were typed in by a person, and the upper case lines are the computer's responses. CAPITAL lines are comments describing some of the features being exhibited.

The dialog was carried out in real time with the response of the "robot" displayed on a CRT screen. Figures are included to show the state of the scene at various points, beginning with Fig. 3.

1. pick up a big red block.

OK.

The system answers "OK" when it carries out a command. In order to pick up the red block, it had to clear it off by finding a space for the green one and moving the green one away.

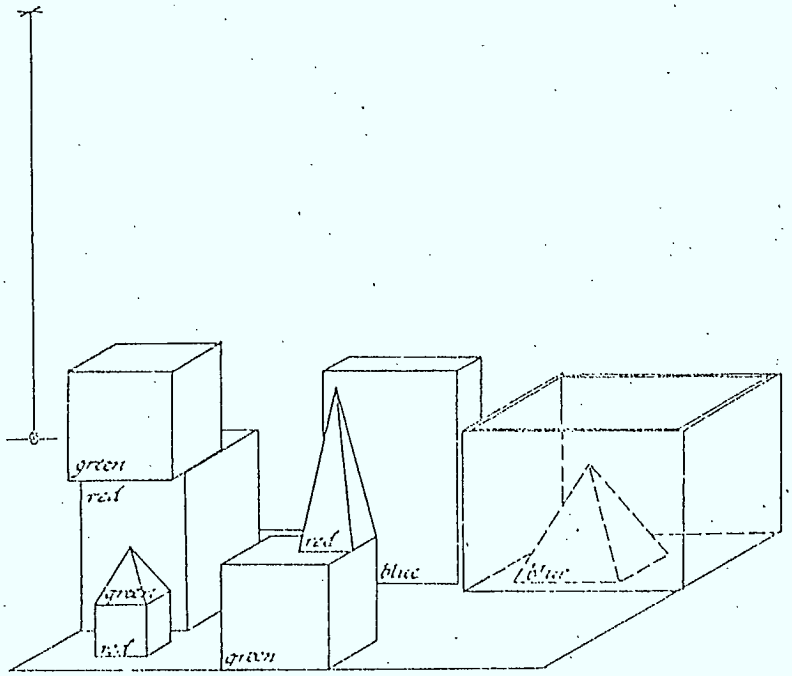


FIG. 3. "Pick up a big red block."

2. grasp the pyramid.

I DON'T UNDERSTAND WHICH PYRAMID YOU MEAN.

There are three pyramids in the scene, so the program does nothing.

3. find a block which is taller than the one you are holding and put it into the box.

The system has to figure out what is meant by "one" and "it," as well as using deduction to decide which block it is holding.

BY "IT", I ASSUME YOU MEAN THE BLOCK WHICH IS TALLER THAN THE ONE I AM HOLDING.

Printed out to keep us informed.

OK.

The hand has to set down the red block to pick up the taller blue one. Figure 4 shows the result of the system's manipulations so far.

4. what does the box contain?

THE BLUE PYRAMID AND THE BLUE BLOCK.

5. what is the pyramid supported by?

Earlier the system responded to "the pyramid" by saying "I don't

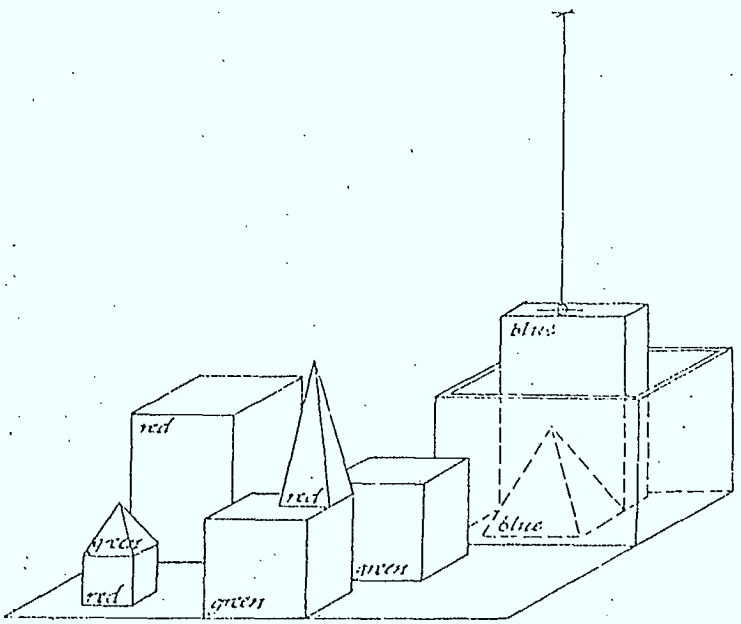


FIG. 4. "Find a block which is bigger than the one you are holding and put it into the box.

understand which pyramid you mean." Now, it assumes that we mean the one just mentioned.

THE BOX.

6. how many blocks are not in the box?

Negatives, such as "not" and "no" are handled whether they appear in clauses or noun groups (such as "no boxes").

FOUR OF THEM.

7. is at least one of them narrower than the one which I told you to pick up?

The phrase "at least one of them" must be analyzed to refer back to the previous question, and "the one which . . ." must also refer to blocks. Noun groups can have complicated numbers such as "at least one", "more than three", exactly seven", etc. The memory of past events is used to deduce which block is "the one which I told you to pick up". Notice the complicated syntactic structure in which "the one" is actually the object of a clause embedded two levels deeper.

YES, THE RED CUBE.

8. is it supported?

Passives can be used without a "by . . ." phrase.

YES, BY THE TABLE.

9. can the table pick up blocks?

NO.

The semantic rules make this a nonsensical question which therefore must be false.

10. can a pyramid be supported by a block?

YES.

The deductive system finds an actual example, so it knows this is possible.

11. can a pyramid support a pyramid?

I DON'T KNOW.

The question makes sense, but there is no example in the scene, so there is no easy way to tell without being able to examine the robot's programs.

12. stack up two pyramids.

I CAN'T.

The robot tries and fails.

13. the blue pyramid is mine.

I UNDERSTAND.

This data is added to the data base.

14. I own blocks which are not red, but I don't own anything which supports a pyramid.

I UNDERSTAND.

Two new theorems are created for proving things about "owning".

15. do I own the box?

NO.

The box supports whatever it contains, including a pyramid.

16. do I own anything in the box?

YES, TWO THINGS: THE BLUE BLOCK AND THE BLUE PYRAMID.

17. will you please stack up both of the red blocks and either a green cube or a pyramid?

OK.

Logical connectives such as "and" "or" "either" etc. are handled in both the grammar and semantics. A command is executed even if it looks like a question. The command is carried out by the following series of steps: It puts a green cube on the large red block (note that it chooses the green cube with nothing on it), then removes the small pyramid from the little red cube, so that it can use that cube to complete the stack as specified, resulting in the situation of Fig. 5.

18. which cube is sitting on the table?

THE LARGE GREEN ONE WHICH SUPPORTS THE RED PYRAMID.

Ordinarily the system would be satisfied with calling this "a big green cube", but since we asked "which cube" it has to be more specific in naming it. The use of substitute nouns (such as "one") and pronouns in answers makes the discourse more natural.

19. is there a large block behind a pyramid?

YES, THREE OF THEM: A LARGE RED ONE, A LARGE GREEN CUBE AND THE BLUE ONE.

20. put a small one onto the green cube which supports a pyramid.

"A small one" must contrast with the earlier phrase "a large block", so this means "a small block".

OK.

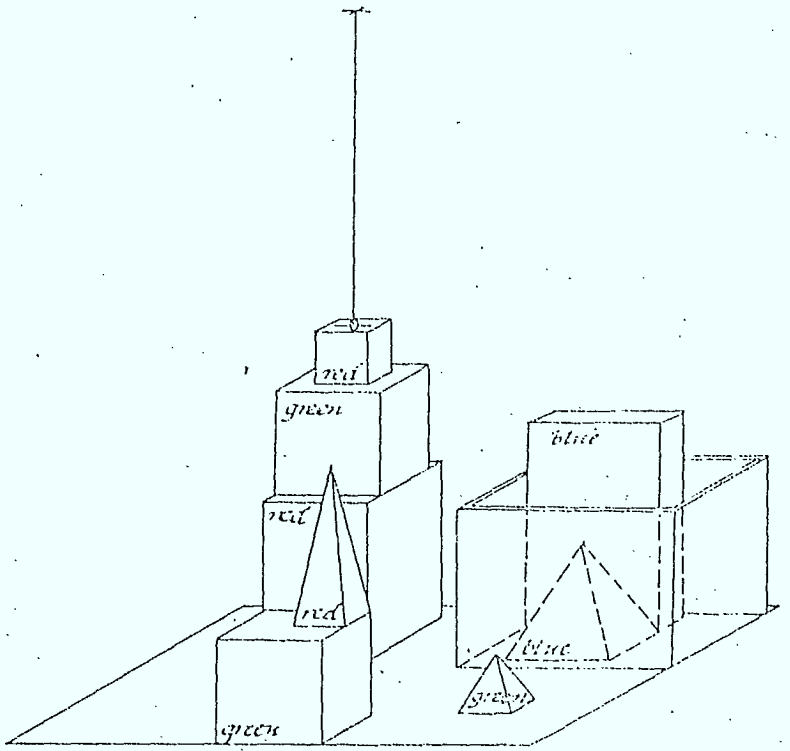


FIG. 5. "Will you please stack up both of the red blocks and either a green cube or a pyramid?"

21. put the littlest pyramid on top of it.

Words like "littlest" are not in the dictionary but are interpreted from the root forms like "little".

OK.

22. how many things are on top of green cubes?

I'M NOT SURE WHAT YOU MEAN BY "ON TOP OF" IN THE PHRASE "ON TOP OF GREEN CUBES".
DO YOU MEAN:
1—DIRECTLY ON THE SURFACE
2—ANYWHERE ON TOP OF?

When there are several interpretations and none is clearly better, the system has to ask the user for more information. The paraphrases were included with the dictionary definition of "on", and the request for more information occurs automatically when the heuristics for resolving

ambiguities aren't sufficient. A request like this can also occur when the meaning of a pronoun such as "it" or "they" is unclear.

2

THREE OF THEM.

3. had you touched any pyramid before you put the green one on the little cube?

YES, THE GREEN ONE

The system deduces from its memory what event is being referred to, and can relate other events to it in time. The analysis includes complex cases of verb groups, and there are special facilities for keeping track of the various forms of irregular verbs like "have".

21. when did you pick it up?

WHILE I WAS STACKING UP THE RED CUBE, A LARGE RED BLOCK AND A LARGE GREEN CUBE.

A time is described by naming the main goal which was being worked on.

25. why?

The system remembers immediately previous sentences to understand questions like this and the following ones.

TO GET RID OF IT.

By keeping track of selected parts of the original subgoal tree, the system has some understanding of its own motives.

26. why did you do that?

TO CLEAN OFF THE RED CUBE.

"That" refers to the action mentioned in the answer.

27. why did you clear off that cube?

Here, "that" means the one just referred to.

TO PUT IT ON A LARGE GREEN CUBE.

28. why did you do that?

TO STACK UP THE RED CUBE, A LARGE RED BLOCK AND A LARGE GREEN CUBE.

29. why did you do that?

BECAUSE YOU ASKED ME TO.

It remembers what it did, not how the request was worded.

30. how did you do it?

"It" refers to the action mentioned in the last question, rather than the answer.

BY PUTTING A LARGE RED BLOCK ON THE TABLE; THEN LETTING GO OF IT; THEN PUTTING A [illegible] GREEN CUBE ON IT; THEN LETTING GO OF THAT CUBE; THEN PUTTING THE RED CUBE ON THAT CUBE; THEN LETTING GO OF THAT CUBE.

This is a description of the top-level subgoals used to achieve the goal.

31. how many objects did you touch while you were doing it?

Time references can refer to a time span, using words like "while".

FOUR OF THEM.

32. what did the red cube support before you started to clean it off?

THE GREEN PYRAMID.

By remembering what has been moved, it is possible to deduce things about earlier states of the scene. We can use complex nestings of clauses like "before you started to clean it off".

33. there were five blocks to the left of the box then.

"Then" must refer to the time mentioned in the last sentence.

NO, ONLY FOUR OF THEM: THE RED CUBE, TWO LARGE GREEN CUBES AND A LARGE RED BLOCK

Earlier in the dialog, new information about "owning" was accepted at face value. But the system knows that it has complete information about the basic properties of objects, including location. It checks any statements about location or other such properties to see whether it agrees or disagrees.

34. put the blue pyramid on the block in the box.

This is syntactically ambiguous, but is understood without ambiguity since the parsing corresponding to "put the blue pyramid which is on the block in the box." does not make sense in the current scene, while "put the blue pyramid on the block which is in the box" does.

OK.

35. is there anything which is bigger than every pyramid but is not as wide as the thing that supports it?

The system understands quantifiers such as "every", "any", "some", etc., and structures such as "bigger than", "as wide as", etc. Here "it" refers to a noun group within the same sentence but two levels up in the parsing tree.

YES, THE BLUE BLOCK.

36. does a steeple

SORRY, I DON'T KNOW THE WORD "STEEPLE".

The system interrupts immediately when it sees a word it can't figure out.

37. a "steeple" is a stack which contains two green cubes and a pyramid.

The quote marks indicate that we are defining a new word.

I UNDERSTAND.

38. are there any steeples now?

NO.

The new definition is used as a description to recognize steeples.

39 build one.

OK.

The description given in the definition is enough to deduce a plan for building new objects as well as recognizing them. The word "one" means "a steeple", and the plan is carried out. First, one of the large green cubes is cleared off by removing the red cube and two pyramids. Then the two green cubes and the tall red pyramid are stacked up to fit the description.

40. call the biggest block "superblock".

OK.

We can also give objects names.

41. have you picked up superblock since we began?

YES.

42. why did you drop it?

BY "IT", I ASSUME YOU MEAN THE SUPERBLOCK.
I CAN'T EXPLAIN A NONEXISTENT EVENT.

There is no record in memory of any block being dropped.

43. is there anything to the right of the red pyramid?

YES, FOUR THINGS: THE BOX, THE RED CUBE, THE BLUE PYRAMID AND THE BLOCK NAMED SUPERBLOCK.

Once an object has a name, the name is used to help identify it in responses.

44. thank you.

YOU'RE WELCOME!

Idioms can be defined without modifying the grammar.

DEPARTMENT OF NATIONAL REVENUE, TAXATION

INTERPRETATION BULLETIN

MINISTÈRE DU REVENU NATIONAL, IMPÔT

BULLETIN D'INTERPRÉTATION

SUBJECT: INCOME TAX ACT
Principal Residence

OBJET: LOI DE L'IMPÔT SUR LE REVENU
Résidence principale

SERIAL NO: IT–120 DATE: September 14, 1973

REFERENCE: Paragraph 54(g) (Also sections 45 and 116, subsections 40(2), (4) and (5), paragraph 54(f) and Part XXIII of the Regulations)

NO DE SÉRIE: IT–120 DATE: le 14 septembre 1973

RENVOI: Alinéa 54g) (Voir aussi les articles 45 et 116, les paragraphes 40(2), (4) et (5), l'alinéa 54f) et la Partie XXIII des Règlements)

1. The vast majority of residences will meet the definition of "principal residence" contained in paragraph 54(g) of the Act with the result that any gain on the disposition thereof will be exempt from tax. Various matters concerning principal residences are discussed under the following headings:

Qualification as a Principal Residence

2. To qualify as the principal residence of a taxpayer, the property in question must be

(a) a housing unit, a leasehold interest therein or a share of the capital stock of a co-operative housing corporation,

(b) owned by him solely or jointly (i.e. – as joint tenants or tenants-in-common or, in Quebec, co-owners) with another person,

PUBLISHED UNDER THE AUTHORITY OF THE DEPUTY MINISTER OF NATIONAL REVENUE FOR TAXATION

1. La plupart des résidences satisferont à la définition de "résidence principale", que contient l'alinéa 54g) de la Loi; par conséquent, tout gain réalisé lors de la disposition de ces résidences sera exempté de l'impôt. Le présent Bulletin traitera de différentes questions concernant les résidences principales, sous les rubriques suivantes:

Admissibilité comme résidence principale

2. Pour être admissible à titre de résidence principale d'un contribuable, le bien en cause doit

a) consister et un logement, un droit de tenure à bail y afférent ou une action du capital-actions d'une coopérative d'habitation constituée en corporation,

b) appartenir au contribuable personnellement ou conjointement (c'est-à-dire en qualité de "joint tenants" ou de "tenants-in-common" ou, au Québec, de copropriétaires) avec une autre personne,

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(c) ordinarily inhabited by him in the year (except in circumstances described in paragraph 19 below), and

(d) designated where necessary (see paragraph 8) by him as his only principal residence for that particular year.

A taxpayer's principal residence need not be located in Canada.

Housing Unit

3. The term "housing unit" as used in paragraph 54(g) of the Act includes a house, apartment in a duplex or apartment building or condominium, cottage, mobile home, trailer or houseboat and the land upon which the housing unit stands (including any adjoining land that contributes to the use and enjoyment of the housing unit).

Ownership of Property

4. The designation of a residence as a principal residence can be made only where there is sole or joint ownership of a housing unit, a leasehold interest therein or a share of the capital stock of a co-operative housing corporation. Where a taxpayer and his spouse own a residence jointly (i.e. – as joint tenants or tenants-in-common or, in Quebec, co-owners) and realize a gain on the disposition of that residence, each will have a gain on the disposition of that property and each must designate his respective interest in the housing unit or share as being his principal residence in order to have some part, or all, of his portion of the overall gain free from tax under paragraph 40(2)(b) of the Act. In these cases, if both spouses designate their respective interest in the housing unit or share as being their principal residence, then any second residence owned by the taxpayer or his spouse (or both) may not be designated as a principal residence during the period of time that the first residence is designated as a principal residence by both spouses. However, where one spouse is the sole owner of one residence and the other spouse is the sole owner of a second residence, then both residences may be eligible for principal residence status during the same period of time if the other conditions described in this Bulletin are met.

5. Subsections 40(4) and (5) provide rules where a taxpayer has, after 1971, transferred a residence to his spouse or a "spouse trust". To come within these subsections, the transfer must take place during the taxpayer's lifetime, or on or after his death and as a consequence thereof, and both the taxpayer and the spouse or trust must be resident in Canada immediately prior to the taxpayer's death, or at the time of the transfer, as the case may be (except where the transfer is to a "spouse trust" on or after the death of the taxpayer in which case the taxpayer must have been resident in

c) être normalement habité dans l'année par le contribuable (sauf dans les circonstances exposées au paragraphe 19 ci-dessous) et

d) être désigné par lui, au besoin (voir paragraphe 8), comme étant sa seule résidence principale pour une année donnée.

La résidence principale d'un contribuable ne doit pas être obligatoirement située au Canada.

Logement

3. Le mot "logement", dans l'acception que lui donne l'alinéa 54g) de la Loi, comprend une maison, un appartement dans un duplex ou dans un immeuble locatif ou dans un condominium, un chalet, une amison mobile, une roulotte ou une maison flottante, ainsi que le fonds de terre sur lequel est situé le logement (y compris une fonds de terre contigu qui facilite l'usage et la jouissance du logement).

Possession d'un bien

4. La désignation d'une résidence comme étant une résidence principale n'est possible que s'il y a possession personnelle ou conjointe d'un logement, d'un droit de tenure à bail y afférent ou d'une action du capital-actions d'une coopérative d'habitation constituée en corporation. Lorsqu'un contribuable et son conjoint possèdent conjointement une résidence (c'est-à-dire en qualité de "joint tenants" ou de "tenants-in-common" ou, au Québec de copropriétaires, et qu'ils réalisent un gain lors de la disposition de ladite résidence, chacun aura réalisé un gain lors de la disposition dudit bien et chacun doit désigner sa participation respective dans le logement ou dans l'action comme étant sa résidence principale, de façon qu'une partie ou que l'ensemble de sa portion du gain total soit libéré de l'impôt en vertu de l'alinéa 40(2)b) de la Loi. Dans ces cas, c'est-à-dire si les deux conjoints désignent leur participation respective dans le logement ou l'action comme étant leur résidence principale, toute autre résidence dont le contribuable ou son conjoint (ou les deux) sont propriétaires ne peut être désignée comme étant une résidence principale pendant la période durant laquelle la première résidence est désignée comme étant la principale résidence par les deux conjoints. Toutefois, lorsqu'un des conjoints est l'unique propriétaire d'une résidence et que l'autre conjoint est l'unique propriétaire d'une deuxième résidence, les deux résidences peuvent être admissibles, en ce qui concerne le statut de résidence principale, ce durant la même période, si les autres conditions exposées dans le présent Bulletin sont remplies.

5. Les paragraphes 40(4) et (5) contiennent les règles qui s'appliquent au contribuable qui, après 1971, a transféré une résidence à son conjoint ou à une "fiducie au profit d'un conjoint". Afin de satisfaire aux exigences de ces paragraphes, le transfert doit avoir lieu durant la vie du contribuable, lors de son décès ou postérieurement et par suite de ce décès; de la même façon, le contribuable et son conjoint ou la fiducie doivent être des résidents du Canada immédiatement avant le décès du contribuable ou au moment du transfert, selon le cas (sauf si le transfert a lieu en faveur d'une "fiducie créée au profit d'un conjoint" lors du décès du contribuable ou

Canada immediately prior to death and the trust must be resident in Canada immediately after the taxpayer's death). If these conditions are met the spouse or the trust is placed in the same position as the taxpayer was and is considered to have owned the property throughout the period during which the taxpayer owned it; consequently the spouse or trust will generally be able to designate the property as being a principal residence for the period.

Meaning of "Ordinarily Inhabited"

6. The question of whether a taxpayer has "ordinarily inhabited" a residence during a taxation year is determined by the facts in each particular case. Where the taxpayer claiming the principal residence status has occupied the residence for only a short period of time during a taxation year (such as a seasonal residence occupied during a taxpayer's vacation or a house which was sold early or bought late in a taxation year), it is the Department's view that the taxpayer "ordinarily inhabited" that residence in the year provided that the principal reason for owning the property was not for the purpose of gaining or producing income therefrom. In circumstances where a taxpayer receives incidental rental income from a seasonal residence, such property is not considered to be owned for the purpose of gaining or producing income therefrom. In the event that a taxpayer is absent from his residence for business or personal reasons for any period (e.g. – armed forces personnel on duty away from home), but his spouse or dependants continue to occupy the residence, the Department considers that the taxpayer "ordinarily inhabited" the residence provided that he was a resident (or deemed resident) of Canada during the period. The comments in this paragraph supersede those in the first paragraph on page 18 of the "Capital Gains" booklet.

7. A corporation or a partnership cannot "ordinarily inhabit" a residence and therefore cannot qualify for the "principal residence" status.

Designation as a Principal Residence (Form T–2091)

8. Paragraph 54(g) and Regulation 2301 provide special rules on the designation of a housing unit, a leasehold interest therein or a share of the capital stock of a co-operative housing corporation as a principal residence. Although it is provided that an otherwise eligible residence is not a principal residence for a taxation year unless it is designated as such in the taxpayer's income tax return for the year in which the disposition or the granting of an option to acquire the property occurs, the Department's administrative position is that this designation need not be filed with the taxpayer's income tax return unless a taxable capital gain on the disposition of a principal residence occurs after deducting the exempt portion of the gain. Where it is necessary to file the

postérieurement, auquel cas le contribuable doit avoir été un résident du Canada immédiatement avant son décès et la fiducie doit résider au Canada immédiatement après le décès du contribuable). Sous réserve de ces conditions, le conjoint ou la fiducie assume le statut qui était celui du contribuable et est considéré comme ayant détenu le bien tout au long de la période pendant laquelle le contribuable de détenait; par conséquent, le conjoint ou la fiducie pourra généralement désigner le bien comme étant une résidence principale pour la période en cause.

Signification de "normalement habité"

6. La question de savoir si un contribuable a "normalement habité" une résidence pendant une année d'imposition dépend des faits de chaque cas. Si le contribuable qui désire tirer profit du statut de résidence principale a occupé la résidence seulement pour une courte période au cours d'une année d'imposition (par exemple dans le cas d'une résidence occupée sur une base saisonnière durant les vacances du contribuable ou d'une maison qui a été vendue tôt ou achetée tard dans l'année d'imposition), le Ministère juge que le contribuable a "normalement habité" la résidence en question dans l'année, à la condition que la possession du bien n'ait pas été principalement dans le but de gagner un revenu de ce bien ou de lui faire produire un revenu. Dans les cas où un contribuable reçoit un revenu de location accessoire d'une résidence saisonnière, le bien en question n'est pas considéré comme étant détenu dans le but de gagner un revenu dudit bien ou de lui faire produire un revenu. Dans le cas où un contribuable s'absente de sa résidence pour des raisons d'affaires ou personnelles pour une période quelconque (par exemple le personnel des forces armées en service à l'extérieur), mais où son conjoint ou les personnes à sa charge continuent d'occuper la résidence, le Ministère est d'avis que le contribuable a "normalement habité" la résidence, à la condition qu'il ait été un résident (ou été réputé être un résident) du Canada au cours de la période en cause. Les observations contenues dans le présent paragraphe annulent celles contenues dans le premier paragraphe complet de la page 20 de la brochure intitulée "Gains en capital".

7. Une corporation ou une société ne peuvent "normalement habiter" une résidence et, par conséquent, ne peuvent tirer profit du statut de "résidence principale".

Désignation comme résidence principale (Formule T–2091)

8. L'alinéa 54g) et le Règlement 2301 indiquent les règles spéciales à suivre pour la désignation comme résidence principale d'un logement, d'une tenure à bail dans ce logement ou d'une action du capital-actions d'une coopérative d'habitation constituée en corporation. Même s'il est stipulé qu'une résidence autrement admissible n'est pas une résidence principale pour une année d'imposition à moins qu'elle n'ait été désignée comme telle dans la déclaration d'impôt sur le revenu du contribuable pour l'année où survient la disposition ou l'accord d'un droit d'achat de la propriété, selon la politique administrative du Ministère, cette désignation n'a pas à être signalée avec la déclaration d'impôt sur le revenu du contribuable à moins qu'un gain en capital imposable provenant de la disposition d'une résidence principale n'ait été réalisé après déduction

designation with the Department, it may be made on form T–2091 attached at the end of this Bulletin. This form is also contained in a package of supplementary schedules for computing capital gains, which is available at any District Taxation Office.

de la partie exempte du gain. S'il est nécessaire de déclarer la désignation au Ministère, on peut le faire en utilisant la Formule T–2091 jointe à la fin du présent bulletin. Cette formule fait également partie d'un ensemble d'annexes supplémentaires pour le calcul des gains en capital disponible à tous les bureaux de district d'impôt.

Land Contributing to Use and Enjoyment of Principal Residence

9. Land upon which a principal residence stands and adjoining land that contributes to a taxpayer's use and enjoyment of his residence qualify as part of a principal residence. No proof of such use and enjoyment is required in respect of one acre of land or less (which includes the area on which the structure is situated).

Fonds de terre facilitant l'usage et la jouissance de la résidence principale

9. Le fonds de terre sur lequel est situé une résidence principale et le fonds de terre contigu qui facilite au contribuable l'usage et la jouissance de sa résidence peuvent être admis comme faisant partie de la résidence principale. Il n'est pas nécessaire de prouver cet usage et cette jouissance quand il s'agit d'un fonds de terre d'une acre ou moins (ce qui comprend la surface couverte par le bâtiment).

10. Where the total area of the surrounding land exceeds one acre, the excess is considered to be part of the principal residence where it can reasonably be regarded as necessary for the use and enjoyment of the residence. The purpose of this provision is to prevent taxpayers from claiming principal residence status on speculative land purchases. However, it is not intended to preclude a taxpayer from having a principal residence which includes land in excess of one acre as is sometimes the case in smaller communities. In determining whether land in excess of one acre is necessary for the use and enjoyment of a housing unit, the Department will consider factors such as the size and character of the housing unit, the use of the land in excess of one acre, the location of the residence on the lot, whether a municipal or provincial law requires residential lots to be in excess of one acre, whether the land can reasonably be severed into two or more viable portions, the zoning of the property at the time of purchase and sale, and other relevant factors.

10. Lorsque la superficie totale du fonds de terre contigu est supérieure à une acre, l'excédent est considéré comme faisant partie de la résidence principale, lorsqu'il peut raisonnablement être considéré comme étant nécessaire à l'usage et à la jouissance de la résidence. Cette disposition a pour but d'empêcher les contribuables de demander le statut de résidence principale pour des achats fonciers de nature spéculative. Elle n'a cependant pas pour but d'empêcher un contribuable de posséder une résidence principale qui comprend un fonds de terre supérieur à une acre, comme il arrive parfois dans les agglomérations de moindre envergure. Au moment d'établir si un fonds de terre supérieur à une acre est nécessaire à l'usage et à la jouissance d'un logement, le Ministère tiendra compte de facteurs tels la taille et le genre du logement, l'usage du fonds de terre supérieur à une acre, la situation de la résidence sur le terrain, le fait qu'un règlement municipal ou une loi provinciale exige que les terrains résidentiels soient supérieurs à une acre ou que le fonds puisse raisonnablement être divisé en deux ou plusieurs portions valables, le zonage du bien au moment de l'achat et de la vente et d'autres facteurs pertinents.

Calculation of Gain on Disposition

11. Residences that are owned and occupied or kept available for occupancy by a taxpayer or members of his family are, by definition, "personal-use property" (paragraph 54(f) of the Act). A capital gain on personal-use property that does not qualify as a principal residence is subject to tax on one-half of any post-1971 gain realized on disposition or deemed disposition. Losses on personal-use property (other than listed personal property such as jewellery, art collections, etc.) are not deductible by virtue of subparagraph 40(2)(g)(iii).

Calcul du gain lors de la disposition

11. Par définition, les résidences qui sont détenues et occupées ou conservées en vue d'une occupation par le contribuable ou les membres de sa famille sont des "biens à usage personnel" (alinéa 54f) de la Loi). Un gain en capital réalisé sur un bien à usage personnel qui n'est pas admissible comme résidence principale est assujetti à l'impôt sur la moitié de tout gain réalisé après 1971 lors de la disposition ou d'une disposition présumée. Les pertes subies relativement à des biens à usage personnel (autres que des biens personnels désignés, tels les bijoux, les collections d'oeuvres d'art, etc.) ne peuvent être déduites, ce en vertu du sous-alinéa 40(2)g)(iii).

12. Paragraph 40(2)(b) of the Act provides that a taxpayer may deduct the amount determined by the following formula from his gain on the disposition (or

12. L'alinéa 40(2)b) de la Loi stipule qu'un contribuable peut déduire, du gain qu'il a réalisé lors de la disposition (ou disposition présumée) de sa résidence principale au cours d'une

deemed disposition) of his principal residence in a taxation year:

$$\frac{1 + \text{the number of taxation years ending after 1971 for which the property was his principal residence and during which he was resident in Canada}}{\text{the number of taxation years ending after 1971 during which he owned the property}} \times \text{Capital gain on disposition}$$

Thus, where a residence has always been the principal residence of a taxpayer since 1971, the total amount of the gain is exempt from tax. While only one residence may be designated by a taxpayer for any given taxation year, the above formula recognizes the fact that he may have two principal residences in the same taxation year (e.g.—where one residence is sold and another is acquired in the same year). The effect of the "1 +" in the above formula is to treat both residences as a principal residence in the same year, but only one residence may be designated as such for that year. The terms "for which" and "during which" in the above formula refer to the whole or any part of a taxation year.

Land Used in a Farming Business

13. Where a taxpayer's principal residence is situated on land used in a farming business carried on by him, he may calculate a capital gain on the disposition of such property by either one of the methods described in the following paragraphs.

14. Firstly, he may divide the land into two portions: one containing the principal residence and adjoining land which may reasonably be regarded as contributing to the taxpayer's use and enjoyment of the residence (see comments in paragraph 10 where this land exceeds one acre), and the other containing the remainder of the land, part or all of which is used in the farming business carried on by him. Under this method, a reasonable part of the proceeds of disposition and a reasonable part of the adjusted cost base are allocated between the two portions of land in order that a gain may be determined for each portion of the land. The portion of the total gain that relates to the principal residence (including the adjoining land) is eligible for a reduction under paragraph 40(2)(b) as described in paragraph 12 above, while any gain relating to the remainder of the property is taxable in the usual manner. In the following example, it is assumed that a taxpayer resident in Canada has sold his ten-acre farm on which his principal residence was situated and that the area of land reasonably attributable to his principal residence was one acre.

année d'imposition, le montant établi à l'aide de la formule suivante:

$$\frac{1 + \text{le nombre d'années d'imposition terminées après 1971 et pendant lesquelles ce bien a été sa résidence principale et au cours desquelles il a résidé au Canada}}{\text{Le nombre d'années d'imposition terminées après 1971 pendant lesquelles il a été propriétaire de ce bien}} \times \text{Gain en capital réalisé lors de la disposition}$$

De cette façon, lorsqu'une résidence a toujours été la résidence principale d'un contribuable depuis 1971, le gain total est exempté de l'impôt. Bien qu'un contribuable ne puisse désigner qu'une seule résidence pour une année d'imposition donnée, la formule qui précède tient compte du fait qu'il peut avoir deux résidences principales au cours de la même année d'imposition (par exemple lorsqu'une résidence est vendue et une autre acquise au cours de la même année). Dans la formule qui précède, "1 +" a pour effet que les deux résidences sont traitées comme la résidence principale au cours de la même année, mais qu'une seule résidence peut être désignée à cet effet pour l'année en question. Les expressions "pendant lesquelles" et "au cours desquelles" que contient la formule ci-dessus se rapportent à l'ensemble ou à toute partie d'une année d'imposition.

Fonds de terre servant à une entreprise agricole

13. Lorsque la résidence principale d'un contribuable est située sur un fonds de terre utilisé dans une entreprise agricole qu'il exploite, il peut calculer le gain en capital tiré de la disposition dudit bien à l'aide de l'une des méthodes exposées dans les paragraphes qui suivent.

14. Premièrement, il peut diviser le fonds de terre en deux parties: la première contenant la résidence principale et le fonds de terre contigu qui peut raisonnablement être considéré comme facilitant au contribuable l'usage et la jouissance de la résidence (le paragraphe 10 traite des cas où ce fonds de terre est supérieur à une acre) et l'autre contenant le reste du fonds de terre, dont une partie ou l'ensemble est usilisé dans l'entreprise agricole qu'il exploite. Selon cette méthode, une portion raisonnable du produit de la disposition et une portion raisonnable du prix de base rajusté sont réparties entre les deux parties du fonds de terre de façon qu'on puisse établir un gain se rapportant à chaque partie du fonds de terre. La fraction du gain total qui se rapporte à la résidence principale (y compris le fonds de terre contigu) est admissible à une réduction en vertu de l'alinéa 40(2)b), comme nous l'avons expliqué au paragraphe 12 ci-dessus, alors que tout gain se rapportant au reste du bien est imposable selon les règles habituelles. Dans l'exemple qui suit, nous supposons qu'un contribuable qui réside au Canada a vendu une exploitation agricole de dix acres sur laquelle était située sa résidence principale et que la superficie du fonds de terre qui peut raisonnablement être attribué à sa résidence principale était d'une acre.

	Principal Residence	Farm Land	Total
Proceeds of Disposition			
Land	$ 3,000	$27,000	$30,000
House	10,000		10,000
Barn		17,000	17,000
Silo		3,000	3,000
	$13,000	$47,000	$60,000
Adjusted Cost Base			
Land	$ 2,000	$18,000	$20,000
House	7,000		7,000
Barn		13,000	13,000
Silo		2,000	2,000
	$. 9,000	$33,000	$42,000
Gain on Disposition	$ 4,000	$14,000	$18,000
Less: Reduction of Gain under Paragraph 40(2)(b)	4,000	—	4,000
Capital Gain (one-half is taxable)	NIL	$14,000	$14,000

	Résidence principale	Fonds de terre agricole	Total
Produits de la disposition			
Fonds de terre	$ 3,000	$27,000	$30,000
Maison	10,000		10,000
Grange		17,000	17,000
Silo		3,000	3,000
	$13,000	$47,000	$60,000
Prix de base rajusté			
Fonds de terre	$ 2,000	$18,000	$20,000
Maison	7,000		7,000
Grange		13,000	13,000
Silo		2,000	2,000
	$ 9,000	$33,000	$42,000
Gain tiré de la disposition	$ 4,000	$14,000	$18,000
Moins: Réduction du gain en vertu de l'alinéa 40(2)b)	4,000	—	4,000
Gain en capital (dont la moitié est imposable)	NÉANT	$14,000	$14,000

15. Under the second method he may elect to compute the total gain on the disposition of his farm land and principal residence without making any allocation of the proceeds or the adjusted cost base. This election must be made in accordance with Regulation 2300 which provides that a letter signed by the taxpayer be attached to the return of income required to be filed by him for the year in which the disposition of the property took place. The letter should contain the following information:

(a) a statement that the taxpayer is electing under subparagraph 40(2)(c)(ii) of the Act,

(b) a statement of the number of taxation years after 1971 for which the property was the taxpayer's principal residence and during which he was resident in Canada, and

(c) a description of the property sufficient to identify it with the property designated as his principal residence.

16. The gain on the disposition of the whole farm property may then be decreased by the aggregate of $1,000 plus $1,000 for each taxation year specified in (b) above. In the above example, assuming that the taxpayer had occupied his house as a principal residence from July 30, 1972 to June 30, 1977, his gain on the sale of the farm land would be determined as follows:

Proceeds of Disposition	$60,000
Adjusted cost base	42,000
Gain on Disposition	$18,000
Less: Reduction of Gain under subparagraph 40(2)(c)(ii) ($1,000 + 6 X $1,000)	7,000
Capital Gain (one-half is taxable)	$11,000

Disposition of Part of a Principal Residence

17. Where a portion of a principal residence is disposed of, as in the case of the granting of an easement or the severance of a parcel of land that forms part of a taxpayer's principal residence (see above comments under "Land Contributing to Use and Enjoyment of a Principal Residence"), the taxpayer may designate the part of the principal residence disposed of as his principal residence and thus reduce all, or some part, of his gain under paragraph 40(2)(b) or (c) of the Act. It is the Department's view in these circumstances that a taxpayer has made the above-mentioned designation in respect of the entire property that is his principal residence and not just the area that is disposed of. The effect of this is that, when the remainder of the principal residence is disposed of, it too will be recognized as the taxpayer's principal residence for the years during which he designated the part that was disposed of as his principal residence.

15. Selon la seconde méthode, le contribuable peut choisir de calculer le gain total de la disposition de son fonds de terre agricole et de sa résidence principale sans faire la répartition du produit ou du prix de base rajusté. Ce choix doit être exercé conformément à l'article 2300 des Règlements, qui stipule qu'une lettre portant la signature du contribuable doit être jointe à la déclaration de revenu qu'il est tenu de produire pour l'année au cours de laquelle la disposition de la propriété a été faite. La lettre en question doit contenir les renseignements suivants:

a) une déclaration faisant état du fait que le contribuable exerce un choix en vertu du sous-alinéa 40(2)c)(ii) de la Loi,

b) une déclaration faisant état du nombre d'années d'imposition après 1971 pendant lesquelles la propriété était la résidence principale du contribuable et au cours desquelles il résidait au Canada et

c) une description suffisante de la propriété pour pouvoir l'assimiler à la propriété désignée comme sa résidence principale.

16. Le gain tiré de la disposition du bien agricole entier peut ensuite être réduit du total formé de $1,000 plus $1,000 pour chaque année d'imposition indiquée en b) ci-dessus. Dans l'exemple qui précède, en supposant que le contribuable ait occupé sa maison comme résidence principale du 30 juillet 1972 au 30 juin 1977, le gain qu'il aurait tiré de la vente du fonds de terre agricole serait établi comme il suit:

Produit de la disposition	$60,000
Prix de base rajusté	42,000
Gain tiré de la disposition	$18,000
Moins: Réduction du gain en vertu du sous-alinéa 40(2)c)(ii) ($1,000 + 6 X $1,000)	7,000
Gain en capital (dont la moitié est imposable)	$11,000

Disposition d'une partie d'une résidence principale

17. Lorsqu'on dispose d'une partie d'une résidence principale, par exemple lors de la concession d'une servitude ou de la séparation d'une pièce de terrain qui fait partie de la résidence principale d'un contribuable (voir les observations précédentes sous la rubrique "Fonds de terre facilitant l'usage et la jouissance d'une résidence principale"), le contribuable peut désigner la partie de la résidence principale dont il a disposé comme étant sa résidence principale et, de cette façon, annuler ou réduire son gain en vertu de l'alinéa 40(2)b) ou c) de la Loi. Le Ministère est d'avis, dans ces circonstances, qu'un contribuable a fait la désignation précitée à l'égard de la totalité du bien qui constitue sa résidence principale et non à l'égard seulement de la partie dont il a disposé. Cela a pour effet que, lorsqu'il y aura disposition du reste de la résidence principale, celui-ci sera aussi reconnu comme étant la résidence principale du contribuable pour les années durant lesquelles il a désigné la partie dont il a disposé comme étant sa résidence principale.

Complete Changes in Use

Principal Residence Converted to Income-Producing Property

18. When a residence is rented or used in a business and thus converted to income-producing property, the owner may elect under subsection 45(2) to be deemed not to have commenced to use his property for the purpose of producing income. Where such an election is made to ignore the change of use taking place, there is no deemed disposition. However, if the election is not made, or if an election previously made is rescinded, a deemed disposition at fair market value occurs at the date the property is converted or on the first day of the year in which the election is rescinded.

19. During the years that an election is in force, the owner may designate the residence to be his principal residence, but not for more than four years, even though he did not "ordinarily inhabit" the property during those years. This rule applies, for example, to an individual who moves out of his residence with the intention of returning to it at a later date and in the meantime uses it for the purpose of earning rental income. In these cases, the individual must be resident, or deemed to be resident, in Canada during the years the property was rented in order for the designation of the property as a principal residence to be of use to him (see formula in paragraph 12 above). During the period covered by the election under subsection 45(2), all income (net of applicable expenses except capital cost allowance) is subject to tax.

20. It is the Department's view that where, prior to January 1, 1972, a taxpayer had rented his residence with the intention of returning to it later, the taxpayer may, if he so desires, be considered for capital gain purposes to have commenced to use the property in question for income-producing purposes on January 1, 1972. If the taxpayer wishes to be so considered, he will be in the same position as he would have been had he commenced to use the property for income-producing purposes in 1972 and he may make an election under subsection 45(2) for 1972 if he so desires. At such time as the taxpayer disposes of the residence or commences to use it again as his principal residence, he will be subject to tax on any recapture of depreciation claimed prior to 1972. Where a taxpayer in these circumstances has claimed capital cost allowance on his residence in 1972 and wishes to revise his return so as not to claim any capital cost allowance on the residence, he may do so by forwarding a letter to the Director of the District Taxation Office in which he files his income tax return. This letter should set out the pertinent information concerning the requested revision along with an amended capital cost allowance schedule.

21. Subsection 45(2) provides that an election must be filed in a taxpayer's return of income for the year in

Changements complets de l'usage

Résidence principale convertie en un bien destiné à produire un revenu

18. Lorsqu'une résidence est louée ou utilisée dans une entreprise et, de cette façon, devient un bien produisant un revenu, le propriétaire peut, en vertu du paragraphe 45(2), choisir d'être réputé ne pas avoir commencé à utiliser le bien aux fins de lui faire produire un revenu. L'exercice d'un tel choix aux fins de ne pas tenir compte du changement de l'usage a pour effet qu'il n'y aura pas de disposition présumée. Toutefois, si le choix n'est pas exercé ou si un choix auparavant exercé est renversé, il se produit une disposition présumée pour la juste valeur marchande à la date à laquelle le bien est converti ou au premier jour de l'année au cours de laquelle le choix est renversé.

19. Au cours des années pendant lesquelles un choix est en vigueur, le propriétaire peut désigner la résidence comme étant sa résidence principale, mais cela pour au maximum quatre années, même s'il n'a pas "normalement habité" le bien durant ces années. Cette règle s'applique, par exemple, à un particulier qui quitte sa résidence avec l'intention d'y retourner à une date postérieure et qui, pendant ce temps, s'en sert aux fins de gagner un revenu de location. Dans ces cas, le particulier doit être un résident ou être réputé un résident du Canada durant les années au cours desquelles le bien a été loué, pour que la désignation du bien comme étant sa résidence principale lui soit de quelque utilité (voyez la formule contenue dans le paragraphe 12 ci-dessus). Au cours de la période couverte par le choix exercé en vertu du paragraphe 45(2), tout revenu (moins les dépenses appropriées, sauf la déduction pour amortissement) est assujetti à l'impôt.

20. Le Ministère considère aussi que, si un contribuable, avant le 1er janvier 1972, a loué sa résidence avec l'intention d'y revenir plus tard, ce contribuable peut, s'il le désire, être considéré, aux fins des gains en capital, comme ayant commencé d'utiliser le bien en question pour lui faire produire un revenu le 1er janvier 1972. Si le contribuable exprime un tel désir, il sera considéré, du point de vue de l'impôt, comme s'il avait commencé en 1972 d'utiliser le bien pour lui faire produire un revenu et il peut exercer le choix prévu au paragraphe 45(2) pour l'année 1972, s'il le désire. Au moment où ce contribuable disposera de sa résidence ou commencera de l'utiliser à nouveau comme sa résidence principale, il sera assujetti à l'impôt sur toute récupération de l'amortissement réclamé avant 1972. Lorsque, dans ces circonstances, un contribuable a réclamé une déduction pour amortissement sur sa résidence en 1972 et exprime le désir de réviser sa déclaration pour annuler la déduction pour amortissement réclamée pour la résidence, il peut prendre des dispositions à cette fin en transmettant une lettre au directeur du bureau de district d'impôt où il produit sa déclaration d'impôt sur le revenu. Cette lettre doit contenir les renseignements pertinents sur la révision demandée, ainsi qu'un relevé modifié de la déduction pour amortissement.

21. Le paragraphe 45(2) stipule que le choix doit être exercé dans la déclaration de revenu que le contribuable produit pour

which the change of use occurred. The proper method for filing such an election is to include in the return a letter signed by the taxpayer describing the property in respect of which the election is being made and stating that he is electing under subsection 45(2) of the Act in respect of that property. Where a taxpayer intended to elect under subsection 45(2) but failed to do so at the time of filing his return of income for the year in which the change of use occurred, the Department will ordinarily accept as a valid election a letter from the taxpayer to the effect that he had so elected provided that the taxpayer has not claimed any capital cost allowance on the property subsequent to the change in use.

Income-Producing Property Converted to Principal Residence

22. When an income-producing property is converted to a principal residence and an election under subsection 45(2) is not in force in respect of the property (see paragraph 18), there is a deemed disposition and reacquisition of the property at fair market value at that time. Any gain on the deemed disposition of the income-producing property is subject to tax according to the rules relating to the disposition of capital property. The right to elect under subsection 45(2) does not apply to the conversion of an income-producing property to a non-income-producing property.

Partial Changes in Use

23. Partial change in use of a taxpayer's principal residence will be dealt with administratively in accordance with the comments in the following paragraphs.

No Structural Changes to Residence

24. In some cases, the business or rental use of a principal residence will be ancillary to the main use of the residence, such as the rental of one or two rooms to boarders, the use of a room for the care of children or for an office or a work area, etc. In these cases, provided that the taxpayer has set aside and used a certain area of his principal residence solely for the purpose of earning income, he may claim a deduction for a reasonable portion of expenditures for maintenance of the residence. In the event that he does not claim capital cost allowance on any portion of the residence, it is the Department's view that a change in use of the property has not occurred and that the entire residence maintains its nature as a principal residence provided it so qualifies otherwise.

25. In the event that a taxpayer wishes to claim capital cost allowance on the area used solely for the purpose of earning income, a change in use of the property is considered to have taken place in the year the room or rooms are converted to business or rental use and the property is deemed to have been disposed of at its fair

l'année au cours de laquelle le changement de l'usage s'est produit. La procédure à suivre pour produire ce choix consiste à inclure dans la déclaration une lettre signée par le contribuable décrivant le bien à l'égard duquel le choix est exercé et indiquant qu'il exerce un choix en vertu du paragraphe 45(2) de la Loi à l'égard de ce bien. Lorsqu'un contribuable avait l'intention d'exercer un choix en vertu du paragraphe 45(2), mais ne l'a pas fait au moment de produire sa déclaration de revenu pour l'année au cours de laquelle le changement de l'usage s'est produit, le Ministère considérera habituellement comme valable un choix exercé sous la forme d'une lettre de la part du contribuable portant qu'il a exercé le choix en question, à la condition que le contribuable n'ait pas réclamé de déduction pour amortissement à l'égard du bien en question après le changement de l'usage.

Bien produisant un revenu converti en résidence principale

22. Lorsqu'un bien produisant un revenu est converti en une résidence principale et qu'aucun choix en vertu du paragraphe 45(2) ne prévaut à l'égard du bien en question (voir le paragraphe 18), il se produit alors une disposition présumée et une nouvelle acquisition du bien à la juste valeur marchande. Tout gain tiré de la disposition présumée du bien produisant un revenu est assujetti à l'impôt en conformité des règles se rapportant à la disposition des biens en immobilisations. Le droit aux choix en vertu du paragraphe 45(2) ne s'applique pas à la conversion d'un bien produisant un revenu en un bien ne produisant pas un revenu.

Changements partiels de l'usage

23. Les changements partiels de l'usage de la résidence principale d'un contribuable seront traités selon les règles administratives habituelles, en conformité des observations contenues dans les paragraphes suivants.

Aucun changement de la structure de la résidence

24. Dans certains cas, l'utilisation commerciale ou locative d'une résidence principale sera connexe à l'usage principal de la résidence, par exemple la location d'une ou deux chambres à des pensionnaires, l'utilisation d'une pièce pour la garde d'enfants ou pour un bureau ou encore pour un espace de travail, etc. Dans ces cas, à la condition que le contribuable ait réservé et utilisé un certain espace de sa résidence principale uniquement dans le but de gagner un revenu, il peut réclamer la déduction d'une fraction raisonnable des dépenses engagées pour l'entretien de la résidence. S'il ne réclame pas de déduction pour amortissement sur une partie quelconque de la résidence, le Ministère estimera qu'il ne s'est pas produit de changement de l'usage du bien et que la résidence entière conserve son caractère de résidence principale, à la condition qu'elle satisfasse aux autres exigences.

25. Si le contribuable exprime le désir de réclamer une déduction pour amortissement pour l'espace utilisé uniquement aux fins de gagner un revenu, on considère qu'il s'est produit un changement de l'usage du bien au cours de l'année pendant laquelle la ou les pièces ont été converties à un usage commercial ou locatif et on présume qu'il y a alors eu une

market value at that time. In these cases paragraph 45(1)(c) deems the taxpayer to have disposed of the property for proceeds equal to

$$\frac{\text{amount of use made for income-producing purposes}}{\text{amount of total use made of the property}} \times \text{fair market value of the principal residence at that time}$$

The basis for determining the amount of use made for income-producing purposes is generally the number of rooms or square footage used for such purposes. However, where some other method produces a more reasonable result, that method is acceptable. Where the residence qualified as a principal residence during the years up to the time of its partial conversion to business use, any gain that occurred to that date is exempt from tax by virtue of paragraph 40(2)(b). At the time of the partial conversion to business use, it is necessary to establish the value of the business portion of the property upon which capital cost allowance may be based. At such time as the residence is sold or the room or rooms are converted back to personal use, any gain attributable to the room or rooms during the period of their business use is subject to tax as a capital gain in the usual manner. In addition, any recapture of capital cost allowance is subject to tax in the year the conversion or sale occurred.

Structural Changes to Residence

26. In other cases, the business or rental use of a principal residence will be substantial and of a more permanent nature, such as the conversion of the front half of a house to a store, the conversion of a portion of a house into a self-contained domestic establishment for earning rental income (a duplex, triplex, etc.), and alterations to a residence to accommodate separate business premises, etc. In these cases, a taxpayer will be allowed to claim the proportionate share of maintenance costs as well as capital cost allowance on the area used for income-producing purposes. Regardless of whether or not capital cost allowance is claimed, it is the Department's view that the nature of such property has changed and that a partial change in use has occurred within the meaning of paragraph 45(1)(c) (see paragraph 25 for method of determining the amount of use made for income-producing purposes). In these cases, any increase in the value of the area of the residence while used for income-producing purposes will be a capital gain subject to tax in the usual manner. The remainder of the residence will be eligible for principal residence status if the taxpayer so designates that portion of the property.

Disposition of a Principal Residence by a Non-Resident

27. Where a non-resident person wishes to obtain a certificate in accordance with section 116 of the Act in

disposition du bien à sa juste valeur marchande. Dans ces cas, l'alinéa 45(1)c) stipule que le contribuable est réputé avoir disposé du bien pour un produit équivalant à la fraction représentée par

$$\frac{\text{l'usage aux fins de produire un revenu}}{\text{l'usage total du bien}} \times \text{la juste valeur marchande de la résidence principale à cette date}$$

La base sur laquelle on établit l'usage consacré à la production d'un revenu représente généralement le nombre de pièces ou la surface consacré à ces fins. Toutefois, si quelque autre méthode donne un résultat plus raisonnable, elle sera accepté. Si la résidence était admissible comme résidence principale au cours des années précédant le moment où elle a été partiellement convertie à un usage commercial, tout gain qui en a résulté jusqu'à cette date est exempté de l'impôt en vertu de l'alinéa 40(2)b). Au moment de la conversion partielle à un usage commercial, il faut établir la valeur de la partie du bien utilisée commercialement et selon laquelle on pourra calculer la déduction pour amortissement. Au moment où la résidence est vendue ou au moment où la ou les pièces sont converties à nouveau à un usage personnel, tout gain tiré de la ou des pièces pendant qu'elles étaient utilisées commercialement est assujetti à l'impôt à titre de gain en capital, de la manière habituelle. De plus, toute récupération de la déduction pour amortissement est assujettie à l'impôt dans l'année pendant laquelle la conversion ou la vente s'est produite.

Changements de la structure de la résidence

26. Dans d'autres cas, l'utilisation commerciale ou locative d'une résidence principale sera plus considérable et de nature plus permanente, par exemple la conversion de la moitié antérieure d'une maison en un magasin, la conversion d'une partie d'une maison en un établissement domestique autonome en vue de gagner un revenu de location (duplex, triplex, etc.) et les modifications à une résidence pour prévoir un espace pour des locaux d'affaires distincts, etc. Dans ces cas, on permettra au contribuable de réclamer une fraction proportionnelle des coûts d'entretien, ainsi qu'une déduction pour amortissement, pour l'espace utilisé en vue de produire un revenu. Qu'une déduction pour amortissement soit réclamée ou non, le Ministère estime que la nature d'un tel bien s'est modifiée et qu'il s'est produit un changement partiel de l'usage, comme le définit l'alinéa 45(1)c). (Vous trouverez au paragraphe 25 la méthode à suivre pour établir l'usage consacré aux fins de produire un revenu.) Dans ces cas, toute augmentation, pendant cet usage, de la valeur de l'espace qui, dans la résidence, sert à produire un revenu, sera considérée comme un gain en capital assujetti à l'impôt de la manière habituelle. Le reste de la résidence sera admissible au statut de résidence principale si le contribuable désigne cette partie du bien à cette fin.

Disposition d'une résidence principale par un non-résident

27. Lorsqu'un non-résident désire obtenir un certificat conformément à l'article 116 de la Loi à l'égard d'une disposition

respect of a proposed disposition of his residence, he is required to make a payment of 25% of the amount specified in paragraph 116(2)(a) or furnish security acceptable to the Department before the certificate will be issued. In cases where some part or all of the gain on disposition of his residence will be exempt from tax by virtue of paragraph 40(2)(b) or (c), the Department will accept, as security under paragraph 116(2)(b), a letter signed by the taxpayer containing a calculation of the expected amount of any capital gain on the disposition (after taking into consideration any reduction under paragraph 40(2)(b) or (c)). This letter should be attached to form T-2062 – "Notice by a Non-Resident of Canada Concerning Disposition or Proposed Disposition of Canadian Property" which is available at District Taxation Offices for use by non-residents proposing to dispose of taxable Canadian property. A payment to the Receiver General for Canada of 25% of the amount (if any) of the above capital gain as or on account of tax for the year must be forwarded with the letter.

éventuelle de sa résidence, il est tenu de verser 25% du montant mentionné à l'alinéa 116(2)a) ou de fournir au Ministère une garantie acceptable avant que le certificat ne soit délivré. Dans les cas où une partie ou la totalité du gain tiré de la disposition de la résidence du contribuable sera exemptée de l'impôt en vertu de l'alinéa 40(2)b) ou c), le Ministère acceptera, à titre de garantie en vertu de l'alinéa 116(2)b), une lettre portant la signature du contribuable et faisant état d'un calcul du montant prévu de tout gain en capital tiré de la disposition (en tenant compte de toute réduction possible en vertu de l'alinéa 40(2)b) ou c)). La lettre susmentionnée doit être jointe à la formule T-2062 – "Avis par un non-résident du Canada de la disposition ou de la disposition éventuelle de biens canadiens", qu'on peut se procurer dans les bureaux de district d'impôt et qui est réservée à l'usage des non-résidents qui se proposent de disposer de biens canadiens imposables. Il faut envoyer au Receveur général du Canada, avec la lettre, un paiement s'élevant à 25% du montant (si montant il y a) du gain en capital susmentionné, à valoir ou au titre d'un impôt pour l'année.

Revenue Canada Taxation | Revenu Canada Impôt

Designation of a Principal Residence

- For use by an individual (or trust) to designate a residence as a principal residence in accordance with subparagraph 54(g)(iii) of the Income Tax Act and section 2301 of the Income Tax Regulations.

- This form need not be filed unless a capital gain on the disposition of a principal residence occurs after deducting the exempt portion of the gain.

- To qualify as your principal residence the property in question must be:
  (a) a housing unit, a leasehold interest therein or a share of the capital stock of a co-operative housing corporation,
  (b) owned by you solely or jointly (i.e. - as joint tenants or tenants-in-common or, in Quebec, co-owners) with another person,
  (c) ordinarily inhabited by you in the year, and
  (d) designated where necessary by you as your only principal residence for that particular year.

  In addition, where you have previously made an election under subsection 45(2) of the Income Tax Act to be deemed not to have changed the use of your property, you may designate the residence to be your principal residence for up to 4 additional years even though you did not ordinarily inhabit the residence during those years.

- Where a capital gain on the disposition of your principal residence occurs, one completed copy of this form should be filed with your income tax return for the year in which the disposition or the granting of an option to acquire the principal residence occurred.

NAME OF TAXPAYER (Print)	SOCIAL INSURANCE NUMBER (if applicable)
PRESENT ADDRESS	

Particulars of Property Designated _____

_____

Number of years (or part years) *after 1971* during which you owned the property _____ Yrs(A)

Number of years (or part years) *after 1971* during which you were a resident of Canada and for which the property is designated as your principal residence (See "Designation" below) _____ Yrs(B)

Proceeds of Disposition _____ $ _____

Deduct: Adjusted Cost _____ $ _____

Outlays and Expenses _____ _____ _____

Amount of gain before deducting exempt portion _____ $ _____ $ _____ (C)

The exempt portion of the gain is $\frac{\text{Yrs(B)} + 1}{\text{Yrs (A)}}$ x $ _____ (C) = _____ (D)

Amount of gain after deducting exempt portion – (C) minus (D) _____ $ _____ *

* Transfer this amount to column 4 under Personal Use Property on the "Statement of Capital Dispositions".

Designation

I hereby designate the property described above to have been my principal residence for the following taxation years: _____
(Specify years designated)

Date _____ Signature _____

Français au verso

Revenu Canada Impôt | Revenue Canada Taxation

Désignation de la résidence principale

- A l'usage d'un particulier (ou d'une fiducie) pour désigner une résidence comme étant sa résidence principale en conformité du sous-alinéa 54 g) (iii) de la Loi de l'impôt sur le revenu et de l'article 2301 des Règlements de l'impôt sur le revenu.

- Il n'est pas nécessaire de produire la présente formule à moins qu'il n'y ait gain en capital lors de la disposition d'une résidence principale, après déduction de la fraction exempte du gain.

- Pour être considéré comme résidence principale, le bien en cause doit:
  a) être un logement, une tenure à bail dans un logement ou une action du capital-actions d'une coopérative d'habitation constituée en corporation;
  b) vous appartenir en propre ou conjointement (c.-à-d., à titre de *joint tenants* ou de *tenants-in-common* ou, au Québec, à titre de co-propriétaires) avec une autre personne;
  c) être normalement habité par vous au cours de l'année, et
  d) être désigné au besoin par vous comme votre seule résidence principale pour cette année-là.

  En outre, lorsque vous avez déjà fait un choix, en vertu du paragraphe 45(2) de la Loi de l'impôt sur le revenu, selon lequel vous êtes réputé ne pas avoir changé l'usage de votre bien, vous pouvez désigner la résidence comme votre résidence principale pendant quatre autres années au maximum, même si vous n'avez pas normalement habité la résidence pendant ces années-là.

- Si vous réalisez un gain en capital lors de la disposition de votre résidence principale, vous devez produire avec votre déclaration d'impôt un exemplaire rempli de la présente formule pour l'année de la disposition ou du choix d'acquérir la résidence principale.

NOM DU CONTRIBUABLE (En majuscules)	Nº D'ASSURANCE SOCIALE (S'il y a lieu)
ADRESSE ACTUELLE	

Détails sur le bien désigné _____

_____

Nombre d'années (ou fractions d'années) *après 1971* durant lesquelles vous avez été propriétaire du bien _____ ans (A)

Nombre d'années (ou fractions d'années) *après 1971* durant lesquelles vous avez résidé au au Canada et pour lesquelles le bien est désigné comme votre résidence principale (Voir la "Désignation" ci-dessous) _____ ans (B)

Produit de la disposition _____ $ _____

Déduire: Coût rajusté _____ $ _____

Débours et dépenses _____ _____ _____

Montant du gain avant la déduction de la fraction exempte _____ $ _____ $ _____ (C)

La fraction exempte du gain est $\frac{\text{ans (B)} + 1}{\text{ans (A)}}$ x $ _____ (C) _____ (D)

Montant du gain après déduction de la partie exempte: (C) moins (D) _____ $ _____ *

* Inscrire ce montant dans la colonne 4, à la rubrique "Bien à usage personnel", de l'"Etat des dispositions de biens en immobilisations".

Désignation

Je désigne par les présentes le bien décrit ci-dessus comme ma résidence principale pour les années d'imposition suivantes: _____
(Préciser les années désignées)

Date _____ Signature _____

English on reverse

BIBLIOGRAPHY

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