CHAPTER 1

Introduction

1.1. Intelligent retrieval

Information retrieval systems are intended for people’s use. Artificial intelligence (AI) techniques are used in this application to assist people in developing their ideas.

Ideally, an information retrieval system will adapt itself to a user’s changing viewpoint. It ought to be designed to suit not a prototypical user, but an intelligent person whose ideas evolve. An intelligent retrieval system would free its user to explore ideas as he wished, unfettered by rigid system limitations.

Our present capability is a long way from the ideal. However, to be worthwhile, any attempted improvement must be set in a realistic framework. The problem of user modelling continues to perplex information scientists. In this work, it is assumed that the user is an individual with changing ideas and that supporting his cognitive activity takes precedence over improving system efficiency. Everyone constructs conceptual patterns as he accumulates experience. The process of learning while living is paralleled, in retrieval, by learning while searching. In order for the searcher to maximize his potential, the system should permit him to shift his perspective as readily as reality requires him to do so. The need for flexibility is perhaps more obvious in searching for a good legal argument than in other kinds of retrieval. However, it is a need we all experience.

Present day AI can take us some distance toward the ideal, but not the whole way. Although it has improved search with generalized inference, the difficulty of handling natural language is a major stumbling block. This dissertation describes work done toward cutting that block down to size. A knowledge representation of contract law cases has been constructed. John Sowa’s conceptual graphs (Sowa 1984), and Harold Somers’s linguistic cases (Somers 1987), have been used.

The law case representations have been organized according to a schema based on Stephen Toulmin’s argument model (Toulmin 1958). A lexicon of legal concepts provides explicit definitions.

Retrieval capability has been demonstrated using a frame matcher to describe how queries can be answered. Realistic questions were derived from the facts of contract cases which followed those represented.

Large volumes of text are characteristic of modern retrieval systems. At present, large-volume applications are beyond the capability of our knowledge base technologies. However, there is no known absolute barrier to large-scale implementations, especially if the language problem is curtailed. The potential power and flexibility of conceptual retrieval are undeniable.

1.2. What the lawyer wants

IR systems are used in many different subject domains. One of the domains that poses both difficult problems and interesting challenges is case law research.

The lawyer wants authority for his point of view. He wants a viable argument that will support his claim—from a binding case if he can get it, from a persuasive one if he cannot. Failing that, he will take any helpful argument he can find. He may even want some configuration of facts and legal concepts which, although it does not constitute an argument in itself, will help him to construct one.

The following description of a lawyer's search shows the usual cognitive phenomenon.

> No lawyer ever thought out the case of a client in terms of the syllogism. He begins with a conclusion 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 the case he may modify his selection of rules of law upon which he bases his case. (Dewey 1927, p. 545)

In order to construct his argument, the lawyer will need to navigate among legal concepts with their related facts; and he will need to make associations among selected legal concepts.

Finding information in law cases is challenging. Each case is unique. Patterns of literary similarity are not common among cases. There are many writers, and many styles. There are no generally accepted conventions as to how decisions ought to be constructed. The reasoning is diffuse, dense, and original. The language used in cases is formal and technical. However, the vocabulary is derived from everyday language.[1] In the past, cases have been indexed manually, with thoroughness appropriate to the subject matter. In indexing one focuses on the selection of nominals. Unfortunately, in the process, the character of the most significant element of the cases, the reasoning, is obscured.

Retrieval of law from codes, statutes, and regulations, using either manually constructed indexes or online systems, has been less difficult than the retrieval of law from cases. The language of statute law is less rich in conceptual description than the language of cases. It is because of the careful use of well-defined terms, and the adherence to technical drafting principles in writing statutes. The vocabulary used in statutes is highly controlled. The sense of each technically used term is strictly limited. In addition, section identification numbers, as well as words, have commonly been used for retrieval purposes. Case law retrieval remains the major problem, in spite of the increasing volume of legislation.

A good case law retrieval system should help the legal researcher develop his thoughts in a natural way. He should not have to think about transforming his ideas into a few keywords or index terms. He should have to neither select the appropriate Boolean operators, nor negotiate inferences with logical exactitude. He should not have to concern himself with adding, adjusting or discarding sets. A conceptual retrieval system could free him from all of this. Needless to say, this ideal is somewhat distant from a realistic model of present day systems.

Representation of text by surrogates, without analysis of meaning, is not adequate for searching case law. We already have good indexes, both topical and factual, but we have known the limitations of the approach for a long time. In 1897, Oliver Wendell Holmes illustrated the problem with indexes quite nicely with the following anecdote.

> There is a story of a Vermont justice of the peace before whom a suit was brought by one farmer against another for breaking a churn. The justice took time to consider, and then said that he had looked through the statutes and could find nothing about churns, and gave judgment for the defendant. The same state of mind is shown in all our common digests and textbooks. Applications of rudimentary rules of contract or tort are tucked away under the head of Railroads or Telegraphs or go to swell treatises on historical subdivisions, such as Shipping or Equity, or are gathered under the arbitrary title which is thought likely to appeal to the practical mind, such as Mercantile law. (Holmes 1897, p. 59.)

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[1] As White says, ‘‘The law has in fact very few technical words: therefore, our original question whether legal concepts are necessarily technical reduces to the question whether the everyday language which makes up the vast body of the law expresses technical or everyday concepts.’’ (1985, p. 17).

Furthermore, there is the fundamental problem of distinguishing cases from each other, as required in accordance with the principle of *stare decisis*.[2] Fine shades of meaning must be recognized in order to make distinctions. Without that capability, a case retrieval system has no vigor.

The analysis of cases must be carried out with awareness of the principles of both logic and linguistics if the meaning of the text is to be represented with integrity. We will not be able to dispense with the decisions themselves. The essence of law exists in the exact wording of the case reports. The importance of language in the law cannot be overstated. Right now we have no way of searching text ‘intelligently’ without adding some logical structure at the time of entry. Such structure is necessary for machine search or even computer-assisted manual search. It is recognized that the possibility of misrepresenting the meaning of the cases exists. What is an acceptable representation now may, in the light of judicial review, become a misrepresentation later.

These objections can be made to keyword, abstract, and text passage representations as well as to knowledge representations. The objections are valid. The situation would be dangerous only if a claim were made that the kr is a substitute for the text—that is, if it were to be claimed that the representation alone gave adequate information about the state of the law.

The conceptual retrieval proposed in this dissertation is intended to improve the capability to search cases. Our method has advantages over other methods examined. It can provide specific items of information rather than documents. It is intended to lead the user to cases on point regardless of their wording and to help him develop his argument as he searches. It is not intended as a replacement for the text of case reports. It is not expected that such a system in our present state of knowledge will substitute for a library of law cases.

1.3. The limitations of traditional systems

Traditional IR systems work but have substantive limitations. In this section those limitations are examined, with the awareness that current evaluation methods may be responsible for perpetuating restrictive system designs.

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[2] ‘‘*Stare decisis*—to abide by or adhere to decided cases’’. (*Black’s law dictionary*, 1990)

Information scientists have developed document retrieval to a high level of efficiency. Emphasis has been placed on the user: interpreting his needs, filling them efficiently, improving interaction with the system, analyzing and re-analyzing the system's efficiency. The results are measured by **precision** and **recall.** Both measures are quantitative; both are derived from users' evaluations of document **relevance.** In most users' studies an attempt is made to avoid bias by using a random sample of subjects, but the sample is seldom large enough to achieve reliable results.

Failure to achieve objective results is compounded by comparing the results of a number of studies employing these same measures. Little is done to compensate for, or to equalize, variants in test samples. Evidently, the way to improve the evaluation technique would be to have very large user samples. Subjective relevance judgements flaw the research. Nothing reliable is learned about the systems' effectiveness. Little attention is paid to the big question: What about the *quality* of the information retrieved? Inverted file structures remain along with the use of keywords in combination with Boolean operators and along with editing devices like 'stemming' and 'wild cards'. There is less confidence in semantic analysis, representation of knowledge, and analysis of cognition. Presumably the evaluation of the results of their use poses an inhibiting problem. Instead emphasis is put on limiting the expressiveness of language with increasingly straitened vocabulary restrictions. The possibilities of automatic inference have not been adequately investigated. Refining existing systems rather than innovating design improvements attracts attention. Little interest is shown in progressing toward *information* retrieval.

Keywords are considered the practical representation for achieving robust retrieval of documents *about* a given subject from large databases. However, when text is represented by keywords, many meanings are attached to the same keyword, resulting in *polysemy* and *homonymy.* Polysemy designates the phenomenon of a lexeme with multiple meanings. Homonymy designates an ambiguity in which words that appear the same have unrelated meanings. The proliferation of ambiguous assertions in the keyword databases makes explicit, precise, information retrieval impossible. Some disambiguation is accomplished by associating keywords with Boolean operators. Recent work in developing more expressive lexicons is an attempt at ameliorating the situation.

Contextual information is lost in the extraction of keywords from text. Once the keywords are extracted from a document, the sentence and the context are abandoned. Associating keywords, through the assignment of Boolean operators cannot result in an adequate representation of textual meaning. Meaning cannot be reconstructed by simply sticking words together. The context cannot be recovered. Ambiguity persists. Document retrieval is possible; *information* retrieval is unlikely.

In addition to being limited linguistically, document retrieval systems are awkward to search. In order to retrieve responses, one must concentrate on formulating the question, choosing the keywords, choosing the operators, monitoring the logic, negotiating the terms while reformulating the question, and bearing in mind the system's operational characteristics. Access difficulty often makes the use of human intermediaries necessary.

Document retrieval systems are limited, rigid, and inflexible with little potential for actually retrieving information. In order to show precisely how difficult it is to negotiate typical searches, a discussion of system limitations with relation to language and to logic follows.

1.3.1. Problems with keyword representations

There are three significant problems in using keywords to represent knowledge:

- lexemes can represent several meanings
- unnamed ideas are not represented
- matching is restricted to character strings without meaning

These underlie the recurring difficulties demonstrated in system evaluation studies.

1.3.1.1. Distinguishing meanings for terms

As noted above in §1.3 keyword representations are polysemic, that is, a keyword may have more than one meaning. The need to distinguish the various senses in which the keywords are used is paramount in order to provide precise information and to avoid ambiguity. Typical difficulties relating to polysemic representations involve: synonymy, paraphrase, syntactic structure, and high-frequency terms.

1.3.1.1.1. Synonymy

Synonymy causes a problem when a document is indexed under one term, the user's query contains a different term and the two terms share a common meaning that would make the document relevant to the user. Synonymy has been controlled as might be expected with varying success. Terms may be equalized in an attempt to avoid the need for precise character matches. But creating the equalizing relationships results in an interpretation of the original information. Where terms are identified in the system as synonymous, the recall is enhanced but the precision reduced. The 'synonymous' terms will have multiple meanings. They will most certainly have some senses which cannot be equated.

It may be argued as well that no two words have exactly the same meaning, or the two words would not exist (Ullmann 1962). At best, it is a matter of informed opinion as to what constitutes a synonym.[3] Decisions made about which terms constitute synonyms are arbitrary and judgemental, introducing another subjective element. Moreover, devices for controlling synonymy age badly. Terminology alters over time causing control devices to malfunction.

1.3.1.1.2. Paraphrase

With regard to paraphrase, that is, the expression of a similar idea in different terms, the same difficulty is found at a higher level. A slight shift in perspective can cause a significant difference in results if the system depends, as do keyword systems, on implacable character matching. There is seldom a way to display the similarity of meaning that underlies variant lexical expressions.

Stylistic problems relate to paraphrase as well. A text might be formal or colloquial in style, or it might be written in business English. It is important that the keyword version include some elements that make the text accessible. Even if a thesaurus is used, the translation from a distinctive style to the language of the thesaurus is not likely to express suitably the meaning of the original utterance. Consider:

(1-1) My car isn't working.
(1-2) The automobile that belongs to me is out of order.
(Winograd 1983, p. 138)
(1-3) My wheels is busted!

[3] Lyons (1968, p. 466) demonstrates the loose meaning of synonymy with an example of different shades of meaning of the word 'nice' expressed in a number of different 'synonyms' from *Roget's thesaurus.*

Here the keyword representation of each sentence would vary with the terminology. The only helpful refinements available are synonym linking devices of limited value. Keywords can not adequately represent these different expressions.

Use of metonymy and metaphor aggravate the problem. A metonymous word stands not for its obvious referent but for something commonly associated with that referent, as in, ‘‘Give me a hand, here!’’ A metaphorical expression is commonly used in a non-literal manner, closely related to analogical reasoning; for instance, ‘‘The President’s claims are indefensible’’ is an example of a common analogy in which an argument is described as if it is a war.

1.3.1.1.3. Syntactic structure

Meaning is conveyed by the words of a text but its underlying syntactic structure makes explicit the relations among the words and so establishes the meaning. Consider Chomsky’s (1957) well-known sentences:

(1-4) John is eager to please.
(1-5) John is easy to please.

The sentences are apparently identical in structure but the relations they explicate are different; in (1-4), John is doing the pleasing, whereas in (1-5), John is being pleased. The difference cannot be captured in a keyword representation. The variant relations among the words cannot be shown. Listing ‘eager’ and ‘easy’ as keywords does not prepare one for the change in the sentence if one were substituted for the other.

Conversely, a single meaning may be expressed by several different sentences. For example, (Martin 1987, p.14):

(1-6) Harry captured the castle.
(1-7) The castle was captured by Harry.
(1-8) What Harry captured was the castle.
(1-9) It was the castle that Harry captured.

These sentences share the same words and import but vary in structure. A keyword analysis would probably include, ‘Harry’, ‘captured’, and ‘castle’ without distinguishing the variant expressions.

Keyword analysis gives us the names of the acts and entities involved in an utterance. It does not attempt to convey meaning. Notice that these are simple rather than complex sentences. Furthermore, their content has to do with concrete objects. There is nothing that is difficult to interpret or ambiguous. There are no abstractions. It appears there would be no problem at all in using keywords to represent the meaning. Indeed it is unlikely that Harry would be captured by a castle, and so we might assume that the keywords would work. But suppose that Harry was George and the castle was a dragon would the keyword representation ‘George’, ‘captured’ and ‘dragon’ be as redoubtable? Representing the directionality of the relationship would make the meaning clear.

1.3.1.1.4. High-frequency terms

The ultimate weakness of keyword representations shows in trying to cope with common or high-frequency terms. The legal examples commonly cited have to do with procedure. For instance, consider

> If a person waives his or her right to trial by jury in one trial, can a jury still be demanded in a subsequent new trial of the same matter?
>
> The words needed to describe the main points of this question are ‘trial’, ‘jury’, ‘waiver’, and various words meaning, ‘new trial’. All of these words are so common in reported cases that any search that retrieved a substantial proportion of the relevant cases would also retrieve thousands of irrelevant cases. (Jacobstein and Mersky 1985, p. 436)

High frequency terms lead to high recall and unacceptably low precision. Using the stratagem of grouping lexical tokens to form larger lexical units or terms is the usual solution to this difficulty, and it does help resolve some of the problems. For example, we might use ‘trial by jury’ or ‘jury trial’ or both, to increase precision. We are unlikely to find to be able to locate the concept of ‘‘a subsequent new trial’’.

1.3.1.1.5. Unnamed ideas

Keywords are powerless to locate unnamed ideas. This limitation is difficult to deal with. Implicit information, unstated assumptions, and relations of many kinds arise as retrieval problems. For example, in the case of *Weeks* v. *Tybald* which we will consider in §3.3.1, neither the word ‘intention’ nor the word ‘offer’ is mentioned in the text, yet almost anyone reading the excerpt would understand that the question at hand had to do with whether or not there was an intention to contract and whether or not an offer had been made.

It is sometimes anticipated that implicit information will be represented by keywords assigned by a human indexer in addition to those extracted from the text. It seems to be a reasonable idea, but how well this supplementary analysis works in practice is something else. It may be necessary to justify the addition of a given keyword. In the text from which the *Weeks* v. *Tybald* excerpt is drawn, (Milner 1985), the chapter section has to do with determining whether or not there is intention to contract. An indexer may or may not add 'offer'. Should he read in a meaning in one instance at a level of perception he may not be able to sustain throughout the work, his work will lack consistency. If he did add the term, he could be subverting the editor's intent, as 'offer' is dealt with elsewhere in the book quite differently. Finally, he might add 'mere puff', another designation for cases of this type. However, he may not know it, or his readers may not use it, or it may not be likely to be used in future.

Jacobstein and Mersky (1985) give examples of two requests for conceptual retrieval. The first, the simpler, is demonstrated by trying to locate information regarding an individual by describing him from different perspectives. For example, a young man, Alfred, might be described as a youth, a minor, a son, the plaintiff, a witness, someone's ward, and so on. These descriptors may be treated simply as synonyms because each relates to the same individual. However, each is a different conceptual description. Each describes a different **role** the individual has in the real world. And he will have other roles as well that are not made explicit in the text and that may or may not be significant in a given context, for example, 'student' or 'hockey player'.

Suppose that a reported case involved this same Alfred, and that the case might have some bearing on a problem with Ronald, a ward of the court. In order to determine the relevance of Alfred's case to Ronald's, we must be able to distinguish Alfred's different roles. Alfred's role as a son would mean he had a different legal status from that of Ronald who is a ward of the court. Yet both share the rights of minors. The differences and similarities in roles are significant in determining the relevance of the decision about Alfred even though they have not been explicitly stated.

In the second example, a still more difficult one is exemplified by the problem of finding other individuals with the same legal standing as one in a particular situation— say a girl who is a minor, or a ten-year-old who is a ward, and so on. In some contexts these terms may actually be synonymous, in others, they would not be. Implicit information of this kind is at present not retrievable through the use of keyword representations. It is our contention that it is most unlikely to be in the future as well.

1.3.1.1.6. Inflexible Matching

One final point must be made about the inflexibility of document retrieval systems. Character string matches are the basis of retrieval. Above, we discussed restricting attention to terminology in fact, the focus of attention is more superficial, for keywords are not used as lexemes but as character strings. Neither syntactic functions nor semantical content are included. There have been a number of compensatory developments, in what are known as the '*ad hoc* query languages' of retrieval systems, to give some systems an appearance of dealing with language when responses are given. In reality, these languages are not based on linguistic principles but derive from electronic data processing. They are based on operations on character strings.

Wild-card symbols may be substituted for a syllable or syllables or simply for a 'piece of word' that changes with a grammar, or spelling variation. **Stemming** is a device used to facilitate search with term variants. most commonly, to deal with the complexity of suffixes in English. One can attain a hit by matching the first few syllables without struggling to proffer the exact search term needed. Recently, morphological principles have had their place in the adaptation of these devices for more effective operation.

Proximity operators are used to bind together terms that occur near each other in text, giving the impression of being able to associate modifiers with nouns, or properties with entities. In so doing the system apparently restricts meaning to exclude noise. These devices simply lengthen search strings. They have nothing to do with grammatical modification and nothing to do with logical conjunction. They have very little to do with meaning.

String-handling aids do make system operations more sophisticated. Nevertheless, the user may have to find his way around misprints, misspellings and linguistic variations. The user is expected to take the responsibility for unraveling multiple interrelated problems in order to carry on his dialogue with the system. His burden is heavy. We must try to alleviate it in order that he may return to his proper subject of concentration, solving his problem with useful information.

1.3.1.2. Summary

The deficiencies we've discussed derive primarily from the use of keywords or index terms. Improving text representation is fundamental to improving the quality of information retrieved. Making progress means being able to do some of those things discussed above that keyword retrieval systems cannot do. In short, it means restoring meaning to the focus of attention and returning to the problem of how to achieve *information* retrieval rather than settling for document retrieval because it is an attainable goal.

1.3.2. Problems with Boolean logic

Boolean logic is extremely powerful. It is unarguably useful for the heavy-volume activity in document retrieval. It can be used to *formulate* complicated search queries without limitation. However, the actual *performance* of a complex search is seldom successfully negotiated. Boolean logic is apparently easy to use, but rapidly becomes very difficult to control. As Karlgren says,

> Not even a trained logician would be able to recognize completely the semantic characteristics of a document set defined by a Boolean expression with a couple of levels of brackets. (Karlgren and Walker 1983, p.284)

Although Boolean logic is admittedly powerful and apparently flexible for use in searching, there is little help for the user who tries to cope with it. Some of the problems he has to face are negation, conjunction, set combinations, and nested phrases.

For example, when the searcher uses an ‘or’ he ought to be aware of the consequences. If he is asks, ‘‘are there any documents about children who have lost a father or a mother’’ and he gets a list of hits, he should know that the set may include documents about any one of the following:

(1-10) children who have lost a father
(1-11) children who have lost a mother
(1-12) children some of whom have lost a father and some of whom have lost a mother
(1-13) children who have lost both parents
(1-14) children some of whom have lost a father and some of whom have lost both parents
(1-15) children some of whom have lost a mother and some of whom have lost both parents
(1-16) children some of whom have lost a father, some of whom have lost a mother, and some of whom have lost both parents.

In short, the only exclusion is the set of documents about the children who have not lost any parents.[4]

Furthermore, the user must bear in mind the possible composition of the set of documents at the next step in the search. For example, if he is interested in children who have lost a father, he may have to isolate the specific subset of documents about children who have lost fathers from a superset containing as well documents about children who have lost a mother and children who have lost both parents. Then he can proceed with his search for a type of father or the type of loss, or whatever else interests him. Suppose, for example, that he had been interested in Indian children. At this point, he might be made painfully aware that his set included West Indian, Amerindian, and East Indian children. He might also have missed Native Americans and First Nations children, without even mentioning the anomalies involved in identifying race especially with regard to parentage. Keeping track of the logical progression of the search at the same time as the question is being pursued requires more effort on the user's part than can practically be asked of him. It is questionable whether the user sustains control over what he is doing. So far, we have not mentioned the difficulty of coping with complex or abstract ideas in retrieval.

Combined with the requirement for paying strict attention to lexical detail at a very low level, this additional burden of logical analysis forces the user to restrict his questioning severely.

> [Query languages] force the searcher to frame his thought processes in terms of a Boolean combination of words and phrases, a process I term the 'Boolean bottleneck'. I refer to this as a 'bottleneck' because the rich set of relationships present in natural language is being restricted to the relations AND, OR, and NOT. (Krovetz 1985, p. 281)

It is counterproductive to require the user to direct his attention to such matters. The primary purpose of a retrieval system is to help one locate information as directly and easily as possible. The Boolean bottleneck, as well as causing difficulty for the user, leads to logical errors and to gaps in coverage that are not acceptable in information retrieval in general, and in legal research in particular.

1.4. The promise of conceptual retrieval

Conceptual retrieval could release the user from character string matching. It would give the user access to the *meaning* of the text by means of a **knowledge base** (kb). He would have the capacity for

[4] Unless of course he has used an 'exclusive or' operator, in which case his answer will be set (1-10) and set (1-11), that is the union of those two disjoint sets.. However, 'exclusive or' operators are much less frequently available and they are normally explicit.

more flexible search because of the inference capability. The significant characteristic of conceptual systems is a representation of the meaning of the text.

Once a conceptual representation has been adopted, the nature of the retrieval system will change. As Schank pointed out,

> Besides making retrieval from the database difficult for users, key words are rather poor as an organisational tool. Key words are not sufficient for expressing the conceptual content or meaning of the contents of a document. (1981, p. 95)

Once a deeper semantic analysis is used, the organization of the system must be reconsidered. For example, inverted files are not suitable. There are three components in a conceptual system: the knowledge representation, an inference mechanism, and some domain-specific knowledge. In the following sections we examine the basic components of such a system.

1.5. Representing meaning

The first system component is the conceptual representation of the text. A concept is simply an idea. In some semantics, 'concept' is formally defined as 'intension'. It is the generalization of something of which we are aware.[5] In that sense it has a classificatory function; things with properties in common are gathered together and a mental process of abstraction results in conceptualization.[6] A concept relates to other concepts as a part of the expression of meaning in our cognitive activity.

In a more technical sense, concepts are simply objects. As Sowa says,

> Concepts represent any entity, action, or state that can be described in language, and conceptual relations show the *roles* that each entity plays. (1984, p. 8)

He goes further to explain how fine-grained concepts are used in AI to construct information systems.

> In AI, the term *concept* used for the nodes that encode information in networks or graphs: a concept is a basic unit for representing knowledge. Defining a concept as a *unit* presupposes that concepts are discrete. (1984, p. 39)

In subsequent chapters I will show how such networks of concepts can be used as the meaning representa-

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[5] ''Concept—A mental image; especially a generalized idea formed by combining the elements of a class into the notion of one object; also a thought or opinion.'' *(Funk & Wagnall's standard college dictionary, 1978)*

[6] ''A concept is that which is logically related to others just as a point is that which is spatially related to others. Concepts can also be likened to classes, groups or categories or, rather, to ways in which things can be classed, grouped, or categorized.'' (White 1985, p. 8)

tions we need for retrieval.

Once the text has been analyzed in a conceptual representation, displaying the concepts of the later type, and the relations among them explicitly, there is a new basis for organizing knowledge for retrieval. The represented text can be seen as a body of knowledge organized about groups of concepts, with the relations between concepts precisely encoded.

1.5.1. Inference

Once we have such a representation, we also gain the power and flexibility of AI style reasoning, or **inference,**[7] with such representations. Inference gives access to information *implicit* in the system but not anticipated by the user in so many words.

1.5.2. General and domain-specific knowledge

Each conceptual representation or kb symbolizes a particular, limited domain. Knowledge specific to the subject domain (in this dissertation, contract case law) must be included in the system. This knowledge must be exact and detailed. It is the quality of judgement used in structuring the domain-specific knowledge—the inclusion of appropriate subject information properly analyzed at a suitable level—that largely determines the degree of success a conceptual system achieves.

Along with the domain-specific information, ‘real world’ or ‘commonsense’ knowledge is essential in order to perform inference and retrieval. Commonsense knowledge is the everyday knowledge people have and take for granted. They assume that everyone above the age of reason has it. Commonsense knowledge fills in gaps and makes it possible for the system to negotiate transitions from one concept to another with some degree of apparent understanding.

1.5.3. What a conceptual retrieval system does

What then can be expected from a conceptual retrieval system? First, we can expect to get information that is implicit in the kb. The user no longer has to match words exactly; he can gain access to the meaning.

[7] ‘‘Inference is the process of deriving conclusions from premises. For example, from the premise that Art is either at home or at work and the premise that Art is not at home, we can conclude that he must be at work.’’ (Genesereth and Nilsson 1987, p. 45)

Furthermore, he can search for abstractions. The system may even 'understand' well enough to give the user the information he *expects*, rather than precisely what he *asks for*, which may be erroneous or meaningless. To return to the example of Alfred and Ronald above (§1.3.1.1.5) above: we can solve that problem because it would be possible to find all the members of a group with the same legal standing. 'Legal standing' is an abstraction about the law—a **legal concept**. The male minor, who had that particular legal standing, was associated with that particular concept. The designation of anyone else within the system to whom the concept related could be found by inference, even though the concept was not named, because the essential properties have been distinguished.

A conceptual retrieval system is able to distinguish between meanings that share the same term. The concept of having 'legal standing' may be described as a legal relation. The relationship of son and father is familial, although it may be considered legal as well. It is possible to distinguish the types of relations that may be described as 'legal' from those called 'familial' without having to add the modifying words. Within the system, the meanings of the relations are fully specified as a part of the conceptual analysis.

Similarly, sentences may share superficially the same concepts and the same structure, but be different in meaning, for example:

(1-17) Mulroney talked with Bush by telephone.

(1-18) Mulroney talked with Mila by telephone.

If the sentences are analyzed semantically the difference between the relationships, a diplomatic event and a personal one, would be understood. The information is accessed by idea, not by term. Sometimes context is enough to disambiguate a meaning, and sometimes commonsense knowledge must be applied as well.

Conceptual representation solves the problem keyword systems have with frequently occurring terms. Recall the problem of using terms such as 'trial', 'jury', and 'waiver' in a civil procedure problem and the hardship of identifying useful documents with them (§1.3.1.1.4). In such an instance, a conceptual retrieval system would work by means of its knowledge representation (kr). It would 'know' what a court is and what a jury is. It can find allusions to a 'new trial' by negotiating conceptual associations. It can work out the meaning of 'subsequent' with regard to its temporal logic component. Ideally, it proceeds to make the appropriate associations between terms, even if they are common, and disambiguates meanings in order to provide an answer. Furthermore, it should respond with all the information in its control, even if that information is incomplete or deficient in some respect.

It is assumed that, in due course, systems of this type will be able to communicate with their users in natural language, with regard to both the questions and answers; that is, both automatic language analysis and automatic language generation will be possible. The kr presented here represents the meaning of the text adequately for inference at a suitable level but not adequately for a full translation of English text. Nor would it be sufficient to support the generation of a response in everyday English. Nevertheless, the intent here is to build a sound basis. Nothing used will misrepresent meaning insofar as it is described, and it can be built upon without incurring undue error.

1.5.4. Problems with conceptual retrieval

Conceptual retrieval systems have yet to be developed. There are a number of reasons why this is so. As well as the fact that recent research trends emphasize users' studies and statistical analyses of text, the primary one is the language problem. The representation of the full expressive power of natural language is still in the future. Although it is possible to represent the meaning behind the language to a much greater extent than is possible with index terms, our krs are limited when compared with everyday language.

Ideally we should be able to store text holistically without any prestructuring and then search for information later, as needed. That target is still remote from us. Conceptual representations surpass retrieval systems in their potential for answering specific queries precisely. They would recall everything relevant to a question without doubt that something in the system remains unaccessed. Finally, they could provide partial answers or information about a question.

The major problems with the implementation of a kb system are the following: the time consumed in developing the representation, the difficulty of conceptual analysis, application to other than simplified or formal language, adapting the system to volumes of text, and modelling real-world knowledge. The first two problems fall together. Developing the representational language takes an inordinate amount of time, care, and knowledge. Yet the success of recent research in several domains indicates that progress is being made, and the variant approaches are converging. They are coming together in developing formalisms. As we stated above, the target representation is intended in the future to be automatically derivable from text.

The difficulty of linguistic analysis still tends to be underestimated in the research environment (Hirst 1989). Trivial sentences commonly used to demonstrate linguistic principles fail to make the desired impact on researchers other than linguists. Nevertheless, progress is being made in computational linguistics and the current interest in text analysis is encouraging. It is apparent that the difficulties encountered in early experiments in kr may be attacked using linguistics as well as logic. It is also important to recognize the need for precise retrieval in particularly important and difficult domains, such as case law research.

Conceptual information retrieval requires kr and a capacity for inference too taxing for traditional keyword-Boolean systems. The problem of volume is dependent for solution on advances in other areas of computation.

The difficulty of modelling domain-specific knowledge is complementary to the representation problems. However, it is beginning to being done with skill and assurance, using like formalisms where there was formerly a proliferation of seemingly *ad hoc* solutions. The kind and amount of real-world knowledge needed is domain and application dependent.

Furthermore, any conceptual structuring results in the imposition of an analyst's interpretation on the information. There is a risk of misrepresentation. It is even possible that the approach of the data analyst can effect an edit, can result in a biased kr. However, it is just as true that the editor of law case reports prejudices the integrity of the system; and that the indexer and the headnote writer determine accessibility of the cases. The need to supply the full text of reports will not abate with the availability of conceptual retrieval since the language of the decisions is the essence of case law. So long as full text reports are available, the possibility of misleading the user is kept to a minimum. So long as the analysis is done in good faith, a fuller representation should be accepted over another, less substantive one. Conceptual representation constitutes an improvement, if not a solution, to the retrieval of case law.

Lastly, the user cannot readily absorb the meaning of logic-based krs. A kb system is not transparent, that is, the user cannot readily follow its operations on information. Some users object to the processing of their information and the objection is hard to counter. As time passes, language processing will become more sophisticated, as will system users and interfaces. Presenting systems of integrity will improve future credibility. Fear is decreasing as commercial systems become familiar to professional users. The systems value is demonstrated by the positive response they elicit. We have chosen to concentrate on the most fundamental problem in bringing about conceptual retrieval, that is, developing a semantic representation. It may be necessary to develop separately elements contributory to a retrieval system since the task of building the entire system model is formidable. Once again, in this context, reconsidering our IR system evaluation methodology is essential.

1.5.5. Quasi-intelligent IR

If knowledge representation is so difficult and time-consuming to do and krs are so bulky to store, then why not use a semi-intelligent system, a half-way solution? It would appear to be more practical to represent only some part of the text, if the representation could provide higher quality information than keywords by, say, inference at the index term level or among abstracts. The precision required to disambiguated meanings gathered by index terms can be built into the lexicon. Disambiguating meanings lexically would not provide conceptual information. The precision required for conceptual retrieval makes an index-level model unsuitable even with inferences.

1.6. Document retrieval and conceptual retrieval

Sometimes an argument is made that full conceptual representation is not required for information retrieval, that, in fact, a topnotch index will allow one to zero in on the information and cut out the noise (Karlgren and Walker 1983; Salton and McGill 1983). It may be argued that keyword retrieval is really adequate, that users are happy with these online systems, that after all, the systems have been in use since the sixties. It may even be argued that keyword polysemy is advantageous in retrieval because it gathers serendipitous information—in spite of the ambiguity entailed.

There may be users who choose imprecise retrieval, who choose to browse through miscellaneous information. Users who search law cases do not fit that description. To legal researchers, recall is essential but precision may not be sacrificed. The importance of building systems that are responsive to recognized needs cannot be overstated.

Our experience with both laboratory and field experimentation since Cranfield (Cleverdon 1962) indicates the see-saw effect of the quantitative measures of precision and recall: when one goes up, the other goes down. Document retrieval may be compared with the working of a sieve. The more general the query, the coarser the sieve, the higher the recall. The more specific the query, the finer the sieve, the greater the precision. The documents not retrieved, like the pieces remaining in the sieve, are not examined. They simply match or they do not. They drop through the holes, or are relinquished. The user decides on the granularity of his sorting mechanism by adjusting the query. Once he has made his selection, the system merely sifts the contents.

A conceptual retrieval system, on the other hand, is not an all-purpose device. It is a precision tool. Its function is quite different from the sieve-like sorting activity of the document retrieval system. The system does not only separate the probably-relevant items from the probably-not-relevant ones, it tries to find a meaningful answer for the question. It can home in on exactly what is sought. There is no choice of emphasis to be made between precision or recall. Anything that relates to the question must be recalled. Nothing that is extraneous may be included.

We will gladly dispense with the quantitative measures of precision and recall. They are rooted in subjective relevance evaluations. Unless samples of considerable size are used, objectivity is not attained. As rates of precision and recall see-saw back and forth, their complementarity is seen to be inevitable. If semantic representation is substituted for the use of words as character strings, it will be seen that both precision and recall can be improved.

It is clear that the problem of polysemy mitigates against the possibility of separating precision from recall. Precision may be achieved with a kr that allows the specification of each concept and its relations. Automatic inference has a potential capacity for achieving unparalleled recall.

Because of the uncompromising nature of term matching in the keyword-Boolean systems we are prevented from retrieving general ideas. Answering questions about ‘waiver’ and ‘new trial’ does not compare in difficulty with answering questions about ‘intention’, ‘foreseeability’, ‘causation’ and ‘justice’. A conceptual kr with a suitable organization and a functioning inference mechanism could break through the Boolean bottleneck. It would lighten the user’s burden. Conceptual representation should, therefore, not be overlooked as a way to progress.

The genuinely difficult problems in making intelligent IR systems are related to how little we actually know about what we are doing. Persistent and penetrating analysis of logic and language issues is more likely to lead to success than disregarding the potential of powerful new technologies, as yet imperfect in application. The IR technology we have now works well to retrieve documents about named, concrete concepts from very large databases and it is practical. However, we need to be able to retrieve information as well, conceptual information.

CHAPTER 2

Literature review and technical background

2.1. IR systems

2.1.1. Evaluative research

IR systems first made their appearance in the 1950s. By the mid-1960s, large online systems were available commercially. The Cranfield experiments (Cleverdon 1962; Cleverdon, Mills, and Keen 1966) were a landmark in IR system evaluation. They were the first laboratory-type controlled experiments in IR and they produced what appeared at first to be hard incontrovertible data. With Cranfield methodology, one could measure exactly what a system could do, and work toward improvement. On closer inspection, however, Cleverdon's work (1962, 1966) was not as rigorous as was first thought. The Cranfield experiments were flawed in several respects (Foskett 1982, p. 522). Nevertheless, they made a great impact and encouraged research that previously had not been feasible. They must be viewed with respect as controlled experimentation in a difficult environment.

Cleverdon was responsible for setting a pattern for experiment that has been sustained. He used recall and precision to measure success in retrieval of documents relevant to a query from a database.[1] Recall and precision are still the preferred evaluative measures twenty-five years later. The best-known IR studies had all given recall and precision ratios, so later studies had to give them to allow comparison. But the nature of recall and precision themselves make comparisons inexact. Although the total size of a given document collection is generally known, it is possible only to estimate the total number of relevant

[1] The measures were defined as follows: **recall** = (100a/a+c); **precision** = (100a/a+b)
where
  a = relevant documents retrieved
  b = non-relevant documents retrieved
  c = relevant documents not retrieved
  d = non-relevant documents not retrieved
  N = documents in the collection
and a+b+c+d = N.
There was one additional measure used as well, **fallout** = (100b/b+d). (Cleverdon 1966, p. 608)

documents (a+c).

Furthermore, relevance tests are subjective. There is no standard for determining relevance. Choices are a matter of users opinions. The judgements are understood to be personal. There have been numerous critics of relevance including Cuadra and Katter (1967), Saracevic (1968), and Regazzi (1980). The tests result in evaluation of users' likes and dislikes rather than of systems performances. Each system is treated as a whole. The test results give little information about the interaction of variables and so are of little help in adjusting the system design. The hedge against variant user behaviour in these tests is the commonality of interest displayed by a core group of a large sample of users. Seldom is the population large or diverse enough to insure objectivity.

Over the years there have been a few tries to substitute other measures of evaluation, but none of them 'took'. Swets, disenchanted with relevance judgements (Swets 1965), developed alternative measures (Swets 1969) that received a certain amount of attention in the literature (Heine 1974), but ultimately they were passed over.

The Cranfield experiments and their successors were designed to measure retrieval effectiveness specifically related to indexing languages. Output was to be improved by altering the input. Since Cranfield, much time and energy have been spent improving this basic approach, but there have been few significant adaptations to the design itself, or to its components, including input. For some time activity centred on the restructuring or improvement of input. Some attempts looked promising with regard to language analysis, among them were statistical analyses of term distributions, automatic analysis of text, and vector manipulation, but none received as widespread acceptance as did the Cranfield results themselves.

2.1.2. Statistical analyses and automatic indexing

Zipf (1949) related the frequency of occurrence of terms in a document to their capacity to carry information. The more often a word occurred, the less information it conveyed. His work was used in many experiments with automatic indexing. The words in the test collections of documents were counted and co-occurrences of terms were calculated under a variety of constraints. Researchers were attempting to improve the precision and recall ratios of document retrieval. Formulas of various kinds were developed in an attempt to establish meaningful bounds for term frequency counts within a document or a collection of documents. Such work is reviewed by Salton (1975) and Sparck Jones (1971) among many others.

The upshot of the counting experiments was a certain advance in the sophistication of the querying part of the system. Ranking and weighting devices were developed to improve upon precision; bonding and clustering were used to simulate a more meaningful search capability.

There were some experiments with automatic indexing, but there was no overall success (Salton and McGill 1983, p. 52–99). Some experiments attempted to take advantage of the research done in computational linguistics—performing simplified syntactic analysis using context-free grammars, and so on. The idea was to construct better index phrases in a computer-aided environment. Emphasis was always on nominalizations, as in the traditional manual indexing. The research yielded very little real progress, since once again, no one took meaning into account. It would appear that the challenge of dealing with the 'big problem' of processing language by machine was too difficult to attempt. In those years, statistical analysis was in vogue. Computer applications in information systems were fundamentally an accumulation of electronic data processing techniques applied to text. Information retrieval became document retrieval.

2.1.3. Vector retrieval

Gerald Salton's SMART system (1968, 1971, 1975) was more innovative. SMART provided 'dynamic' information processing by means of vector searching. It was an automatic 'natural language'[2] indexing system, that 'zeroed in' on a search profile for each user by statistical methods. The file structure was different from other IR systems in that related records were clustered in classes. A list of documents was presented to the user, who ranked them by their relevance. SMART used that feedback to list retrieved documents according to the relevance of each to the user's need for information. The system, using this relevance feedback, developed query vectors zeroing in on the areas of relevance identified in previously retrieved documents.

[2] That is, a 'natural language' used in the same sense as in Cranfield II (Cleverdon and Keen 1966), in that the terms used as keywords were not supplied by an indexer, but were taken directly from the text.

The major criticism was that although the idea of vector searching was an improvement over other methods of the day, it could not be used with large volumes of data because of the prohibitive cost it incurred. Nevertheless, there were some applications (Malthouse 1978; *RADC* 1975).

Vector searching is still an interesting concept. The vector relationship shows an understanding of associations in information. It constitutes a creative application of relevance feedback but not a breakthrough in IR. It is a technique for making document retrieval more efficient. Furthermore, it demonstrated that there are limits to efficiency modifications. The system seems not to have been tested on collections of more than ten thousand documents. Vector searching cannot, practically yet, be expanded to a greater volume of documents than the relatively small test collections. SMART did not attempt to deal with language, and there is no evidence of awareness of linguistic variation within it.

2.1.4. IR and natural language systems

The literature shows a *continuum* of development from document retrieval to full text IR. At the beginning of the continuum are keyword-Boolean retrieval systems. At the end is the situation that Charles Meadow predicted for 2001, anticipation by information scientists of ‘‘a world of holistic recording in which the intellectual effort of deciding what is worth seeing comes after the recording’’ (1979, p. 218). Between those two extremes there are a number of other positions, among them text passage retrieval (O’Connor 1975, 1980), compromises between controlled vocabulary and knowledge representation (Karlgren 1977), and conceptual retrieval (Schank *et al*, 1981).

The underlying thought in this perspective is that from good efficient document retrieval we will eventually develop IR. However, going from document retrieval to information retrieval requires a conceptual leap. Efficient document retrieval is never going to become effective enough to crack the problem of natural language understanding.

Information scientists might look elsewhere for a technique that could be successfully applied in research to improve retrieval. The early question-answering systems that purported to ‘understand’ language seemed at first a big breakthrough. IR researchers studied Winograd’s system SHRDLU (1972). Moving a simulated robot around a highly controlled micro-world and instructing it to manipulate blocks demonstrated only a very limited kind of 'language understanding' (Winograd 1983, p. 261, 310). Not much of SHRDLU was really of use as it turned out. Nevertheless, attention was attracted to a language analysis problem for a time, because it appeared that computers could do that sort of work.

Similarly the simulated dialogue experiments, like DOCTOR (Weizenbaum 1966), were interesting at first glance. Using ELIZA, a conversation with a psychiatrist was simulated. The user responded to questions presented by the system. Fragments of the user's response were used in stock phrases included in the next question that the system generated. The dialogue continued back and forth on this basis. The system only feigned understanding. It did not take a user long to penetrate the stereotypical responses of the 'doctor'. The patterns were obvious.

The question-answering systems were, in retrospect, an oddity. They caused a sensation at the time because of their dramatic demonstrations of apparent language understanding. However, interest waned quickly. Natural language understanding went in directions other than question answering in the ensuing years.

In information science, the superficiality of these systems created a certain prejudice against further investigation of language analysis. It was probably a reaction to the original popularity of the question-answering systems. They had appeared to be more penetrating than they were. Secondly, question-answering systems were clearly very limited in the volume they could handle—not much potential for information retrieval system development. Information scientists had also been disappointed by the machine translation experiments of the sixties and were generally discouraged by what came to be called 'the language problem'.

Salton regards the question-answering systems and their successors, up to and including conceptual retrieval, as separate from the development of document retrieval systems. He sees them as unrelated; either you go that way, or this (Salton and McGill 1983). In his thinking, the proper study of information science does not include *information* retrieval as distinct from document retrieval.

In order to achieve *information* retrieval one needs to have a way of working with the meaning underlying the language. The need for meaning, in the present technological environment at least, implies a need for knowledge representation (kr). We know that experiments to improve the efficiency of systems as they stand is not going to result in better information retrieval. We have no tools at hand, in information science, that are effective against this barrier.

The language problem is at the root of the difficulty. The focus of research has shifted to the development of user-friendly interfaces, front-ends with database-like query languages. The forerunner of these was the LUNAR system (Woods *et al*, 1972), which itself had much more in common with query languages, a very rigid format and not much capability for expression.

The reason the language problem has been avoided is because of its difficulty. No one seems to have a clear idea of how to go about solving it successfully. The variation in linguistic theories is an indication of how complex the problem is. Nevertheless, the problem of analyzing language and finding a suitable symbolic representation for its meaning cannot be avoided if we are to have information retrieval. Using knowledge gained about language understanding in other disciplines may be helpful. It does not matter that the continuum is not a sustained development within a single discipline so long as the goal is achieved.

There are indications in the literature of an interest in looking beyond information science, specifically to AI techniques, to improve information retrieval (Futrelle and Smith 1982; Croft 1984; Cross and de Bessonet 1985; Rau 1987; *International journal of intelligent systems*, Special issue 1989). Van Rijsbergen's (1989) analysis of theory is particularly encouraging. Periodically, articles appear recommending indexing that is closer to kr. There is too some dissatisfaction with the performance of systems of traditional design (Blair and Maron 1985).

Some part-way measures have been attempted (Karlgren and Walker 1983) in which linguistic devices were used to disambiguate index terms. The results are less than satisfying, yet almost every general survey of retrieval system development suggests the implementation of more syntactic devices without going the whole way to attempt a kr. The trend to the use of syntactic devices is becoming more pronounced.

Belkin's recent work, (Belkin and Vickery 1985) based on the 'anomalous states of knowledge' that he studied earlier (Belkin 1982), employs a **semantic net**.[3] However, the description of the work general.

[3]**semantic net**:–''the collection of all the relationships that concepts have to other concepts, to percepts, to procedures, to procedures, and to motor mechanisms.'' (Sowa 1984, p.76)

It is difficult to ascertain what progress is being made with regard to language. Salton sees kb systems as the descendants of the question-answering systems and regards them as distinct from document-based IR systems (Salton and McGill 1983, p. 297). Although he does not regard kb systems as being of interest in IR research, he does say that they are justifiable in subject areas where low-level detail and particular attention to language are important, such as pathology data and medical diagnostic summaries (Salton and McGill 1983, p. 292). It is conjectured in this dissertation that case law is just such an area.

The problems with the literature, the need for full recall along with satisfactory precision, and the urgency of our need make case law a prime candidate. Moreover, in law, the detail necessary to construct a conceptual representation will always be useful in searching the text. The detail will be appreciated so long as it is possible to avoid it on occasion. It is important to persist in experimenting with the theory now available that we may achieve better quality retrieval in areas where we most need language analysis and detailed knowledge.

2.2. Retrieval systems for legal information

2.2.1. The special requirements of law

A quick survey of the characteristics of the legal literature is called for, before we begin to discuss the special retrieval needs of the legal profession. To begin, it must be noted that in case law research, full recall is essential. A case law search with even a small percentage of error is not to be tolerated. Certainty is of paramount importance. If the case is there, it must be located. If the system responds that the case is not there, the system must be right.

The need to make precise distinctions in meaning puts heavy emphasis on language in law. Moreover, important cases are closely reasoned, and the conceptual content as well as the language needs detailed analysis. It is necessary to follow ideas through the text in order to develop an argument. ‘Aboutness’ is not enough (Blair and Maron 1985). Document retrieval is not enough. Full recall is the first priority.[4]

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or example, in 1988, the goal of their then current research at Mead Data Central was a 98-100% recall system. Personal communication from Nicholas D. Finke, of Mead Data Central, September 1988.

There is also the physical problem of dealing with an endless flood of incoming cases. It is the volume of literature that has spawned the creative organization in law publishing. There are numerous formats to allow text updating—loose-leafs, many types of serial publications, stick-in updaters, re-issued pages, section and volume advances, slip laws, and many others; nevertheless, the volume of literature continually arriving and the ceaseless need to update, are the prominent characteristics of legal publications. They are most obvious in case law reports.

For all these reasons a modern IR system would be tremendously useful. If indeed the output was information rather than documents, the end would doubtless justify the effort of building it.

2.2.2. Online retrieval systems

The retrieval systems available for legal literature—Q/L, CAN/LAW, WESTLAW, LEXIS, and so on—share the problems of other document retrieval systems. Their greatest difficulty is the limitation of the keyword-Boolean format. It is worth looking briefly at the structures of some of them to see how they handle legal literature.

2.2.2.1. Q/L

Q/L (*CLIC Guide*, 1987), originally Quic/Law, was developed at Queen's University in the seventies by Keith Latta and Hugh Lawford. It was one of the earliest legal information systems, and its success undoubtedly encouraged others. The project began as an attempt to cope with native rights treaties. Federal funding was an important asset, as data conversion was a major developmental problem.

During Q/L's history, databases have come and gone as demand required, and as financing was found for the conversion of data. Headnotes of law reports were added to Q/L some years ago, not kept up, then begun again, depending on the funding available. In recent years the full text of cases has been added, and coverage continues to grow. With the advent of electronic publishing and the co-operation of Canadian law publishers, it has been possible to concentrate on software development rather than data conversion.[5]

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[5]Hugh Lawford, personal communication, March, 1982.

The financial problems of the middle years have been alleviated by the Law Society of Upper Canada, which now administers the system, although Lawford has stayed with the project in one capacity or other throughout the years. Today, the system's biggest draw is online access to the full-text *Ontario reports.* The Law Society insists that all searching be done by a lawyer. Both lawyers and librarians are pleased with the results.[6] The system is, however, still slow, a bit old-fashioned in its searching capability. Most queries result in long lists of references which the lawyer must cull. Recall is stressed in search, as is usual in law.

2.2.2.2. WESTLAW

The WESTLAW system (West Computer Law Retrieval System, New York City) (*Westlaw introductory guide to legal research* 1988; *Westlaw reference manual* 1990) is based on the content of the *National reporter system* and the digest and key number system of the West Publishing Company. West publications have been a standby for the legal profession for many years because of their comprehensive coverage and rapid publication.

The best-known feature of West's indexes is the key number system. Key numbers link together the same subject in all their indexes. For example, if you wish to look at a particular subject in an Arkansas index and then transfer to New York State, it is possible to carry the number assigned to the subject with you so you can go directly to the same subject in the New York State jurisdiction, even if the terminology varies. The use of numbers to link subject headings across the jurisdictions has been a popular feature for many years. Needless to say, it lends itself to computerized retrieval. The WESTLAW system is an online replication of the manual system. It contains headnotes, key numbers, and topic headings, as well as case reports. There have been some improvements over the years but its format remains an automated version of the digest and indexes of a large-scale law reporter.

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[6] Theresa Roth, Reference Librarian, Great Library, Law Society of Upper Canada, personal communication, October, 1985.

2.2.2.3. LEXIS

LEXIS (Mead Data Central, Dayton Ohio); (*Lexis libraries guide*, 1986) is the most sophisticated of the law systems. Originally known as The Ohio Bar Foundation project (OBAR), it was limited at first to the jurisdiction of Ohio but later expanded. It became a part of Mead Data Central and is now used throughout North America. In Canada, Butterworths is the marketing agent. It is now well established and commonly preferred in law libraries.[7]

Like WESTLAW, it covers U.S. federal and state jurisdictions. Much of the state material was gained through the support of the state bar associations. Both codified statutes and case reports are available. The inverted file structure is said to include all significant words in the texts. Each LEXIS database is individually structured, and must be searched separately. LEXIS too, is a keyword-Boolean system.

2.2.2.4. Summary

In summary, the online IR systems in law are generically the same as other IR systems. They are essentially inverted file databases with a Boolean retrieval capability. As seen before, language analysis is necessary for true information retrieval. For legal information retrieval, special demands make the need even more pressing.

2.2.3. Knowledge-based systems

The reason for looking at AI techniques, however imperfect, is to facilitate development of a system that does retrieve information, especially conceptual information. The earliest developments in AI-based information retrieval took place in the mid-1960s. **Jurimetrics** aroused interest in the possibilities of using logic in searching and drafting law. The journal around which the activity centred was *Modern uses of logic in law,* which later became *Jurimetrics journal.* The foremost names in jurimetrics were Lee Loevinger and Layman Allen. Colin Tapper was among the principal critics.

As time went on, the focus changed from drafting and retrieval to the question of whether or not legal reasoning could be replicated by computer. Currently there is a good deal of interest in the use of

[7] Clare Lyons, Librarian, Campbell Godfrey, Toronto and Secretary, Toronto Association of Law Libraries 1984, personal communication, 1984.

rule-based expert systems for tasks such as separating the hard from the easy cases in law office operation. The easy cases are then handled routinely by machine, and the hard ones are referred to people. Notable among these systems are the Rand Corporation's estate planning system (Schlobohm and Waterman 1987; Schlobohm 1989) and the IRS employee pension plan screening system (Grady and Patil 1987).

Most of these systems are implemented in Prolog. Because of the limitations of the rule-based expert system design, the techniques used are not suitable for adaptation to the retrieval of case law.

2.2.3.1. Legal reasoning systems for legislative instruments

An important branch of development in computerized law-based systems involved statutes and codes since they are written in carefully drafted technical language. TAXMAN (McCarty 1977; McCarty and Sridharan 1980, 1981, 1982), a kb system used to sort out a particular time problem in corporate reorganization litigation, is one of the best known. The early research used only rule-based representations, organizing the facts as they changed over time (McCarty 1977). In later research, the problem of legal concepts, described as amorphous, was handled in a 'prototype and deformation' structure (McCarty and Sridharan 1980, 1981).

McCarty and Sridharan have received critical praise from artificial intelligence researchers for their work in solving this problem. The prestige of the research lags behind the accomplishment of the system.

The TAXMAN research continued nevertheless. It is interesting that McCarty began with a problem he considered typical of legal reasoning and a simple rule-based model. The goal since then has changed to using the prototype and deformation structures to replicate the development of a legal argument—to dynamically construct steps in legal reasoning (McCarty and Sridharan 1982). McCarty himself has gone on to work with Hohfeld-based (1967)[8] deontic logics (McCarty 1983). He has admitted (McCarty 1983) that the lesson learned from TAXMAN is that deep conceptual models would have to be built to be able to perform conceptual retrieval in law.

Another example of a statute-oriented system is the Louisiana Civil Code Legal Information Processing System (CCLIPS) (de Bessonet 1982; de Bessonet and Cross 1984, 1987). Once again, the work

[8] Hohfeld's work originally appeared in print in 1920.

definitely breaks new ground in helping the lawyer to find information by working through the state code and associated cases. The research does not show a true case law approach,[9] although it is said to handle cases. The linguistic problems dealt with are restricted in scope as is the language in statutes. As de Bessonet himself says,

> Statutes seem to be instantiations of general formalisms that represent typical patterns, such as patterns for defining rights and for describing how rights are created, extinguished, and modified. Therefore, it is usually easy to determine the point of a given segment of statutory information. (de Bessonet and Cross 1987, p. 338-339)

For CCLIPS, the goals at present are to be able to interpret the statutory input with understanding and to read and understand facts submitted to it by users in a limited subset of English. In short, it is a rule-based system and is handling more technical legal language than that found in law cases.

2.2.3.2. Case-based legal reasoning systems

Gardner's *An artificial intelligence approach to legal reasoning* (1987) is a landmark in case law systems. She developed a system that analyzes law school examination questions in contract law, as a first-year student is required to do. The system uses an **augmented transition network**[10] to analyze the issues. It sorts facts from legal concepts; and works through the problem to determine whether it is an easy case or a hard case. Cases in which the issues can be decided with the knowledge in the database are identified. Hard cases are those in which an argument can be made on either side.

Gardner worked with open-textured concepts in the style of H.L.A. Hart (1961), that is, incompletely defined concepts. Examination questions for law students are designed to test their analytical ability. The questions, therefore, contain a great deal of factual detail, some of it conflicting. Furthermore, they lend themselves to argument on the basis of general principles of law. There are no clear-cut answers. The problem cases may be argued in a number of ways. Unfortunately, constructing a kr of the factual content was very difficult. And AI reasoning techniques, normally applied to specific low-level factual material, were not equal to the task of arguing well on general principles of law.

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[9] Case law that accumulates in a civil jurisdiction interprets the statute to which it relates but may deal as well with matters not covered by statute. (Jacobstein and Mersky 1985, p. 5)

[10] An augmented transition network (ATN) is a directed network for structure recognition in which the arcs are augmented with tests and operations for building structures. A significant amount of backtracking is used to develop the structures, since failure to pass a test means the arc is not to be traversed and another is to be sought. (Bolc 1983)

Gardner draws attention to many unsolved problems, principally the need to base analysis on the structure of arguments and the need to know more about the kinds of arguments that there are in law cases. It is significant that, in her recommendations for future work, she advocates persisting with AI research to make the techniques more powerful. It is important to note as well that she, like McCarty, came to the decision that the way to building legal reasoning systems was to base them on the analysis of argument.

The other major research in this area is HYPO, associated with Edwina Rissland and Kevin Ashley (Rissland 1982, 1983, 1985; Rissland and Ashley 1987; Ashley, 1990). The domain of interest is trade secrets law, and it is case-oriented. The project is to develop hypotheticals as the search progresses, to test them, and to adapt them as the goal of problem solution is reached. Current fact situations are presented to the system. A case analysis record and a ‘claim lattice’ are prepared by using fact-oriented predicates and ‘dimensions’. A point–counter-point argument structure is built.

Case searching, as seen earlier, is not done in a logical linear fashion. It is done by repeatedly redefining the original claim, as new information is gathered, until the answer is attained or the search abandoned. Rissland’s work displays an understanding of this phenomenon. Her taxonomy of operations provides a mechanism for approaching search from this angle.

Both Rissland’s and Gardner’s systems are legal reasoning systems. They share the same approach to the problem. Their approach is to assist the lawyer, not to replace him but to work through a problem as he would, using case law in their knowledge bases. As the approach is different, so the result is different. These are not information retrieval systems, but theorem provers designed for problem solving. They are built to find the right answer. Nevertheless, they show how important analysis of the argument structure is in working with legal language in conceptual systems.

2.2.3.3. Conceptual retrieval

The only conceptual retrieval system in law so far was built by Carole Hafner (1978, 1981). Her work is statute-based, although interpretive cases were involved in the research. Legal concepts were represented by a **semantic net**, a representation that consists of a network of concepts and their relationships. It was possible to locate cases in which a concept had been recognized without knowing the exact expressions for the concept. For example, ‘unauthorized signature on a draft’ was matched with ‘a forged endorsement on a check’. The conceptual analysis, expressive representation, and use of associations made the retrieval possible. Still, the concepts represented were broad rather than deep, in the interest of practicality. For a conceptual retrieval system to be feasible, deep conceptual analysis will ultimately have to be done.

Hafner has subsequently worked on another approach to retrieval using the highly-regarded scholarly notations in *The American law reports* (A.L.R.) (Hafner 1987) The idea is to fit case descriptions into a structured domain of legal knowledge, relying on the A.L.R. for case description and interpretation of the law in the area. The unfortunate choice of problem, of working from case annotations, is less fortuitous than it might perhaps have been. However, her approach stressed natural language processing and conceptual retrieval and so was anticipated with eagerness. But the project did not come to fruition.

2.2.4. Summary

In summary, there has so far been no real progress with the text-processing problems nor with case-law retrieval. The AI systems have clearly made the greatest progress. The problem of analyzing arguments stands out as the next big roadblock in retrieval. Language analysis in law is as difficult a problem as occurs in any domain. The understanding of the nature of legal concepts, be they amorphous, open-textured, natural kinds, or something else, will continue to present difficulties. The theoretical understanding of legal reasoning, although not essential to case law retrieval, has helped to unravel a number of knotty problems in legal text. Finding suitable formalisms for typical legal reasoning components will be helpful in the design of future retrieval systems.

The problem of volume has not deterred research in AI and law. Moreover, the climate of opinion in the legal profession regarding automated information retrieval is favourable, thanks to the popularity of the big online systems and specialty databases dealing with government regulatory information.

2.3. AI and IR

The indication in recent research is that a major breakthrough is necessary to take the step from document retrieval to information retrieval. AI systems have come closer to dealing successfully with the problems of searching legal literature and retrieving case law than have others. The following approaches found in the AI literature support the opinion that information retrieval can be done on the basis of AI technologies.

2.3.1. What is a knowledge representation?

It appears that the only viable way to move from document retrieval to information retrieval is through the use of a **knowledge representation.**

> Intuitively, a knowledge representation technique is a way of . . . encoding [knowledge] for use by a computer program. A knowledge representation scheme is a system of formal conventions—sometimes called its 'syntax'—together with a way to interpret what the conventions mean—sometimes called its 'semantics'. Any knowledge representation scheme has two parts: a knowledge base and an interpreter that manipulates it. (Stillings *et al* 1987, p. 142)

A **knowledge representation** is a computable notation for information that is used by a specific system attempting AI tasks such as machine reasoning and language understanding.[11] Any particular representation will be more or less formal depending on the system for which it was designed. The degree of formality depends on how important it is that the system provide **completeness**, that is, that the inference rules are adequate for all the formulas to be proven,[12] And the system should provide **satisfiability**, that is, that a model can be found in which every consistent formula in the set is true—the model satisfies the set of consistent formulas.[13]

Knowledge representations are sometimes described as languages. The language must be precise enough to make the desired level of machine reasoning possible and expressive enough to describe the knowledge of the particular domain chosen, allowing for good information retrieval with a minimum of ambiguity. It should also make reasoning possible at the level and of the kind appropriate to the task—deductive, inductive, or abductive.

Perhaps, the most significant kr decisions are made about the issue of level of detail. Levesque and Brachman (1984) call this the tradeoff. If the representation is too detailed, reasoning becomes impossibly complex. If it is too general, the expression of knowledge is constrained. The appropriate description of a good kr is the coarsest-grained one with which it is possible to reason successfully: one that is fine enough

[11] Brachman and Levesque (1985) is a collection of papers on fundamental and current research in knowledge representation.

[12] **Completeness**:–The set of formulas that are provable from some set of axioms is identical to the set of formulas that are true in all possible models of those axioms. (Sowa 1984, p. 164)

[13] **Satisfiability**:–A sentence is said to be *satisfiable* if and only if there is some interpretation and variable assignment that satisfy it. Otherwise, it is *unsatisfiable*. (Genesereth and Nilsson 1987, p. 26)

for expressing rules of action and all the conditions of the problem.

As well as domain knowledge, the kr language must represent low-level factual detail commonly called **real-world knowledge**. For example, let us assume that you have a household robot whose task it is to do the cooking. If you order him to make scrambled eggs, he must have enough knowledge about eggs to know that he must break the shells and extract the contents before attempting to scramble them (Hogan 1979). Real-world knowledge is then factual knowledge at varying levels about concrete, everyday things that people regularly employ in their daily living and seldom consider. Because we do not often think about what we are doing, it is particularly difficult to apprehend the appropriate knowledge in order to accomplish **common-sense reasoning**. Common-sense reasoning is of course what the robot-cook would have to do to get those eggs to the scrambling situation.

Furthermore, a kr must adequately handle low-level *abstract* information, not just concrete factual information about the physical world. For example, human language expressing thought betrays evidence of underlying **assumptions** and **beliefs** all the time. Consider the following assertion.

> Gladys said, ‘‘Isvenko ignored the invitation to indulge himself!’’

One underlying assumption is that Isvenko *got* the invitation. It is *possible* that he did not. It is also possible that no **intention** was involved in the ignoring. He may not have recognized something as an invitation, or he may simply have overlooked the matter. However, we do know that the speaker, Gladys, *assumed* that Isvenko received the invitation and that she *believed* that he *intentionally* did nothing about it. We do not know from the quotation what actually happened in the real world. We do not know the truth value of Gladys’s assertion about Isvenko. We do know that it is true that she did say it.

For some retrieval tasks, like recognizing factual and hypothetical parts of arguments, the representation of **modalities** such as belief is crucial to successful performance. In the example above, it may be important to know the difference between the facts of the real-life situation and the facts as they exist in other **possible worlds** such as the possible world represented by Gladys’s beliefs as expressed in the quotation above. In dealing with legal decisions, it is important for a kr to have the capacity to represent factual information as presented by the adversaries and as determined by a judge or judges to have existed. The question may or may not arise as to which version is true, that is, which is the possible world in the real-world version.

In order to do all this real work, a kr must have capabilities in two distinct but overlapping areas; these are **logic** and **linguistics.** Although it appears to some people that a kr is a complex data structure, the question is sometimes asked, ''What is the difference between a knowledge base and a database?'' A knowledge base may involve process as well as data. Knowledge-based systems are much more than data structures with a search module; they have the potential to do some work themselves, to reason. Such systems usually have their roots in **first-order logic** (FOL).[14] Included in FOL notation are Boolean operators, variables, quantifiers, and predicates.

Many demands are made on the representation in such a system. Problems of **quantifier scoping**[15] and the representation of collective and distributive sets may arise, as well as the need to represent a set, the membership of which is not specifically described. The use of **disjunction**, 'or', is important and it requires the existence of a true negative, the 'not', as well. The system may have to perform **default reasoning**, dealing with uncertain or incomplete information, or **fuzzy logic** operations that deal with vague information.

As shown above, some extensions to the basic FOL are desirable to express modalities. In particular we will want to know what is logically **possible** and what is logically **necessary** in most textual representations. For a knowledge base of legal information, **deontic** operators are essential. These represent the degree of obligation involved in a given rule. As well as modalities, FOL fails to accommodate some other examples of human expression, among which the following are often considered useful: intensional reasoning, verb tense, knowledge, and belief, and the precise meaning of such words as 'only', 'more', and 'most'. Decisions regarding the need to represent any of these must be based on practical design conditions in the individual system.

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[14]''It is called *first-order logic* because the range of quantifiers is restricted to simple, unanalyzable individuals. Higher-order logic also allows function symbols and predicate symbols to be governed by the quantifiers.'' (Sowa 1984, p. 386)

[15]For example, it should be possible to write correctly in the formal language that ''Two students read three books.'' This means either that two students *each* read three books, or that two students read three books between them. It might be nice to know in the first interpretation whether or not the students each read the same three books, but then again it might not be significant in view of the task to be performed.

The linguistic component, the other element of kr, deals with the expressive quality of the formal language. Many people consider FOL inadequate for the translation of natural language. **Predicates** in FOL take only simple elements as arguments.[16] Higher-order logics are required in order to accommodate sets and subsets as arguments. For the present, since the capability of dealing with higher-order logics is relatively undeveloped in this work, the kr is restricted to near-FOL usage. The choice of predicates is most important for clearly expressing the ideas in a text. Multiple senses must be recognized and properly dealt with in order to avoid ambiguous interpretations later. The goal is to make sense of words and to make sense of sentences.

There is an important decision to be made here as well about which kind of predicates to use. The choice ranges from ‘parsimonious primitives’ to ‘promiscuous plenty’.[17] On the parsimonious end are the Schankian primitives, fourteen in number, which are used to express the whole of human cognition and are thought to be adequate to the job (Schank and Abelson 1977). When primitives are used, knowledge is generalized. It is possible to make some inferences with primitives that could not otherwise be negotiated, however, the reduction in expressiveness is obviously significant. At the other extreme are the KRL-type systems (Bobrow and Winograd 1977). We are even considering representations that allow pieces of natural language text to appear in the formal language. However, most representations fall somewhere in the middle of the range.

When dealing with legal text it is possible to get some additional help from the legal **sublanguage**, the technical language of the law, which is clearly defined and commonly used with unambiguous meanings. However, there is the problem of properly representing many **open-textured concepts**, ideas that are incompletely defined and that change their meaning over time, as, for example, **contractual intention**. Such concepts must be represented as **natural kinds** having different roles at different times and in different places.

A system to be used for information retrieval will be geared to the level of anticipated questions. The representation must be capable of making the necessary distinctions but must avoid making additional

[16] Sowa describes a predicate as, ‘‘a function of one or more arguments whose range is the set of *truth* values, {**true**, **false**}.’’ (Sowa 1984, p. 380). For example, *eats(fox, chicken).*

[17] As described by Eduard Hovy, personal communication, Feb. 2, 1990.

superfluous ones. Legal problems are more difficult than most because they have as Gardner noted (1987, p. 15), different levels of detail. The representation language must, therefore, be particularly adaptable to change in the level of detail. There must be the appropriate level of modification required for suitable precision in some instances. Conversely, there must be enough subsuming levels to be able to represent the information with the required degree of generality.

Developing a kr suitable for conceptual retrieval thus requires consideration of a number of factors. There is no consensus as to the best kr or even the best type of kr. The nature of the domain will determine how the decisions about level and formality should be made. Clearly it need not be as expressive a representation as those used for language generation, but it will need to be more expressive than a keyword or index representation. It will be necessary to consider **metaknowledge** too, the knowledge the system has about its knowledge base, and **control** knowledge, the knowledge the system has for its own operation. Since any knowledge base is necessarily incomplete, not representative of all the world's knowledge, **defaults** are necessary to fill in where there is insufficient information. This is but a brief outline of the basics.

In the long term it is to be hoped that kr will become automatic with the acquisition of text by a system, and that answers containing information will automatically be generated in natural language. At present, this brief description gives an indication of the degree of complexity it is necessary to deal with in attempting to accomplish a part of the ideal, a simple IR system in which the basic requirements of **matching** can determine when the truth condition of one sentence is implicit in another, with a guarantee of **uniform substitution**, that is that the value of *x* is always replaced by the same value in **unification**. We are willing to relax requirements for **completeness** and **satisfiability** in the interest of practical retrieval. Using a kr, we are, therefore, able to accomplish more powerful and varied information retrieval operations, in particular we are in a position to attempt conceptual retrieval.

2.3.1.1. Kr for conceptual retrieval

Since 1975, conceptual retrieval has been of interest to many researchers in kr. However, there is a variety of notations and of structures used in implementing systems. A preferred kr has not yet clearly emerged.

Roger Schank (Schank 1975; Schank, Kolodner and DeJong 1981) was explicitly concerned with semantic analysis and conceptual retrieval. His **conceptual dependencies (CD)** constitutes a notational variant of FOL. He analyzed text into **semantic primitives;** that is, he reduced language to a few seminal concepts and recombined them to represent the knowledge in the text. The use of primitives in language analysis is subject to all the philosophical questions relating to reductionism. For example, there is the question of whether or not it is really possible to break cognitive objects into smaller units without changing their nature. It is possible that there are some entities, like linguistic objects, that, when functioning normally have something that is lost when they are reduced to smaller components.

Schank combined his representations in larger structures called **scripts** that resemble the frame structures to be discussed below (§2.3.1.4). They are a kind of **prototype** based on **causality.** They have a time-sequencing aspect not evident in other complex-object-representing structures. Scripts made it possible to analyze narratives.

Sowa's work (1984) on **conceptual graphs** was also motivated in part by interest in retrieval applications. His kr is an attempt to expand the capability of FOL and to make an accessible notation based on C.S. Peirce's visual logic (Peirce 1987–1906, 1960; Roberts 1973) for semantic analysis of natural language. Sowa's graphs were presented in terms of 'cutouts' or templates to represent logical connections. There is a linear format that allows for the representation of more complex expressions. Conceptual graphs include direct extensions for modal and higher-order logics. More will be said about conceptual graphs in chapter 4.

Thorne McCarty has been developing a representational language for use with legal text which looks promising, but as yet lacks some of the capability we require for a rather coarse grained representation. (McCarty 1989). An analysis of kr suitable for conceptual retrieval in law was written by Cross and de Bessonet (1985). They reviewed the strengths and weaknesses of representations in the AI systems and discussed the difficulties of manipulating representations of legal concepts.

2.3.1.2. Frames

Frames are a structuring device for representing knowledge and are especially useful for organizing detail about complex objects. They were introduced by Marvin Minsky in 1975. The original idea was based on vision, and Minsky attributes the concept to psychologist F.C. Bartlett (Minsky 1986, p. 259). Minsky did not describe how he thought they could be implemented;[18] they were simply a result of his insight into cognitive activity. He understood them as a way of representing the cognitive action of adding new knowledge to a framework of already familiar knowledge.

Many kr systems and notations have since been developed that are based on Minsky's original idea. Most frame systems are essentially equivalent to FOL. in their expressiveness, but gain computational agility from the structure that frames impose.

A frame may be described as a prototype of a concept. Each frame describes either one individual object, a **token** or **instance,** or the concept of one **type** of object. A frame contains a number of **slots**, each with a name designating the type of information it holds. It is the hospitable nature of the slot that makes the frame particularly adaptable. A slot will welcome almost any type of value: declarative information, procedural attachments, components of objects, restrictions on types, inheritance constraints, default values, and even pointers to other frames. A slot, unless otherwise restricted, may contain a set of values rather than just a singleton. For example, a frame describing a computational linguistics (cl) student, Felicity Sparkle, might look like that shown in figure 2.1.

Felicity is one of a group of students and shares many characteristics with them. The frame for the group of cl students could look like that shown in figure 2.2. All the details specified in the frame for the type will automatically apply to each instance as well and need not be repeated in the instance frame. Such properties are said to be **inherited.** As well as inheriting such properties, the instance frame will include additional values for slots that are unspecified by the frame for the type.

[18] Minsky himself says that he was as explicit as was necessary, ''The essay influenced the next decade of research on Artificial Intelligence, despite the fact that most readers complained that its explanations were too vague. In retrospect, it seems that those explanations were at just the right level-bands of detail to meet the needs of that time, which is why the essay had the effect it did. If the theory had been any vaguer, it would have been ignored, but if it had been described in more detail, other scientists might have 'tested' it, instead of contributing their own ideas. . . Instead, many versions were suggested by other people. . . Two students in particular, Scott Fahlman and Ira Goldstein, claimed to understand what I had meant—and then explained many details I hadn't imagined at all.''(Minsky 1986, p. 259)

Frame:	instance#3
isa:	cl-student
name:	Felicity Sparkle
login:	sparkfel
phone:	978-6666
degree-sought:	phd
degrees-held:	B.Sc., M.Sc.
nat-lang:	English, French, Sarcee
comp-lang:	Prolog, Turing,
courses:	complete
depth-paper:	complete
depth-oral:	passed
proposal:	complete
topic:	An appealing approach to parsing Athapaskan languages automatically.
etd:	1992

Fig. 2.1. A frame describing a token, a cl-student.

So far our frames seem to be static data structures, not much different from records subdivided into fields. However, there are some important differences.

Frame:	type#5576
typ-name:	cl-student
department:	computer science
supervisor:	Graeme Hirst
research:	nlu, mt, ir, cai
assoc:	NLU group
meet-when:	Thurs. 3:00
meet-often:	biweekly
meet-where:	SF#3207
e-mail:	ai.toronto.edu
name:	
login:	
phone:	
degree-sought:	
degrees-held:	
nat-lang:	
comp-lang:	
courses:	
depth-paper:	
depth-oral:	
proposal:	
topic:	
etd:	

Fig. 2.2. A frame describing the type, cl-student.

The first difference is that, as we saw, Felicity can **inherit** the characteristics of the cl-student type. For example, although she has her own phone number, she shares an e-mail address with the other members of the group. The e-mail address data is entered in the system only once for all the members of its group. Felicity inherits the address from the group frame. It would be possible as well to enter a special separate e-mail address for Felicity, if she had one, but she hasn't. Therefore, she takes the group e-mail address by **default** to fill in the incomplete knowledge in her own frame. It is possible to extend the use of inheritance further by **transitivity**. Suppose there is a type, 'stud-type', defined for 'students' (figure 2.3). Felicity inherits the values of the slots in the 'stud-type' type as well. She, like all the others, must pay fees and must be registered. However, some of the information may be overriden in specific cases. For example, if Felicity is a teaching assistant (TA) she will almost certainly receive a salary. If such information is given for her, it will override the inference from 'stud-type' that her salary is 'nil'. And it might be stipulated that a slot is not inherited at all. As a TA, Felicity will be a part of yet another group, and we may expect that she will receive the stated salary for TAs to be determined by following the paths through the network of frames allowing **multiple inheritance** from another **subsuming** frame, in this case for TAs.

As well as representing complex factual information at multiple levels, frame systems can represent **aggregates** and **components**. We have seen how Felicity was described and her group was described. It is possible in the same way to describe an event, for example, a contract, in one frame, and to describe a particular aspect of that contract, say a penalty clause, in great detail in another frame. The penalty-clause frame will be linked to the contract frame by a relation normally designated **part-of**.

All the frames discussed so far have contained **declarative** information. But, it is also possible to attach **procedural** information to a frame. For example, somewhere in the system, there would be a frame

Frame:	type#30
typ-name:	stud-type
criterion:	registered
prerequisite:	hs certificate
requirement:	pay fees
status:	citizen or visa
salary:	nil

Fig. 2.3. A frame describing the type, student.

carrying registration information about Felicity. It would certainly have her date of birth, but probably not her age. The registration frame could point to an algorithm that calculated a student's age, as of a given date, but worked only when called upon. We would be able to match Felicity's name or student number and get her age promptly upon request, without the system wasting memory by storing the ages of all students, or wasting time calculating ages that were not required. A particularly common procedural attachment is an 'if-added' procedure that defines slot constraints for that frame and helps to control changes to the knowledge base as additions of instances of that frame are made, for additions necessarily affect the relations and the state of knowledge in the system. There is the problem of finding the appropriate frame for the information. Most successful methods are adaptations to failures. Such procedural attachments can be used for many purposes: reasoning, structure control, and avoidance of data duplication are among the most common.

The frame network has another interesting search capability derived from **failure analysis**. Suppose an attempt is made to match an instance to a given concept. If it matches in many respects, but varies in one, the system has been alerted to some useful information. It is possible that a cl-student does not exactly fit the bill. For example, Roger may have another supervisor, and still be a member of the cl-student group. The **exception** will be noted in the course of matching Roger's frame at the time of installation. With this ability, a system will be able to tell whether or not Roger may still be subsumed under the cl-student type. In this case, he probably would be, but if, for instance, his 'assoc' was numerical analysis he would not be an exception but a mismatch; he would be fitted in under another subsumer.

Frame structures offer potential utility for powerful IR. For instance, it is clear that complete matches are not required. If we are able to get to Felicity's frame, or to get to one of the subsuming frames, we can follow the path created by our search decisions to get much more information about her. The internal structure of the information established by the relations is particularly useful in solving problems with more abstract concepts, and more complex associations, a process similar to constructing arguments. When an attempted match is not successful, other associated frames are tried until a match is achieved or the attempt is abandoned. This arrangement has greater retrieval potential than a conventional database.

So far I have discussed applications reminiscent of data processing. Now let us look at the language analysis advantages of using frame-based systems. Each sentence can be represented by a frame, in most applications. The predicate of choice is the main verb of the sentence, the other sentence elements fall into place in their appropriate slots. As each sentence is a structured object, as was Felicity, so larger semantic patterns can be inferred from the relations among frames, as were data inferred about Felicity.

Different senses of the same word, denoting distinct concepts, can be represented by variant frames. Even more important, we are not restricted to matching lexical symbols character for character; we can search for further information in order to differentiate the senses and locate the most appropriate concept. As we saw above when following the chains of inferences about Felicity, it was possible to make implicit knowledge explicit—Felicity as a cl-student had Hirst as her supervisor. It is often possible by following such chains to determine the intended sense of a word in context. For example, if a question were being asked about ‘bolts’ we would be able to determine very quickly whether the correct interpretation was related to weather, security systems, or textiles. This method was developed by Hirst (1987) as part of his Polaroid Words system for lexical disambiguation.

Inference improves simple matching algorithms and allows us to introduce new assumptions. It would be possible to determine that a penguin is a bird in a system describing birds. At first, penguins may be listed as an exception to the rule that birds fly; but in fact penguins do fly under water. Knowing this adds another facet to the concept of ‘fly’, a new assumption that broadens our knowledge. Recall that Minsky conceived of frames as adding additional knowledge to what is already familiar.

It is important to be able to access the components of a frame. There are a number of indexing approaches, the implementation of which are discussed in detail by Charniak (Charniak, Riesbeck and McDermott 1980; Charniak and McDermott 1985). They show how the property-list data-as-program features of the programming language Lisp make it a particularly suitable implementation language. It is also possible to describe frames in a straightforward manner in the logic programming language Prolog (Clocksin and Mellish 1981).

In summary, frames may be regarded as prototypes. A frame may carry the description of an instance or of a generic type. Either way, the frame represents the information only once. There is no duplication as there is in the field-record structure of information retrieval systems or in the tuples and entity-property organization of DBMS organizations. Frames are suitable for representing complex information associated with entities and associations in linguistic representations.

2.3.2. Natural language processing

Text processing, the appropriate designation for the work done in constructing a retrieval system, is subsumed under natural language processing. In AI, 'natural language' means dealing with the full range of English as it is appears in the source. Language analysis problems have been treated as secondary to logic problems in the development of kr. The problems with language processing are almost overwhelming (Winograd 1983; Allen 1987). Our knowledge of how language works is still limited. We can, at present, understand only a subset of the problems with the help of linguistic theory. The apparently strong early start associated with the work of Winograd (1972), which provided a false hope of early results, was followed by more fruitful work on speech acts (Cohen and Perrault 1979), anaphora and referents, discourse analysis (Brady and Berwick 1983), and a number of other problems; a useful survey is given in Grosz, Sparck Jones, and Webber 1986.

2.3.2.1. Case grammars

The most successful knowledge representations that have been developed with regard to language processing are strongly rooted in an understanding of linguistic **case** theory, (Fillmore 1968, 1977; Bruce 1975; Somers 1987; Cook 1989; Haas and Metzer 1989). Sentences with different syntactic relations may be analyzed to show similar deep structure. For example, the following sentences with different syntactic structures share a single meaning.

(2-1) John broke the rock with the hammer.
(2-2) The hammer broke the rock.
(2-3) The rock broke.

The semantic value of each noun phrase remains the same. The rock is always the object of broken. John instigates the breaking, using the hammer as his tool in (2-1). And in (2-2), the hammer is still the tool, although John is not mentioned. Case grammars can be used in analyzing and representing the *sense* of a text. For example, recall Chomsky's sentence pair (1-4) and (1-5),

(2-4) John is eager to please.
(2-5) John is easy to please.

The substitution of 'easy' for 'eager' changes the **case structure** of the sentence as John becomes the object of the verb 'please' rather than the subject. As Hirst explains it,

> In its most basic form, case theory views a sentence as an assertion whose predicate is denoted by the verb of the sentence and whose arguments are denoted by the noun phrases. (1987, p. 7)

A case analysis makes it clear how each noun phrase in a sentence relates to the verb. In the example above, if John is *eager* to please, he is the **agent** of the verb 'please', the one who is doing the pleasing. If John is *easy* to please, he is the **experiencer**, the one who is being pleased by some unspecified agent. Cases such as 'agent' and 'experiencer' have been called **deep cases**, indicating a representation of the meaning of the sentence analyzed.[19] Cases are marked by prepositions and by subject, object, and indirect object positions of the sentence. Such indicators or **flags** are not unambiguous, nor is there a generally agreed-upon set of cases, although many theorists have attempted definitive lists of cases. There are, however, a number of commonly used cases which appear in most applications. Among them are **agent, patient** or **experiencer, instrument, dative,** and **locative**. The agent case describes the instigator of an act. In more recently devised systems, the instigator may be either animate or inanimate, though in early systems it was required that it be animate. The **patient** or **experiencer** is the entity that receives the action of the verb. The experiencer was originally associated with psychological verbs, such as 'enjoy', that have some distinct peculiarities; however, it has since been more broadly used. **Object** is a more general term covering a range of syntactic phenomena somewhat broader than the other two, but certainly encompassing the same territory. In recent years, **theme** has been used to express the carrying out of the verb's activity. Theme is understood to represent most often the old objective case, but may be the subject or something else, depending on the semantic impact of the verb. The other characteristic that makes use of theme distinctive is that most proponents allow the attachment of both theme and another case to a single noun phrase.

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[19] This use of the word 'case' has nothing to do with its legal sense. Sometime later on, we will see both senses used in a single sentence; it will be clear from the context which is which. This provides an excellent demonstration of the problems of language understanding.

The **instrument** case describes an entity used in accomplishing an action. The **dative** case represents the indirect object involved in an action, and the **locative** case has to do with place in relation to the verb. However, the relationship between surface and deep structures in case-based representations depends on the system and varies greatly. It is clear, however, that cases represent a mixture of syntactic and semantic analysis. In a given utterance where the syntax differs, case grammars show the similarity in meaning. Where there is syntactic similarity, semantic differences are shown.

Research over the years has not determined a best set of cases or a standard one. No set used seems to satisfy all the needs in accommodating linguistic forms. Normally a set of cases is chosen and adapted as needed to analyze the text or language at hand. In chapter 5, we will discuss a sophisticated, fine-grained case system especially suitable for the analysis of text.

2.3.2.2. Case-slot organization

The problem of developing a good kr is intimately connected with language analysis and of course with understanding. The relation between language and frame representations centres on case analysis. With the combination of frames and case grammar, it is possible to devise a kr that accounts for some of the semantic-syntactic features of language.

The degree of correspondence between the case analysis of a sentence and a frame representing the verb of the sentence is the basis of **case-slot identity theory** (Charniak 1981). In its strongest form, this theory states that, when a sentence is represented as a frame, the cases of the sentence should be mapped one-to-one to the slots of the frame. In the minimal version of the theory, each verb is idiosyncratic as to the cases it admits. The cases must be mapped to the available slots in each instance; there is *no* regularity or pattern of co-occurrence. In the developed version of the theory, there are a number of (unspecified) typical case-selection patterns that relate cases to verbs that might be used to establish rules for the regular co-occurrence of slots with those verbs. The case-slot identity theory is supported by the evidence that there are groups of verbs that behave similarly to each other, for example transitive and intransitive groups. Other verbs, such as the psychological verbs mentioned above, may be grouped according to semantic significance and may be arranged hierarchically. The advantage of the hierarchical arrangement is that slots (and hence the corresponding cases) may be inherited. In the hierarchy, the upper levels containing the more general terms have very stable, well-established patterns of case occurrence, while the lower-level verbs have less stable patterns. Some have required slots in addition to those inherited; some override their inherited slots. The lower level verbs have less stable patterns. Charniak contends that this arrangement obviates the need for a uniform set of cases—something linguists and computer scientists have failed to develop.

Although there is evidence to support the case-slot identity theory, there is also evidence against it. A potential counter example that may be turned in its favour, as Charniak points out, is the commonality of the frames for ‘buy’ and ‘sell’.[20] What distinguishes them is how the cases map into the slots. In the sentences

(2-6) Fred sold the car to Joe.
(2-7) Joe bought the car from Fred.

Fred is the source in both sentences, and Joe is the destination. But, in (2-6), Fred is also the agent, while, in (2-7), Joe is the agent.[21] Just knowing who is the agent is not enough. Knowing who is the source is a part of the picture too. Clearly more information needs to be represented than previously assumed by case-frame users.

The upshot of all this is that we have a lucid picture of the functional operation of case-slots in a network of frames, their strengths and weaknesses. Sowa’s conceptual graphs (1984) may be used in a case-oriented way. The developmental work of Hirst (1987) derives some of its strength from reliance on case analysis.

2.3.3. Sublanguage

The language of law is distinctive in both syntax and semantics. It is in effect a **sublanguage** of English. The seminal article on sublanguage analysis or, as it was previously called, analysis of language in a limited domain was Harris’s *Mathematical structures of language* (Harris 1968). There has recently been a resurgence of interest in sublanguages, as seen in the following collections: Britton and Black 1985, Grishman and Kittredge 1986, and Kittredge and Lehrberger 1982. The characteristics of language used in law

[20] The two verbs, ‘buy’ and ‘sell’ are used here in their natural language or everyday sense, rather than as legal terms.
‘Agent’ is used here as a linguistic case. It does not have the connotation of ‘agent’ in the legal sense.

cases have been of interest to a number of different groups related to law and computers for years (Mellinkoff 1963; Dickerson 1965; Sprowl 1979; Charrow, Crandall, and Charrow 1982; White 1985).

The value of recognizing sublanguage characteristics in representing text is to reduce instances of ambiguity by specifying constraints on meaning. Some syntactic characteristics of the language of the law have been identified (Dickerson 1965). Among them are the commonly recognized examples of embedding clauses in multiple layers and using two-noun phrases that emphasize meaning, such as ‘fair and reasonable’ and ‘known and communicated’. But in law, as in other distinctive domains, syntactic variation itself has not proven to be especially helpful in disambiguation of sublanguages.

Rather, the most distinctive feature of sublanguages is word selection, and it is this that appears to be the most useful in disambiguation. Characterizing word groups, specifically noun classes, with regard to their contextual use is a start. The difficulties arise in using the sublanguage of law. They come up, for example, in trying to distinguish clearly the technical use of a particular noun or group of nouns commonly used in everyday language. Other problems are involved in the use of language, sometimes with intentional vagueness to allow for broad interpretation. Finally, there are the problems of the changing meanings for specific terms (a phenomenon of historical growth) and of open-textured concepts that change as the ideas they represent become more clearly defined as cases.

2.3.4. Argumentation

Work on rhetorical reasoning began, of course, with Aristotle *(Topics, The rhetoric)* and Plato *(Phaedras, Georgias).* Emphasis was placed on the oratorical element for many years after that. The oratorical element had to do with style in speaking, which was then related to written language. In recent years, interest in the analytical element has reawakened; see, especially, Perelman (1963) and Perelman and Olbrechts-Tyteca (1969).

Stephen Toulmin (1958, 1972) followed in the same tradition. He constructed a model of argument that has been demonstrated as applicable to law (Toulmin, Rieke, and Janik 1979) and, furthermore, has received favourable notice from members of the profession.

> The model of reasoning which is closer to what is actually engaged in, especially at the appellate level, and the model which is the most adequate for the purpose (and, I think ought to be used) is what some call the

'good reasons' approach (particularly identified with Stephen Toulmin). (Blackstone 1971, p. 234)

In addition, a recent attempt has been made to combine the model with a Montague grammar (1973) to produce a computable formulation for arguments (Brkić 1986).

The work of the argumentation theory writers, as opposed to the rhetoricians, is concerned with dialogue and with the cognition of sender and receiver. Among them are Brockriede (1975), Cherry (1978), and Hample (1979). Similarly, Birnbaum's talks about with a functional form of argument (Birnbaum, Flowers, and McGuire 1980; Birnbaum 1982). However, arguments in law cases are the reported reasons for decisions. They are not transcripts of the presentation of the argument from both sides. Argumentation theory is not suitable for the analysis of decisions.[22] The rhetoricians' analytical approach that focuses on the persuasive reasoning techniques appears to be better suited. In it, an argument is taken as a unit and analyzed in section. I chose their perspective as more appropriate for case analysis than that of the argumentation theorists whose focus is on the dialogue between opponents. Toulmin's model will be presented in detail in §6.6.

2.3.5. IR and AI

To sum up: information retrieval research currently focuses on the problem of providing better user interfaces and more efficient versions of the accepted processes. Information scientists, particularly those interested in statistical analyses, have seldom looked at conceptual analysis and information retrieval. The present expenditure of research energy on the largely subjective opinion surveys and user studies distracts attention from problems inherent in the systems. Although user satisfaction is the ultimate goal, a highly significant advance could be made in information science by improving the system itself and providing a strong foundation for better IR.

Recent progress in AI indicates that both reasoning and language analysis are possible. Admittedly, reasoning and language analysis do not perform well in high volume operations, but with complex problems it is often necessary to progress a little at a time. There is no indication that AI research is stalled at

[22] Alvarado's recent work (1990) on argument comprehension is heavily influenced by this work. Although he mentions application to legal matters, the work generally deals with editorial opinions. Alvarado uses argument units for organizing patterns of belief relationships.

any logical or mathematical limit.

The following chapters will demonstrate that building a conceptual retrieval system, capable of giving information about a given question, is quite possible. We will show that having a legal information retrieval system, sensitive to the structure of argument and ultimately adaptable to legal reasoning is possible. In this first stage the kr, based on linguistic case analysis and Sowa's conceptual graphs, will be especially tuned to the nuances of legal language. However, it will be shown that the technique is suitable for adaptation in other domains. Moreover, although it has not been explicitly stated in this research, it is assumed that eventually the target representation would be constructed automatically and that ultimately answers would be generated in English.

This research is not intended to prove that such a large job can be done. It is intended only to show that, so far as we have been able to adapt an AI technique, conceptual retrieval, to information retrieval, a much better product can be produced and significant advances in system design can be anticipated.

CHAPTER 3

Contents of the knowledge base

3.1. Introduction

The goal of this research is to retrieve information rather than to do legal reasoning, or to advise the layman. The domain chosen is law because there is need for improvement in legal information retrieval.

Legal literature presents a number of interesting challenges on its own, but also shares the characteristics of other literatures from which information is retrieved automatically. For example, legal literature, like chemical literature, deals with precise but complicated facts in technical problems. It shares with education the characteristic that everyday terms can have technical meanings. And law, like political economy, has abstract principles—some of them named, some of them not—that are used in more than one type of situation and might be retrieved by describing such a situation. Legal literature may be taken, therefore, as an example of technical literature. There is no inherent reason why results from information retrieval research using legal literature should not be applied to information retrieval (IR) in general.

Within legal literature, law cases rather than statutory instruments have been chosen as the subject of study, because of the language problems they present in retrieval. Moreover, the volume of case law to be searched, in comparison with the volume of statute law, is tremendous. Statutes are meticulously drafted and their precise, carefully chosen vocabulary aids retrieval. The subdivision of statutes into sections and subsections makes referencing easier and helps to keep the flow of discourse orderly. Statutes lend themselves to the construction of logical knowledge representation (kr) and to efficient search. Statutes deal with situations that have become problematic in our society. The passing of a statute is an attempt to keep life orderly.

In contrast, cases are idiosyncratic. They are more difficult than statutes to work with because the language is less technical, less regular. The style, choice of words, and type of argument are different from case to case, like everyday, natural language text. Moreover, each case records the reasoning of a judge or judges. The reasoning may be readily accessible or rigorous and difficult to apprehend. Within the cases themselves, there is limitless variety in the situations recounted, as there is in human experience.

The specific domain is contract law. It has been chosen because of the clarity of its concepts and precise language in relation to other types of law. Furthermore, contract law is reasonably simple at the start, and later becomes more complex. It affords the opportunity to begin with an apparently simple problem and then to progress to more complex ones. For instance, contractual agreements are familiar to everyone. However, the problems of third parties to the action, and of contract **remedies**,[1] especially **equitable** ones, are more complex. Contract remedies decisions would be a good source of more difficult problems for use later. A conceptual retrieval system for simple cases may be a start.

The cases chosen have been taken from a casebook by Milner (1985). A casebook, a text used for the instruction of student lawyers, was chosen as a source in order to guarantee the selection of substantive cases with a minimum of text. This casebook contains, in some instances, complete case reports and, in others, pithy excerpts from cases. However, because the book is a teaching instrument, each case or case excerpt is sharply focused on a particular problem. Furthermore, each is edited to exclude extraneous material. Similarly, the kr will focus on the foremost issue and argument of each case presented.

3.2. Which cases?

Each of the cases presented contains at least one **issue;** some have more. The issue of determining whether or not there is ‘‘contractual intention’’, that is the ‘‘intention to create legal relations’’, is the focus of the first three cases. The final case deals with the issue of **remoteness of damages**. In it the contractual intention is known to have existed and the contract was completed; it is the **breach** of the contract and its consequences that are the subject of concern.

Although the cases are related in subject, the language used varies because of the diverse characteristics of the cases themselves. Three of the cases are British and one is American. Different judicial levels are involved in each. The first two cases are trial decisions, the others appellate. The appeal in the last case was held in the Exchequer Court (U.K.), whose jurisdiction includes matters of trade and commerce.

[1] Boldface is used to introduce technical legal terms; these are explained in Appendix B.

Finally, the cases range over a long period of time, 1605 to 1942. As a consequent of all these variations, the cases chosen exhibit a broad range of linguistic expression, as might be expected.

In order to focus attention on the difficulty of handling language problems, the cases were also chosen for ease of comprehension. Cases with reasonably simple fact situations, involving everyday matters, were chosen. None of the cases has an unduly complex story line, although in the last two, temporal relations may require some concentration.

Moreover, the cases involve legal concepts that are interconnected. They display the development of some legal concepts in a natural way. I will present them below in the order which shows the development of the themes they express. The first three cases appear in the order in which they are presented in the casebook. The last is quite different and appears in another section of the casebook but is related to the others as will be shown below. (A full exposition of each will be given in §3.3.)

The first two cases, *Weeks* v. *Tybald* and *Stamper* v. *Temple*, deal with simple factual situations in which a determination was made as to whether or not the respective defendants intended to create legal relations. There is no true argument in the text of these cases. There is only a decision on the facts, with skeletal reasons being given for the decision in each. As it turned out, the 'contract' discussed in each of these cases did not come into existence.

The next case, *Upton-on-Severn Rural District Council* v. *Powell*, involved a more complicated situation. Again at issue was defendant's intention. However, a full-fledged argument was presented in this instance. It was in fact a controversial argument, one that has not been accepted in Canadian law.[2] The problem concerned a payment for service. As it turned out, the contract was inferred. Other underlying issues concerned **mutuality** and the possibility of **unjust enrichment.**

The fourth and final case, *Hadley* v. *Baxendale* is an established precedent that has been followed repeatedly for over a hundred years. *Hadley*, in contrast to the others, deals with a performed contract, and a contract which was breached. Intention to contract was clearly not at issue. The problem deals with remoteness of the damage, the proximity of the breach to a significant loss of profit. The argument in this

[2] ''Case and comment'' (1942) 20 C.B.R. 557.

case was fully developed. Unlike that in *Upton*, it is respected for its quality. In the previous cases, the tests for intentionality were objective. In *Hadley*, both objective and subjective tests for intention to do damage in connection with the breach are described. Also, where *Upton* dealt with only a service contract, *Hadley* involves a typical commercial contract with the associated protections.

3.3. The cases

This section presents the details of each of the four cases that will be represented. For each, the text of the decision from Milner (1985), is presented followed by a brief discussion.

3.3.1. *Weeks* v. *Tybald*. (1605) Noy 11; 74 E.R. 982

The case of *Weeks* v. *Tybald* (figure 3.1) involved the determination of whether or not there was intention to contract. Tybald, a father in 17th-century Britain, anxious to ensure his daughter's future security, made a statement publicly that he would give £100 to any man who would marry his daughter, so long as he himself consented to the marriage.

A young man, Weeks, and his father heard the statement. Weeks, in due course, married the Tybald girl with her father's consent. Weeks then proceeded to claim the £100. Tybald would not pay. The case does not mention Tybald's statement in his own defence. We may assume that he claimed his remark was not made seriously and that he had *not intended* to make a contract.

The decision was made in Tybald's favour. The judge's reasons were firstly that Tybald had not indicated the target of his remark. He had not directed his statement to anyone, nor indicated to whom he was speaking. The second reason was that the words were general, and vague. They were said to have

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In this case it would appear that the plaintiff or his father was told by the defendant, whose daughter the plaintiff later married, that he would give 100 pounds to him that should marry his daughter with his consent.' Held, for defendant. 'It is not averred nor declared to whom the words were spoken, and it is not reasonable that the defendant should be bound by such general words spoken to excite suitors.'

Fig. 3.1. *Weeks* v. *Tybald* (Milner 1985, p. 268)

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been spoken to arouse the excitement of potential suitors.

It may be argued that a spur of the moment statement could not arouse interest as an offer. Nevertheless, the judge found that it was not reasonable for D to be ‘bound’ in the legal sense. That is, the judge decided that D’s actions did not bind him legally. In short, there was no contract. There was no contract, because the facts, D’s actions, did not indicate an intention to contract.

Implicit in this discussion is the legal concept of **offer**. However, the word ‘offer’ is not mentioned in the case. A technical discussion of what constitutes an offer does not ensue. Nonetheless, Tybald’s statement holding out the £100 to a prospective son-in-law might arguably have been an offer.

It appears that what in fact happened was that the father, anxious to have his daughter married, made his statement perhaps in exasperation. Perhaps he wanted one of the young men to make an offer of marriage. Perhaps he wanted apparent suitors to press their suits with greater vigour. Perhaps he intended to hold out the prospect of good fortune to a future son-in-law. He did not intend to make a payment of £100 on the marriage of his daughter. In short, his statement was just a bit of a blow off.

3.3.2. *Stamper* v. *Temple*. (1845) 6 Humph. 113 (Tennessee).

In the next case, *Stamper v. Temple* (figure 3.2), the fact situation is similar although the period and the locale are quite different. The trial took place in 19th-century Tennessee. D, Temple, having been injured by some unknown person or persons, offered a reward of $200. The reward was to be associated with the arrest of his assailants. Presumably it was for proffering information leading to their arrest. Once again, the ‘offer’ was the important evidence in the decision. The ‘offer’ was called ‘‘an expression of his

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TURLEY, J.: ‘‘We are constrained to believe that what is called an offered reward of $200. was nothing but a strong expression of his feelings of anxiety for the arrest of those who had so severely injured him, and this greatly increased by the distracted state of his own mind, and that of his family; as we frequently hear persons exclaim, ‘Oh, I would give a thousand dollars if such an event were to happen or vice versa’. No contract can be made out of such expressions: they are evidence of strong excitement, but not of a contracting intention.’’

Fig. 3.2. *Stamper* v. *Temple* (Milner 1985, p. 268)

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feelings''. The statement was said to have been motivated by the emotional state in which D found himself and his family upon his being injured. Turley J. compared the offer to a **promise** in the style of ''Oh, I would give *x* amount if *y* were to happen'', which he stated was definitely *not* an expression of intention to contract. Once again, the intention of the offeror did not create legal relations.

In this case, the statement is said to be an 'offered reward'. Nevertheless, it bore the same characteristics as the 'public statement' in *Weeks*. It was a general statement, made at large, and directed to no one in particular. It was motivated by emotion and was in fact an *expression of emotion*. For these reasons, there was no intention to contract apparent in either of these cases, according to the respective judges.

The judges' decisions were based on an objective test. The public statements were the basis of the judgement. The crux of the determination was the meaning as understood by an undesignated hearer or hearers as to whether or not there was contractual intent. Furthermore, D, the 'offeror' was the one who sought to deny that a contract existed.

Like *Weeks*, the *Stamper* case was a judicial decision on the facts. It was determined that the facts show no intention to effect a change in legal relations. The law was not argued, but the principle is established that intention is a necessary prerequisite to making a contract. Note that the essential parts of a contract including **offer, acceptance,** and **consideration** were not discussed. The intention to contract is an essential since it determines whether or not a contract exists.

3.3.3. *Upton-on-Severn* v. *Powell*. England. Court of Appeal. [1942] 1 All E.R. 220

In the case of *Upton-on-Severn Rural District Council* v. *Powell* (figure 3.3) an appeal case, the respondent (R), the District Council of Upton, is claiming payment for fire-fighting services provided by its fire brigade. The question is whether or not there was an intention to contract on the part of the appellant (A), Powell, in requesting service.

The situation as reported was this. A's barn caught fire. He called the local Upton police inspector and asked for *a* fire brigade to be sent. The police informed the Upton fire brigade, which promptly dispatched a unit to the Powell farm. Six hours after their arrival, an officer of the Pershore fire brigade arrived at the farm. He told the Upton brigade officer that the fire was in fact in the fire district of Pershore.

LORD GREENE M.R.: The appellant lives at Strensham, and in November 1939 a fire broke out in his Dutch barn; he thereupon telephoned to the police inspector at the Upton police office and told him that there was a fire and asked for a fire brigade to be sent. The police inspector telephoned a garage near to the fire station at Upton, which itself had no telephone, the Upton brigade was informed and immediately went to the fire, where it remained for a long time engaged in putting it out. It so happens that, although the appellant's farm is in the Upton police district it is not in the Upton fire district. It is in the Pershore fire district, and the appellant was entitled to have the services of the Pershore fire brigade without payment. The Upton fire brigade, on the other hand, was entitled to go to a fire outside its area, and, if it did so, quite apart from its statutory rights, it could make a contract that it would be entitled to repayment of its expenses. The sole question here is whether or not any contract was made by which the Upton fire brigade rendered services on an implied promise to pay for them made by or on behalf of the appellant. It appears that some six hours after the arrival of the Upton fire brigade, the officer of the Pershore brigade arrived on the scene, but without his brigade; he pointed out to the Upton officer that it was a Pershore fire, and not an Upton fire, but the Upton fire brigade continued rendering services until the next day when the Pershore fire brigade arrived and took over. In the view that I take in this case, what happened in relation to the arrival of the Pershore officer and his conversation with the Upton officer and the subsequent arrival of the Pershore fire brigade has nothing what ever to do with the issue which we have to decide. The county court judge held that the appellant when he rang up the police inspector, asked for "the fire brigade" to be sent. He also held that the inspector summoned the local Upton fire brigade, which was perfectly natural, and that he took the order as being one for the fire brigade with which he was connected. It appears that neither the appellant, nor the police officer, nor the Upton fire brigade, until it was so informed by the Pershore officer, knew that the appellant's farm was, in fact, not in Upton area, but was in the Pershore area. The county court judge then goes on to find that the inspector passed on the order and sent his fire brigade, and that was the fire brigade, I have no doubt, which the appellant expected. The county court judge said:

"The defendant did not know that if he sent for the Pershore fire brigade what advantage he would have obtained. In my view, there is no escape from the legal liability the defendant has incurred. I think he gave the order for the fire brigade he wanted, and he got it."

Now those findings are attacked, because it is said that, as the defendant did not know what fire brigade area he was in, what he really wanted was to get the fire brigade of his area, whatever it might be. It does not seem to me that there is any justification for attacking the finding of the judge on that basis. What the defendant wanted was somebody to put out his fire, and put it out as quickly as possible, and in ringing up the Upton police he must have intended that the inspector at Upton would get the Upton fire brigade; that is the brigade which he would naturally ask for when he rang up Upton. Even apart from that, it seems to me quite sufficient if the Upton inspector reasonably so construed the request made to him, and, indeed, I do not see what other construction the inspector could have put upon that request. It follows, therefore, that on any view the appellant must be treated as having asked for the Upton fire brigade. That request having been made to the Upton fire brigade by a person who was asking for its services, does it prevent there being a contractual relationship merely because the Upton fire brigade, which responds to that request and renders the services, thinks, at the time it starts out and for a considerable time afterwards, that the farm in question is in its area, as the officer in charge appears to have thought? In my opinion, that can make no difference. The real truth of the matter is that the appellant wanted the services of Upton; he asked for the services of Upton - that is the request that he made - and Upton, in response to that request, provided those services. He cannot afterwards turn round and say: "Although I wanted Upton, although I did not concern myself when I asked for Upton as to whether I was entitled to get free services, or whether I would have to pay for them, nevertheless, when it turns out that Upton can demand payment, I am not going to pay them, because Upton were under the erroneous impression that they were rendering gratuitous services in their own area." That, it seems to me, would be quite wrong on principle. In my opinion, the county court judge's finding cannot be assailed and the appeal must be dismissed with costs.

LUXMOORE L.J.: I agree. GODDARD L.J.: I agree.

Fig. 3.3. *Upton-on-Severn* v. *Powell* (Milner 1985, p. 80)

The following day, the Pershore fire brigade arrived and took over from Upton. Now, Powell's farm was actually in the Pershore fire district, so, had he called the Pershore fire brigade, he would have had free service. But instead he had called the Upton police department, in whose district the farm was, and asked for help. The Upton police officer, assuming it was the fire brigade from his own district that was wanted, sent the Upton brigade, which provided service out of district. They were therefore entitled to a fee if there was a contract extant. Powell refused to pay, and Upton brought suit.

In the County Court trial, the judge found in Upton's favour, saying that a contract existed: Powell had asked for *the* fire brigade to be sent. The basis of Powell's appeal was that he, Powell, did not know what fire district the farm was in. He just wanted help in an emergency and so called the local police. Lord Greene, Master of the Rolls, decided that the Upton officer called the fire brigade he thought was indicated by Powell's request. So, A's action in calling the police was interpreted as a request to Upton fire brigade for service.

Furthermore, the Upton brigade was legally able to make contracts to sell its services. It took the Powell job, thinking that it was a free one—that is a fire within their district. Nevertheless, the brigade was allowed to charge. Lord Greene's position was that A asked for and received services. He, therefore, cannot refuse to pay simply because he did not know he would be charged. It might be argued that the Upton fire brigade thought it was providing a free service and so the service should be given freely. Greene, however, found that this was wrong in principle.

First, regarding the issue of intention, this case may be distinguished from those preceding it by the fact that it dealt with a service contract rather than a social promise. Powell did indeed ask for service. It was said that he should have found out about costs ahead of time. The critical point is the nature of the request Powell made for *a* or *the* fire brigade. Lord Greene read Powell's intention as being to obtain service from the Upton brigade, as in fact he did. The test of intention was a totally objective one—how did the action appear to the outsider, the policeman.

However, the ambiguity of the language and the ambivalence of the situation did not make it at all clear that Powell wanted the Upton fire brigade. Milner asks the reader to consider whether the decision would have been the same if Powell had pulled a handle on an alarm box and it had rung Upton instead of Pershore because of defective wiring. There is no recognition that it was an emergency situation. The promisor, A, was unable to defeat the contract by proving his lack of intent to create legal relations.

Furthermore, there was no **acceptance;** it is difficult to see an **agreement** here. At no time did Powell and the Upton fire brigade exchange any direct communication. There is a real question as to whether there was **mutuality** of the contract. It might even be argued that the case was not suitable for a suit in contract. Nevertheless, the question of acceptance relates to the case. This is a situation where an acceptance was implied. It is a particularly difficult problem to retrieve information implied or negated by omission. It is for this sort of problem that we require the capability of being able to retrieve unnamed ideas.

The question naturally arises as to who received the unpaid-for benefit, Powell or the Pershore fire brigade. The solution may lie in **quantum meruit**. It would be appropriate to retrieve the case in response to some questions regarding an action for *quantum meruit.*

3.3.4. *Hadley* v. *Baxendale*. (1854) 9 Exch. 341, 156 E.R. 145

In *Hadley* v. *Baxendale* (figure 3.4), in contrast to the other cases, there was a clear indication of intention to contract. There was an offer, an acceptance, and consideration, and, as well, the contract was **performed.** Since intention was not an issue, it was not discussed or implied. At issue was the problem of **remoteness of damages.** This trial, also an appeal, took place in the United Kingdom in the Exchequer Court in 1854. The argument was not as straightforward as were the facts. Alderson began his opinion by specifying a rule for the jury to be stated by judges in future trials of the type. The rule was that damages awarded in respect of breach of contract should be such as are considered to arise naturally from the breach. This part of the rule constituted an objective test.

If, however, there were special circumstances at the time the contract was made, and if those circumstances were communicated by one party to the other, then the damages should take into account the

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The plaintiff owned a steam powered mill at Gloucester. The shaft having broken, the plaintiff had to send it to Greenwich, near London, to serve as a pattern for the manufacture of a new one. The defendant was in the business of carrying goods. The plaintiff sent the shaft for an agreed price, but its delivery at Greenwich was delayed beyond what was found to be a reasonable delivery time. The final delivery of the new shaft to the plaintiff was consequently delayed, and the plaintiff brought an action against the defendant for the profits lost due to the mill standing idle during that period of delay. At the trial, the jury awarded a sum of money in respect of the lost profits. The defendant sought an order [a 'rule'] for a new trial.

ALDERSON B.: We think that there ought to be a new trial in this case; but, in so doing, we deem it to be expedient and necessary to state, explicitly the rule which the Judge, at the next trial, ought, in our opinion, to direct the jury to be governed by when they estimate the damages.

It is indeed, of the last importance that we should do this; for, if the jury are left without any definite rule to guide them, it will, in such cases as these, manifestly lead to the greatest injustice. . . .

Now we think the proper rule in such a case as the present is this: Where two parties have made a contract which one of them has broken, the damages which the other party ought to receive in respect of such breach of contract should be such as may fairly and reasonably be considered either arising naturally, i.e., according to the usual course of things, from such breach of contract itself, or such as may reasonably be supposed to have been in the contemplation of both parties, at the time they made the contract, as the probable result of the breach of it. Now, if the special circumstances under which the contract was actually made were communicated by the plaintiffs to the defendants, and thus known to both parties, the damages resulting from the breach of such a contract, which they would reasonably contemplate, would be the amount of injury which would ordinarily follow from a breach of contract under these special circumstances so known and communicated. But, on the other hand, if these special circumstances were wholly unknown to the party breaking the contract, he, at the most, could only be supposed to have had in his contemplation the amount of injury which would arise generally, and in the great multitude of cases not affected by any special circumstances, from such a breach of contract. For, had the special circumstances been known, the parties might have specially provided for the breach of contract by special terms as to damages in that case; and of this advantage it would be very unjust to deprive them. Now the above principles are those by which we think the jury ought to be guided in estimating the damages arising out of any breach of contract. It is said, that other cases, such as breaches of contract in the non-payment of money, or in the not making a good title to land, are to be treated as exceptions from this, and as governed by a conventional rule. But as, in such cases, both parties must be supposed to be cognizant of that well-known rule, these cases may, we think be more properly classed under the rule above enunciated as to cases under known special circumstances, because there both parties may reasonably be presumed to contemplate the estimation of the amount of damages according to the conventional rule.

Now, in the present case, if we are to apply the principles above laid down, we find that the only circumstances here communicated by the plaintiffs to the defendants at the time the contract was made, were, that the article to be carried was the broken shaft of a mill, and that the plaintiffs were the millers of that mill. But how do these circumstances shew reasonably that the profits of the mill must be stopped by an unreasonable delay in the delivery of the broken shaft by the carrier to the third person? Suppose the plaintiffs had another shaft in their possession put up or putting up at the time, and that they only wished to send back the broken shaft to the engineer who made it; it is clear that this would be quite consistent with the above circumstances, and yet the unreasonable delay in the delivery would have no effect upon the intermediate profits of the mill. Or again, suppose that, at the time of the delivery to the carrier, the machinery of the mill had been in other respects defective, then, also, the same results would follow. Here it is true that the shaft was actually sent back to serve as a model for a new one, and that the new one was the only cause of the stoppage of the mill, and that the loss of profits really arose from not sending down the new shaft in proper time, and that this arose from the delay in delivering the broken one to serve as a model. But it is obvious that, in the great multitude of cases of millers sending off broken shafts to third persons by a carrier under ordinary circumstances, such consequences would not, in all probability, have occurred; and these special circumstances were here never communicated by the plaintiffs to the defendants. It follows, therefore, that the loss of profits here, cannot reasonably be considered such a consequence of the breach of contract as could have been fairly and reasonably contemplated by both parties when they made this contract. For such loss would neither have followed naturally from the breach of this contract in the great multitude of such cases occurring under ordinary circumstances, nor were the special circumstances, which, perhaps, would have made it a reasonable and natural consequence of such breach of contract, communicated to or known by the defendants. The Judge ought, therefore, to have told the jury that, upon the facts then before them, they ought not to take the loss of profits into consideration at all in estimating the damages. There must therefore be a new trial in this case.

Fig. 3.4. *Hadley* v. *Baxendale* (Milner 1985, p. 41)

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special circumstances. This second part constituted an attempt to establish a subjective test. It was an attempt to determine the state of mind of the parties.

Alderson was dealing with the problem of the **foreseeability** of consequences. The breacher should be responsible for only those consequences of his act that he could reasonably be expected to anticipate. If the special circumstances were not communicated to him at the time of contracting, he could not be expected to evaluate their effect when he intentionally breached the agreement.

As the judge pointed out, in other legal situations where the above rule deviated from the practice, such as the non-payment of money and not making a good title to land, there are conventional rules that deal with the exceptions. Because of the existence of the conventional rules, the parties did not need the protection of the new rule he suggested. The conventional rules were said to be known to all who take part in such business ventures, and so they naturally protected themselves against the eventuality of breach of promise.

In the case at hand, the special circumstances—that the mill could not operate and there would be no profit until the broken shaft was replaced—were not communicated to Baxendale, the carrier, at the time of contracting. Furthermore, Alderson assumed that, in most cases, the delay in delivering the shaft, caused by Baxendale, would not have resulted in such an egregious loss of profits. He, therefore, could not have been expected to foresee the aggravated loss, when he breached by not fulfilling the contract with Hadley on time.

In conclusion, the judge decided that the damages to be charged against D should be limited to the amount of damage that would naturally have occurred as the result of a breach in normal circumstances, that is to say that P's loss of profits should not be taken into account in the damages. Finally a new trial was ordered.

The issue of remoteness concerned the distance from the breach to the loss of profits. If the loss was too remote to be attributed to the breach, then P must bear the costs. If the loss could be attributed to P's bad planning, or to overextending himself, or other causes, D must in the interest of justice not be required to pay for P's imprudence.

The use of a subjective test, an attempt to judge the state of mind of D, is quite different from the objective tests of the cases above. Clearly there was evidence of intention to contract. There was an undeniable acceptance and then the contract was performed to some extent. A breach occurred causing a loss of profits. The subjective test was applied to determine D's state of mind prior to the breach. Trying to judge foreseeability is like trying to evaluate intention. It is a matter of determining someone's mental state in retrospect. The judge, as well as making a decision on the facts, stated a rule for decision-making. Furthermore, he required it to be used for instruction of the jury when evaluating foreseeability in future cases. It is a test that supposedly was intended to mitigate against the effect of uneven decisions and produce consistent results with regard to the remoteness problem from then on.

3.4. Conclusion

These cases were chosen because the themes carried through them allow one to make a kr with a rich set of associations suitable for testing the possibility of retrieving legal ideas as information.

CHAPTER 4

Representing knowledge using Sowa's conceptual structures

4.1. What are Sowa's conceptual structures?

Sowa's conceptual structures are a notation for knowledge representation (kr) for use in text analysis that is well-founded mathematically and is highly expressive. Conceptual graphs, based on the logic of C.S. Peirce (1897−1906, 1960; Roberts 1973), are the building blocks of conceptual structures. Sowa describes them as the **logical forms** that state relationships between concepts and so represent meaning (Sowa 1984, p. 10).

4.1.1. Basic conceptual graphs

A **conceptual graph** (cg) is a finite, connected, bipartite graph (Sowa 1984, p. 73).

> Formally, a *graph G* consists of a nonempty set *N*, whose elements are called *nodes*, and a set *A*, whose elements are called *arcs*. Every arc in *A* is a pair of nodes from the set *N*. (Sowa 1984, p. 375).

A cg and the Peano-Russell notation (a frequently-used notation for first-order logic (FOL)) for the same assertion are shown in figure 4.1. It is readily apparent that the cg is shorter, simpler, and easier to read. The square brackets indicate **concept** nodes, and parentheses indicate **conceptual relation** (conrel) nodes. The arrows that link the conrels to the concepts represent **arcs**.

A cat sat on a mat.
An English sentence

[CAT]->(STAT)->[SIT]->(LOC)->[MAT]
A simple cg

$\exists x \exists y \exists z$(cat($x$)and stat($x$,$y$)and sit($y$)and loc($y$,$z$)and mat($z$))
Peano-Russell notation

Fig. 4.1 A conceptual graph compared with Peano-Russell notation

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Concepts include persons, things, attributes, and events. Sowa provided a catalogue of some basic concepts, to give the user a start (Sowa 1984, p. 408-414). In Sowa's representation, each concept has two fields, a **type field** that contains a **type label**—the name of a concept—and a **referent field** that contains a symbolic descriptor. The two fields are separated by a colon. A variety of symbols may be used in the referent field, as shown in figure 4.2.

Conceptual relations are usually dyadic but may be monadic, such as the relation *negation* (NEG), or they may have *n* number of arcs. Sowa provided a catalogue of fundamental conrels (Sowa 1984, p. 415-419). Appendix A of this dissertation contains an augmented version of that catalogue, with comments on some of the definitions that are apparently ambiguous or in conflict with each other. Among the relations defined by Sowa are a number of *deep cases*, as described in §2.3.2.1. Appendix A includes a number of additional cases, which will be discussed below in chapter 5.

<table>
<tr><th>Kind of referent</th><th>Example</th><th>English reading</th></tr>
<tr><td>Generic or existential</td><td>[CAT] or [CAT:*]</td><td>a cat or some cat</td></tr>
<tr><td>Unspecified individual</td><td>[CAT:*x]</td><td>some cat x</td></tr>
<tr><td>Individual</td><td>[CAT:#10872]</td><td>the cat #10872</td></tr>
<tr><td>Named individual</td><td>[CAT:Muffy]</td><td>Muffy or the cat Muffy</td></tr>
<tr><td>Measure</td><td>[WATER:@5litres]</td><td>a five litres of water</td></tr>
<tr><td>Unique existential</td><td>[CAT:@l]</td><td>one and only one cat</td></tr>
<tr><td>Definite reference</td><td>[CAT:#]</td><td>the cat</td></tr>
<tr><td>Set</td><td>[CAT:{Muffy,Yojo}]</td><td>Muffy and Yojo</td></tr>
<tr><td>Partially specified set</td><td>[CAT:{Muffy,*}]</td><td>Muffy and others</td></tr>
<tr><td>Generic or default set</td><td>[CAT:{*}]</td><td>cats or some cats</td></tr>
<tr><td>Counted generic set</td><td>[CAT:{*}@5]</td><td>five cats</td></tr>
<tr><td>Definite set reference</td><td>[CAT:{*}#]</td><td>the cats</td></tr>
<tr><td>Distributive set</td><td>[CAT:Dist{*}]</td><td>each cat</td></tr>
<tr><td>Collective set</td><td>[CAT:Col{*}]</td><td>some cats</td></tr>
<tr><td>Disjunctive set</td><td>[CAT:{Leopold|Alexander}]</td><td>a cat, Leopold or Alexander</td></tr>
<tr><td>Universal</td><td>[CAT:∀]</td><td>every cat</td></tr>
<tr><td>Universal negative</td><td>[CAT:˜]</td><td>no cat</td></tr>
<tr><td>Universal plural</td><td>[CAT:∀{*}]</td><td>all cats</td></tr>
<tr><td>Universal negative plural</td><td>[CAT:˜{*}]</td><td>no cats</td></tr>
<tr><td>Fuzzy quantifier</td><td>[CAT:{*}@many]</td><td>many cats</td></tr>
<tr><td>Fuzzy measure</td><td>[WATER:@much]</td><td>much water</td></tr>
<tr><td>Question</td><td>[CAT:?]</td><td>which cat?</td></tr>
<tr><td>Question plural</td><td>[CAT:{*}?]</td><td>which cats?</td></tr>
<tr><td>Question measure</td><td>[WATER:@?]</td><td>how much water?</td></tr>
<tr><td>Focus</td><td>[CAT:!]</td><td>a cat (with emphasis)</td></tr>
</table>

Fig. 4.2 Referents identifying individual(s) referred to by concepts.

Arcs show the ordering of arguments and optionally may be numbered. Examples of their use in Sowa's work (1984, 1987, 1988) show varying types of application. In this dissertation, precise representation of sentence meaning has been the purpose of the application.

4.1.2. The linear form and its punctuation

Sowa's original cgs were written in a **graphic form**, derived from Peirce's existential graphs (Peirce 1897-1906, 1960; Roberts 1973). The graphic form shows concepts as boxes and conrels as circles as shown in figure 4.3. Arcs may enter boxes from many directions. However, normal keyboards are not adapted to the use of the graphic form. Furthermore, variables can not be used with the graphic form and programming languages are not suited to its use. The alternative form, the **linear form** that has already been shown as well as in figure 4.3, is less cumbersome, closer to commonly-used FOL notation, and well-

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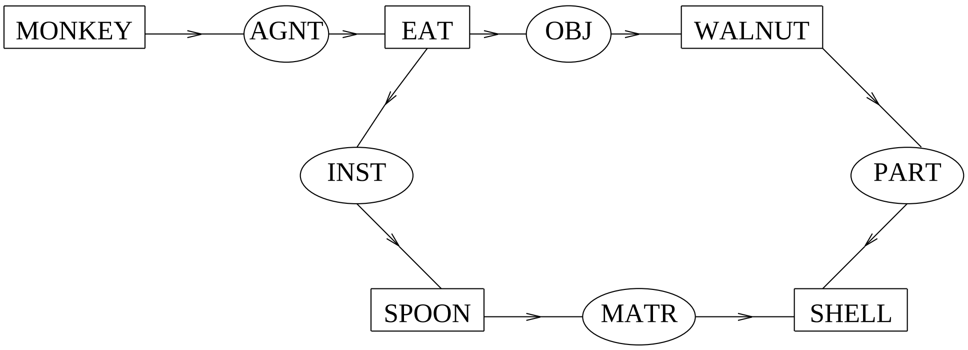
A monkey eating a walnut with a spoon made out of the walnut's shell.
An English utterance.



A conceptual graph—graphic form.

[EAT]-
(AGNT)→[MONKEY]
(OBJ)→[WALNUT: *x]
(INST)→[SPOON]→(MATR)→[SHELL]←(PART)←[WALNUT: *x].

A conceptual graph—linear form.

Fig. 4.3 Graphic and linear forms of cgs, Sowa 1984, p. 78.
(Note the representation of the cycle in the graphic form.)

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adapted to use for sentential analysis.

In using the linear form, one must chose a concept as the **head**. It should be a concept central to the proposition, the one to which most other concepts in the assertion are related. When analyzing a sentence, the verb is commonly used as the head. A dash (-) follows the head and precedes a list of relations following on consecutive lines. A period signifies the end of a complete graph. Between the dash and the period are listed the conrels and the concepts, other than the head, comprising the graph. Other cgs may be embedded within the main, or outer, graph. Each embedded graph has a head followed by a dash and each ends with a comma. Variables may be used within the linear form to represent unspecified instances of named types. It can readily be seen that the linear form lends itself to use with the programming languages Lisp and Prolog. A formal **context-free grammar** description of the linear form follows. In it, a vertical bar (|) shows alternatives, square brackets ([]) indicate an option and brace brackets ({}) show grouping. An ellipsis (. . .) indicates 1 or more repetitions, however square brackets followed by an ellipsis ([]. . .) show 0 or more repetitions. ''The nonterminal symbol CGRAPH represents a conceptual graph consisting of either a CONCEPT followed by an optional relational link RLINK or a RELATION followed by a required concept link CONLINK.'' (Sowa 1984, 395)

```
CGRAPH->{CONCEPT [RLINK]|RELATION CONLINK} {''.'' | '';''}
RLINK->ARC RELATION [CONLINK]|''-'' RLIST '',''
CONLINK -> ARC CONCEPT [RLINK] | ''-'' CONLIST '',''
RLIST->{NEWLINE RELATION [CONLINK]} . . .
CONLIST->{NEWLIST ARC CONCEPT [RLINK]} . . .
CONCEPT->''['' TYPEFIELD ['':'' REFFIELD] '']''
RELATION->''('' TYPELABEL '')''
ARC->[NUMBER] {''←'' | ''->''}
NUMBER->DIGIT . . .
DIGIT->''0'' | ''1'' | . . . | ''9'' ''[1]
```

[1] Sowa 1984, p. 395-396.

4.1.3. Logic notation

Sowa does not provide a symbol to represent **conjunction**. Instead, conjoined elements simply appear next to each other with nothing intervening. **Negation** is defined as a conrel (NEG) and is read as 'no'. The negation symbol (˜) may be used with larger groups of graphs, for simplicity. Negation may be used in a number of ways. If a **type label** is negated, the concept represents something that is not of that type, for example, [˜WISE] means 'unwise', and [˜KNOWN] means 'unknown' in the sense of not being recognized or identified rather than 'not known' even though it could be known. Similarly, [˜CAT] says something is not a cat. However, [CAT: ˜] tells us there is 'no cat'. If negation is used as a **relation type label**, it similarly changes the meaning of the relation, for example, (˜ON) may be read as 'not on' and (˜PART) indicates that something 'is not a part of' something else. Larger units such as contexts, about which more will be said below in §4.1.9, can be negated as well. Examples of the use of negation may be seen in figure 4.4.

It is possible to combine conjunction and negation to produce **implication** and **disjunction**, and Sowa recommends that style of notation, since it displays clearly the logical form, as shown in figures 4.5 and 4.6. However, in this dissertation, the expressions 'if . . . then' and 'or' will be substituted, for ease of comprehension by the reader.

Sowa has augmented the notation by including commonly-used **modal operators** as conrels. **Necessity**, represented by a square symbol (□), has been defined as the conrel (NECS). **Possible**, usually represented by a diamond symbol (♦), has been defined as the conrel (POSS). As well, Sowa has indicated how other modals may be added to represent other possible worlds. The conrel (MODE) expressing 'modality' has been defined for use in this way. In this dissertation, the **deontic** operators **may** and **ought** have been defined in order to be able to express degrees of obligation. Following Sowa's prescription, they have been defined as conrels (MAY) and (OUGHT). They are used in this dissertation for the representation of legal obligations.

4.1.4. Lambda expressions

A lambda expression may be used to define complex types using simple ones. Lambda or the lambda symbol(λ) specifies one or more concepts as parameters in the type description. In figure 4.7, (λ*x*) says that *x* is

[CAT: ~]→(ON)→[MAT]
No cat is on the mat.
(The mat is devoid of cats.)

[~CAT: !]→(HAVE)→[WINGS]
No *cat* has wings!
(It may have wings but its not a *cat*!)

[~[KNOW]-
  (EXPR)→[GIRL: Alice]
  (OBJ)→[SUBJECT: arithmetic]].
Alice did not know arithmetic.

[~KNOW]-
  (EXPR)→[GIRL: Alice]
  (OBJ)→[THEORY: Relativity].
The theory of relativity was unknown to Alice.

~[[FROST]→(ON)→[PUMPKIN]]
The frost is not on the pumpkin.
(It is not true that the frost is on the pumpkin.)

[FROST]→(~ON)→[PUMPKIN]
The frost is not on the pumpkin.
(There is frost, but not on the pumpkin.)

~[[CAT: Leopold]→(PART)→[PURR]]
The cat, Leopold, hasn't any purr.

[CAT: Leopold] →(~PART)→[PURR]
There exists a purr but it is not a part of the cat, Leopold.
(Leopold may have a purr, but there is at least one that is
not his. Note that this does *not* say that Leopold has no purr!)

Fig. 4.4 Some examples of negation.

If Baxendale and Labatt's are carriers, then Labatt's carries beer to Baxendale.
An English sentence.

˜[[BAXENDALE: *x][CARRIER: *x]
[LABATT: *y][CARRIER: *y]
˜[[CARRY]-
(AGNT)→[CARRIER: *y]
(OBJ)→[BEER]
(RCPT(→[CARRIER: *x].]]
Representation using conjunction and negation.

if [[BAXENDALE: *x][CARRIER: *x]
[LABATT: *y][CARRIER: *y]]
then [[CARRY]-
(AGNT)→[CARRIER: *y]
(OBJ)→[BEER]
(RCPT)→[CARRIER: *x].]
Representation using 'if' and 'then'.

Fig. 4.5 Representing 'if . . . then' constructions.

Jorge likes ale or beer.
An English sentence.

[PERSON: Jorge]←(AGNT)←[LIKE]→(OBJ)→˜[˜[ALE]˜[BEER]]
Representation using conjunction and negation.

[PERSON: Jorge]←(AGNT)←[LIKE]→(OBJ)→[ALE] or [BEER]
Representation using 'or'.

Fig. 4.6 Representing disjunction.

the variable, so [CAT: *x] is the formal parameter.

PET_CAT = (λx) [CAT: ∗x]←(PTNT)←[OWN]←(STAT)←[PERSON]
'Pet cat' is a new type of cat—a cat owned by some person.

Fig. 4.7 A lambda expression with a new type label, Sowa 1987, p. 11.

4.1.5. Quantifiers and scoping

In a database, all entities are assumed to be universally quantified; however, in a frame-based system, existential quantification is necessary to perform intensional reasoning. In cgs, all entities are assumed by default to be existentially quantified. If another quantifier is applied, it is specifically shown in the referent field as illustrated in figure 4.2 above. The scope of each quantifier includes the **context**, that is, the group of propositions describing events at the same time and in the same place (§4.1.9, below) in which it is found, and any other contexts nested in that context. The examples in figure 4.8 illustrate their use. The precedence hierarchy of quantifiers is as follows:

- strong quantifiers, the universal quantifier, '∀', the universal negative, '~', and fuzzy quantifiers, like 'much',
- the unique existential quantifier, '@1',
- the existential quantifier, '∃'.

Contexts and lambda expressions are used to limit quantification scope. Lambda expressions may be used to define unlabeled types and so interpret anaphoric references, relative clauses, and quantifier scoping, as demonstrated in figure 4.9. The English sentence would normally be interpreted with a universal quantifier, which would be incorrect. The alternative would have been to make a 'type' circus-elephant,

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[MAN: ∀]←(EXPR)←[LOVE](->(PTNT)(->[WOMAN: ∀]
Every man loves every woman.

[MAN: ∀]←(EXPR)←[LOVE](->(PTNT)(->[WOMAN]
Every man loves some woman.
(For each man, there exists some woman whom he loves.)

[WOMAN: *x][[MAN: ∀]←(EXPR)←[LOVE](->(PTNT)(->[*x]]
Every man loves some woman.
(There exists a woman x whom every man loves.)

[MAN: ~*x] [[*x]←(EXPR)←[LOVE](->(PTNT)(->[WOMAN: ∀]]
There is no man who loves every woman.

Fig. 4.8 Quantifier scoping, Sowa 1987, p. 13-14.

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which would be an inefficient solution.

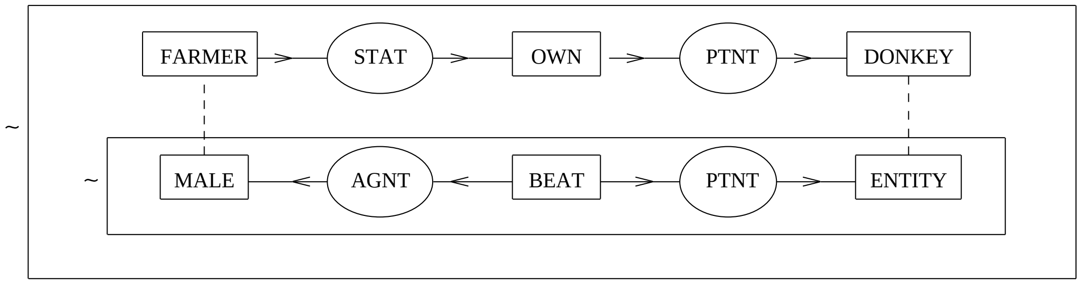
4.1.6. Co-reference links

Where two concepts are written in the same context and refer to the same individual, they may be represented by a **co-reference link**. A co-reference link may also be called a **co-referent** and may be regarded as a 'see' or 'x' reference. A co-reference link, an asterisk with a variable, for example, '*x', may be attached to a concept in the referent field, as in figure 4.10. Henceforth, within the same context, whenever the referent is used, it will refer to the same individual, regardless of the associated type label.

[λ*x*)[ELEPHANT: *x]←(AGNT)←[PERFORM]→(IN)→[CIRCUS]: fa]-
(AGNT)←[EARN]→(PTNT)→[MONEY].
Every elephant that performs in a circus earns money.
(Every x where x is an elephant that performs in a circus
earns money.)

Fig. 4.9 A lambda expression, Sowa 1988, p. 2-14.

If a farmer owns a donkey, then he beats it.
An English sentence.



Co-reference links in a graphic representation.

if [FARMER: *x]→(STAT)→[OWN]→(PTNT)→[DONKEY: *y]
then [MALE: *x]←(AGNT)←[BEAT]→(PTNT)→[HUMAN: *y]
Coreference links in a linear representation.

Fig 4.10 Using co-reference links, Sowa 1987, p. 10.

Co-reference links are useful in asserting new roles for entities. The hash symbol (#) may similarly be used in disambiguating anaphora. It is read as 'the' and refers to the preceding instance of the same entity each time it is used within a single context.

4.1.7. Set notation

A **set** is a loose association among entities that share a common property, see Sowa 1984, p. 118-119. Although FOL allows variables to range only over simple individuals, cgs allow the use of sets and subsets, convenient, for example, for the representation of plural noun phrases. Several types of sets are distinguished. All are indicated by the use of brace brackets ({ }), and kinds of sets are differentiated by notational variants. Examples may be seen in figure 4.2 above. A **collective set** is one in which all members participate as a group in some relationship. The designation 'Col' appears as a prefix. A **distributive set** is one in which each member separately satisfies a specific relation and the set has a prefix 'Dist'. A **default set**, as defined by Sowa (1988 p. 2-20), may be read either as a collective or as a distributive set. It is represented by the symbol ({*}) without prefix. The need for it is caused by the ambiguity of English. If a word such as 'each', 'all', or 'altogether' were added, it would make an assertion unambiguous and the default unnecessary but it not always is. A **disjunctive set** is one in which only one member of the set participates in the relation, but it is not known *which* one. The set functions like an 'exclusive or' operator or a series of 'exclusive or' operators. The members of the set are separated by vertical bars (|), making what is commonly called a **partitioned set**. Needless to say, the use of disjunctive sets carries with it all the difficulties incumbent upon the use of disjunction in deduction.

4.1.8. Mass nouns

Mass nouns such as 'water', 'butter', 'convoy', 'jury', 'service', *etc*. represent quantities rather than discrete entities. They appear to be singular and are usually represented as such. However, they deal with quantities and do express plurality. Indeed, some pluralized nouns such as 'ashes' and 'mashed potatoes' are coming to be considered as mass nouns. It may be that some part of the mass is significant enough to be discussed separately. There may be a need to represent that part as an individual, as an entity itself, causing representation problems relating to pluralization and quantification (Gillon 1990). It is desirable sometimes to be able to represent a part of a mass noun as a set member in order to indicate something about its relationship to the original mass. Sowa has suggested another approach as shown in figure 4.11. The convoy is represented as a singular entity and will be the referent for any singular anaphoric reference, while the set of tankers is plural and will attract plural anaphoric reference. In a sense, 'convoy' and 'some tankers' are synonyms. This graph shows a way of dealing with plurality as well. The tankers cannot be said to be set members since the convoy is represented as an entity. Some problem arises in the semantic interpretation, and Sowa has not defined the conrel (MEMB).

4.1.9. Combining graphs

In order to represent more complex ideas, it is necessary to combine simple graphs in a structured way. **'Proposition'** has been defined as ''a concept whose referent is a set of cgs that are being asserted'' (Sowa 1984, p. 139). It makes possible the representation of embedded ideas as in complex sentences. Typically, complex sentences are used in legal argument as will be seen below, §6.8. As well, with propositions so defined, it is possible to represent **opaque contexts**. Opaque contexts are the embedded clauses associated with intensional verbs such as 'say', 'know', 'think' and 'ask', which are typically related to different possible worlds from the main clause. For example, in figure 4.12, it may be true that Sam thinks that the dinner is hot, that is, that the main clause is true. At the same time, the dinner might actually be quite cold, that is, the embedded clause may be false.

Sowa goes further to define a **situation** as ''a state of affairs that occurs at a single place and time,'' (Sowa 1988, p. 2-7). The set of propositions that describes a situation is called a **context** (Sowa 1988, p. 2-7). For example, figure 4.12 shows a situation of Sam eating his dinner while it is hot. The 'eating' and the 'hot' occur at the same time and place, in the same context, as a part of the situation. Both 'proposition'

[CONVOY: *x]→(MEMB)→[TANKER: Col{*}*y]
Some tankers, y, are members of a convoy, x.

Fig. 4.11 Representing a mass noun, Sowa 1988 p. 2-22.

[PERSON: Sam]←(EXPR)←[THINKS]→[PROPOSITION:
[DINNER]→(ATTR)→[HOT]]
Sam thinks that the dinner is hot.

[SITUATION: [PERSON: Sam]←(AGNT)←[EATS]→(OBJ)→[DINNER]
[DINNER]→(ATTR)→[HOT]]
Sam is eating his dinner and the dinner is hot.

Fig. 4.12 A proposition and a situation with its context.

and 'situation' types may be used without type labels. They both default to the universal type 'T'; therefore, a set of brackets suffices to indicate their use. It follows naturally that the outside set of brackets in a conceptual structure indicates the extent of a context.

4.2. Why use Sowa's cgs?

There are two principal reasons to use Sowa's notation: it is eminently easy to read and it has expressive power. Sowa has developed it in a way that sustains the lucidity of the original visual, modular concept. There are a number of aspects of the notation's expressiveness that are important in this work. It is capable of representing the full range of FOL and some extensions as well. As discussed above in §4.1.7, a number of different types of sets may be used.

Sowa has established a psychological base for his conceptual structures. In his work, a **concept** may be either concrete or abstract. 'Concept' may designate an interpretation of a mental image, that is of a **percept** or percepts and so be a representation of a **concrete** object. Alternatively, it may designate an interpretation of an entity for which there is no percept and so be a representation of an **abstract** object.

The philosophical foundation of Sowa's analysis of conceptualization is derived from Ogden and Richards (1923) but is established within the western tradition. In particular, he relies upon the recognition of the 'meaning triangle' (figure 4.13) that relates an **extension,** object or referent in the world,[2] to the

[2]''The *extension* of a word is the set of all existing things to which the word applies.'' (Sowa 1984, p. 11)
''A set specification that lists all elements explicitly is called a definition by *extension*.'' (Sowa 1984, p. 368).

intension, that is, the sense, thought, idea, or mental representation of that extension.[3] Finally, both the extension and the intension are related to a **lexical token**, word, or symbol. Pragmatists, in particular Richard Rorty (1989, 1990), argue that the distinction made between intrinsic and extrinsic is not correct and that the distinction between appearance and reality be exchanged for an understanding that some descriptions of the world are useful for some purposes and other descriptions are useful for other purposes. In this way they expect to get away from the problem of language forming a barrier between appearance and reality. Sowa's interpretation is a viable base for work in AI and is within the same philosophical framework as successful implementations of other krs.

The expressive power of cgs makes them useful for work in natural language understanding, as Sowa stresses the importance of semantic interpretation (Sowa 1984, p. 211; Sowa 1991a, p. 157). Furthermore, he has not tied the graphs to any particular linguistic theory but instead has demonstrated the breadth of their scope.[4] Of particular interest in the context of this research, he has recognized the importance of *deep cases* as described above in §2.3.2.1.

Furthermore, cgs may be used in order to construct frames. Recall that frames were used to describe types and tokens or instances of those types. Sowa also shows that **schemata** may be used with cgs as well. Schemata are definitions of broader concepts than are types, concepts which are commonly-used

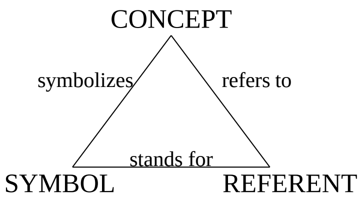


Fig 4.13 The meaning triangle, (after Sowa 1984, p. 11).

[3] ''The *intension* of a word is that part of meaning that follows from general principles in semantic memory.'' (Sowa 1984, p. 10-11) ''A [set] specification that states a property that must be true of each element [of the said set] is called a definition by *intension*''. (Sowa 1984, p.368)

[4] Sowa, however, admits his own linguistic preference (Sowa 1984, p. 9) for a point of view shared by Jackendoff (1972) and Quillian as expressed in a personal communication to Woods, (Woods 1975) that there is a base structure of semantic meaning to which is applied a set of 'stage instructions' determined by pragmatics. **Pragmatics** The use of language and its effects on the listener. (Sowa 1984, p. 216)

amalgams of associations. Such concepts are derived from our experience. For example, the concept 'energy' is used in many ways. Each different aspect of 'energy' would be described in a different schema and would present a different perspective on its use. All the 'energy' schemata taken together would constitute the definition of the concept 'energy'. The elements of a schematic definition are the commonly associated accidental properties of the concept from a particular perspective. Schemata are useful too in attempting to express abstract ideas and complex associations often used in argument.

A final conceptual structure defined by Sowa is the **canonical graph.** In a given application, canonical graphs establish the worldview represented in the knowledge base (kb). They determine which cgs are acceptable as **well-formed**, that is, meaningful with regard to the worldview described. They describe allowable combinations of words, often based on semantic selection in the style of Katz and Fodor (1963), and so prohibit other undesirable combinations of words. For example, Chomsky's famous example of a syntactically correct statement that was nonsense because of the lack of a valid semantic interpretation, *Colourless green ideas sleep furiously*, would not be allowable in a system that knew that 'sleep' takes only an *animate agent.* As knowledge is acquired by the system, more and more complex rules are necessary to order the system's worldview. Canonical graphs are used in this dissertation to express *Rules for semantic selection* Appendix D.

4.3. Adapting the notation to use

Although Sowa's cgs are expressively powerful, there are a number of areas in which they are weak for the work at hand. Where possible, the notation has been extended by using other sources. For example, some adjectives were difficult to handle and Yawar Ali's work was used (Ali, 1985).

4.3.1. Cases

The prime example of adding to the notation is the use of Harold Somers's case grid (Somers 1987), which will be discussed at length in chapter 5. Sowa does include some deep cases among the conrels in his catalogue which is included in Appendix A. However, they are mainly traditional cases and, as we will see, they are not sufficient for the representation of a number of variations. For instance, although there is one graph in which the conrel 'goal' appears, Sowa neither defines nor discusses it. 'Source' is defined, but only as linking an 'act' with an 'entity'. Both 'goal' and 'source' are of particular interest in case analysis because of the directionality problem. In Somers's cases, they form a fundamental part of the grid. Although Sowa's conrels were consulted in the process of case analysis, where there is a conflict, that is, where Somers had defined a case, that case was used in preference to Sowa's conrel. The reason is to avoid arbitrarily assigning cases additional to those of Somers, one of the ills that the Somers grid was intended to avoid. Nevertheless, as will be seen in chapter 6, in some instances it was necessary to make use of the Sowa conrels. It is not clear that these additional relations were always cases.

4.3.2. Temporal predicates and tenses

Time is treated lightly in Sowa's notation. He defined a concept [TIME], and conrels: 'point-in-time' (PTIM) and 'successor' (SUCC). The hash symbol (#) expresses 'now', and the plus symbol (+) indicates the time of some other event. The underlying idea is that time is a series of points, an attempt at conveying continuity, as is the conrel 'state' (STAT). (STAT) is defined in two ways. First, it is used to link a **stative verb** to its subject. Stative verbs are verbs, like 'own' and 'believe', that express a state of being, a continuing situation rather than a circumscribed event. Second, (STAT) is defined as a general predicate of 'being in a state'. It is this meaning that may be interpreted to express the *duration* of an event in Sowa's notation. However, it is inadequate to represent the ideas of time expressed in English. Wherever possible, I represented a more clearly defined idea.

Attempting to cope with the problem of representing time, I have used, in addition to Sowa, James Allen's notation (Allen 1983) that permits the representation of time as intervals instead of points. Each **temporal interval** is given its own designation in relation to the frame of which it is a part, as Allen prescribes. So in this dissertation, for example, the time interval associated with the instance #U2 of 'put out' is designated [TIME: put_out#U2], that is, the time interval for the instance number 'U2' of 'put out'. The upper bound of the interval is marked by a '+' and the lower bound by a '-'. In the example, the interval's upper bound is [TIME: put_out#U2+] and its lower bound is [TIME: put_out#U2–]. Allen's notation for operations on temporal intervals has been used in this dissertation without exception. It has been possible to relate intervals in varying ways and to describe several instances of continuity and some kinds of overlapping intervals. It is augmented by Sowa's notation for the measurement of quantity in order to express such concepts as 'six hours later', which becomes (SUCC)->[HOURS: @6], which is, literally, 'succeeded by hours in the quantity of 6'.

Closely related, to the question of time, is the question of **tense** in language. Following Sowa's recommendation and the common practice in representing knowledge, most propositions are represented as if in the present tense. Where some event or situation clearly is described as in the past, in relation to some meaningful element in the present, the conrel 'past' (PAST) is attached to its context. Sowa commented optimistically on the user's capability to define tenses, like 'past', using the primitive conrel 'tense' (TENS). In practice, the matter is not so simple. Also the behaviour of verbs is idiosyncratic. No attempt has been made to develop a representation suitable for reasoning with time values in the future.

4.4. Conclusion

Sowa's conceptual structures provide the overall framework for the kr, the system, to be used in this dissertation. Next I will describe the extension of that system of notation by the use of Somers's case grid for a more expressive representation of natural language text.

CHAPTER 5

Somers's case grid

5.1. Introduction

Somers's cases (Somers 1987) are used in this dissertation to extend the conceptual graph (cg) notation, to add precision to the linguistic analysis and expressive power to the representation. Sowa's notation was designed to accommodate Fillmore-type **deep cases**, (§2.3.2.1 above) which combine syntactic and semantic features and lend themselves to use with first-order logic (FOL). Cases are to Sowa additional conceptual relations (conrels), (Sowa 1984, p. 223). He included a number of commonly-used or traditional cases among his definitions of conrels, along with constraints on their use in cgs. These cases were not distinguished from other conrels, a number of which could also function as cases, as shown in §5.5 below.[1] Nevertheless, the list was not judged adequate for text analysis in this research. To augment Sowa's notation, I have adapted Somers's case grid to use with cgs within the constraints specified for its application.

5.2. Why use Somers's cases?

Among the many case grammars, no single one has emerged as clearly superior, as was discussed in §2.3.2.1. Nor has it been possible to reach a consensus on a list of fundamental cases. Somers's work on case (1987) proposes an approach that is intended to remedy some of the persistent problems experienced. In so doing, he exploits the syntactic-semantic character of deep cases to advantage. Moreover, as Somers says of this work, ''its main thrust is as a work of pragmatic application'' (Somers 1987, p. *ix*). His particular interest is machine translation, but his general purpose was to make his cases useful in computational linguistics. Somers's proposed grid was designed to provide a functional approach to computational linguistics based on and perhaps extending Fillmore's 1968 work. He focused on the importance of the

[1] It is interesting to note as well that prepositions are commonly used by Sowa as conrels, and that he recommends the user to define them as required. Prepositions are often regarded as case markers, which on occasion makes Sowa's use problematical.

verb and its relations in the sentence.

5.3. Somers's approach to case grammar

The attraction of cases is their apparent regularity. As Somers put it, ''Case is altogether a question of making significant generalizations'', (1987, p. 119). When it is possible to use a case analysis to predict or deduce a meaningful interpretation of a sentence, then the analysis works. Somers classified the problems in using case into three categories. All three are really just aspects of the same problem, the difficulty of making significant generalizations. The lack of a definitive set of cases for widespread application reflects this.

The first problem Somers identified was the **specificity-multiplicity problem,** or the inappropriate subdivision and merging of cases. As an example of problematic specificity, he cited the example of the subdivision of the object into affected, effected, and neutral. As an example of inappropriate merging he cites his own error in an earlier work (Somers 1980, p. 7) of broadly defining 'patient' to mean entities affected by action verbs, stative verbs, and changes of state, as well as entities that specify the content of experiences (Somers 1987, p. 112). He discusses favourably the possibility of using supercases and subcases in achieving a solution. Finally, he says that the rubric for solving the problem should be to fulfill the requirements of the particular application. This appears to be another way of describing the need for a knowledge representation (kr) to be adjusted to the appropriate level of detail for the problem at hand.

The second problem is the **arbitrary assignment of case names** to designate exceptions to the commonly used cases. In short, it is a failure to attempt a significant generalization, and reflects instead the idiosyncratic behaviour of verbs with a relatively unrestrained proliferation of cases.

Finally, the third problem he identified, his principal insight, was the recognition of the **duality** of roles in some sentences—the need for two case assignments for a single entity. Duality occurs where two semantic expressions are included in one lexical entity. Somers identified three types of commonly occurring duality: source-goal directionality, agent-patient co-referentiality, and experiencer/agent optionality.

5.3.1. Source-goal directionality

Some classes of verbs, including those expressing transfer, communication, and propulsion, have patterns of case relations in which some lexical expressions are arguments with dual semantic roles. One role is directional, either source or goal; the other is something else, usually agent.

An example involves the verbs of transfer, 'buy' and 'sell', which both involve an original possessor, a source, and a final possessor, a goal, in their structural pattern. One of them is an agent as well. The agent of 'buy' is the *goal*, while the agent of 'sell' is the *source*.[2]

In the context of contract law, 'offer' and 'accept' are similar.

(5-1) John offered Sam a good deal.
(5-2) Sam accepted John's good deal.

In (5-1), John is both agent and source, while in (5-2), Sam is both agent and goal.

If the agent role is used as the case in a kr and the directional role is suppressed, the semantic parallel between the verbs is not made explicit. If the directional role is used and the agent role is suppressed, the difference between the verbs is lost.

Even if one role were to be chosen as dominant, it is not clear how dominance could be determined for a variety of verbs to be considered.

5.3.2. Agent-patient co-referentiality

With verbs of motion like 'rise', 'arise', 'ascend', and 'lift', one lexical entity may represent the two semantic roles of agent and patient. The entity that undergoes movement is appropriately labelled 'patient'. If the agent slot is unfilled, it may be co-referential with the patient, unknown, or unstated.

(5-3) Paul moved the wardrobe.
(5-4) The wardrobe was moved.
(5-5) Dave moved.

'Wardrobe' is clearly the patient in (5-3) and in (5-4). In (5-5), 'Dave' is the patient and is as clearly the agent as is 'Paul' in (5-3).

[2]Other arguments such as instrument and patient may be included, but are not relevant here.

In other contexts, this construction is the source of some ambiguity.

(5-6) John went to the hospital.
(5-7) John went to the hospital by ambulance.
(5-8) John went to the hospital on foot.

In (5-6), 'John' is certainly the patient. Whether or not he is the agent as well depends on whether the situation conformed with that described in (5-8) or the one in (5-7).

This structure is similarly to reflexive verbs in French and verbs like 'wash' and 'shave' in English. A further complication occurs in causative constructions where the patient of the causative is also the agent of the action verb, the action verb itself already having an agent-patient conflict.

(5-9) The sergeant marched the soldiers across the parade ground.

In (5-9), the 'sergeant' is the agent of causation of the soldiers action, and the 'soldiers' are the patient of the sergeant's action; at the same time the 'soldiers' are the agent and patient of 'march'.

5.3.3. Agent and experiencer optionality

The class of agentive perception verbs including 'look', 'listen', 'taste', 'smell' form pairs with non-agentive verbs such as 'see', 'hear', 'taste', 'smell'. Cognition pairs such as 'learn' and 'know' and 'discover' and 'invent' are included in this category, although they also share the source-goal directionality problem. It may be seen that members of some pairs are lexically identical, for example, both 'taste' and 'smell'.

In sentences containing these verbs, either an agent and an experiencer can be distinguished, or the constructions can be treated as ambiguous. Somers demonstrates the different senses of 'taste' in relation to its various translations in French as *gouter* or *sentir*. In addition, the use of 'can' in the sense of permission can be used to test whether or not the verb is agentive. Other tests are the use of the imperative form and the use of the verb in conjunction with 'persuade'.

(5-10) Persuade the child to learn German.
(5-11) ∗Persuade the child to know German.

The use of manner adverbials like 'carefully' and progressive form occurrences are indicators of the distinction too. However, the manifestations of this problem are more subtle than the others and less likely to be relevant in this application.

5.4. Somers's proposed solution

Somers's solution to these problems is a method of case analysis that uses two-dimensional cases. His solution was reached by combining case with his version of valency.

Valency is a theory of linguistic analysis popular particularly in Germany. It is a verb-centred approach to grammar. The focus of syntactic analysis is the distinction between **complements**, or parts of the sentence governed by the verb, and **adjuncts**, or sentence elements which fall outside the verb's governance. For example, in the following sentences (Somers 1987, p. 190-191), the phrase 'in the garage' is of interest.

(5-12) John keeps his car in the garage.
(5-13) John washes his car in the garage.

In (5-12) the phrase is governed by the verb 'keeps', and so is a complement. If John kept his car anywhere but in the garage, the meaning of the sentence would be quite different. But in (5-13), the same phrase is a sentential adjunct; it does not change the meaning of 'washes', it only adds a little more information. Complements are said to be 'valency-bound', that is, bound to the verb in appropriate combinations.[3] It is these valency-bound arguments that are the basis of generalizations about verb behaviour; that is, they lead to establishing lists of useful cases. Somers suggests that as adjuncts are loosely associated they may be 'stacked', that is, occur in multiples within a given sentence. It will improve analysis if they are not too closely tied to the verb. The valency-bound arguments are of particular interest with regard to case because they exhibit definite patterns in combining with the various types of verbs.

Somers developed the idea of linguistic valency by extending the analogy to chemical valency in order to explain patterns of arguments with verbs in various sentence structures. As in the combining of chemical elements, where the number of bonds or 'hooks' of atomic elements may be changed as a result of the action of elements of different structure combining together, so in the composition of sentences, verbs may combine variously with arguments. Somers suggests that as an atom may be connected to

[3]In contrast, other modern views of grammar involve a sentential approach. Chomsky, for example, has considered the 'kernel sentence' consisting of subject and predicate. (Chomsky 1965, p. 17-18)

another with two hooks, so a noun phrase (NP) may be bound syntactically to a verb phrase (VP) by two roles. Thus, in the sentence *Paul rolled down the hill*, 'Paul' is both the agent and the patient. Somers argued that verbs of motion may be univalent, bivalent, or trivalent, and that it was to be expected that a valency change might occur under certain circumstances, namely the sense in which the verb was used.

In this way, Somers developed the idea of dual-roles in syntactic analysis in order to provide a solution to the duality problems he had isolated. He then went on to develop the concept by constructing a grid of two-dimensional cases.

5.5. The case grid

Somers proposed the use of a grid of cases composed of four columns and six rows. Each of the twenty-four cells represents a case embodying dual role concepts. Somers's grid is shown in figure 5.1.

The six row designations, in the leftmost column, are characteristic grammatical relations. The four columnar designations, along the top, are semantic realizations. Each case cell is read as a combination of a grammatical relation and a semantic realization. It is apparent that Somers is attempting to specify the

	Source	**Path**	**Goal**	**Local**
Active	instigator of action ±volitive ±animate	instrument or means	intended result (−animate) active recipient (+animate)	non-passive patient
Objective	original state (−concrete)	counter- instrument passive means	result state (−concrete)	undergoing
	material (+concrete)		factitive (+concrete)	change-of-state
Dative psychological:	stimulus	medium	experiencer ±dynamic	content
possessive:	original owner	medium/price	recipient	thing transferred
Locative	place from where	space traversed	final destination	static position
Temporal	time since	duration	time until	time at which
Ambient	reason	manner	aim(+volitive) consequence (−volitive)	condition

Fig. 5.1. Somers's case grid (1987, p. 206)

nature of the link between syntactic analysis and semantic meaning. Furthermore, the Dative and Objective rows are subdivided to give additional sets of cases related to distinctly different uses of those traditional cases. The grid is in this way adaptable to a specificity-multiplicity modification.

The four columnar designations, across the top, are localist for space and time. Each row of cases may be read across from 'source' to 'goal'. The arrow in figure 5.2 is a visual representation of the idea of progression through time or space and shows how the direction expressed by the cases may be read. For example, if the row of Temporal cases is being read, the arrow represents the passage of time. A is the 'source', the time at the beginning, the 'time since'; B is the 'goal', the time at the end, the 'time until'. AB is the 'duration' of an event and is expressed by the 'path' case. Finally, point C represents the time of an occurrence, the 'time at which' or the 'local' case.

Each row and each column is read as a parameter of cases. Using the case grid involves understanding the fundamental concept behind each of the headings. I shall describe first each of the row parameters in turn, with some comments on particularly interesting cells. Comparisons will be made both with traditional cases and with those conrels of Sowa's which are similar, at least in some respects, to the Somers case in question. Figure 5.3 compares Sowa's conrels with correlative cases from Somers's grid.

The **Active** parameter expresses action with emphasis on volition and intention. The 'active source' case is similar to the traditional case 'agent' and also like Sowa's conrels, 'agent (AGNT)' and 'initiator (INIT)'. In a sense it is the grammatical element 'subject' but it is not used to represent sentence subjects where there is no initiative expressed. The 'active path' case is akin to the traditional 'instrument' case, and to Sowa's 'instrument (INST)' conrel. However, as may be seen below, the Path column cases express some kind of instrumentality.

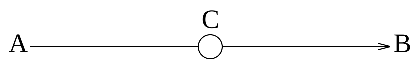


Fig. 5.2. The localist arrow indicating direction.

Sowa's case	reads	Somers's case	reads	Comment
ACCM	accompaniment	ACTL	active local	
AGNT	agent	ACTS	active subject	
ATTR	attribute	AMBL	ambient local	a condition
CAUS	cause	AMBS	ambient source	any path or source case
CHRC	characteristic	AMBL	ambient local	a condition
DEST	destination	LOCG	locative goal	
DUR	duration	TEMPP	temporal path	
EXPR	experiencer	DATPSYG	dative psycho-logical goal	
GOAL	goal	___G	goal	any goal case
INIT	initatior	ACTS	active source	
INST	instrument	ACTP	active path	or any path case
LOC	location	LOCL	locative local	
MANR	manner	AMBP	ambient path	
MATR	material	OBJS +concrete	objective source	
METH	method	ACTP	active path	
PATH	path	LOCP	locative path	
POSS	possession	DATPOSSL	dative possessive local	
PTIM	point in time	TEMPL	temporal local	
PTNT	patient	OBJL	objective local	
RCPT	recipient	DATPOSSG	dative possessive goal	
RSLT	result	OBJG +concrete	objective goal	
SRCE	source	___S	source	any source case
STAT	stative	OBJL	objective local	
UNTL	until	TEMPG	temporal goal	

Fig. 5.3. Sowa's and Somers's cases compared.

The **Objective** parameter expresses the idea of undergoing process. In contrast to 'Active', it is about passivity, undergoing rather than carrying out. The semantics of objective cases are intimately related to the meanings of the verbs which they accompany. Objective cases endure the verb's activity. The cases along this parameter are traditionally the 'patient' cases. However, grammatical 'objects' sometimes do not fit in here. Of particular interest are two cases, the 'factitive', that designates something manufactured as a result of an action, and the 'objective local' that represents a 'passive patient'.

The **Dative** cases are generally flagged by the preposition 'to' and relate to the traditional dative and genitive cases. **Dative Psychological** cases relate to experiential verbs expressing perception, cognition, and emotion. The psychological experience impinges at point B on the arrow, the 'dative psychological goal'. This case is equivalent to the traditional 'experiencer' case, and to Sowa's conrel (EXPR).. Where the goal is '+dynamic', the verb expresses a process. Where the goal is '−dynamic', the verb expresses a state.

The **Dative Possessive** parameter does some of the work of the traditional 'possessive genitive' case. It must be noted that wherever the 'source' or 'goal' is agentive, it properly belongs to the Active parameter. This is the appropriate case parameter for the representation of transference or for those ideas represented often by the TRANS primitives in Schank's work. It applies as well to verbs of communication or the transfer of information. However, there is a difficulty with using the 'local' case, the 'thing transferred', since information may be transferred but still be in the possession of the original owner.

The **Locative** parameter describes relative locations or the spatial orientation of an event. Although it may be used as a complement, Somers recognizes it as a peripheral case and allows for the stacking of locatives or use of multiple locative cases. This is the traditional 'locative' case, or some senses in which it has been used. Sowa's 'locative (LOC)' conrel bears a resemblance. In his work he employs prepositions defined as conrels to extend spatial relations. The cases along the parameter read exactly as the arrow.

Similarly, directionality is obvious in the use of cases along the **Temporal** parameter. Both the traditional 'temporal' case and Sowa's conrels 'point-in-time (PTIM)' and 'until (UNTL)' are similar to cases along the parameter. Sowa has made a useful addition in the conrel 'frequency (FREQ)' which represents habitual actions. Duration is expressed by Somers in 'temporal path' and by Sowa in his conrel 'duration (DUR)'. However, the continuity of events through time is most difficult to represent. Allen's temporal predicates (§4.3.2) were used in this dissertation as a notational supplement to ameliorate this need.

Finally, the **Ambient** parameter describes the context at some distance from the verb. The cases in this row are very loose and typically express abstract concepts. In applying them, it is necessary to take care that the parameter does not become a wastebasket for awkward, leftover concepts. The 'ambient source' case is said to express the 'reason' for the event. Surprisingly, it therefore expresses one sense of causality, which is more commonly represented by 'instrument' or 'path' cases. Also, it is only along the Ambient parameter that Somers gives us a place to class modifiers. 'Ambient path' is the case for manner modifiers, and 'ambient local' is the place for anything that might be called a 'condition' of the event. Sowa has allowed the use of conrels 'attribute (ATTR)' and 'characteristic (CHRC)' for use with modifiers. Further discussion of the problems in using these cases and conrels will be found below in chapter 6.

Turning now to the columns or semantic realizations, once again, they are read as parameters. Somers regards the column parameters to be closer to traditional use. **Source** is the first. 'Source' is closely related to the Latin ablative case and is marked by the preposition 'from'. Although 'source' is the normal surface subject there is a potential conflict with 'agent', which must be 'active'. Somers does not comment on this matter. As with the other spatially-oriented categories along the direction arrow, many of the uses of 'Source' are metaphorical. It is particularly difficult to sort out directionality with verbs of cognition, perception and emotion.

The cases along the **Path** parameter at first glance appear to be disparate. Path cases express the metaphorical space image from 'source' to 'goal', that is AB in figure 5.2. This concept is interpreted variously as 'means', 'duration', 'instrumentality' and 'causality'. All of this falls in line with common case grammar practice and problems. Sowa's conrels include a 'path (PATH)' that has a spatial interpretation, 'duration (DUR)', 'instrument (INST)' and 'cause (CAUS)', which are clearly related, and some others, which may or may not be properly considered 'path' cases in the sense that Somers intends. The cases in this column seemed to work surprisingly well in the analysis in chapter 6. However, it is easier to interpret each of them individually in relation to the other, syntactic axis to which it belongs. It must be said that the analysis of causative cases or relations leaves much to be desired.

Cases on the **Goal** parameter designate the end of an event. The case marker is the preposition 'to', and the symbol B in figure 5.2 represents 'goal'. Some of the cases here are extremely difficult to interpret. In particular, the 'active goal' case with the +animate feature is said to apply to an 'active recipient', but one who operates without volition. Again in the 'ambient goal' cell are categorized both 'aims' and 'consequences'. It is often very difficult to determine the degree of intention in relation to goals. These have a way of becoming confused with causes. Furthermore, it is difficult to determine whether an event is an 'intended result' or an 'aim', except perhaps with regard to its relation to the specific verb—whether or not it is a peripheral argument.

Finally, the **Local** parameter has a collection of cases that, like the 'Ambient' parameter, are in danger of collecting the debris of confusion. 'Local' is represented by the point C on the arrow. 'Local', unlike 'locative', is not a space metaphor but means local as opposed to general. It is associated with the case marker 'at'. In some senses, 'local' designates a terminus and it is difficult to distinguish it from 'goal' unless the other dimension of a particular case is carefully taken into consideration. The 'active local' case represents a kind of reflexive role commonly called the 'co-agent' and marked by the preposition 'with', as in, ''The Prime Minister met with his remaining ministers''. The ministers were presumably 'non-passive patients' at the cabinet meeting. The 'objective local' case describes a lesser degree of initiative than the 'active local'. It also accommodates elements 'undergoing' change, or those whose state is described by a stative predicate. This use is similar to a use of Sowa's conrel 'stative (STAT)'. The remaining 'local' cases are relatively straightforward insofar as their 'local' dimension is concerned.

In using the grid it is important to take into account the meaning of each of the two dimensions involved, as well as the cryptic descriptions in the individual cells. It may be seen how the grid works by applying it to the problem sentences above. In (5-1), 'John' would be the 'instigator of the action', 'active source' (ACTS).[4] In (5-2), 'Sam' would be the animate 'active recipient', 'active goal' (ACTG), solving the first duality problem with a suitable representation of the dual role concept. 'Paul', in (5-3), would be 'active source' (ACTS) and the 'wardrobe' would be undergo the action as the 'objective goal' (OBJG). In (5-4), the 'wardrobe' would retain the same case as in (5-3) in spite of its position as subject of the passive sentence. 'Dave' in (5-5) would take the case 'active goal' (ACTG), 'active' expressing the agentive role, and 'goal' the patient. The cell description, 'active recipient (+animate)', is appropriate as well.

5.6. Conclusion

Somers has provided an intuitively acceptable set of cases that allow for greater expressiveness while retaining the characteristic regularity. They will support expectation-driven processing. His semantic analysis is well-supported by historical arguments. Even though he has deviated from Fillmore's rule that each case must represent only one argument, he has justified his decision with the analysis of problems related to case and his arguments concerning linguistic valency. Although he dealt only peripherally with adjuncts, since the grid is not expected to allow for the satisfactory analysis of syntactic elements

[4]The notation adopted in the representation is an abbreviation of the combined dual roles, active-source then is ACTS. Cases appear in the alphabetical listing of conrels in Appendix A, along with their definitions and abbreviations.

peripheral to the sentence, he has been successful in providing a plan that will accommodate a two-dimensional semantic representation in deep cases.

Somers's method is computationally practical, and firmly rooted in case. For these reasons I have chosen it for use in analyzing arguments from law cases in a manner suitable for question answering.

CHAPTER 6

Representing arguments

6.1. Introduction

The subject of this chapter is the knowledge representation (kr) itself, the texts of the arguments as they are represented by conceptual graphs (cgs). The organization of the knowledge base (kb) is shown first and a more detailed description follows. The general approach to text analysis is discussed, including an early attempt and its failure. A description of the major elements of the system follows next. Finally, there is a line-by-line description of the representations. This detailed description focuses on the lowest of the organizational levels, the cgs themselves, but occasionally includes a reference to something from a higher level for clarification.

6.2. Knowledge base structure

At the highest organizational level of the kb, there is a set of **case identification** (case-id) frames. Each one describes a case in the kb. A case-id contains information about the judicial proceeding, for example, the jurisdiction of the court and the level of the trial. Included as well is bibliographical information about the published case report including the essential citations in prescribed style.

The actual representation of each case is centred about an argument model or schema derived from the work of Stephen Toulmin (1958). As discussed in §3.2, each text is taken from a standard casebook. Some case reports are represented in their entirety; others are excerpts focusing on a central argument of the case, what may arguably be called the *ratio decidendi.*

The Argument schema is an aggregate of parts identified in Toulmin's analysis. The Claim of the Argument is stated at the beginning. Statements about facts and about reasons are separated and placed in their appropriate categories. The model demonstrates which facts and which reasons are marshalled to prove an individual Claim. A complex argument would require further analysis resulting in a number of related schemata as it would present more than one claim. Within the Toulmin model, the reasons are not directly linked to the facts that support them, but once the facts and reasons are sorted into their appropriate categories in relation to each claim, it is possible to construct links between the individual reasons and their associated facts in order to elucidate the argument. The Toulmin model of argumentation is described in detail below in §6.6.

As well as case representations, the kb contains a lexicon of legal concepts (lconcs). The lconcs are also represented as cgs. They are prototypical definitions of ideas of legal import. The lexicon of lconcs is, however, not static. Legal concepts are open-textured concepts; they can never be exhaustively defined. Each one comes into focus as it is limited by an accumulation of associated fact situations. Each lconc in the system, as in the real world, is progressively, aggregatively defined. Associative links are made between each lconc and its uses. Although the lexicon contains the original core definition, the associated uses refine and sometimes change the meaning of the lconc as the kb grows, as cases, that is, instances of the lconc, are added. The meaning of an lconc comes into focus only gradually.

It should be noted as well that the fact situations related to a use of a particular lconc become associated with each other indirectly through their relations to the lconc, which they help to define attributively. As a result, lconcs appear as the centres of clusters of related situations. The concepts are presented from different perspectives in the variant problem situations described in the cases.

There are thus three distinct elements in the kb. There is first, at the highest level of organization, the Argument that follows the prescription of a schema. Each part of the Argument is clearly defined and the parts follow in predetermined sequence. The lexicon of lconcs is a second, separate and supplementary part of the structure. The lexicon may be used in operations on high and on low levels of the kb. Although the lconcs themselves become part of the conceptual network because of their associations with the facts, the lconc definitions may be regarded as a simple dictionary to be referred to as needed. The third element, the lowest level of the kb, is the associatively linked representation showing the meaning of the text.

When I began the textual analysis, none of this structure was available, nor had I any organization in mind. The first piece to fall into place was the argument model. The discovery of the Toulmin model was the first breakthrough. The rest of the structure came slowly through trial and error, from many attempts to analyze the text at the lowest level. The final form of the kr is more intelligible in the light of discovery cast in contrast to the early failures, a brief description of which follows.

6.3. Text analysis—the general approach

The lowest level of the kr itself, which ultimately became the cg representation of the case arguments, was much more difficult to accomplish than the higher levels. The elements contributing to the difficulty were typical text analysis problems: a large volume of data, distinctive use of language within the knowledge domain, use of hortatory expressions, inclusion of some literary content of dubious value as information, and so on.

It has already been noted that access to the full text of case reports was judged essential for inclusion in a case retrieval system. Although the Argument structure was used to organize the textual representation, my intention was to stay as close as possible to the language of the cases themselves.[1] The first attempts at text analysis were based on an indirect method of analysis and were an abysmal failure. A description of those early tribulations follows.

6.3.1. Indirect analysis

The early attempts at representation I have called ‘indirect analysis’ because they involved an additional step in going from the text, to propositions written in English, to the final form of the kr. The analytical procedure originally followed was to break each sentence of a case report into phrases approximately encompassing the extent of a single logic proposition. Then each phrase was transcribed in a simple FOL notation. The result was an undesirable, awkward and inexact kr. For instance, the offer in *Weeks* was described as an instance of ‘assertion’ and had an embedded statement of implication. The conditional was not suitably represented. Something was simply ‘implied’ about an event ‘marries’. There were too many words, and not enough meaning. That attempt to translate the text into anglicized logic was a time consuming failure. The test that determined its failure was that in reading the propositions against the full text as a final proof, I found that a number of important facts had not survived the conversion. For example in

[1] Recall also, that the Argument structure prototype is regarded as a test kb. It is assumed that a fully implemented system would provide access to the entire text of case reports in the process of retrieval.

Weeks where Defendant (D) had told either Tybald, father or son, that he would give the money, the disjunction was represented as the indirect object (indobj) of the verb, but at no time was it possible to determine which Tybald. Similarly, the agent of the event ‘marries’ was represented as ‘?x’ but was never appropriately bound to any value, since the ‘indobj’ could not be resolved. Information had been inadvertently omitted. Attempting a logical interpretation of a number of sentence adjuncts or modifiers, resulted in distortions of meaning. Early attempts to represent all the verbs in the first sentence of the *Stamper* case were the worst examples. The sentence is discussed below in §6.3.2 and §6.8.2. Its meaning had been clear in the original text, but was obscured in the representation!

It is entirely possible that my lack of skill in writing propositions was to blame. However, I made repeated, careful attempts to extract the propositions from the sentences and then, just as carefully, tried to transcribe them. Despite no small degree of coaching, the problem was not remedied. Perhaps the most undesirable result of the early attempts was the first draft representation of *Upton* that was the ultimate, overly descriptive literary representation. In desperation, I sat down and very rapidly and carelessly wrote a symbolic representation of the meaning of the text directly from the printed page. The obvious improvement in the quality of the representation when I changed from the indirect method of interpretation to writing notation directly from the text was convincing evidence. The direct approach prevailed. From then on, I wrote the representation directly from the text without attempting first to extract the propositions in English from the sentences.

The relationship between grammar and logic is commonly recognized but not fully understood. Many difficulties arose where what approximated clausal analysis of the sentence did not result in neat, clean propositions. The difficulties had sometimes to do with structural complexity, for example, where coreferent problems and multiple nested clauses were involved. They also sometimes had to do with expression of meaning related to other complexities of natural language. Throughout, I was attempting to extract information from the text in a meaningful way. When I did that and then attempted to write the notation, it was often necessary to backtrack and to repeat a considerable amount of information from a previous proposition or set of propositions. I began to ask myself yet again ‘‘What do we mean by information?’’

Another difficulty had to do with the interpretation of natural language terms. Variant phrases or terms were used to represent the same idea in a slightly different way, or from another aspect, or in a different connection. From one perspective this is the synonym problem encountered by indexers and kr writers. From another perspective, it is the problem of deciding on the level of representation. Some but not all descriptive nuances of the written language ought to be converted into the logic-based representation. Nor could I determine how much literary expression was necessary for retrieval. These problems did not go away with a change to direct transcription; but they became easier to negotiate.

Finally, the worst problem with the original, indirect method was that for some reason, the choice of predicates was indescribably bad. Although I read everything I could find on the nature, selection, and use of predicates, I was unable to construct a viable representation of even simple factual descriptions. And of course, because the choice of predicates was faulty, it followed naturally that the arguments did not fit. They were badly chosen, and badly represented. There were ambiguities in the propositional interpretation that required the addition of convoluted expressions for clarification.

6.3.2. Direct analysis

The direct method of analysis worked on the first try. Looking desperately for a solution, I had gone back to the original text, to a very factual passage. When I worked directly from the text to frames, using a standard FOL notation, everything fell into place suddenly much more easily. There were some loose ends and pieces to be tucked in or cleaned up, but in the main, sentence structure analysis came more easily.

My awareness of linguistic entities seemed to be heightened. Where previously I had concentrated on analyzing text to derive information, I now became aware that deriving information had much to do with how language worked. Focus shifted from clausal analysis to the choice of predicates. The choice of predicates was more clearly indicated—sentence analysis worked easily and naturally. The sentences literally fell apart, although it was apparent that my skill at writing propositions was not great; the analysis was simple and natural, even if not elegant. Work proceeded apace, whereas previously it had become stuck on every irregularity. The work then became a matter of going through the text, analyzing it sentence by sentence, not struggling to extract the information from the literal expression. Later, that problem did recur though at a different level.

When I worked directly from the text at first, the kr took the form of standard FOL propositions. The first problem I encountered was the common one relating to sentence transcription, ‘‘Is it necessary to transcribe the *whole* sentence?’’ Early on I determined that it was not. The interest here is not in meticulous parsing but in information. Each sentence was analyzed in relation to the legal argument of which it formed a part. All parts of all sentences were not represented, but what was represented was meaningful in the context of the argument. The styles of the judges’ literary expositions suffered from this, but their reasoning came through clearly.

Little notice was taken of paragraphing. The emphasis was placed on keeping within the Toulmin Argument schema. In some respects, the argument analysis is comparable to discourse analysis, but in general it is not.[2] In discourse there is more interaction between speaker and hearer. Although an argument is constructed to persuade the hearer, and often the arguer inserts what he assumes to be the questions or objections of the hearer, the main line of the argument is clearer and more straightforward than the backing and forthing of a discourse.

The Argument is goal-oriented; a Claim or goal is stated at the first and the argument is developed to prove it. There is no problem of having to determine whether or not the hearer understands the speaker’s utterances. We don’t know what the hearer understands from the context of the case report; nor do we need to know it. We know only what the arguer tells us about *his* knowledge of the hearer’s point of view.

Anaphors are not as sticky a problem in argument analysis as they are in discourse analysis since the story is told from a single perspective. Anaphors, nevertheless, occur commonly enough to require notation that will accommodate them.

Finally, sentential adverbs play their part in linking sentences and in linking paragraphs in discourse analysis. Similarly, in analyzing arguments they have been powerful and problematic. The principal problem has been establishing their effects on the truth values of the statements associated with them. Generally they have been treated according to the most obvious interpretation. Occasionally, they have been

[2] The work of Alvarado 1990, regarding argument comprehension, is closer to the discourse analysis model.

interpreted as modal operators with scopes encompassing the entire sentence to which they are attached. It was correspondingly difficult to see their use as linking devices, and so to represent that function with any degree of accuracy. The structure of the Argument is the stronger, more relevant thing. The first priority was to keep it clear, to keep the goal, that is the Claim, in sight.

As discussed earlier, information relevant to the argument was extracted from the sentences and represented without regard for hortatory embellishment. Also, the representation of legal argument was stressed rather than the linguistic content. The prime example occurs in *Stamper*. Recall the levels of meaning in a single sentence:

(6-1) ‘‘We are constrained
to believe
that what is called an offer
is nothing but a strong expression. . . .’’

It is important to know which of the levels need be expressed. In this instance, we are not faced with a ‘belief’, but with a statement of opinion, and so the statement is related to the modal operator representing the judge’s decision. ‘Constrained’, ‘believe’, and ‘called’ have not been included. The representation belies the language but conveys the meaning. Some of the language representation problems became logic problems as will become apparent later.

I also found that words one would expect to find do not always appear in the text. This is where conceptual retrieval will truly come into its own right if the kr is adequate. For example, in both *Weeks* and *Stamper*, the discussion is about a putative ‘offer’, and a ‘reward’; neither term appears in the text, but the case should be retrievable by either. In some places where the sense was clearly indicated, additions have been made to explicate the meaning. Representation of the facts and the arguments of the cases must be adequate to allow for conceptual retrieval. For this reason, some additions were made to the actual textual expression and some deletions as well.

With this general introduction to the approach in this dissertation, let us proceed to a discussion of the actual construction of the conceptual representation. It should be borne in mind that it is necessary to interpret the text on three levels while undertaking the transcription. First, the reasoning must be understood in order to maintain the argument’s cohesion. Second, ambiguous language must be recognized and interpreted. I attempted to make careful decisions staying close to the text, and interpreting the language strictly in context. Third is the problem of writing the representation, of transcribing the concepts in conceptual graphs.

6.4. Conceptual graphs

To this point, the problems involved analyzing the text. Now that a basic method for approaching the kr had been decided upon, the transcription of meaning in an appropriate notation was the next challenge.

I had been working awkwardly with a homely adaptation of FOL notation, making comparisons along the way with notations in other frame-based natural language representations. Then I came upon conceptual graphs, which immediately appealed. Indications of how to solve many of the kr problems I had encountered were given in the text describing the notation (Sowa 1984). Using cgs I would be able to develop an open system with the advantages of FOL, and could convert natural language concepts from text to an established notation.

The most significant advantages of cgs follow. Sowa provided the logical structure for graph interpretation with the required proofs. As well, he provided catalogues of defined concepts and conceptual relations (conrels) which gave the new user a good start at using them correctly. Cgs had been shown to be adaptable to the analysis of text. It was a pleasure to find a notation that allowed for symbolic representation of coreferents, that dealt with quantifiers and that was suitable for semantic representation, at least at the level I contemplated. Cgs allow the use of a case grammar, and some traditional cases are included in the conrels. In general, cgs make available a large and flexible set of structures for semantic analysis without tying one to a particular linguistic theory.

With regard to the notation itself, it is particularly easy to read, and often results in a more succinct representation than the FOL alternative. The concepts and relations are mnemonic. Using defined conrels shows connections clearly, and often more directly than using variables.

Use of deep cases was allowed, and although some cases were provided as conrels, it soon became apparent that they were not adequate to the task of full text analysis. The Sowa conrel cases were occasionally used where a suitable Somers case could not be isolated. I came to regard those cases as general descriptions of a semantic phenomenon; they became ‘holders’ for a variety of slot fillers with a common attribute that needed further analysis.

There were some problems as well in applying the notation itself. The diagrams and examples in the expository work (Sowa 1984, 1987, 1988) were occasionally contradictory; examples of such instances are noted in the catalogue of conrels in Appendix A. Generally there were problems deriving from two difficulties. The first was the scope of the universal quantifier, which closed at the ‘end-of-context’ symbol, the period. As a result, any concept not appropriately protected was included in the scope of the universal quantifier, causing some curious misinterpretations. Sowa resolved the first problem of quantifier scoping (1988), and others as well as time progressed (1989).

The second was the problem of using the dash-comma pair to bracket embedded clauses. As the dash comes at the end of the first concept, the placement of the comma with relation to brackets that precede the concept was tricky to do and to read correctly. I was often inveigled into error in both reading and writing the nested concepts so enclosed. Mentally visualizing them as a bracketing pair didn’t really help very much. I simply found it easier to work around the use of the dash-comma pair as far as possible, using it where it was helpful and using something else where it was less clear.

A general difficulty with the notation is the problem of dealing with clauses embedded at many levels. Granted, the complexity of the syntactic structure is real enough, the linear format of the graphic notation is more difficult to handle than might appear at first sight. The problem will show itself from many perspectives as the case representations are discussed in detail below.

Some of the difficulty is related to the syntactic analysis of complements. Often a whole complex clause had to be hung precariously from an object, which caused me to introspect at some length about the nature of complements. More will be said about this below; however, here it must be noted that it is intimately associated with the problem of identifying the correct Objective case, about which there is more to be said as well.

Interestingly, when attempting to improve any part of the notation by adding or subtracting elements or changing symbols, I always returned to the original version as more accurate or more economical. I did find I was adding peripheral comments to the notation for my own use and that they became quite stylized.

I was interested to see that Sowa 1991 has added an additional field in the concept description, separated by a semi-colon, for syntactic comments that are to be ignored by the interpreter.

Finally, although the symbolic representation worked well enough where serial events were being described, the weaknesses of the notation discussed in §4.3 above persist. The most disappointing one has to do with the representation of concurrent and interacting events. Limitations were evident where continuity, simultaneity, or intermittent activity were being described. It is clear that some aspects of real world knowledge cannot be represented easily and naturally. However, they are known to be problems in other krs and it may be the way we currently approach the problems that is at fault. The difficulty with regard to linguistic cases was alleviated if not remedied by using Harold Somers's cases.

6.5. Somers's case grid

Somers's approach to case grew out of an exhaustive analysis of the use of linguistic cases. It was an attempt to consolidate knowledge and to point the way to improvement in computational linguistics. Somers's idea of building a grid to solve the problem of choice between cases for nouns with dual roles seemed to be a good one. In practice in such situations, where there is a directional element in the semantics of the verb or where the source-goal element is relevant, the grid works very well. The dual role problems were discussed in §5.3.

Some parameters of the grid work particularly well. For example, all the Dative Possessive cases are straightforward. Each is clearly distinguished from the other. Each case fits a particular need and is clearly correct in certain situations. The Temporal is another parameter that is conspicuously accurate. Where other krs require a recognition of the prepositions involved, here the Temporal cases correctly express the time relations at a coarse level. There is no need to verify the presence, express or implied, of a case marker.

The individual cases in some cells sometimes work better than others. For example, ambient local (AMBL), the most peripheral of the adjunctive cases, describes a condition under which an event occurs. It is a powerful relation, and like the Objective cases, allows the attachment of a clause. Similarly, the ambient path case (AMBP), which describes the way in which an event occurs, relates directly to manner modifiers. Needless to say, it is useful.

On the other hand, some parameters caused problems from the start. Although I attempted to work with the cases, I felt in the end that I had developed only an interpretation of their meaning, not a definitive approach to implementation. My biggest problem was interpreting the cases along the Objective parameter. It dovetailed with the problem of representing syntactic objects with cgs, as will be discussed below repeatedly in §6.8. In spite of the convenient ambient path case, for manner adverbs, there was difficulty in properly handling modifiers. Some additional analysis had to be done with regard to adjectives in particular as will be noted in the discussions of the uses of the peripheral cases, especially the Ambient cases. The conrels, attribute (ATTR) and characteristic (CHRC), were involved.

The outside parameters were generally less satisfactory than those inside. Somers made the point that he had not paid as much attention to the cases he regarded as taking sentence adjuncts as he did to the internal ones. In particular, the Ambient and Local parameters had to be carefully tended in order to be avoid using them as wastebaskets for odd items.

Temporal and Locative cases posed special problems. The cases were adequate as far as they went, but situations arose that they did not cover. In both instances, additions had to be made to the combined representational capability of the Sowa and Somers systems in order to express the meaning of the text. More will be said about that below (§6.8). It is apparent that Temporal and Locative cases can be used mistakenly in place of each other, and that there is a relationship between them.

Finally, of the various verb types, the psychological verbs were the most difficult to analyze and the most interesting. In particular, the verbs of cognition and perception caused difficulty in the choice of a case to express the idea of ‘experiencer’. This can be described adequately only with recourse to specific examples. Within the descriptions of the representations (§6.8), comparisons will be drawn between the various verbs and their argument patterns.

The cgs that comprise the kr at its most fundamental level are organized in the next higher level into an Argument structure. A schema of an Argument has been developed using Toulmin’s ‘good reasons’ model of argumentation.

6.6. Toulmin arguments

Focusing on the argument may be seen as a way of structuring the discourse. The Toulmin or 'good reasons' model of analysis, shown in figure 6.1, can be applied to any argument type in any domain. It is an uncomplicated model. Toulmin starts with the Claim of the argument, the goal, as in fact one often does in making an argument, then proceeds to relate the remaining parts of the argument to the Claim and to one other.

When the 'good reasons' analysis is applied to a *ratio*, the facts and lconcs stand in appropriate relation to each other. The facts fall into the Grounds category.[3] The lconcs are most likely to appear in the Warrant. Notice, however, that the model is simplistic. There is no way of indicating the relations between specific facts and specific lconcs, only of relating the Grounds to the Claim, and the Warrant to both of them.

The parts of the schema are shown in figure 6.1 and may be described in the following manner. The **Claim** is the statement that the argument is said to support. It is also the conclusion or goal of the argument. The **Grounds** are the facts asserted to support the Claim. The **Warrant** is the logical authority, the reason for going from the Grounds to the Claim. In the application of the schema, the Warrant section has been called **Reasons**, as a representation of the judge's 'reasons for judgement'. A Warrant is described by Toulmin as a hypothetical, bridge-like statement. He elaborates on the nature of Warrants: The **Backing** establishes the general authority for the Warrant. Its validity is determined by the rules of the area of

Claim:	The conclusion or goal of the argument.
Grounds:	Facts asserted to support the Claim.
Warrant:	The logical reason for going from the Grounds to the Claim.
Backing:	Authority for the Warrant and its validity.
Modal qualifiers:	Limit the scope of the application of the Warrant.
Rebuttal:	Statement opposing the validity of the Warrant.

Fig. 6.1 Toulmin's argument model.

[3] Grounds were originally called 'data' by Toulmin. The change in name does not indicate a change in meaning.

> This distinction, between data and warrants, is similar to the distinction drawn in the law-courts between questions of fact and questions of law, and the legal distinction is indeed a special case of a general one—we may argue, for instance, that a man whom we know to have been born in Bermuda is presumably a British subject, simply because the relevant laws give us a warrant to draw this conclusion. (Toulmin 1958, p. 100)

argument. In the example above, was the relevant legislation still in force?

Modal qualifiers, such as ‘probably’, ‘presumably’, and conditions of acceptance, limit the scope of the Warrant’s application. Toulmin says,

> we may need to add some explicit reference to the degree of force which our data confer on our claim in virtue of our Warrant (Toulmin 1958, p. 101).

Assertions of **Rebuttal** are included when the authority of the Warrant must be set aside. For example, the man from Bermuda may have become a naturalized American.

It is apparent that the Toulmin model is adaptable to structuring discourse or creating a higher-level of organization of cgs. The reason for using an Argument structure is ultimately to provide the legal researcher with a cognitively natural search mechanism. As he searches cases, he is trying to develop an argument; if the retrieval is done in the most natural way for him, he will be able to develop his argument as he searches. Analyzing the cases with due regard to their argument structure provides a basis for developing the kind of retrieval mechanism the modern legal researcher needs.

6.7. Lexicon of legal concepts (lconcs)

Complementing the case representations is the lexicon. Legal concepts (lconcs) are fundamental ideas central to legal reasoning, that is, legal principles of sorts.

Some lconcs are very easily recognized because they are named by terms that have distinctive legal connotations. For example, ‘injunction’, is seldom used in a nonlegal sense. Then again, a legal sense may be attached to normal everyday terms, creating a possibly ambiguous situation. For instance, ‘promise’ may or may not be used to describe an event that entails legal consequences. And again, a phrase may have a legal connotation but not be recognized at the outset as being appropriately classed as an lconc. An example might be one of the double verb phrases typical of the legal sublanguage, such as ‘advise and consent’. Its meaning is not significantly different from the everyday interpretation of the phrase; however, the conjunction of the two verbs serves to emphasize a point that has legal significance in some circumstances. Many lconcs were unearthed in the process of doing this work; it is too much to hope that none has escaped detection.

In any event, it should be stressed that the legal meanings have been emphasized rather than the senses associated with common usage, what we have called ‘everyday meanings’. Often, the common meanings have been disregarded. They have no relevance to the text at hand. Presumably they would be added in due course as the kb grew, since lconcs are associated with new information as it is added. An lconc’s name may be matched by a named concept in a case. Its definition may be matched by a similar set of facts or an unnamed idea underlying an argument. Each time a case is added and an associative link is made to the lconc, that lconc acquires new meaning. The system might, in a very broad stretch of the imagination, be said ‘to learn’. In the process, everyday meanings would be accumulated through term matches. Instances of term uses having everyday meanings would be attached when they occur in incoming cases.

Definitions for all the lconcs identified in the cases were taken from recognized standard legal dictionaries, as indicated in the individual references. The English-language definitions appear in Appendix B. The cg representations of all the lconcs are arranged alphabetically and are to be found in Appendix C. In the course of the analysis, three kinds of lconcs were recognized: words and phrases, simple definitions, and complex lconcs. The legal phrases were regarded as idiomatic phrases, and then included in either the simple or complex category as was suitable—usually the simple. It was anticipated that extra care would be required to represent the complex lconcs properly. This did not turn out to be the case. The complex concepts were pared down and concentrated. Their definitions were simplified but the elements significant to the cases at hand were retained. Transcribing the complex concepts was as straightforward as transcribing the simple ones. To me, this was a very significant finding, even though their complexity had been considerably reduced. The difficulty occurred in the definition of meaning rather than its representation. It appears that, if the ideas can be defined, writing the kr is relatively easy. We can use defined ideas for knowledge-based retrieval. It seems describing what we know rather than finding a way to write it is the problem in representing complex abstractions.

Some definitions were abridged as they were being transcribed. Meanings that are quite acceptable but not relevant to this work were eliminated. Quotations from law cases, normally a part of the law dictionary definitions, were also eliminated. Although those definitions were not as pithy as one would have liked, the transcription went surprisingly quickly.

This section completes the general description of the kb. In the next section, I describe in detail the individual case representations, drawing attention to particular features.

6.8. The representations

For each case analyzed, the whole Argument constitutes a single frame that contains other frames. The outer frame, the Argument frame, is a schema. The first Argument in the kb is designated #1, similarly, the first Claim is #1 and the first Grounds section is #1, all within the same schema.

As well as at least one Argument frame, each case has a case-id frame. The [CASE_ID] frame for *Weeks* (figure 6.2) identifies it as case #1. The conrel (INCL) is used to group items of information together. It links the frame name to a concept of the type [PROPOSITION], which is not named but is represented by a pair of brackets indicating the scope of the section (Sowa 1984, p. 177; Sowa 1988, p. 2-7). It goes on to give identifying information about the case itself and the publication of its reports. Many of the conrels in a case-id frame are especially defined for use here. Their definitions are included in

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[CASE_ID: #1]→(INCL)→[
   (STYLE)→[*Weeks* v. *Tybald*]
   (PARTY)→[P: Weeks]
   (PARTY)→[D: Tybald]
   (CITE)→["(1605) Noy. 11"]
   (CITE)→["(1605) 74 E.R. 982"]
   (CITE)→["Milner 1985, 274"]
   (LOCL)→[Eng]
   (JURIS)→[EXCHEQUER]→(PART)→[DIVISION: trial]
   (DISP)→[D: Tybald]
   (PART)→[ARGUMENT: #1]]
]. *;end of Case-id*

Fig. 6.2 An example of a case-id frame.

Appendix A.

The first relation we encounter is (STYLE). (STYLE) indicates ‘style of cause’, that is, the official name of the case. Normally each case has only one (STYLE) but it is conceivable that common use of an abbreviated title, or a widespread misreporting of the name would make another (STYLE) slot useful.

Each party to the action is related to the case by its own (PARTY) conrel. In figure 6.2, the roles of the parties are stated. ‘P’ stands for ‘plaintiff’ and ‘D’ for ‘defendant’. Other roles are possible, for example, ‘CD’ for ‘co-defendant’. As many (PARTY) relations as are needed may be added. It is possible to designate third parties to an action, as well. They require a distinctive conrel.

Case citations are joined by the conrel (CITE). There may be several (CITE) slots. Normally the official citation will appear in the first slot. However, since it may not be available, and since the form of official citations is so readily available, it was decided not to make a special, required citation relation for the official citation. In figure 6.2, the first citation is the official one. It refers to an old English reporter, *Noy*, a nominative. Such citations are expected to be accompanied by citations to more recent re-issues of the old reports. Here, the second citation refers to the *English Reports* (E.R.). As many citations may be added as are known or considered useful. The third citation in the example above gives a reference to the appropriate page in Milner’s casebook. It is useful since we are looking at cases taken from that source. It would not normally have been included in a kb of law cases unless no other cite was available. Note that the citations are enclosed in quotation marks. They are represented as phrases rather than concepts. Phrases within quotation marks are read as character strings rather than as objects.

The place where the trial took place is given as a geographic location. Here, ‘Eng’ is used rather than ‘U.K’ for reasons that will be apparent to the reader. (LOCL) is the abbreviation for the locative-local case which, as shown in Appendix A, designates a ‘‘static position at which an event occurs’’. The example given is, ‘‘Fire breaks out in The Cat’s Pajamas’’, and (LOCL) relates ‘The Cat’s Pajamas’ to the verb ‘breaks out’, as here, it relates ‘Eng’ to the proposition describing case #1. (JURIS), the conrel designating judicial jurisdiction shows the court and the level. The Trial Division is a part of the Exchequer Court.

Finally, we get to the disposition (DISP) of the case. Here, D Tybald, is shown to have won. A conrel (HIST) might be added in order to link the case-id to previous cases of interest. If this had been an appeal case instead of a trial, there would have been a value for the (HIST) slot. But most significant for our purposes, the [CASE_ID] frame #1 shows that [ARGUMENT: #1] is (PART) of the case. (PART) has a physical connotation. The whole, that is, the case identified here, actually contains the part, that is, the Argument. Only the name of the Argument frame is given. Nevertheless, the Argument is a part of the case frame. For example, it will be recognized that Argument #1 falls under the procedural rules of the Exchequer Court.

The conrels (PART) and (INCL) are alike. (PART) acts as a pointer from a case-id frame to an Argument related to that case. (INCL) indicates scope, that is, that an integrated contextual unit follows.

The definitions of all the conrels used in the representations, including those taken from Sowa’s and Somers’s work, as well as those defined especially for this project, are listed alphabetically in Appendix A. Linguistic cases are shown in the grid (figure 5.1) as discussed in §5.5. Recall that all linguistic cases are conrels. They appear with their definitions in Appendix A, as well as in the case grid. Dictionary definitions of the lconcs appearing in the kb may be found in Appendix B. The lconcs representations appear in Appendix C.

Within the Argument representations, concept numbers are prefaced by a mnemonic character; for example, in the frame for the *Weeks* v. *Tybald* Argument, the first instance of ‘promise’ is designated [PROMISE-n: #W1]. The mnemonic ‘W’ stands for ‘Weeks’.

The krs for the four Arguments follow. Each kr is preceded by a detailed description. Recall that the text of each case, along with a discussion of the facts may be found in chapter 3.

6.8.1. Case 1: *Weeks* v. *Tybald*

The case is discussed in detail in §3.3.1. The text appears in figure 3.1. [CASE_ID: #1],figure 6.2, points to [ARGUMENT: #1]. [ARGUMENT: #1],figure 6.3, includes blocks of Argument called: [CLAIM: #1], [GROUNDS: #1], and [REASONS: #1] within its outer context as indicated by the conrel (INCL) and an additional set of square brackets, ([ ]). Closing brackets for inclusions are followed by comments, for example, ‘‘end of ARGUMENT’’. Every comment is preceded by a semi-colon (;). Each of the Argument blocks has its own (INCL) and opening bracket at the beginning and its own closing bracket and final comment at the end.

6.8.1.1. Claim

The Claim section of the Argument model, it may be recalled from §6.6, describes the conclusion of the Argument, the statement the arguer wishes to persuade his audience to accept.

[CLAIM: #1] says that there was no contract between the two parties Weeks and Tybald, that is, that D Tybald was not legally bound by the promise he made because he did not intend to contract. Evidence of the fact that D had not intended to contract is the promise he made.

[CLAIM: #1] includes three cgs with their contexts. Each of the three concepts is followed by a dash (−) indicating that the following graphs come within the context of that concept. Each of the contexts ends with a period.

The first, [˜CONTRACT-n], has within its context graphs representing the Plaintiff (P) and D. Each of them is associated with it by the conrel (PARTY). The object [CONTRACT-n] includes an '-n' indicating that 'contract' is a noun. The symbol of negation (˜) means that whatever it was that existed between the parties, it was not a contract. It is like the example in figure 4.4 where [˜CAT: !] designated an entity with wings that was something other than a cat. Here, the entity may have parties, but it is not a contract. We are being told that this is not a failed contract, as in an action for breach, but a contract-like entity that never existed. The contract is an **inchoate entity** (Hirst 1989). It is a non-event, yet must be discussed throughout the Argument as if it had existence.

As discussed above, the concept of contract is linked to each of the two parties named. The conrel (PARTY) links it with P and D, whose concept labels are specified by the personal names of Weeks and Tybald, respectively, in their referent fields.

The next concept is also a negative, but of a different kind. The difference between the negative representations is subtle but substantive. The real question in *Weeks* is whether or not D is legally bound. [LEGAL_BIND: ˜] indicates that the entity does exist, however, there is no instance of it here. There is an absence of a legal bond in this context, as in figure 4.4, there was an absence of cats on the mat. The concept exists, but does not apply to D in this context. Simply stated, D is not legally bound.

[LEGAL_BIND] is a legal concept (lconc), the first of many to be encountered. [INTENTION_TO_CONTRACT], below, is another. More will be said about lconcs later when we have encountered a number of examples.

Within the same context as [LEGAL_BIND: ˜], the first conrel (ACTP) indicates that the means or instrument by which the lack of binding came about is, [PROMISE-n: #W1]. [PROMISE] here is a noun, as shown by the '-n', and it is an instance of the type 'promise' numbered 'W1'.[4] D is the (OBJL), the object of the [LEGAL_BIND: ˜]. He is undergoing the effects of the event. He is in the state of not being legally bound. The use of (OBJL) indicates that the condition described by the verb is ongoing, indeterminable within the statement. The current expression is what is important. (OBJL) tells us what is happening at point 'C' on the directional arrow. We cannot yet see 'B', the goal, from our vantage point now.

The conrel (AMBS) shows the reason D is not legally bound by the lack of intention to contract, [INTENTION_TO_CONTRACT: ˜]. Again, a negative in the label field shows that the concept does not exist in the context. There is an absence of intention to contract, rather than a presence of intention *not* to contract. There is indeed intention, but as the judge states, intention to do something *other* than contract.

The third graph in the [CLAIM] is [INTENTION_TO_CONTRACT: ˜]. The first conrel, (ACTS) links D to it as the agent of the event, even though it is a non-action. This case is the closest one in Somers's grid to the traditional subject. Its selection is very much a matter of interpretation.

Intention is often discussed in terms of modal logics. If intention were to be treated as a modal, it would signify the creation of a possible world. The content of the intention would possibly be true within the limited context of that world, and would have other conditions attached to its truth value, its value as a fact, in the mainstream argument. The truth value of the intention is to be settled by the judge. It is not a context that will figure in any reasoning that would be done with the representation. The semantic content of primary interest to us does not require moving the event out of the main argument.

The [INTEND] concept might have been treated as a psychological verb with different consequences. [INTEND] does have psychological content. It is a verb of cognition. If intention were to be

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[4] [PROMISE-n: #W1] has not been defined yet; it will be specified in the [GROUNDS] frame.

treated as a psychological verb, D would be represented as the ‘experiencer’. He would be the benefactor of the intend event. The experiencer, in Somers, the (DATPSYG), is an objective case, an argument affected by the verb. However, intending is also a willful activity. If D were represented as the (DATPSYG) the element of volitivity would be suppressed and so would the associated component of agency, initiative. Determining whether or not D intended to do something is central to this case. The trial is like a fact-finding inquiry as to whether or not the intending was done. Intention as it is used in the lconc ‘intention to contract’, means a definite, willful, or volitive decision. If the experiencer case is used, the important element of volitive decision-making would not be expressed. For these reasons, I elected to use (ACTS) for the argument, rather than (DATPOSSG), describing D as the volitive instigator of the *action*. ‘Intend’ then is treated as an action verb, rather than a psychological verb.

The remaining concept within the context of [INTENTION_TO_CONTRACT: ˜] is [PROMISE-n: #W1]. The dyadic relation is evidence (EVID), an addition to the Sowa list. (EVID) is used when a particular piece of information is proffered in support of an lconc. Its definition is not specific, but it does indicate a strong connection of legal consequence between two concepts. In contrast, the case (AMBS) expresses causation. It was used above to show that the lack of contractual intention accounted for the failure to bind D legally. (AMBS) is peripheral, an outer case. It is a kind of pre-condition, a weak expression of causation. It is one of the cases we are guarding against turning into a catch-all, since it lends itself to a wide range of interpretations. Note, however, that [INTENTION_TO_CONTRACT: ˜] is certainly a precondition to [LEGAL_BIND: ˜] just as [INTENTION_TO_CONTRACT] would normally have preceded the contract.

6.8.1.2. Grounds

As discussed in §6.6, the factual basis of the Argument is revealed in the Grounds section. By means of the (EQUIV) conrel another role is assigned to Weeks. It is asserted that he is an instance of the type [MAN]. There is a potential ambiguity here. Further down in the representation, the father of Weeks is included. It could be inferred that a father is a subtype of the type [MAN] and so of course that the senior Weeks may also be said to be a man. However, since that information is inferred by way of the subtype relationship, the two instances of [MAN] named ‘Weeks’ may be disambiguated procedurally if necessary.

[PROMISE-v: #W1] is instance #W1 of the verb 'to promise'. D Tybald, the (ACTS), is the instigator of the action; he is the promisor. It appears then, according to the text, that the promise was made to Weeks or to his father. Putting aside the question of truth values, and of the scope, the problem of representing a disjunction is complex. To whom was the promise made? Was it made to someone, to the father, to both, or to either? The statement is not precise, so the representation cannot be precise. Furthermore, the statement in the text is preceded by the phrase ''it would appear'', adding to the uncertainty of the utterance.

(DATPOSSL) describes the thing transferred, the content of the promise. This use of Somers's (DATPOSSL) is slightly imprecise. If something is possessed and then transferred, it stands to reason that the original possessor actually gives up the thing transferred, that he no longer possesses it. Nothing is really transferred here. An offer is made to do something in the future, upon a condition being fulfilled.

In describing the promise, the text does not actually use the word 'promise' but says 'told'—the judge is simply relating the facts of the situation before giving judgement. In this representation, a format has been established in order to represent with some regularity this promise and other contractual offers. Promises, in this kb, always take the form of conditional statements. The structuring does add some information. [PROMISE] conveys more of the meaning of contractual offer than is warranted by the text, although the terms are clear. There is a definite *quid pro quo*. In the representation, it appears as an *if. . . then* statement. Note that Sowa allows this representation of implication rather than the combination of negation and conjunction that displays the true logical form, as discussed in §4.1.3. We use the if. . . then here to expedite comprehension by the reader.

The representation of the terms of the 'contract' is found in the promise. The concept [TERM] is a subtype of the concept [PROPOSITION] and is used to group several graphs in the context of the promise. The use of Sowa's 'contain' conrel, (CONT), is metaphorical since the promise does not physically contain the terms. The whole proposition is the value of the (DATPOSSL) slot. The graphs representing the promise are nested in the context of the concept [PROMISE-v: #W1]. This is the first example of nested contexts. They will be discussed repeatedly throughout this chapter. It may be noted that the way of handling them here was to define a structure, suitable to the domain and likely to be used repeatedly. The offer structure, [PROMISE]→(CONT)→[TERM], controls the representation of those complex pendant clauses. It is anticipated that the structured promises will be useful in retrieval and reasoning about arguments and lconcs.

The antecedent of the implication is a conjunctive concept, ‘to marry with consent’. D Tybald says that if some unknown man, designated by the variable *x*, marries his, that is, Tybald’s, daughter, and if Tybald himself consents to the marriage, then Tybald will give to the man in question money in the amount of £100.

The case of Tybald’s daughter in the event [MARRY: #W1] is the (ACTL), the active local, the non-passive patient. This is a perfect example of the use of the case as Somers defined it. Other linguists have called it the ‘co-agentive’ or the ‘second agent’. It might also be said that the (ACTL) is a type of ‘patient’. It has a reflexive quality in that the (ACTS) and the (ACTL) do something to bring about an event and through that event, affect each other. In an event of the type [MARRY], each participant is an instigator and each is a recipient of the action. In a [MARRY] event, it cannot be determined which of the spouses is the actual agent. Both are animate; both take part willfully and actively. Generally, only the syntax tells us which is the prime initiator since the sentence requires a subject. Although it is possible to say ‘Mike and Anita married.’ It is as common to say ‘Mike married Anita’ or ‘Anita married Mike’. Notice that the comma after the (ACTL) graph indicates the end of the graph attached to [MARRY: #W1].

[CONSENT_TO] is the first of a number of particle constructions in which the preposition is kept with the verb as a unit in order to achieve an accurate semantic representation of the verb phrase, like an idiomatic phrase. More will be said about this below.

(OBJG) is used for the event to which Tybald has consented. A major difficulty in applying the case grid is the choice of the appropriate objective case to represent the meaning or meanings of what we have come to know as patients or themes. Any case along the Objective parameter is more passive than its counterpart on the Active parameter, in that its NP is suffering the affects of some process. (OBJG) represents the end of the Objective continuum the result of a completed action, the ‘B’ on the directional arrow (figure 5.2). The verb describes a single, complete action. The act [MARRY: #W1] has achieved the result state.

The consequent of the condition states simply that the (ACTS), Tybald, will 'give' to the unnamed spouse of his daughter, money in the amount of £100. In this instance, the (DATPOSSL) is used precisely in accord with the usual physical implications. The money is to be transferred from Tybald to the man. Nothing of the thing transferred would remain with the transferor. Although, in correctly written English, the tense of 'give' should be a future, the logical form of the condition satisfies the need to represent future time. The actual time at which the promise was made is given as an interval named 'promise#W1'. Finally, the period at the end of the time assertion signifies the completion of the context of the concept [PROMISE-v: #W1].

Still within the Grounds, the remaining assertions have to do with factual occurrences following the promise. There is an implicit conjunction between each graph and the one following it (§4.1.3). P Weeks did in fact marry D's daughter. Since we know that Weeks is an instance of type [MAN], the variable '*x*' is instantiated as 'Weeks'.

The marriage followed the promise in time. The time at which the marriage occurred is the interval named, 'marry#W1'. The minus sign (–) designates the beginning of the interval. Since the beginning of the interval 'marry#W1–' is greater than (>) the end of the interval 'promise#W1+', the marriage follows the promise in time.

Next we see that D Tybald did indeed consent to the marriage. The antecedent of the condition has been fulfilled, however, the consequent has not. The entire proposition including the concept [GIVE: #W1] has been negated. It is not true that the event happened, as in the example in figure 4.4, it was not true that there was frost on the pumpkin.

Punctuation of the graphs should be noted. The period at the end of the graph corresponds with the dash (–) after the concept [GIVE]. The dash-period pair delineates an inner context, the positive proposition. The outer context is the negation of that concept. The last bracket in the graph corresponds with the bracket before the negation sign (˜) and encloses the outer context.

Next, we see that the judge is offering an opinion on a matter of fact. Since it is his opinion, it is prefaced by the modal (JD). He says that Tybald neither averred nor declared to whom the promise was made. The conjunction of [AVER] and [DECLARE] is made, as may be recalled from §4.1.3, by juxtaposing the elements. No symbolic representation of conjunction is necessary. The judge's determination has to do with the fact that, as we saw above, the statement of offer was made to either Weeks or to his father. Graphs are conjoined to the graphs appearing before and after them within any context. The use of the implicitly conjoined phrase 'aver and declare' is a typical example of legal syntax. The two verbs are used together for emphasis. The judge is saying that D showed his intention *neither* by action *nor* by words. Such a phrase commonly becomes an indexing term for legal text. It functions as an indicator that a legal principle of serious import is at hand (Mellinkoff 1963, p. 100). There is also a procedural connotation attached to this particular verb pair since it commonly appears in pleadings. However, the question at hand is not one of erroneous pleadings.

The judge says that D did not indicate a [PERSON : ?] as the recipient of the promise. It is significant that this assertion is distinguished as the judge's belief since it conflicts with the above assertion that the recipient was P or his father. It also highlights the problem of representing disjunctions. The judge has interpreted the disjunction to mean that the statement was in fact made to no one. A choice of one of two people does not convince him that the offer was made to *someone*. Since it was directed to no one in particular, the offer was too general.

Note that the arrow pointing to the (DATPOSSG) shows that the person was the recipient of the promise. The final string of punctuation includes a comma to end the graph attached to [PERSON: ?], a period to close the context of the two verbs, a bracket to enclose the context of the modal (JD) and a final bracket, followed by a comment to close the [GROUNDS] section.

6.8.1.3. Reasons

From the Grounds section we proceed to the Reasons. Recall that the reasons for judgement are the Warrant of the Toulmin model as discussed above in §6.6. They are hypothetical statements that link the facts, the Grounds, to the Claim. They show how the Claim is proven by the facts.

In this case, all the reasons are within the modal (JD), indicating that they express the judge's opinion. The first reason is that Tybald has not formed an intention to contract. The judge cites as evidence of lack of intention, that the promise had the characteristic (CHRC) of consisting of [PHRASE: "general words"].

His second reason is that the promise was made to an unknown person, that is not made to anyone in particular. The final reason is that D is not legally bound by his promise because his intention was other than to contract. The judge simply makes a determination on the facts as shown, characterizing them in his own way rather than offering them as a part of an argument. It is apparent that this is really not an argument but is rather a decision on the facts. It is the schematic analysis that makes the relationships of the propositions stand out clearly. The 'good reasons' model is functioning, showing the deficiency.

There are no authorities cited in this Argument. Perhaps there was no earlier case on contractual relations of this sort known at the time. Nevertheless, it is important to note that no authorities have been cited, no real argument has been made, and no Rebuttal is recorded.

The concept that D is being legally bound is negated. The case indicating the passive position of D is (OBJL), is used again as above where the NP described an intermediate state rather than the terminal result of an event. The state continues beyond the temporal aspect of the predicate. Had D been legally bound, the promise would have been the instrument or means of accomplishing that end, the (ACTP). Here it is the entity responsible for the lack of bond. Notice the circularity of the Argument. Appropriately, the Reasons restate the Claim.

The (AMBS) slot contains the reason that D is not legally bound. It is not true that D had an intention to contract. It is true that D had an intention to excite unknown suitors. Therefore, the promise is not legally binding.

Within this context, intent is a matter of legal fact. Where above it was discussed as an action verb because of the need to represent volitivity and agency, here it is discussed as a psychological verb because of its effects. What is intended, the content of the intention, is expressed by the (DATPSYL) slot. [TO_EXCITE] is a psychological verb which truly does not express volitivity, and the experiencers, the potential suitors, take the (DATPSYG) case. In a sense, they might also have been recipients (DATPOSSG) since the excite event is only intended for them. However, it may be argued that they were intended to experience it. Since the suitors are unknown, their concept designation symbol is the one for a default set ($\{*\}$), and it is followed by a question mark (?) indicating that the identity of the suitors is unknown. The means of binding, or not binding, is the promise. Final brackets signal the closing of the modal (JD) and the ending of both Reasons and Argument.

```
[ARGUMENT: #1]→(INCL)→[

[CLAIM: #1]→(INCL)→[
   [~CONTRACT-n: #W1]–
        (PARTY)→[P: Weeks]
        (PARTY)→[D: Tybald].
   [LEGAL_BIND: ~]–
      (ACTP)→[PROMISE-n: #W1]
      (OBJL)→[D: Tybald]
      (AMBS)→[INTENTION_TO_CONTRACT: ~].
   [INTENTION_TO_CONTRACT: ~]–
     (ACTS)→[D: Tybald]
     (EVID)→[PROMISE-n: #W1].
] ;end of CLAIM

[GROUNDS: #1]→(INCL)→[
   [P: Weeks]→(EQUIV)→[MAN: Weeks]
   [PROMISE-v: #W1]–
      (ACTS)→[D: Tybald]
      (DATPOSSG)→[P: Weeks] or [FATHER: Weeks]
      (DATPOSSL)→[PROMISE-n: #W1]→(CONT)→[TERM:
                              if    [MARRY: #W1]–
                                         (ACTS)→[MAN: *x]
                                         (ACTL)→[DAUGHTER: Tybald],
                                    [CONSENT_TO-v: #W1]–
                                       (ACTS)→[D: Tybald]
                                       (OBJG)→[MARRY: #W1],
                              then  [GIVE: #W1]–
                                          (ACTS)→[D: Tybald]
                                          (DATPOSSG)→[MAN: *x]
                                          (DATPOSSL)→[MONEY: @L100],]
      (TEMPL)→[TIME: promise#W1].
   [MARRY: #W1]–
       (ACTS)→[P: Weeks]
       (ACTL)→[DAUGHTER: Tybald]
       (TEMPL)→[TIME: marry#W1-]→(>)→[TIME: promise#W1+].
   [CONSENT_TO-v: #W1]–
      (ACTS)→[D: Tybald]
      (OBJG)→[MARRY: #W1].
   [~[GIVE: #W1]–
         (ACTS)→[D: Tybald]
         (DATPOSSG)→[P: Weeks]
         (DATPOSSL)→[MONEY: @L100].]
   (JD)→[[~AVER][~DECLARE]–
                (ACTS)→[D: Tybald]
                (OBJG)→[PERSON]–
                         (DATPOSSG)←[PROMISE-v: #W1] ,.]
] ;end of GROUNDS

[REASONS: #1]→(INCL)→[
   (JD)→[[INTENTION_TO_CONTRACT: ~]–
```

```
    (ACTS)→[D: Tybald]
    (EVID)→[PROMISE-n: #W1]→(CHRC)→[PHRASE: ‘‘general words’’].
  [PROMISE-v: #W1]–
     (ACTS)→[D: Tybald]
     (DATPOSSG)→[PERSON: ?]
     (DATPOSSL)→[PROMISE: #W1]
     (AMBG)→[LEGAL_BIND: ~]→(OBJL)→[D: TYBALD].
  [LEGAL_BIND: ~]–
     (ACTP)→[PROMISE-n: #W1]
     (OBJL)→[D: Tybald]
     (AMBS)→[INTEND: #W1]–
                 (ACTS)→[D: Tybald]
                 (DATPSYL)→[INTENTION_TO_CONTRACT: ~]
                              [INTENTION_TO_EXCITE: #W1]–
                                (DATPSYG)→[SUITORS: {*}?],,.
] ;end of REASONS
] ;end of ARGUMENT
```

Fig. 6.3 Argument #1
Weeks v. *Tybald*

6.8.2. Case 2: *Stamper* v. *Temple*

The facts of the case were discussed above in §3.3.2. The text appears in figure 3.2 and the representation in figure 6.5. The instance numbers in this case are preceded by an ‘S’ rather than a ‘W’ as in *Weeks*. This case is quite similar in content to the previous one. Both involve offers or rewards of a sort. In *Stamper*, the reward for the arrest of miscreants seems more likely to be a true offer. It might have been made in the spirit of vengeance or desperation, rather than as a casual statement in hopes of having a daughter married. The facts in *Weeks* and *Stamper* make it appear to be the same problem from a slightly different perspective. The difference highlights the problems in representing real world events. There is an emotional element in *Stamper* that requires the use of more psychological predicates to represent more abstract concepts than were found in *Weeks*. Similarly, the reasons are a little more complicated than the simple conclusions the judge drew from the facts in *Weeks*.

6.8.2.1. Claim

The Claims in the two cases are much the same. Once again in this Claim there are the representations of inchoate and negative entities. And a [PROMISE] is offered as (EVID) of lack of [INTENTION_TO_CONTRACT]. The case relations are like those in *Weeks*.

6.8.2.2. Grounds

The first occurrence in the Grounds is the event [INJURE], which D Temple undergoes. The source of the injury is some unknown group of people, recognized as a collective set with the symbol ‘Col{$*$}’ and as unknown by the variable *x*. The ambient path case (AMBP) is used for the manner modifier, ‘severely’, as discussed below.

The Ambient row of cases, one of the peripheral parameters, will often be used for modifiers. The semantic content of cases on this parameter overshadows the syntactic content. Within Somers’s paradigm (1987, p. 105), that is to be expected. He stated that he had concentrated on the inner cases, to the neglect of the outer ones. It makes sense in the context of valency. The outer cases, along the peripheral parameters, are less closely connected with the verb. The bonds between the main verb of a sentence and its accompanying NPs are much stronger than are the relations between the verb and those parts of the sentence related to it by Ambient cases. The outer cases are of a different kind. Their semantic content makes them more like the other conceptual relations, broader in scope. Ambient cases say something abstract about the situation at hand and deal with side-effects at some distance from the verb. In a sense, an Ambient case gives the general atmosphere of the event.

The Path parameter is the vehicle for expressing continuity. Path cases describe what happens over the length of the directional arrow, figure 5.2, from A to B. The (AMBP) slot calls for lexemes that describe the atmosphere of an event. Because it is a Path case, it describes something that is on-going, an enduring quality of the event’s environment. (AMBP) attracts manner adverbs, that is, descriptors that answer the question, ‘‘how?’’, and commonly end in ‘-ly’, like ‘severely’ above. They often co-occur with an agentive case such as (ACTS).

Although Sowa has not called his conrel manner (MANR) a case, he has recognized the need for the expression of the same idea. (MANR) ‘‘links an [ACT] to an [ATTRIBUTE],’’ (Sowa 1984, 417) telling the manner in which something is done, as shown in figure 6.4. The case-like association of the modifier with the verb is recognized in the graph.

D, having been injured, was upset. The next two predicates describe psychological states. [ANXIOUS_FOR] describes D; (DATPSYG) indicates that he is in the state of being anxious for

The ambulance arrived quickly.
An English sentence.

[AMBULANCE: #]<-(AGNT)<-[ARRIVE]->(MANR)->[QUICK].
A conceptual graph.

Fig. 6.4 Representing a manner adverb. (Sowa 1984, p. 417)

something. The goal case represents ‘B’ at the end of the arrow, the experiencer of the state. The feature marking for this case allows ‘±dynamic’. In this case ‘−dynamic’ is appropriate for an experiential *state* as opposed to an experiential *process*, which would be marked ‘+dynamic’.

Somers has made analysis of a number of relations more explicit by separating the Dative Possessive cases, encompassing some aspects of the Latin genitive, from the Dative Psychological ones. The Dative Psychological parameter applies to experiential predicates including those dealing with perception and cognition.

Sowa recognized the need to provide an experiencer case, (EXPR), which he defined as linking a [STATE] to an [ANIMATE] who is experiencing it (Sowa 1984, p. 416). He did not distinguish psychological states from other real states such as ‘being dead’ or ‘being cold’. Predicate adjectives are in some instances appropriately as fillers of this case. The experiencer is commonly in the syntactic position of a subject, but is semantically the receptor rather than the initiator of the event. Somers analysis allows a nice expression of this duality.

The (DATPSYL), in the same Dative Psychological row, expresses the localist position, the ‘C’, which Somers defines as the content of the experience. The value of this slot is a full cg rather than a simple concept, as have been most other slot fillers. The cg is enclosed in its own set of brackets indicating that it is a [PROPOSITION]. It says that what D is anxious about is the idea of the arrest of the people who injured him. We have no information about who initiated the arrest. The action of arrest is done to the (OBJG), the same set of [PERSON]s as described in the [INJURE] event.

Another psychological predicate [STATE_OF_MIND], further describes the situation. Temple and his family are members of the set of experiencers of the event. As in *Weeks*, where types [FATHER] and [DAUGHTER] were specified in the referent field by the family name, so here [FAMILY: Temple] is an instance of the type ‘family’. These familial relations are defined as concept types in order to simplify identifying persons of the same name by using the type hierarchy. The state of mind that these family members share has the attribute (ATTR) of being distracted [DISTRACT]. We could have chosen distracted as the principal concept to head the graph, and avoided telling about the state of mind. The choice depends on the significance of the facts. The judge pointedly discusses the participants state of mind. It is important that the information be included.

[DISTRACT] is an attribute of the predicate [STATE_OF_MIND]. It is understandable that such a modifier would be associated with its predicate by the conrel (ATTR). Its semantic content is the significant part. The syntactic relation does not convey information and meaning would not be clarified by using the alternative, the (AMBL) case.

The promise has the same structure as the promise in *Weeks*. It is made by the (ACTS), the initiator, Temple, to the (DATPOSSG), the promisee, an unknown person or persons. The promise contains [TERM], as in *Weeks*. In the antecedent, if some unknown [PERSON], *y*, would effect the arrest of the unknown perpetrators of the injury, he would be acting as the instrument of the arrest. The (ACTP) case is equivalent to the traditional instrument case. The [PERSON] would serve as a means, to bring about the arrest.

The Path column refers to the space ‘AB’ between Source and Goal, which Somers interprets metaphorically to describe ‘means’, hence instrumentality. All the Path cases are instrument cases of greater or lesser vitality. They may be active as this one is, the (ACTP); they may be passive and simply *allow* something as does the (OBJP). They may act as media as do both (DATPSYP) and (DATPOSSP). Some linguists attribute an element of causality to the traditional instrument case. Somers did not really analyze causation relations, but it appears that he relegated aspects of ‘cause’ to other parameters. The most obvious example is the (AMBS), whose cell description is ‘reason’. It is satisfactory for only some causes. He also recognized intention to attain goals. Two Goal cases, (ACTG) and (AMBG), express planning or intending. They are indicators of causation as well. Sowa recognized the instrument case (INST) in his analysis, as a link between an [ENTITY] and an [ACT] in which the entity is *causally* involved (Sowa 1984, p. 416).

The consequent of the [PROMISE] is dominated by the predicate [GIVE] as it was in *Weeks*, though the meaning is stronger. A reward is being offered. In a sense, ‘give’ is a euphemism for ‘pay’. In the previous case, it is unlikely that Weeks, as desperate as he was, would substitute ‘pay’ for ‘give’ to someone who would marry his daughter. Here is an example where the conceptual analysis displays a deeper sense of the import of a seemingly insignificant gift. D will give to the [PERSON: $*y$] a [REWARD]. The amount of the reward is shown through the use of the conrel (MEAS). By measure contraction, that is, redefinition of the volume term following the conrel to allow it to express an amount (Sowa 1984, pp. 84, 417), the relation is reduced to form the concept [MONEY: @$200]. The [PROMISE] assertion is complete at the period.

Following the representation of the promise, there are two factual occurrences as we resume the narration of events. In [ARREST-v: #S1], P, Stamper, is identified as the (ACTP). The unnamed persons who injured D although arrested remain unnamed. The collective set symbol continues to represent them as a group. The group may be regarded as a singular expression insofar as agreement is concerned, unlike other instances to be seen later. The antecedent of the condition has been fulfilled, the consequent has not.

[GIVE: #S1] and its context is negative. D did *not* give the reward to P. [GIVE] functions here as a predictable ditransitive verb. Someone gave *something* to *someone* else. The two objects of the verb are suitably represented by the (DATPOSS_) cases. (DATPOSSL) functions as the case normally called the ‘direct object’ in syntactic analysis, and (DATPOSSG) as the ‘indirect object’ or ‘dative’, to use its Latin name.

6.8.2.3. Reasons

The (JD) modal operator makes a ‘possible world’ of the entire [REASONS] section of the case. It may be noted that meaning has been stressed rather than accurate textual transcription of the linguistic content. In the opening sentence of the text (6-1) there are four levels of expression in which the judge hedges.

‘‘We are constrained
to believe
that what is called an offer
is nothing but a strong expression. . . ’’

It is necessary to make a decision as to which of the levels are meaningful in the context of the case—which should be represented. ‘Constrained’, ‘believe’ and ‘called’ have been excluded. They were the judge’s way of stating an opinion, the deciding opinion, in the face of an opposing argument. They might mean as well that he was stating an opinion of which he is unsure, since he did not state any reasons. Nevertheless, the moods of doubt seemingly expressed in the opening sentence were not taken to be real limitations on the truth values of the predicates in the representation.

[PROMISE-n] is said not to be an [OFFER] but instead has the (CHRC) of being, in a phrase, an "expression of strong feeling". The judge states in the second line of the text that the statement had been characterized as an ‘offered reward’. Although the judge did not say directly that the promise was not an offer, the underlying idea is apparent. This instance of ‘promise’, #S1, is not subsumed by the type, ‘offer’.

The (CHRC) conrel by definition must be applied to an inalienable property, one that cannot change without changing the nature of the entity. In contrast, (ATTR) links an entity to some attribute that is not essential to its nature. The distinction is a matter of some dispute. Whereas all (CHRC)s are (ATTR)s, not all (ATTR)s are (CHRC)s (Sowa 1984).

Although the ["expression of strong feeling"] phrase characterizes the promise, it does not convey much conceptual information, so an alternative, conceptual, representation is provided with an (EQUIV) relation. The alternative says that it was an [EXPRESSION], and what was expressed was ‘strong feeling’ or ‘anxiety’. Here the embedded graphs are completely enclosed in brackets, encapsulated so as to keep together the entire content of the filler for the (CHRC) slot. All are [PROPOSITION]s.

The next item is the (AMBS) of the [PROMISE]. Causality is clearly intended to be attributed to the entities involved. (AMBS) expresses the reason for an event. The two causes, [ANXIOUS_FOR] and [STATE_OF_MIND] are represented as a set. They refer to the two events mentioned earlier which describe D’s psychological state. Together they form a precondition for the event described.

Next the judge proposes two hypothetical promises prefaced by the concept [HYPO]. [HYPO] is a special case of the type [PROPOSITION] as defined in Sowa (1984, p. 177; 1988, p. 2-7). The definition of the special type is not essential, but it keeps the structure under control. Furthermore, we are less likely to lose sight of the fact that these are interjections if they are typed. [HYPO] indicates a hypothetical context in which the promises exist. They may exist in the same world as the rest of the context, the rest of the (JD), or they may exist in another. Both promises are included in the one situation since they are closely associated as shown below.

[PROMISE-n: #S2] proposes that if some unnamed [EVENT], designated by the variable *a*, happened, then the unnamed promisor, *m*, would [GIVE] a [REWARD]. The case to be chosen for the [EVENT] in question could be one of several, as it is the subject of the intransitive verb, 'happen'. If one interpreted the situation as a change of state, without agentivity, then (OBJG) would be the best choice. The subject event would be the patient of 'happen'. However, if one interpreted 'happen' as requiring some agentivity, perhaps 'causal potency', it could take the case (ACTS) with both negative features ('−volitive' and '−animate'). Here, there is no evidence of agentivity from another source, or in the alternative, that the event is actually undergoing some process. The event seems to be better characterized as a reason for the happening than as a result of it, even though there is no evidence of initiative in its role as source. It appears here that the most satisfactory choice would be the (ACTS). The verb 'happen' belongs to a group of verbs that appear to be similar. 'Occur' is another. They are sometimes regarded as stative verbs, but seem rather to record changes of state, particularly when used with a progressive aspect.

Alternatively, [PROMISE-n: #S3] records a similar offer if an [EVENT] does *not* [HAPPEN]. In the text, the judge's assertion of the hypothetical promise says that the offeree is to be paid if such and such an event occurs or does not occur. His statement has been represented as two separate promises because of the difficulty of representing disjunction described above in §6.8.1.2. It appears that what he is saying is that the offer may be made in one of two ways. In either case, the offer is made to no one in particular.

Next the judge proposes a comparison between D's promise and his demonstratively frivolous hypothetical one, to show that D's promise was similar. He is saying in fact that D's promise is analogous to the hypothetical one. In order to make comparisons, it was necessary to define a conrel, compare

(COMP), which says that one [ENTITY] ‘is similar to’ another [ENTITY]. Sowa in fact uses a conrel, (COMP), in defining the conrel (ABOV) (1984, p. 226), but does not include a definition of it in his work. In effect, making a comparison means that a partial match is anticipated between two propositions. We expect some objects and relations to match. However, we know that the propositions are not equivalent. We will often be interested in the remaining, unmatched objects.

The judge proceeds to say that D’s [PROMISE] may be said to be like his own examples of unrealistic promises. Those two promises, #S2 and #S3, are evidence of strong excitement but they are not evidence of an [INTENTION_TO_CONTRACT]. Since [PROMISE: #S1] is comparable to [PROMISE: #S2] and [PROMISE: #S3], it may be inferred that [PROMISE: #S1] is not evidence of [INTENTION_TO_CONTRACT] either.

```
[ARGUMENT: #2]→(INCL)→[

[CLAIM: #2]→(INCL)→[
   [~CONTRACT-n: #S1]–
      (PARTY)→[D: Temple]
      (PARTY)→[P: Stamper].
   [LEGAL_BIND: ~]–
      (ACTP)→[PROMISE-n: #S1]
      (OBJL)→[D: Temple]
      (AMBS)→[INTENTION_TO_CONTRACT: ~].
   [INTENTION_TO_CONTRACT: ~]–
     (ACTS)→[D: Temple]
     (EVID)→[PROMISE-n: #S1].
]   ;end of CLAIM

[GROUNDS: #2]→(INCL)→[
   [INJURE: #S1]–
     (ACTS)→[PERSON: Col{∗}∗x]
     (OBJG)→[D: Temple]
     (AMBP)→[SEVERE: #S1].
   [ANXIOUS_FOR: #S1]–
      (DATPSYG)→[D: Temple]
      (DATPSYL)→[ARREST-v: #S1]→(OBJG)→[PERSON: Col{∗}∗x].
   [STATE_OF_MIND: #S1]–
      (DATPSYG)→{[D: Temple] [FAMILY: Temple]}
      (ATTR)→[DISTRACT: #S1].
   [PROMISE-v: #S1]–
      (ACTS)→[D: Temple]
      (DATPOSSG)→[PERSON: {∗}?]
      (DATPOSSL)→[PROMISE-n: #S1]→(CONT)→[TERM:
                          if    [ARREST-v: #S1]–
                                  (ACTP)→[PERSON: ∗y]
                                  (OBJG)→[PERSON: Col{∗}∗x],
                          then   [GIVE: #S1]–
                                    (ACTS)→[D: Temple]
                                    (DATPOSSG)→[PERSON: ∗y]
                                    (DATPOSSL)→[[REWARD: #S1]→(MEAS)→[MONEY: @$200]],].
   [ARREST-v: #S1]–
      (ACTP)→[P: Stamper]
      (OBJG)→[PERSON: Col{∗}∗x].
   [~[GIVE: #S1]–
         (ACTS)→[D: Temple]
         (DATPOSSG)→[P: Stamper]
         (DATPOSSL)→[REWARD: #S1].]
] ;end of GROUNDS

[REASONS: #2]→(INCL)→[
   (JD)→[[PROMISE-n: #S1]–
              (~<)→[OFFER]
              (CHRC)→[[PHRASE: ‘‘expression of strong feeling’’]–
                            (EQUIV)→[EXPRESSION: #S1]–
```

```
                                        (OBJL)→[[[FEELING: #S1]→(ATTR)→[STRONG: #S1]]
                                        or [ANXIETY: #S1]]]
            (AMBS)→{[ANXIOUS_FOR: #S1] [STATE_OF_MIND: #S1]}
          [PROMISE-n: #S1]→(~>)→[OFFER]
          [HYPO: [PROMISE-n: #S2]→(CONT)→[TERM:
                    if    [HAPPEN: #S1]–
                             (ACTS)→[EVENT: ∗a],
                    then  [GIVE: #S2]–
                              (ACTS)→[PROMISOR: ∗m]
                              (DATPOSSL)→[REWARD: #S2]→(MEAS)→[MONEY: @$1,000]].
                  [PROMISE-n: #S3]→(CONT)→[TERM:
                    if    [~[HAPPEN: #S2]–
                             (ACTS)→[EVENT: ∗b].]
                    then  [GIVE: #S3]–
                              (ACTS)→[PROMISOR: ∗n]
                              (DATPOSSL)→[REWARD: #S2]–
                                          (MEAS)→[MONEY: @$1,000].]]
          [PROMISE-n: #S1]→(COMP)→[PROMISE-n: #S2]
          [PROMISE-n: #S1]→(COMP)→[PROMISE-n: #S3]
          [PROMISE-n: #S2][PROMISE-n: #S3]→(EVID)→[EXCITEMENT: ∗]–
                                                   (ATTR)→[STRONG: #S2]
         [PROMISE-n: #S2]→(~EVID)→[INTENTION_TO_CONTRACT: ∗]
         [PROMISE-n: #S3]→(~EVID)→[INTENTION_TO_CONTRACT: ∗]
         [PROMISE-n: #S1]→(EVID)→[INTENTION_TO_CONTRACT: ~]
       ]                         ;end of (JD)
  .                             ;end of Reasons
 .
                                ;end of Argument
```

Fig. 6.5 Argument #2
Stamper v. *Temple*,

6.8.3. Case 3: *Upton-on-Severn Rural District Council* v. *Powell*

Recall from the discussion in §3.3.3 that the fact situation in this case is intricate. The text appears in figure 3.3 and the representation in figure 6.6. Although the focus of interest in *Upton* is on the concrete facts, there are some abstractions introduced. Throughout, I have attempted to keep the kr as close as possible to the actual language of the text.

Many kr problems appear in *Upton*. Notable are the problems of dealing with complex sentences and multiple levels of graph nesting. Transcribing *Upton* is also a good test of how well the notation handles referents as discussed in §4.1.6.

There are also multiple uses of both Locative and Temporal cases. The Locative cases from Somers's grid seem to work well, in spite of the fact that he focused little attention on them, since they were outer cases. With regard to time, in *Weeks* there were a few simple examples where temporal intervals were named but not really used; and in *Stamper*, there were no examples of temporal intervals at all. In *Upton*, the intervals have been used to advantage to show relationships between concurrent and consecutive events.

The long name of the plaintiff is abbreviated to *Upton* for convenience. The mnemonic in the instance numbers is ‘U’. The designations of the parties are taken directly from the text. ‘A’ means appellant and ‘R’, respondent.

6.8.3.1. Claim

Generally, [CLAIM: #3] states that a contract was made by the parties, such that R was required to render service because of an implied promise to pay made by A or his agent.[5] The Claim is stated as simply as possible and reflects the language of the text. It is drawn from the first sentence of the second paragraph.

R and A are conjoined as (ACTS). The compound filler shows that both parties contributed to and were initiators of the event. It might have been represented as a set, but the parties acted independently of each other. Alternatively, there might have been two (ACTS) slots, each with its own filler, but any reference to (ACTS) would have been ambiguous with little gain in expressiveness. This filler was written as a syntactic compound subject. Agentivity, in the linguistic sense, is expressed by the (ACTS) case; both features ‘volitive’ and ‘animate’ are marked ‘+’ for both of the parties.

Since the predicate is [MAKE], (ACTS) is appropriate and (PARTY) is not. We could have chosen to say the parties contracted, rather than that they made a contract. However, the choice was to stay as close as possible to the wording especially since this is a peculiar case, and there is some doubt as to whether there is a contract in the usual sense.

In any event, Upton and Powell acted together to make what is called a contract, related by the case (OBJG) because it is a completed action. The case may be interpreted to mean either the final state in a change-of-state or the traditional factitive, designating a physical thing resulting from some process. Fillmore also recognized the factitive case as applying to something made or constructed as a result of the

[5] ‘Agent’ here is used in the legal sense rather than the linguistic sense. A definition of ‘agent’ may be found in Appendix B.

action of the verb. Furthermore, the text talks about a contract being *made*. The factitive occurs with ‘make’ rather than with ‘do’. The contract should be thought of as a completed agreement rather than as a physical document. It may be argued, therefore, to be an abstraction. Nevertheless, as a completed agreement it will be regarded here as a concrete entity. The feature ‘+concrete’ is marked. Finally, it might be argued that the (OBJG) should be interpreted instead as the result state in a change-of-state as one cannot point to *material* from which the contract was constructed. Nevertheless, the completed agreement is more appropriately regarded as a new entity than as an altered state. On the other hand, if the wording of the sentence had described something about a change in a legal relationship, the feature might have been appropriately marked ‘−concrete’.

[CONTRACT-n: #U2] is next. As seen above, noun and verb senses are distinguished by the attachment of a mnemonic, in this instance, ‘-n’. The device is artificial and admittedly not ideal, but it does serve the purpose. Such attachments are not made to all homonymous nouns and verbs, only to those susceptible to ambiguous interpretation within the kb at present.

This contract, unlike the promises in the other cases, is a completed agreement. The definition reads that R will render service in return for an act, [PROMISE-v: #U1]. The (DATPOSS_) cases are used as something is transferred in the act of rendering service. [SERVICE] is singular though a plural appears in the text. In a sense, it is a mass noun. There is no instance in this text in which it is necessary to struggle with the divisivity problem, the difficulty of representing a part of the entity described by a mass noun. The ‘services’ contracted for by the fire brigade were not discussed as distinguishable entities.

[CONTRACT-n: #U2] has the characteristic, (CHRC), [IMPLIED_CONTRACT] which of course is heavily significant. This is not a true contract but an *implied* one. The (AMBL) case, the only suitable case in the grid, is too tenuous to adequately describe an element essential to the entity’s nature. The Sowa conrel (CHRC) is used instead as [IMPLIED] is an inalienable property of the contract. If the characteristic of being [IMPLIED] were to be changed, the nature of the contract would be changed.

The [PROMISE] was to be made by Powell or his agent, as yet unspecified. The conrel (POSS) is used to express the genitive as the grid does not contain one, in spite of the existence of the Dative Possessive parameter. It may be suggested that (DATPOSSS), the original owner, is appropriate. However, its use anticipates a property transfer. It could be argued that the (DATPOSSG) is appropriate as the present state possessor, or benefactor. However, the desired meaning is simple possession. The agent will remain Powell's agent throughout. (POSS) has been used as the most suitable relation. The direction of the arrows shows which entity owns the other.

Note that to express this idea of possession, we have reverted to use of Sowa's general conrel (POSS) rather than use a specific but inaccurate case. This is an example of only one kind of possession; examples of others appear below. The cases we have available do not cover all aspects of possession. Nor do they express the meaning encompassed by the genitive case with regard to various possessory attachments. It may be concluded that possession is a complicated idea with numerous components. The (DATPOSS_) cases work for property transfers. (POSS) is being used for others in this research. The full range of (POSS) has unfortunately not been clearly defined.

The object of [PROMISE-n: #U1] is [PAY_FOR] and the object of that is [SERVICE]. For both the localist object was originally used. The (OBJL) case came to be the Objective case most often used commonly in default as a more suitable case could not be found in a first attempt. Somers said the following about it,

> The Objective Local is the element undergoing a change-of-state, or whose state is described in a stative predicate (Somers 1987, p. 204)

The local element means that the case stands for the 'C' position on the directional arrow, some point. Given that the alternative choice 'B' position cases express either a result state if not concrete, or a factitive, if concrete, the choice of (OBJL) was commonly made. We were getting very little return out of the case analysis of complements as a result of its use, and revision began. I very often felt it did not fit quite correctly but was at a loss to improve upon the choice until I began to perceive that the distinction should be temporal.

In due course, the analysis was refined and both cases at hand were changed. [PAY_FOR] is the object of the [PROMISE], and [SERVICE] is the object of [PAY_FOR]. Both objective relations became (OBJG). The thing promised may be compared to a factitive. [PAY_FOR] is not a process; and the thing is paid for as a single finite instance. The requisite element of incompleteness for (OBJL) is lacking in both predicate relations.

[PAY_FOR] is a particle structure. It performs like an idiom. [PAY_FOR] has quite a different meaning from 'pay'. Nor can 'pay' be appropriately adapted by any cunning use of cases to mean 'pay for'. The semantic content of 'for' in [PAY_FOR] cannot be expressed in this kr independently. It is, therefore, treated as a part of the verb phrase (VP), that is to say, idiomatically. Notice that the valency of [PAY] and [PAY_FOR] are quite different.

A generic type, [AGENT: ∗], is defined in the catalogue of lconcs in Appendix C. The definition of [AGENT] says that it is a person authorized by another person, a principal, to make obligations for the principal. From the definition of [OBLIGATION] in the same Appendix, we know that those obligations are legal in nature. The representations of the lconcs are done in the same style as those of the Arguments and are used to complement them, as will be demonstrated in chapter 7.

6.8.3.2. Grounds

[LIVE] is a stative verb; therefore, although Powell is in some sense undergoing or experiencing the living, he is the subject of the sentence stating that he resides somewhere. [A: Powell] is the (ACTS) of the concept [LIVE]. It might be argued that the other function of (OBJL) applies here as Powell is the entity whose state is described by the stative predicate. The syntactic construction is not passive as in other stative predicates like 'be cold' and 'be dead'. Although the Active case may be a little strong, it was judged less satisfactory for Powell to be a patient with regard to how he directs his life. There was no viable alternative on the Objective parameter. As a result, (ACTS) was the final choice.

The first of the place cases in *Upton*, (LOCL), expresses the place *where* A lives. The Locative parameter cases describe spatial relations and so are particularly adaptable to the use of the directional concept. The Local parameter expresses the idea of 'C' on the directional arrow. The elements of (LOCL) combine to express a local place, here, Strensham.

[BREAK_OUT] is another particle construction. The semantics of [BREAK] is radically altered by attaching to it the particle 'out'. It is easy to see that prepositions like 'out' and 'in' can be defined conceptually in terms of physical relations. Uncovering the core meanings is a difficult enough task in itself. In this instance, it is not easy to see how individual meanings of the two terms could be represented and then combined to show how a fire could ‘break’ ‘out’ *in* a barn. This brings to mind the theory of compositionality. It is difficult to see how the meaning of the expression could ever be achieved by neatly defining and representing the meaning of its constituent elements. For the present, this kr is limited by using particles as verb phrases.

[BREAK_OUT] is a process verb, one that causes a change like ‘happen’ and ‘arise’; unlike ‘reside’ and ‘own’ which are clearly stative. [FIRE] takes the (ACTS) although it is neither ‘+volitive’ nor ‘+animate’. It has a quality that Somers calls, ‘causal potency’ as in his example,

(6-2) ‘‘The tornado demolished the house’’ (Somers 1987, p. 112).

If the judge had used ‘occur’ instead of [BREAK_OUT], it might be argued, as it is with ‘happen’ that causal potency is lacking in some contexts. Here, it is reasonably clear that [BREAK_OUT] attributes an element of agentivity albeit, involuntary, to the [FIRE]. Contrast it with, ‘‘the jar breaks’’ for example, in which the jar receives the action rather than starts it.

(LOCL) is used to tell ‘the place where’ the fire broke out. It occurred at one static position. The [BARN] has the attribute [DUTCH_BARN] since [DUTCH] alone does not express the idea of the design appropriately and is ambiguous. In this situation, the attribute is an adjective modifying a noun. None of the cases in the Somers paradigm lend themselves to description of this relationship quite as well as the conrel, attribute (ATTR), which is traditional in kr use. Note that the (ATTR) relationship does not have to do with the VP and the NPs in the sentence, but with the modification relationship, something quite different from valency-oriented cases and not accommodated by the grid cases. The [BARN] itself has a (LOCL), a static position, a place—the [FARM: #U1], and that farm is (POSS) by Powell. We are using the conrel from Sowa to express the possessory genitive idea. The arrows are reversed from the usual direction for accurate representation of the relationship.

(TEMPL) shows the time ‘at which’. It describes the ‘C’ position on the directional arrow. The concept [TIME] contains in its referent field the name of the temporal interval to be connected with the fire, namely, ‘burn#U1’. (DATE) is a conrel and the types [MONTH] and [YEAR] are in common usage. The whole cg expresses the time and date of the outbreak of the fire.

We now begin the story leading up to the conflict between the parties. The present tense is being used throughout, in story telling mode. It is understood that the events being related all occurred in the past. Only where it is necessary to distinguish different 'pasts' or to distinguish 'past' from 'present', does the problem of tense intervene.

The first instance of [TELEPHONE-v] occurs when Powell calls the [POLICE_INSPECTOR] at the office in the District of Upton. The (LOCG) case is used to show the destination of the phone call. (LOCL) shows that the police office is in the District of Upton. The conrel (IN) could just as well have been used (Sowa 1987, p. 6). Using (IN) in some places has made the notation of stacked locatives a little less ungainly and a little more accessible to the reader. It does not affect the semantic representation.

[TELL: #U1] is a straightforward cg. A tells the [POLICE_INSPECTOR] some information. This is the first of many uses of the (DATPOSS_) cases for the transfer of information. (ACTS) is used for the teller as he is the agent, and, as Somers instructs, is properly represented by an Active rather than by a Dative case. Moreover, although he originally possesses the information and he does tell it, he does not transfer it in the sense that he retains it. This characteristic of transferring in the sense of sharing something, rather than giving it away, is typical of verbs relating to communication. The two types of transfer should be distinguished in a domain where both will figure in inferences. Otherwise, we shall be representing semantically different texts with a single expression, increasing the potential for ambiguous interpretation. The (DATPOSSG) is simply the recipient. The (DATPOSSL) is a message, the thing transferred. The [INFO], the piece of information transferred, is that fire has broken out. [INFO] is a special type of [PROPOSITION] and is used in the description of messages. What is told is the content of the message, the situation described. [INFO] adds no information. It simply structures the message for easy reference later.

Next, Powell asks the Inspector to do something for him. He requests him to send *a* or *some* fire brigade. [REQUEST-v] is used to simplify the variation among the verbs expressing the same idea. Since 'ask', 'ask for' and so on carry virtually the same information in the context of this Argument, and since the representation is not expanded to include the full conceptual and sense representations of all the predicates, this concept has been simplified and [REQUEST-v] is used. However, we contend that it is possible to represent faithfully the conceptual content of each of the alternatives. Since we are focusing on IR rather than the literary aspects of text analysis, developing full conceptual representations of each variant was considered excessive. [REQUEST-v: #U1] is made by A, Powell, to the police inspector for a specific thing described by [REQUEST-n: #U1]. (DATPOSS_) cases are the most appropriate for expression of the standard ditransitive construction. The content of the request is spelled out, to send [FIRE_BRIGADE: ∗], that is the generic concept ‘a’ or ‘some’ fire brigade, which implies the existential quantifier (∃).

The [FIRE_STATION] has, in a sense possesses, a telephone. However, the proposition is negative. The bracket after the period corresponds with that preceding the sign of negation. The context ends with the period, but use of the closing bracket makes the scope of the negative clear. In the frame for [TELEPHONE-v: #U2], a telephone call is being made by the inspector to the garage. Since the garage is not animate, it cannot be said to be the recipient of the telephone call, unless the ‘garage’ is used metonymously to mean the staff of the garage. (LOCG) shows the place *to which* the call was made. Such an interpretation is reasonable since the sentence continues about locations, rather than the content of any message.

The [GARAGE] is (NEAR) the fire station. The predicate [INFORM] is simple. The police inspector informs the Upton brigade about the fire, that is, he conveys the information. In the frame [GO: #U1], the (LOCG), the final destination, is specified. The proposition filling the (TEMPL) slot says that the time interval of [GO: #U1] began right after the time interval of [INFORM: #U1] ended, that is, that the fire brigade left immediately after it was told about the fire.

The brigade remained at the site for a long time. Since there is no real prescription for adjectival modification of nouns in the case grid, once again (ATTR) is the best choice, as might be expected. The case (TEMPP) works well for the expression of the duration of time, the distance ‘AB’ on the arrow. Sowa has a conrel duration (DUR) which expresses a similar relationship but is not a case. The Upton brigade is the (ACTS) of [REMAIN] and of [PUT_OUT]. [PUT_OUT] is a process that begins here and continues for some time. The representation shows throughout how difficult it is to convey an idea of continuity when using discrete symbols. (TEMPP) shows the duration of the act of [PUT_OUT] to be long. It would be desirable to have a (MEAS) here of how long, but unfortunately that is not possible. ‘Long’ like ‘near’ is a relative concept expressed as a relation. Unfortunately, it is not possible to show a measure of how long without further knowledge. We are aware of the semantic content of the expressions, but cannot represent them without further information. The lexical representation of continuity is not especially helpful; we need a conceptual representation. Realization of the extent and interplay of ongoing events comes through only indirectly. We need a more satisfying expression. The farm's location is declared to be in the Upton police district and in the Pershore fire district. The conjunction of the locational prepositions is shown by their contiguity. One may notice the use of (LOCL) and of (IN) for easy reading among the stacked locatives.

Powell's rights are asserted next. He is entitled to have service from the Pershore brigade without payment. Powell is the possessor of the [RIGHT]. No agent of the verb is named. [RIGHT] is another subtype of the concept [PROPOSITION] and is used to structure the content of the privilege conveyed to Powell. Notice that the deontic modal (MAY) is used in connection with the proposition describing the right so as to express the correct mode of its logical content. 'Right' is regarded here as being an amorphous concept, especially difficult to handle in relation to other incompletely defined concepts. (DATPOSSL) is used to express the object of [HAVE], the thing possessed. The (AMBL), or the condition under which the service is given, is that there is no payment. The negative, [˜PAYMENT], says that there is an 'un' payment or free condition, rather than that no payment exists in that context, [PAYMENT: ˜], which would be interpreted as a payment not being there instead of the service being free.

In [ENTITLE: #U2], the Upton fire brigade is entitled to go to any fire that is not in its district. The next assertion is that if the fire brigade does go to a fire out of its district, then the fire brigade has a right to make a contract regarding the terms of service. The conrel (IN) is negatived in order to express the idea of 'not in' the Upton fire district.

[HAVE], in the consequent of the condition, is another difficult verb with regard to the allocation of cases. It may reasonably be said to be stative in this use. Since the fire brigade is clearly not agentive, it seems appropriate to use (DATPOSSG) to show that the fire brigade is the recipient of the right, if indeed the antecedent of the condition is fulfilled. The recipient may be understood here in more neutral terms as the benefactor. The semantics of 'have' indicate that a possessory interpretation is correct. Again, [RIGHT] is used to describe the content of the entity the fire brigade has. This very artificial construction is one attempt to deal with the difficulty of expressing abstractions. In a kb with many instances of [RIGHT], the difficulty would become very obvious. The use of ‘entitle’ and ‘right’ together predispose one to put this section within a (MAY) operator. Doing so is not enough. Undoubtedly, here the idea of permission or privilege is prevalent, but by just using a preceding modal and not attempting to deal with the semantics of the statements, we would miss the significance of concepts like ‘entitle’ and ‘right’. When reasoning is attempted with the kr, these propositions will have to be recognized as expressions of permission. The factitive case (OBJG) is used to show that the contract may be made, may result from, the action of the verb, [MAKE].

The terms of such a contract would be that if the fire brigade provided service for someone, then the fire brigade would be entitled to repayment of its expenses. It is entitled to this as well as to the set of statutory rights. The rights referred to are those in the Grounds.

To this point, the discussion has embodied background information. Now we encounter the story of the events that caused the law suit. To begin, in frame [ARRIVE: #U1], the Upton fire brigade arrives at the fire at [TIME: arrive #U1]. (TEMPL) is local, the time at which something occurs, ‘C’ on the directional arrow.

In [ARRIVE: #U2], an [OFFICER] from Pershore arrives after ‘arrive#U1’ by a measurement of ‘6 hours’. [ARRIVE: #U3] says that it is not true that the Pershore fire brigade did not arrive at the same time as the Pershore officer. The Upton brigade arrived, and during its stay, the Pershore officer arrived without his brigade. Note the expression of overlapping times in these events. The temporal intervals allow us to show the overlap, but continuity is expressed lexically.

Then the Pershore officer imparted some knowledge to his counterpart, the Upton officer. [POINT_OUT] is an example of another VP with an irreducible particle. Although (OUT) lends itself nicely to description alone it has not been possible to devise a conceptual representation of it that would allow for composite use with verbs and result in predictable interpretations. A second instance of [TELL] has been substituted for [POINT_OUT]. The story will not lose anything in the translation and some potential ambiguity will be avoided. This is an instance of the attempt to conflate some predicates in the attempt to reduce common referents to a minimum. A fully conceptual representation would be much finer-grained representation than this. The meanings of both predicates would be fully represented and there would be no difficulty in locating both in search and no difficulty in distinguishing the meanings of each. However, our purpose is conceptual retrieval rather than verbatim transcription of text. The (DATPOSS_) cases are used for the transfer of information, for communicating, even though the information is retained by the transmitter and also given to another. The [INFO] that is transmitted is that the fire is in the *Pershore* Fire District and is not in the *Upton* Fire District.

Above we saw the problem of representing continuity with regard to extinguishing the fire. [CONTINUE] is used as the ultimate example of the difficulty of representing time passing with discrete symbols. It is one thing to write the concept [CONTINUE]; it is quite another to represent an act as continuing and then continuing while other events occur. The act of putting out the fire is related to the act of rendering service. They are joined by the conrel (COMP), which invites comparison without guaranteeing equivalence. In short, they are equivalent for some purpose within the context. That is to say, the service rendered by the fire brigade was the extinguishing of the fire. Here, what is continuing is the act of 'service', with Powell being the benefactor of that act. The continuance lasted one day, from the time of Upton's arrival *until* (TEMPG) a day after. (OBJL) is used for the object of the continue event. Somers would say it is an ongoing process, the object is undergoing the continuing. In addition it is clear that there is no determinable interval within the predicate for extent of the process. (OBJL) is the case events of such indefinite duration.

The Pershore fire brigade arrived next as shown in frame [ARRIVE: #U4]. The farm is represented as a destination, a (LOCG). The time at which they arrived, (TEMPL), is a day later than the time of arrival of the Upton fire brigade.

[TAKE_OVER] is a metaphoric phrase. Nothing is literally taken anywhere, but the task is in a sense captured. Pershore is the active recipient (ACTG) of the take-over. This case, seldom used, worked well whenever it was. The Upton fire brigade is the (DATPOSSS), in this situation, the benefactor of the action but the source or original possessor of the thing transferred. Literally, the Pershore fire brigade seized from the Upton brigade, the job of putting the fire out. Although the Pershore brigade would be said to take over *from* the Upton brigade, the representing case is a dative marked by the use of the preposition ‘to’. Here, ‘from’ may be regarded as the negative of ‘to’, and still a suitable case marker for the dative. As it happens, the text does not spell out from whom the takeover was made. Nevertheless, that information is included for clarity.

(DATPOSSL) represents the action of [PUT_OUT] as the object of the takeover. The representation of the conceptual content of [TAKE_OVER] a metaphoric phrase, suggestive of military action, has not been attempted. The representation here is not satisfying as it relies on the metaphor. It shows conceptually neither the operation of controlling the fire, nor the change of control. Any reasonable attempt resulted in a kr for a single concept that was so much more detailed than the rest of the kb that it was impractical to use it. A kr that fine-grained would unduly complicate pattern matching. Yet sustaining the metaphor leaves us open to ambiguity.

(CCJ) is a modal operator that says that the assertions within its scope are attributed to the County Court Judge, whose jurisdiction would normally include decisions on the facts. They are facts not in the sense of having objective reality but rather in the sense of having judicial verification.

Now we encounter the second instance of the description of the request. The essential predicates are uniform. At the time of the phone call, Powell is said to have requested that the police inspector send *the* fire brigade. Here, as in the actual conversation, the referent is not clear. We don’t know which fire brigade is *the* brigade The judge has declined to use the generic term, ‘some or any fire brigade’.

Next the police inspector summoned the ‘local’ fire brigade in a manner (AMBP) that was ‘natural’. One of the most difficult matters in this argument is the conceptual analysis of ‘local’. It is the crux of the case since it describes D’s selection of fire brigade. The judge says that ‘natural’ means doing the usual thing. The text, the (CCJ), says that the inspector ‘‘took the order as being one for the fire brigade with which he was connected.’’ The inspector took the request as being, in the sense that he understands the content of the idea, namely that *the* fire brigade is that one with which he is himself connected, that is to say, the Upton fire brigade.

A lambda expression is used to present [REQUEST-n: #U2], the request for *the* fire brigade, as the police inspector understands it, that is, from the CCJ’s point of view. The expression functions as a transcription of a restrictive clause. However, the restriction to the [REQUEST]'s description is valid only within the context of the predicate [UNDERSTAND: #U1]. To some extent, this definition of his understanding of *the* fire brigade is also a conceptual representation of the idea of 'local'. It interprets 'local' to mean 'connected with the police inspector'. Finally, the bracket in the left margin signals the close of the modal operator (CCJ).

The next modal, (ACJ), shows the narration is in a new possible world. The Appeal Court judge is stating *his* opinion on a question of fact. He begins by saying, ''It appears that. . . .'' Chafe, in his work on evidentials (1986, p. 268) said that 'apparently' and 'it seems' indicate hearsay. The judge is presenting hearsay and interpreting it for us as he relates the facts of the case. He says simply that none of the experiencers knew that the farm was in the Pershore District and not in the Upton district until the time at which the Pershore inspector pointed it out to the Upton inspector.

The (DATPSYG) because like 'understand', and in contrast to 'learn', [KNOW] does not take an agent. Knowing is experienced rather than performed. The negatives may be interpreted as 'neither Powell, nor the inspector, nor the Upton fire brigade', Their 'not knowing' continued *until* the (TEMPG), that is, it was terminated at the time the fact was told. If the kr was to be precise, it would be necessary to assert who knew *after* that time, that is, to declare the positive proposition.

After this interpolation, the Appeal Court judge goes on to relate more of the County Court judge's determination. A double level modal would be correct but is unnecessary. All we are ever going to need to know about this matter will be the ACJ's opinion. The police inspector passed the request on to the Upton fire brigade, [REQUEST-v: #U3], and sent that brigade to the fire. In fact the text says that he, the police inspector, sent *his* brigade to the fire. In spite of there being no true concept of possession in their relationship, the (DATPOSSL) relation is shown, designating the thing that is sent as if there were a transfer of possession. The stylistic expression of possession is sustained.

The idea of possession introduces another way of representing the concept of 'local' here. The judge's approach is important because he is trying to convince us that the police inspector interpreted the request in the most *natural* way he could. This passage shows very clearly the difficulty in representing the subtlety of language in a symbolic representation. It is possible to capture rhetorical reasoning, that is, persuasive reasoning; it is not so easy to capture rhetoric, that is, style, which is also intended to persuade. Although style is not the focus of this work, it is, in other analyses, as important as rhetorical reasoning is here. It is sometimes difficult to determine which aspect of rhetoric is more significant in making the point of an argument, especially a weak argument unsupported by strong reasons, such as this one.

The judge goes on to make his point directly, that Powell *expected* the brigade that was in fact sent. [EXPECT] is a psychological verb with a sense of future time. The content of the (DATPSYL), the expectation, is that the fire brigade would come, would arrive. No attempt has been made here to show the future time. If the expectation had extended to a more complex concept, an embedded clause with an included act, for example, ‘expected the fire brigade *to arrive* to-morrow’, then the need to express it would have been greater. Here, sticking closely to the wording has made it possible to avoid it. The difficulty of reasoning with regard to future time inhibits us from wreckless attempts at representation.

The judge further impresses his opinion on us by adding the parenthetical emphasis, ‘I have no doubt’. The comment lends nothing new to the argument. It has not been transcribed. The statement is not a reason. It adds emphasis to his expression of certainty.

The next proposition, connected with the concept [KNOW: #U2], is negative. Like Alice in figure 4.4, who did not know arithmetic, Powell did not know that if he requested the Pershore brigade, then he would obtain an advantage. The case, (ACTG), is not common and is used here with [OBTAIN] and the feature ‘+animate’ to say that Powell is an *active* recipient. The advantage he doesn’t know about is, of course, free service, ‘un’ payment service, as we saw earlier. (AMBL) is the most distant peripheral case. It provides an attachment for any condition related to the head concept.

The CCJ is stating a belief as a part of his judgement. The fact that it *is* of his judgement, makes the statement *fact* in the appeal. He says that D ‘‘gave the order for’’, that is, requested, ‘‘the fire brigade he wanted.’’ He assumes that ‘‘*the fire brigade*’’ is an unambiguous expression in that situation. And he goes on to state that D furthermore *got* what he wanted, *the* fire brigade, which was sent. In this passage, it is quite clear that the CCJ is attempting to read D’s mind for us. He has interpreted the facts presented to him to mean that D was aware of what he wanted, asked for what he wanted, and got it. The instance numbers indicate that the request described differs from the one discussed previously. We are talking about the possible world of the CCJ's belief. In using the verb 'want' in kr as well as in law, there is concern about the existence of intentionality. If it is absent, the subject is an experiencer; if present, he is an agent. Here, he is an agent, because the judge states that he knows what he wants, asserting intention. Finally, the ACJ reports that the CCJ says that D got what he wanted, that is to say, he got the fire brigade that he had wanted when he gave the order.

6.8.3.3. Reasons

The Grounds and Claim are explicitly linked in this section. Where the reasons are well developed, the discussion involves closely reasoned ideas, abstractions, which are difficult to represent. The problems encountered in representing abstractions are more formidable than those involved in representing concrete ideas. Although descriptions of aspects of real world knowledge, as we have seen already, are quite challenging themselves. The success of the representation of the Reasons depends upon the quality of representation of the facts. If the kr of the facts is too coarse-grained, the Reasons cannot be constructed with the desirable precision. In this section, we can see again the problems of representing continuous acts and events. There is also a need to realize a representation of interacting events and ideas. Here too, the limitations of the kr language show clearly.

The rebuttal appears next in the text. However, Rebuttal is the last section of the schema. Briefly it states that the CCJ is wrong to say that D asked for and got the fire brigade that he wanted, because D did not know what fire district the farm was in. What he wanted to get was the fire brigade of the area, whatever it was. (ACJ) modal encloses the Reasons that follow. The appellate judge gives his opinion. He first negates the Rebuttal; it is simply not possible to justify it. D, Powell, wanted someone who would put out the fire as soon as possible. (TEMPP) indicates the duration of the act. The construction of 'as soon as possible' says that the time of 'put_out#U2' should begin immediately after the start of the time of 'fire#U1'.

That D, Powell, placed his telephone call means, to the judge, that he *must* have *intended* that the Upton police would get the Upton brigade. Chafe regards 'must' as an indicator of inductive reasoning with a high degree of reliability when it is used in *spoken* language (1986, p. 266). It appears that this is the judge's intended meaning here. So it may be said that Powell telephoned with the intention that the inspector would get the Upton fire brigade. The lambda expression spells out the restriction—the Upton fire brigade was the brigade that the inspector naturally asked for at the time he called.

The judge goes on to indicate that the reasons he is about to give are strong enough to stand independently from his determination regarding D's intent. The next reason is a condition; if the inspector so construed the matter, that is, that A's request was indeed for the Upton brigade, then the construction the inspector put upon the request made to him is evidence of what A intended. (ACTS) is used for the inspector because he exercised his will in [CONSTRUE]. Like 'intend', 'construe' conveys volitivity or willfulness. The inspector consciously thought the matter over. The construction he placed on the events did not just occur to him. What he construed is the value of the slot, (DATPSYL). If, in the antecedent, the policeman did construe that the original request Powell made for 'a' fire brigade was in fact a request for the *Upton* fire brigade, then [CONSTRUE: #U1] must be taken as evidence that Powell did intend to request the Upton brigade. The expression of the value of (DATPSYL) is awkward. If it had been possible to give the unknown fire brigade a variable label in the first instance, much of the representation would have been simpler. However, the statement was that Powell had asked for 'a' fire brigade, in the most general terms, although the County Court judge took it upon himself to interpret the request to be for 'the' fire brigade. There is no indication in the facts related in the report that Powell wanted either 'a particular' or 'the' fire brigade. In this respect, representing the meaning of the language in this argument shares with some examples of discourse analysis, a thorny problem of determining the proper antecedents for referents.

In this passage, the judge interjects repeatedly with statements such as ''it seems to me'' and ''indeed, I do not see what other construction. . . ''. There are two significant results of this in relation to the text. The first is that the formal, written decision has become demonstrably more like spoken language more so than expected. The second is that he is stressing in any way he can aspects of his own opinion; attempting to persuade using rhetorical artifices. The argument continues that if the police inspector had in fact construed the events in a natural way, then that would be sufficient to interpret D's request in the way the judge wishes it interpreted. The case (AMBG) indicates the consequence, the result, interpreted here as -volitive consequence. It is something outside the event, afterward, beyond the Goal case.

Next the ACJ draws his conclusion, saying that ‘‘on any view’’, not just his now but any or really, *every* view, D **must** be treated as if he had asked for the Upton brigade. [TREAT] begins the statement of a rule of law, the first one encountered here. The scope of the deontic operator, (OUGHT), is the full frame.

The [COURT] here is an unusual concept that in a full kb would require further definition in order to avoid ambiguity. It means the [COURT] at hand, that is to say, the judge in the current context. However, by implication, [COURT] is metonymous indicating generally, the law. I have made no attempt to represent this as it is an amorphous concept of many dimensions. It indicates how complex the knowledge clusters can become. Capturing all the relationships of such powerful ideas is much more taxing than representing even difficult concrete concepts. It tests the limit of the kr’s semantic expressibility. It would be edifying to have a kr environment that allowed one to specify multi-level associations adding depth and richness to the cognitive representation and at the same time enable us to navigate the kb efficiently and to search with precision.

With the concept of [COURT] set aside, the content of the rule is still difficult to convey. Literally it says that the Court must treat Powell as if he had asked for the Upton brigade. What is really being said is that the meaning of his request is being interpreted with finality. The (AMBP) case here is somewhat abused. Instead of a nice little manner adverb, its filler is an interpretation of a past event that says ‘how’ A is to be treated. The (PAST) tense modal distinguishes the difference in time of the interpretation the judge is placing on the event from the actual occurrence of the event. Within the (PAST) scope, stated in the judge’s current time, the description of the events may vary from the textual description of the events as they occurred in their own real time. The judge is saying that Powell must now be treated as if he had asked for the Upton brigade. He is reconstructing the event but his statement is within the context of two limiting modals, (PAST) and (OUGHT), and of course the (ACJ) modal, the one which tells us that what we are looking at is *his* truth, not factual knowledge from the real world.

The judge next proposes an elaborate hypothetical to make his point. The [HYPO] concept is a subtype of [PROPOSITION]. This is a condition with an embedded antecedent. In the first part of the antecedent, which says that if the person who asks for service makes a request to the Upton brigade, there are no unusual features. The embedded second part is more difficult. It says that, if the Upton brigade responds to the request, renders service to the requester, and thinks erroneously that the farm is located in its district at the time it went there and for a considerable time after, then the condition is fulfilled. The judge goes on in the text to say, parenthetically, that that is what the Upton officer ‘appears’ to have thought. ‘Appears’ is another indication of hearsay and, to some extent, a hedge on the judge’s part. It’s full import is not represented.

The consequent follows, prefaced by another ‘‘In my opinion’’. [THINK: #U2] and its associated statement comparing it to [THINK: #U1] are placed at the end, outside the scope of the [HYPO] proposition. It says that such an erroneous thought does not prevent a contractual relationship from existing between the two parties. The (OBJP) case is used to describe the role of the erroneous thought as an enabler, a passive means. It is an instrument which simply does not stand in the way of an event. Once again, a strength of the case grid is shown. The active and passive uses of the instrument case are distinguished. The passive instrument is sometimes not recognized but, with the help of the grid’s analysis, in this instance the case of choice became quite obvious. The term [OBLIGATION], that is, a legal obligation, as defined in the lexicon, was not prevented from arising. If ‘contractual relationship’ had been used, it would have been truer to the text. However, it would not have given us any more real information. ‘Contract’ could have been substituted. However, there is no definite object called a ‘contract’ in existence or being described. What we have might be called an ‘implied’ contract, or a ‘quasi-contract’, but the judge has not spelled that out.

With respect to [THINK: #U2], the Upton officer is an experiencer. There is no indication that he chooses what he will think, or even to think. This utterance expresses the idea that thoughts occur to him. Now the judge reveals to us that ‘‘The real truth of the matter’’ is that the content of Powell’s [REQUEST] and [WANT] were Upton’s services. Each concept needs an objective case and a dative case. The object of [REQUEST] must has been expressed in terms of possession as it seemed most appropriate to the meaning. Arguably the (OBJ_) cases could have been substituted. [WANT]’s difference is that it is a psychological verb and so appropriately takes (DATPSYL). Verbs such as ‘want’ that may carry with them varying degrees of volitive activity have had to be evaluated instance by instance, or, more appropriately, in context, in order to establish whether or not there *is* intention entailed by the psychological activity. The idea of 'want' is quite dramatically stated and probably there would be little argument that agentivity is involved here, so (ACTS) would be readily accepted. And the fire brigade is rather the source or possessor of the service wanted than the stimulus of the wanting, as it would have to be to merit use of the (DATPSYS) case. The problem is the disposition of the thing wanted. Is the object a thing to be possessed or a thing to be desired? Obviously it is both, yet the psychological character of the verb seems to mitigate toward the use of a suitably 'psychological' object, (DATPSYL).

The judge relates his interpretation of Powell's original request, that it was made for service to the Upton brigade. The brigade responded and provided the service. The text goes on to say that A ''did not concern himself''. [CONCERN] is one of those psychological verbs with an agentive element and so the (ACTS) case is used for A Powell. However, expressing the reflexive pronoun is more difficult. We have several choices. (ACTL) is one, however it is not a true reflexive and it is difficult to see how the agency can be attributed to 'himself' as well as to A as separate entities. It is possible that the objective case, (OBJL), for something undergoing a process, might be used, but [CONCERN] *is* a psychological verb. The final choice is (DATPSYG) which, reasonably enough, says that 'himself' is the experiencer of the verb. The hash mark (#) in the referent field of 'A' concept of course refers to the previous use of 'A' with the specifier 'Powell'. The object of Powell's concern, or rather lack of it, since the proposition is made negative, is his supposed right of entitlement to free service. The second predicate [CONCERN: #U2] expresses the negative aspect.

Then, as it turns out, Upton can demand payment. The judge continues. His next statement is in the form of an implication. The antecedent states, if it is possible for Powell to say that he ought not to pay for service for the reason that he thought, and thought for some time, that he was using the services of his district, then the consequent is engaged. The possibility operator (PSBL) encloses the antecedent. The deontic modal (OUGHT) expresses an obligation. The conrel (˜OUGHT) encompasses the content of the object, the service, in its scope. The consequent states that the [COURT], then, would be, in a phrase, 'wrong on principle'. It is difficult to conceive of a conceptual representation for this blunt statement. Master of the Rolls, Greene, simply dismisses the appeal, without further ado, except to say that, in his opinion, the

CCJ's finding cannot be assailed.

6.8.3.4. Rebuttal

The Rebuttal argument was not accepted by the ACJ. The text says that the County Court judge's assertions that D asked for the fire brigade he wanted and got what he wanted, are wrong. It also states that the CCJ's statements are wrong for the reason that Powell did not know which fire district the farm was in. Moreover, he really wanted to get the brigade from the district the farm was in. Frame [KNOW: #U4] states that it is not true that D knew the farm was in the Pershore fire district, or in some unspecified fire district. The text states that he did not know *which* fire district it was in. However, the representation of the fire district as an unknown, [FIRE_DISTRICT: ?], along with the negative statement that he did not know, creates the confusing assertion that Powell did not know that the fire district was not known! The true meaning is of course that he did not know the *name* of the fire district, let alone that there was a choice of *which* fire district he might choose. The meaning of the statement with regard to the argument is represented here. Regrettably, the language of the text is not.

The [WANT: #U2] frame similarly is not entirely satisfactory. 'Want' here involves volition. Unfortunately, the act of arguing this case has involved the court in attempting to read D's mind from his actions. Although it is unlikely that in the emergency Powell gave much willful thought to what he actually *wanted*, everyone is trying to interpret his actions so as to determine what his will was at the time. In other words, they are attempting to attribute clear *intent* to Powell by interpreting his actions after the fact. In that context then, the (ACTS) will be used with [WANT] although it seems that (DATPSYG) is more honest a choice.

```
[ARGUMENT: #3]→(INCL)→[

[CLAIM: #3]→(INCL)→[
[MAKE: #U3]–
    (ACTS)→[R: Upton][A: Powell]
    (OBJG)→[CONTRACT-n: #U2].
[CONTRACT-n: #U2]→(CONT)→[TERM:
   if    [PROVIDE: #U3]–
            (ACTS)→[R: Upton]
            (DATPOSSG)→[A: Powell]
            (DATPOSSL)→[SERVICE-n: #U6].
   then  [PROMISE-v: #U1]–
              (ACTS)→[A: Powell] or [[AGENT: ∗]←(POSS)←[A: Powell]]
              (DATPOSSL)→[PAY_FOR: #U2]–
                             (DATPOSSL)→[SERVICE-n: #U6],.]
[CONTRACT-n: #U2]→(CHRC)→[IMPLIED_CONTRACT: #U1]
] ;end of Claim

[GROUNDS: #3]→(INCL)→[
   [LIVE: #U1]–
      (ACTS)→[A: Powell]
      (LOCL)→[PLACE: Strensham].
   [BREAK_OUT: #U1]–
      (ACTS)→[FIRE: #U1]
      (LOCL)→[BARN: #U1]–
                  (ATTR)→[DUTCH_BARN: #U1]
                  (LOCL)→[FARM: #U1]←(POSS)←[A: Powell],
      (TEMPL)→[TIME: burn#U1]→(DATE)→[MONTH: Nov][YEAR: 1939].
   [TELEPHONE-v: #U1]–
      (ACTS)→[A: Powell]
      (DATPOSSG)→[POLICE_INSPECTOR: #U1]
      (LOCG)→[POLICE_OFFICE: #U1]→(LOCL)→[DISTRICT: Upton].
   [TELL: #U1]–
      (ACTS)→[A: Powell]
      (DATPOSSG)→[POLICE_INSPECTOR: #U1]
      (DATPOSSL)→[INFO: [BREAK_OUT: #U1]←(ACTS)←[FIRE: #U1]]
      (TEMPL)→[TIME: tell#U1].
   [REQUEST-v: #U1]–
      (ACTS)→[A: Powell]
      (DATPOSSG)→[POLICE_INSPECTOR: #U1]
      (DATPOSSL)→[REQUEST-n: #U1]–
                      (CONT)→[SEND: #U1]–
                                  (ACTS)→[POLICE_INSPECTOR: #U1]
                                  (OBJG)→[FIRE_BRIGADE: ∗].
   [~[HAVE: #U2]–
         (DATPOSSG)→[FIRE_STATION: #U1]
         (DATPOSSL)→[TELEPHONE-n].]
   [TELEPHONE-v: #U2]–
      (ACTS)→[POLICE_INSPECTOR: #U1]
      (LOCG)→[GARAGE: #U1]–
                  (NEAR)→[FIRE_STATION: #U1]→(LOCL)→[DISTRICT: Upton],.
```

```
[INFORM: #U1]–
  (ACTS)→[POLICE_INSPECTOR: #U1]
  (DATPOSSG)→[FIRE_BRIGADE: Upton]
  (DATPOSSL)→[INFO: [FIRE: #U1]]
  (TEMPL)→[TIME: inform#U1].
[GO: #U1]–
   (ACTS)→[FIRE_BRIGADE: Upton]
   (LOCG)→[FIRE: #U1]
   (TEMPL)→[TIME: go#U1-]→(>)→[TIME: inform#U1+].;immediately after
[REMAIN: #U1]–
   (ACTS)→[FIRE_BRIGADE: Upton]
   (LOCL)→[FIRE: #U1]
   (TEMPP)→[TIME: remain#U1]→(ATTR)→[LONG: #U1].
[PUT_OUT: #U1]–
   (ACTS)→[FIRE_BRIGADE: Upton]
   (OBJG)→[FIRE: #U1]
   (TEMPP)→[TIME: put_out#U1]→(ATTR)→[LONG: #U1].
[FARM: #U1]–
   (LOCL)→[POLICE_DISTRICT: #U1]→(IN)→[DISTRICT: Upton]
               [FIRE_DISTRICT: #U2]→(IN)→[DISTRICT: Pershore].
[ENTITLE: #U1]–
   (DATPOSSG)→[A: Powell]
   (DATPOSSL)→[RIGHT: #U1]→(CONT)→
                        [(MAY)→[[HAVE: #U1]–
                             (DATPOSSG)→[A: Powell]
                             (DATPOSSL)→[SERVICE-v: #U1]–
                                                  (ACTS)→[FIRE_BRIGADE: Pershore]–
                                                           (LOCL)→[DISTRICT: Pershore],
                                                  (DATPOSSG)→[A: Powell]
                                                  (DATPOSSP)→[~PAYMENT],,]].
[ENTITLE: #U2]–
   (DATPOSSG)→[FIRE_BRIGADE: Upton]
   (DATPOSSL)→[RIGHT: #U2]→(CONT)→
                        [(MAY)→[GO: #U2]–
                          (ACTS)→[FIRE_BRIGADE: Upton]
                          (LOCG)→[FIRE: ∗]→(~IN)→[FIRE_DISTRICT: #U1],
   (AMBS)→[STATUTE: #U1],]].
if    [FIRE_BRIGADE: Upton]←(ACTS)←[GO: #U2]
then  [HAVE: #U2]–
            (DATPOSSG)→[FIRE_BRIGADE: Upton]
            (DATPOSSL)→[RIGHT: #U3]→(CONT)→
                                  [(MAY)→[MAKE: #U2]–
                                                 (ACTS)→[FIRE_BRIGADE: Upton]
                                                 (OBJG)→[CONTRACT-n: #U1]→(CONT)→[TERM:
                                                          if [SERVICE-v: #U2]–
                                                                 (ACTS)→[FIRE_BRIGADE: Upton]
                                                                 (DATPOSSG)→[PERSON: ∗x],
                                                        then [ENTITLE: #U3]–
                                                                 (DATPOSSG)→[FIRE_BRIGADE: Upton]
                                                                 (DATPOSSL)→
      [RIGHT: #U4]→(CONT)→
         [(MAY)→[REPAY: #U1]–
                        (ACTS)→[PERSON: ∗x]
                        (DATPOSSG)→[FIRE_BRIGADE: Upton]
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                        (DATPOSSP)→[EXPENSES: ∗],]],]]].
   [ARRIVE: #U1]–
      (ACTS)→[FIRE_BRIGADE: Upton]
      (LOCG)→[FIRE: #U1]
      (TEMPL)→[TIME: arrive#U1].
   [ARRIVE: #U2]–
      (ACTS)→[OFFICER: Pershore]
      (LOCG)→[FIRE: #U1]
      (TEMPL)→[TIME: arrive#U2]→(>)→[TIME: arrive#U1]–
                                             (MEAS)→[HOURS: @6],.
   [~[ARRIVE: #U3]–
        (ACTS)→[FIRE_BRIGADE: Pershore]
        (LOCG)→[FIRE: #U1]
        (TEMPL)→[TIME: arrive#U2].]
   [TELL: #U2]–
      (ACTS)→[OFFICER: Pershore]
      (DATPOSSG)→[OFFICER: Upton]
      (DATPOSSL)→[INFO: [FIRE: #U1]–
                           (LOCL)→[FIRE_DISTRICT: #U2]
                           (~LOCL)→[FIRE_DISTRICT: #U1],].
   [CONTINUE: #U1]–
      (OBJL)→[PUT_OUT #U1]–
                  (ACTS)→[FIRE_BRIGADE: Upton]
                  (OBJG)→[FIRE: #U1],
      (LOCL)→[FARM: #U1]
      (TEMPG)→[TIME: continue#U1]→(>)→[TIME: arrive#U1]→(MEAS)→[DAY: @1].
   [PUT_OUT: #U1]→[COMP)→[SERVICE-v: #U2]
   [ARRIVE: #U4]–
      (ACTS)→[FIRE_BRIGADE: Pershore]
      (LOCG)→[FARM: #U1]
      (TEMPL)→[TIME: arrive#U4]→(>)→[TIME: arrive#U1]→(MEAS)→[DAY: @1].
   [TAKE_OVER: #U1]–
      (ACTG)→[FIRE_BRIGADE: Pershore]
      (DATPOSSL)→[PUT_OUT: #U2]→(OBJG)→[FIRE: #U1]
      (DATPOSSS)→[FIRE_BRIGADE: Upton].
(CCJ)→[[REQUEST-v: #U2]–
           (ACTS)→[A: Powell]
           (DATPOSSG)→[POLICE_INSPECTOR: #U1]
           (DATPOSSL)→[REQUEST-n: #U2]→(CONT)→[[SEND: #U2]–
                            (ACTS)→[POLICE_INSPECTOR: #U1]
                            (DATPOSSL)→[FIRE_BRIGADE: the],]
           (TEMPL)→[TIME: telephone-v#U1].
        [SUMMON: #U1]–
           (ACTS)→[POLICE_INSPECTOR: #U1]
           (OBJG)→[FIRE_BRIGADE: Upton]→(ATTR)→[LOCAL: #U1]
           (AMBP)→[NATURAL: #U1].
        [TAKE: #U1]–
           (ACTS)→[POLICE_INSPECTOR: #U1]
           (OBJL)→[REQUEST-n: #U2]←(ACTS)←[AS_BE]–
                    (OBJL)→[REQUEST-n: #U2]=
                       lambda x [REQUEST-n: ∗x]–
                            (CONT)→[FIRE_BRIGADE: the]–
                                     (ATTR)→[CONNECT_TO: #U1]–
                                              (OBJG)→[POLICE_INSPECTOR: #U1],
```

```
                                               (EQUIV)→[FIRE_BRIGADE: Upton].]
] ;end of CCJ
 (ACJ)→[[KNOW: #U1]–
        (DATPSYG)→[~[A: Powell]
                  [~[POLICE_INSPECTOR: #U1]
                  [~[FIRE_BRIGADE: Upton]
        (DATPSYL)→[INFO: [FARM: #U1]–
                        (LOCL)→[FIRE_DISTRICT: #U2][~[FIRE_DISTRICT: #U1],]
        (TEMPG)→[TIME: tell#U2].
] ;ACJ ends
 (CCJ)→[[REQUEST-v: #U3]–
       (ACTS)→[POLICE_INSPECTOR: #U1]
       (DATPOSSL)→[REQUEST-n: #U2]
       (DATPOSSG)→[FIRE_BRIGADE: Upton].
      [SEND: #U2]–
        (ACTS)→[POLICE_INSPECTOR: #U1]
        (OBJG)→[FIRE_BRIGADE: Upton]
        (LOCG)→[FIRE: #U1].
      [EXPECT: #U1]–
        (DATPSYG)→[D: Powell]
        (DATPSYL)→[FIRE_BRIGADE: Upton].
      [~[KNOW: #U2]–
          (DATPSYG)→[D: Powell]
          (DATPSYL)→[if   [REQUEST-v: #U4]–
                              (ACTS)→[D: Powell]
                              (DATPOSSL)→[FIRE_BRIGADE: Pershore],
                     then  [OBTAIN: #U1]–
                               (ACTG)→[D: Powell]
                               (DATPOSSL)→[ADVANTAGE: #U1]=
                                  lambda x [ADVANTAGE: *x]–
                                               (EQUIV)→[SERVICE-n: #U2]–
                                                       (ATTR)→[~PAYMENT],,,.]
        [REQUEST-v: #U5]–
          (ACTS)→[D: Powell]
          (DATPOSSL)→[[REQUEST-n: #U3]–
                      (CONT)→[[FIRE_BRIGADE: #U3]=
                              lambda x [FIRE_BRIGADE: *x]←(DATPSYL)←[WANT: #U1]–
                                  (ACTS)→[D: Powell],].
        [GET: #U1]–
          (ACTG)→[D: Powell]
          (DATPOSSL)→[FIRE_BRIGADE: #U3].
 ] ;end of CCJ
] ;end of Grounds

[REASONS: #3]→(INCL)→[
(ACJ)→[(~PSBL)→[[JUSTIFY: #U1]–
               (OBJG)→[REBUTTAL: #3]]
               (AMBS)→[WANT: #U3]–
                      (ACTS)→[D: Powell]
                      (DATPSYL)→[PERSON: *]=
                          (lambda x) [PERSON: *x]←(ACTS)←[PUT_OUT: #U2]–
   (OBJG)→[FIRE: #U1]
   (TEMPP)→[TIME: put_out#U2-]→(>)→[TIME: fire#U1-],,.
 [INTEND: #U1]–
```

```
  (EVID)→[TELEPHONE-v: #U1]
  (ACTS)→[D: Powell]
  (DATPSYL)→[REQUEST-v: #U6]–
                  (ACTS)→[POLICE_INSPECTOR: #U1]
                  (DATPOSSL)→[FIRE_BRIGADE: Upton]=
                           (lambda x) [FIRE_BRIGADE: *x]←(DATPOSSG)←[REQUEST-v: #U3]–
                             (TEMPL)→[TIME: telephone-v#U2]
                             (AMBP)→[NATURAL: #U2],,.
 if  [CONSTRUE: #U1]–
      (ACTS)→[POLICE_INSPECTOR: #U1]
      (DATPSYL)→[REQUEST-n: #U1]→(EQUIV)→[REQUEST-n: #U2]
      (AMBP)→[REASONABLE: #U1].
 then [SUFFICE: #U1]–
       (AMBG)→[CONSTRUE: #U1]→(EVID)→[REQUEST-n: #U2].
(OUGHT)→[[TREAT: #U1]–
               (ACTS)→[COURT: #U1]
               (OBJL)→[A: Powell]
               (AMBP)→[(PAST)→[[REQUEST-v: #U2]–
                                      (ACTS)→[A: Powell]
                                      (DATPOSSL)→[REQUEST-n: #U2],].] ;end of ought
[HYPO: if    [REQUEST-v: #U7]–
               (ACTS)→[[PERSON: *
               (DATPOSSL)→[SERVICE-n: #U3],
               (DATPOSSG)→[FIRE_BRIGADE: Upton].
         then if [RESPOND: #U1]–
                 (ACTS)→[FIRE_BRIGADE: Upton].
               [RENDER: #U2]–
                 (ACTS)→[FIRE_BRIGADE: Upton]
                 (DATPOSSL)→[SERVICE-n: #U3]
                 (DATPOSSG)→[PERSON: *x].
               [THINK: #U1]–
                 (DATPSYG)→[FIRE_BRIGADE: Upton]
                 (DATPSYL)→[FARM: #U1]→(LOCL)→[FIRE_DISTRICT: #U1]
                 (TEMPL)→[TIME: go#U1]→(s)→[TIME: think#U1]→(MEAS)→[CONSIDERABLE: #U1]
               (AMBP)→[ERRONEOUS: #U1],.
            then [~[PREVENT: #U1]–
                    (OBJP)→[THINK: #U1]
                    (OBJL)→[OBLIGATION: #U1]–
                              (PARTY)→[PERSON: *x]
                              (PARTY)→[FIRE_BRIGADE: Upton],.]
    ]; end of HYPO
     [THINK: #U2]–
       (DATPSYG)→[OFFICER: Upton]
       (DATPSYL)→[FARM: #U1]→(LOCL)→[FIRE_DISTRICT: #U1].
     [THINK: #U2]→(COMP)→[THINK: #U1]
     [REQUEST-v: #U8]–
       (ACTS)→[A: Powell]
       (DATPOSSL)→[SERVICE-n: #U4]
       (DATPOSSG)→[FIRE_BRIGADE: Upton]
       (TEMPL)→[TIME: request-v#U8].
     [WANT: #U4]–
        (ACTS)→[A: Powell]
        (DATPSYL)→[SERVICE-n: #U4]
        (DATPOSSS)→[FIRE_BRIGADE: Upton].
```

```
     [RESPOND: #U2]–
        (ACTS)→[FIRE_BRIGADE: Upton].
     [PROVIDE: #U1]–
        (ACTS)→[FIRE_BRIGADE: Upton]
        (DATPOSSL)→[SERVICE-n: #U4].
     [~[CONCERN: #U1]–
          (ACTS)→[A: Powell]
          (DATPSYG)→[A: #] ;reflexive
          (DATPSYL)→[RIGHT: [(MAY)→[ENTITLE: #U4]–
                                      (DATPOSSG)→[A: Powell]
                                      (DATPOSSL)→[SERVICE-n: #U4]
                                      (DATPOSSP)→[~PAYMENT: #U2],]
          (TEMPL)→[TIME: request-v#U8].]
     [~[CONCERN: #U2]–
          (ACTS)→[A: Powell]
          (DATPSYG)→[A: #]
          (DATPSYL)→[RIGHT: [(MAY)→[~[ENTITLE: #U4]–
                                       (DATPOSSG)→[A: Powell]
                                       (DATPOSSL)→[SERVICE-n: #U1]
                                       (DATPOSSP)→[~PAYMENT: #U2],]
          (TEMPL)→[TIME: request-v#U8].]
      (MAY)→[[DEMAND: #U1]–
                  (ACTS)→[R: Upton]
                  (DATPOSSL)→[PAYMENT: #U3]
                  (TEMPL)→[TIME: demand#U1].]
      if  (MAY)→[[SAY: #U1]–
                   (ACTS)→[A: Powell]
                   (OBJG)→[~[PAY_FOR: #U1]–
                               (ACTS)→[A: Powell]
                               (DATPOSSL)→[SERVICE-n: #U1]
                               (AMBS)→{[THINK: #U1][THINK: #U2],]}
                               (TEMPL)→[TIME: say#U1]→(>)→[TIME: demand#U1].]
           then [UNJUST: #U2]–
                  (OBJL)→[COURT: #U2]–
                             (ATTR)→[PHRASE: ‘‘wrong on principle’’].
     [DISMISS: #U1]–
        (ACTS)→[JUDGE: Greene]
        (OBJG)→[APPEAL: #U1].
] ;end of ACJ
 ] ;end of REASONS

[REBUTTAL: #3]→(INCL)→[
   [UNJUST: #U1]–
      (OBJL)→(CCJ)→[[REQUEST-v: #U5][GET: #U1]]
      (AMBS)→{[WANT: #U2][~[KNOW: #U4]}.
   [FARM: #U1]→(LOCL)→[FIRE_DISTRICT: *w]
   [~[KNOW: #U4]–
        (DATPSYG)→[D: Powell]
        (DATPSYL)→[FIRE_DISTRICT: *w] = [[FIRE_DISTRICT: #U2] or
                                          [FIRE_DISTRICT: ?]].]
   [WANT: #U2]–
       (ACTS)→[D: Powell]
       (DATPSYL)→[GET: #U3]–
                     (ACTG)→[D: Powell]
```

(DATPOSSL)→[FIRE_BRIGADE: #]–
(LOCL)→[FIRE_DISTRICT: ∗]→(CONT)→[FARM: #U1],,]
(AMBP)→[REAL: #U1].
]*; end of REBUTTAL*
]*; end of ARGUMENT*

Fig. 6.6 Argument #3
Upton-on-Severn Rural District Council v. *Powell*

6.8.4. Case 4: *Hadley* v. *Baxendale*

Unlike *Upton*, *Hadley* v. *Baxendale* is a case with a reasoned argument. The facts of the case appear in figure 3.4 and a lengthy discussion of them in §3.3.4. The representation is in figure 6.7. It deals with a situation in which negotiations are in the past. The contract was completed. There is no question about the contract's existence. The case is about the damages following upon a breach of that contract. Unlike, the previous cases we have which deal with entering into agreements. In the first two cases, putative offers were made and apparent acceptances came about when the reciprocating parties acted upon those 'offers'. In each case, there was no 'meeting of minds', no agreement, no face-to-face acceptance and no metaphorical handshake. In *Upton* the situation is very similar. D issues a cry for help in an emergency. P receives the request from a middleman and acts upon it. Again there is no meeting of minds, no real agreement. Nevertheless, the court constructs or implies a contract in order to deal with the thorny question of who should pay the cost of emergency service.

Finally, in *Hadley* v. *Baxendale* the agreement itself is unquestioned. The circumstances surrounding it are reconstructed in order to determine what D could foresee when he decided to breach the contract. Still, as in the previous cases, there is an attempt to determine the intention of the parties. In other words, to determine how much damage did D foresee he would do when he breached. Did he in fact understand that the mill would stand idle until he delivered the new mill shaft to P? Although the concept of 'intention' is investigated, it is never named in the case. One of the challenges is to construct a representation that expresses the idea of intention to the extent that it is present in the text.

An excerpt from the case containing a part of the argument is used. The facts have been summarized at the start. The idea is to give the reader the informational content rather than the full factual exposition in the case. Since the summary of facts is not derived from the case report itself, some liberty has been taken in representing its language. I have not attempted to stay as close to the wording of the text as previously but tried instead to represent the meaning clearly. I found that a much more explicit representation was needed in this case than one would have assumed at first glance. A number of predicates were added in order to describe exactly the progression of events. That is to say, it became clear that a finer-grained representation was necessary if the kr was to be intelligible and unambiguous. An argument was developed fully in this case and so the kr was much more precise than the others. The dominant criterion was that the argument be intelligible.

In the previous cases, a faithful representation of the linguistic expression was not always possible, but was given a high priority. The focus in *Hadley* is on the argument. I was anxious to determine whether it was possible to construct a viable conceptual representation for legal reasoning, that is, very loose legal reasoning such as is typically done in preliminary research on some problems. Such reasoning is suitable in a design for an intelligent retrieval system that is modelled on legal research in order to achieve naturalism. The problems concern suitability for reasoning. Once again the difficulty of representing ideas, abstractions, was a significant part of the problem

In the representation for Argument 4, the mnemonic in the instance numbers is ‘H’. Again, we are dealing with an appeal procedure. P and D become A and R respectively at intervals as the judge’s narration switches back and forth between the appeal at hand and the preceding trial.

At the beginning of Argument 4, before the Claim is introduced, there are a number of lambda expressions, definitions that will be used throughout the representation. Although some lambda expressions have been used in the previous representations, the noticeable increase in number here results from the complexity of the material. One of the difficulties noted earlier, in §4.3, was the use of the linear notation to interpret complex sentences with several levels of embedded clauses, that is to say, several predicates with complements. The discussion of the lambda expressions will be integrated in the discussion of the kr and the text, as definitions have less impact in isolation than they do in context. The reader may find, however, that the main thrust of the argument is easier to absorb with the discussion of the conceptual definitions removed. The remaining Argument representation appears to be straightforward.

There are definitions of legal concepts within the system that are not derived from the cases themselves. Appendix C contains a lexicon of all the legal concepts. The definitions are general. Where instances occur in the kb, there are definitions linked to those instances in the lexicon, that come into play automatically.

The definitions at the beginning of this case are local definitions. Lambda expressions were used here in order to produce a good conceptual analysis of difficult ideas in simple notation. Lambda expressions could have been used in Appendix C as well, however, it was originally conceived as a lexicon and was so written.

The limitation of quantifier scope with (DEFN) is the same as if it were a lambda expression. The definitions in figure 6.7 are local, restricted to the Argument of which they are a part. There may be some confusion for the reader in attempting to ascertain why a particular definition appears where it does. For example, the lambda definitions for [BREACH] and for [GENERAL_DAMAGES] might quite reasonably have been expected to have counterparts in the lexicon. However, the concepts are used in a restricted sense within the Argument at hand, the information content they include is sufficient for limited use. They are definitions tailored to a specific use. They are not comprehensive, they are correct as far as they go.

6.8.4.1. Claim

The Claim begins by stating simply that it was not possible for A and R to have fairly and reasonably considered the loss of profits resulting from the breach of contract at the time the contract was made. Both [LOSS] and [BREACH] were defined just above as lambda expressions. [LOSS] is expanded to mean loss of profits and [BREACH] to mean breach of contract. The second part of the Claim goes on to say that the judge in a new trial must tell the jury, on the basis of the facts before it, that is, the Grounds of the Argument, that it, the jury, must not consider the loss of profits at the time when the damages are estimate.

The first question of importance is time in the sequence of events. In order to represent the text with absolute integrity, a sophisticated set of time indicators including tense and other elements would be necessary. However, one of the weaknesses of this kr is that such a set of indicators, is not available. The opinions of each judge are included within a modal and so are segregated from the original set of facts in the dispute and from those decided upon by other judges.

There is a primitive (PAST) tense, which places the events in its scope, prior to the time of the telling. Since the story of each case is told in the present but, as shown above in §6.8.3.2, taken to mean in the simple past (PAST) places events within its scope further back in time. Simply then, the judge's position is in the present. His relation of the events of the case and any prior decisions are read as being in the simple past. The events within a (PAST) tense indicator occurred prior to the time being described. In this case, the (PAST) events are the parties considerations at the time of contracting. The event that preceded the contract and the breach, which are being related as though current.

Reasoning becomes complex almost immediately because of the need for modal operators. The modal (˜PSBL) in association with the (PAST) context, makes a multiple-level nesting. Further down, outside the context of the (˜PSBL) modal, the deontic (OUGHT) expresses obligation. There are two distinct obligations. The first, the outer one tells how the judge in the new trial should instruct the jury. The second, the inner one tells the content of the rule. The judge's comments is interpreted conveying obligation. The reason is of course that in saying 'ought' the judge is speaking courteously. Nevertheless, he expects his decisions to be binding as indeed the legal system ensures they will be. There is no discretion allowed here. The rule is definite.

Ambient cases perform well here. The (AMBG) case is not common. Its use in associating [BREACH: #H1] with [LOSS: #H1] shows the loss as a consequence of the breach. The feature mark is '–volitive'. The consequence is unintended. The judge gives as the reason, (AMBS), for the rule, the facts of the case, that is, the [GROUNDS].

6.8.4.2. Grounds

The facts put before the jury are simple. The use of [OWN] is clearly transitive. Hadley's state of owning is described. Since it expresses possession, the object slot is (DATPOSSL). (DATPOSSG) has been used here for the owner in order to express his situation as possessor, as distinguished from recipient. (DATPOSSG) with the feature '-dynamic' makes the distinction.

(OBJL) is commonly used for the element described by a stative predicate, the element 'undergoing', would not be a happy choice here. The semantics of [OWN] dispose one to express possession. However, there is no transfer involved in [OWN], and it is not clear that the (DATPOSS_) cases are appropriate. The cell notation for (DATPOSSL), for example, is 'thing transferred'. The mill has not been transferred, and indeed, has not changed state. Somers says that the distinctions between the (OBJL) and (DATPOSSL) cases are subtle and relate to the domain. (DATPOSSL) seems to be suitable here for the [MILL], as expressing the idea of a continuing state of simple ownership.

The [MILL] has a characteristic, that it is a [STEAM_POWERED_MILL]. The contrast between the (ATTR) of the [BARN], that it is a [DUTCH_BARN], and the (CHRC) of the [MILL], that it is a [STEAM_POWERED_MILL], highlights the difference in the use of the conrels (ATTR) and (CHRC). If the barn had a door other than a Dutch door, it would not change the nature of the barn as a barn. However, if the mill was not a steam-powered mill, it would be an entity of another kind, essentially different. It would still mill, but with a different mechanism, perhaps a water wheel.

The narration begins. The mill shaft breaks. The parties agree on a price, and a promise is made, which becomes a contract. The terms of the agreement are that if Baxendale delivers a new replacement shaft, Hadley will pay him. Then P, Hadley, follows up immediately by acting on the contract and sending the broken shaft. D, Baxendale, is given another role, the role of [CARRIER], through the use of the conrel (EQUIV). The carrier is the (ACTP), the instrument or means by which the shaft is sent. The (LOCS) and (LOCG) pair, showing the source and terminus of the trip, demonstrate a strength of the Somers approach in two ways. First the source-goal direction is evident, and second the locatives are clearly distinguished and the ideas well expressed.

The predicate, [SEND], affords an example for a demonstration of the flexibility of case with fully transitive verbs. As we have seen, verbs often express incomplete transitivity. The (ACTS) and (ACTP) cases are obvious in their application to standard types of NPs. The (OBJG) case is used rather for a limitable action. The shaft is simply sustaining the action of 'send'. Note that although the shaft is transported, there is no change in ownership. There is a change in possession but not in ownership. We have chosen to represent the action of sending the shaft, rather than the change in possession because of the overriding consideration of ownership. This instance shows one aspect of the complexity of possessory relations.

Use of the case (DATPOSSP) here is curious, as the case content description of itself ‘price’; so the value of the price slot is ‘price’! But notice that the price is not for the (OBJG) of the verb, but for the actual action of [SEND]. That is, the shaft is not being paid for; the action of transporting it is.

The intended result, (ACTG), of the action [SEND] is for the broken shaft to [SERVE_AS] a pattern. (ACTG) expresses purpose. There is a sense of planning that adheres to it as opposed to (AMBS), reason, which we interpret as a precondition. And (AMBG) is a −volitive consequence. The other sense of (AMBG) ‘‘aim +volitive’’ expresses purpose, but less intensely. Also, cases are to be interpreted within the meaning of the parameters. The Active parameter expresses initiative, while Ambient cases describe conditions.

[SERVE_AS] creates a new role for [MILL_SHAFT]. The concept fills the slot, (OBJS), at the beginning of a process, and (OBJL) as it proceeds. Although [MILL_SHAFT] is the syntactic subject, it lacks any hint of agentivity. (OBJS) has been used to denote an inactive subject. [PATTERN], a concept, which describes the same mill shaft, fills the slot of (OBJL). It is undergoing a process. But since it is a concrete noun, must take the change-of-state reading. That reading seems to be suitable since the extent of the event is not determinable in the context of the verb. [SERVE_AS] is indefinite and could go on if not limited by another assertion. This was originally interpreted as (OBJG) in the sense of a new object having been created. But in fact there was no change in the object. It was simply used as something else. Whereas, [MANUFACTURE: #H1] appropriately takes the case (OBJG) for its argument [MILL_SHAFT: #H2]. This is, by definition, a factitive use when +concrete is the feature. The intended result, (ACTG), of the predicate [SERVE_AS], is the manufacture a new mill shaft, instance #H2.

The next four predicates describe the carrier’s service. He delivered the broken mill shaft to Gloucester and delayed delivery for an unreasonable, [˜REASONABLE], amount of time. The negative is used in direct relation to the concept. It ‘undoes’ the conceptual content of the entity. The carrier delivered the new mill shaft, but the time of that delivery was delayed because of the previous delay. The second delay was caused by the first delay.

The case expressing the relationship of the first delay to the second delay, (AMBS), does not truly express causation. It says only that the first delay is the *reason* for the second delay. A more penetrating analysis of causation would be necessary for any attempt at reasoning concerning these events. Sowa's conrel (CAUS) tells us little more about the relationship. A case relation has been used in preference to a conrel wherever possible to sustain the integrity of the grid.

These predicates show again the useful construction of Somers's Temporal and Locative cases for clear exposition. P did not have a spare shaft. As a result, we see that the mill stood idle from the time when the mill shaft broke until the time when new shaft was delivered. The shaft takes the case (OBJL) here as there is clearly stative. It is simply undergoing the state of inactivity expressed by the predicate adjective 'idle'. During that time, P lost profits. As a result, of the unwarranted delay, he sued D for loss of profits occasioned by the delay. The (OBJP) case here is the 'counter-instrument'. The delay allowed something to happen. It did not cause the loss to occur; it enabled it to happen.

The trial decision is reported as fact in contrast with the modal reportage of the (CCJ) in *Upton*. We are told simply that the jury awarded P [MONEY: @?], that is, some unstated amount of money, by reason of the loss of profits occasioned by the delay in delivery of the new mill shaft. Predictably, D Baxendale, sought a 'rule' or order for an appeal.

6.8.4.3. Reasons

The Reasons constitute the appeal judge's decision as the modal operator (ACJ) indicates. It includes the entire Reasons section. Much of the argument is composed of a discussion of rules, generic concepts. They may have an asterisk in the referent field or be without any referent (figure 4.2). The judge begins by stating a general rule to be followed in breach of contract cases, such as the one before him. Where two parties, *x* and *y*, have made a contract and one of them has breached, then the other should receive damages. The lambda expression defining [BREACHER] appears earlier, but here we see that the breacher may be one, but not both, of the parties to the contract. The one who may receive damages is then the party who is *not* the breacher.

Also among the definitions at the beginning of the case representation are the descriptions of the kinds of damages that are allowed. The definitions build upon each other. [BREACH_DAMAGES] are, of course, those damages resulting from a breach of contract. Then [BREACH_DAMAGES] are of two kinds, those which arise 'naturally' and those which can be foreseen. [NATURAL] means that although the *manner* of arising is 'naturally', the *condition* under which the arising is done is in the general course of things. [NATURAL_DAMAGES] are then damages which some jury reasonably and fairly considers as having arisen naturally, that is in the general course of things.

Distinguished from natural damages [FORESEEN_DAMAGES] are those which a jury reasonably supposes parties contemplated at the time the contract was made. the underlying assumption is that the damages may have appeared to the parties as being likely to occur. In other words, the [FORESEEN_DAMAGES] would appear to be those which could be expected to arise within the general course of things as well. No extravagant exercise of imagination is expected of the parties at contract-making time. Although the text says damages that must be paid are either one or the other, the real meaning is that damages of both kinds will be payable. The distinction is that one type of justification or the other must be given to support a claim for damages. The judge goes on to say that the judge, in the new [TRIAL], (OUGHT) to direct the jury to apply principles in accord with the rule he has pronounced.

The argument continues as an 'argument by division', a dilemma (Perelman and Olbrechts-Tyteca 1969, p. 234-241). Either something is true, or it is not. In this case, either D knew of the special circumstances that caused the exceptional loss of profits, or he did not. If P had communicated to D the special circumstances of the situation, that is, that the mill shaft was the only one he had and that the mill would stand idle until the new shaft was delivered to him, that if both parties *knew* these special circumstances, then the [BREACH] would entail both [NATURAL_DAMAGES] and [FORESEEN_DAMAGES]. The type [SPECIAL_CIRCUMSTANCES] is defined above as special circumstances that existed at the time a contract is made. Notice that although these objects are written as plurals, they are similar to mass nouns.

On the other horn of the dilemma, if the [BREACHER] did not know about the special circumstances that existed, then the jury should deal with the case as if the [BREACHER] had contemplated general damages. The negative associated with this assertion may be stated in one of two ways. It may be interpreted either as ‘it is not true that he knew’ or as the special circumstances were unknown [˜KNOW] to him. An argument may be made for either interpretation. However, since the special circumstances appear to have been knowable, the first interpretation is more likely correct. [GENERAL_DAMAGES], are, defined as damages incurred by a breach of contract where no special circumstances are involved.

The judge goes on to explain that, if in fact both parties had known about the special circumstances, they could have provided special contractual terms to deal with the eventuality of a breach under the conditions imposed by the special circumstances. Again, [BREACH_TERMS] is defined at the start.

The terms of the judge’s statements about the [BREACH_TERMS] are difficult to analyze. He is at the same time talking about the case before him, and generalizing, about the effect his decision might have. He is saying that in general it would be very unjust for a judge to make a decision about a special-circumstances breach, without asking whether or not the breacher knew the special circumstances at the time of breach.

The import of the assertion is a little convoluted. If the judge makes such a decision, he removes from the contracting parties the freedom to provide for such eventualities as may result from the special circumstances surrounding their agreements. That is to say, if his decision is followed, then contracting parties, will have been deprived of deciding for themselves about the effect of special circumstances. Ostensibly he does not wish to limit freedom in contracting.

With regard to the situation at hand, if the judge made an arbitrary decision, he could not remove the advantage from *Hadley* v. *Baxendale*, not only because it didn’t exist, but because, if it had existed, it is clear that they did not take the advantage.

A compromise was used in constructing the representation. The predicate [DEPRIVE] specifies the case at hand, the judge, and the parties. The advantage is however, generic and applies to contracting parties at large.

In general, juries must be guided by the principles he has laid down in the discussion relation to [RULE: #H1] above. He is saying that the rule is stated with regard to this case but intended to apply generally to cases regarding breach of contract. [JURY] is generic.

The appeal judge then goes on to discuss an anticipated rebuttal. The following assertions form such a strong part of the argument that they are presented within the Argument instead of in a Rebuttal. The second reason for putting them there is that there is no indication in the text that such a rebuttal was attempted in the case. The judge is discussing generally recognized exceptions.

The exceptions were defined at the start. The supertype is [EXCEPT], which includes contract breaches that are governed by conventional rules. Within [EXCEPT] are two subtypes, [EXCEPT1] and [EXCEPT2]. [EXCEPT1] has to do with breaches occurring when there is failure to pay an obligation, while [EXCEPT2] includes breaches in which good title is not made. [GOOD_TITLE] is not defined locally, but in the lexicon. Although all the entailments of ‘good title’ are not included in the definition, the concept is used in a general and conventional sense.

Returning to the ratio, if a breach belongs to the class described by [EXCEPT], then it must be governed by a conventional rule, as we have seen. Now the judge carries the argument a step further, saying that, in such cases, the court (OUGHT) to [SUPPOSE] the contracting parties [KNOW] the applicable rule. The notation ({2}) says that the set of two parties, is supposed to have known. This assertion is an interesting one. Presumably it is rooted in the concept that ignorance of the law is no excuse. If the rule is conventional, the parties must be assumed to know the rule as a part of the ordinary man’s knowledge. Still within the obligatory modal, (OUGHT), the judge goes on to say that *the* conventional rule, in each instance, must be applied as if accompanied by special circumstances. The reason is that it must reasonably be presumed that the contracting parties estimated damages with the help of the conventional rule.

Next he states his opinion about the facts. The only information that P communicated to D was that he, P, owned the mill and that D should carry the mill shaft to Greenwich. P *did not* tell D about the special circumstances that the mill’s operation was dependent upon his delivery. [COMMUNICATE] is a predicate that lends itself to a number of interpretations. If it is regarded as a psychological verb, the idea of the possession is lost. In addition, a physical act of communication is inferred. In any interpretation, the communicator is an initiator and must be designated (ACTS). The recipient may be either (DATPSYG) or (DATPOSSG). Here, because of the significance of the idea of the *transfer* of information, the

(DATPOSSG) has been used. Again, the content of the message communicated may be either (DATPSYL) or (DATPOSSL). The content of the special circumstances is of course a psychological entity in that it is either *known* or *not known*. But the *possession* of that information is especially important in the context of the contractual agreement. The difficulty with the (DATPOSS_) cases is once again that the information, although transferred, never leaves the source or the agent. Although the communicator gives it, he also retains it. There is no true transfer in the sense that only the recipient has possession afterword. Nevertheless, in this example, (DATPOSSL) was used because the possession of the information about the special circumstances was so important that it is comparable to the possession of a concrete physical entity. Nothing is lost if the psychological aspect of ‘communicate’ is overlooked. We care only who has been told about the potential for loss. We don’t care about what the parties know in relation to what they think or feel or perceive.

In order to clarify his reasoning about the case, the judge proceeds to discuss two hypothetical situations. They are represented as conditions, which seems suitable. The antecedents of both conditions have not and never will be matched in the case at hand. The situations they describe will not be confused with any reality in the current context. These two hypotheticals are designed to show that the delay and the loss of profits are not as inter-dependent as might be thought at first evaluation. In the first, the judge asks ‘what if’ P had had a spare mill shaft, and he proceeded in the same way as he did in reality, that is, if he had sent the broken shaft for repair. If the delivery was delayed in that instance, as it was in fact in the case, then no loss of profits would have ensued. P would simply have used his spare shaft and continued milling. ‘Repair’ may be treated as taking the factitive case. It may be used with (OBJG) if it is regarded as like ‘make’ or ‘manufacture’. And indeed, something is produced as the result of the repair. (AMBG) +volitive tells us the aim or objective.

In the second, the judge proposes that the mill might have had a defect, other than a broken shaft, that would prevent its functioning while the shaft was away. That is, the loss of profits and the delivery of the mill shaft are two distinct events. Then, the time of delivery would have no effect on the loss of profits. The loss of profits was demonstrably caused by something extraneous to the performance of the contract.

Both the situations the judge described were possible within the context of events as they appeared from D's point of view. The judge is showing how sketchy the information passed on to D was. Both the hypothetical situations he describes fit the facts as D knew them, indicating that, really, D had no reason to believe his delaying delivery would result in a such serious loss. He could not foresee the results of his breach. They were too remote.

The judge sums up saying that the mill stoppage was due directly to the delay, for which D was responsible, and to the special circumstances that were not communicated to him. It is not possible for the court to reasonably consider P's loss either as a natural result of the breach or as foreseeable by D at the time of breach. The judge at the trial ought to have told the jury that the loss ought not to be considered a part of the damages resulting from the breach. The Appeal Court judge, therefore, orders a new trial.

In the past tense, it is difficult to express the strongest degree of obligation. We lack a word for 'must' in the past. 'Ought not' makes sense in the past context; 'must not' does not. Also, (OUGHT) to some extent connotes courtesy in the way one judge would speak of another. The statement in the text regarding the future trial denotes obligation. It is a rule delivered by the judge who is sitting, and the rule is an order that *must* be obeyed.

The predicate [TELL] may be compared with [COMMUNICATE] above. In both, information is transferred. [TELL] denotes a physical act. There would normally be no cause to discuss any psychological content in relation to it. In this context, it functions as a predicate in exactly the same way as did [COMMUNICATE] above. The case relations associated with the two are the same. They serve virtually the same function, that is, to describe the transfer of information. The comparison is used here to provide another justification for the use of the (DATPOSS_) cases with [COMMUNICATE].

In contrast to both [TELL] and [COMMUNICATE] the next predicate [CONSIDER], or rather [˜[CONSIDER]], has a psychological component. Although it must be agentive in this context where the jury is instructed *not* to [CONSIDER], it is also quite clear that [CONSIDER] designates a cerebral event. It is not at all clear that [COMMUNICATE] does.

The predicates [COMMUNICATE], [˜[COMMUNICATE]], and [TELL] carry additional information about the facts. It is arguable that they belong in the Grounds, in which their content is implicit.

Furthermore, the manner of stating them lends a good deal to the judge's development of his argument. I decided that, at this stage of the work, it is appropriate to represent the argument directly, as it has been put forth. If later an implementation that attempted reasoning made it essential to represent these facts expressly in the Grounds, the representation could then be appropriately adapted. The predicates could be placed in the best way so as to make the information available when needed in the processing, without unnecessary duplication and without leaving a consequential gap in the judge's decision!

Finally, once again the Argument comes full circle. The last statement of the Reasons mirrors the Claim. In developing the reasons, a number of repetitions of the facts from the Grounds have been encountered. In the present format, it appears that this cannot be avoided, although it would be desirable to do so. The lambda expressions have helped to some extent. Ideally, further work would result in a more highly refined Argument structure in which specific Reasons could be associated directly with selected Grounds, and then linked in logical sequence directly to the Claim they were meant to support.

[ARGUMENT: #4]→(INCL)→[

[LOSS]=

lambda *x* [LOSS: *x*]→(OBJG)→[PROFIT: ∗].

[BREACH]= [BREACH_OF_CONTRACT] =

lambda *x* [BREACH: *x*]→(OBJG)→[CONTRACT: ∗].

[CONPARTY]=

lambda *x y* [CONTRACT-v: ∗]–

(ACTS)→[PARTY: ∗*x*]

(ACTS)→[PARTY: ∗*y*].

[BREACHER]=

lambda *x* [CONPARTY: ∗*x*]←(ACTS)←[BREACH: ∗].

[NATURAL]=

lambda *x* [NATURAL: *x*]←(AMBP)←[ARISE]–

(OBJL)→[DAMAGES]

(AMBL)→[PHRASE: "in the usual course of things"],.

[BREACH_DAMAGES]=

lambda *x* [DAMAGES: ∗*x*]←(AMBG)←[BREACH].

[NATURAL_DAMAGES]=

lambda *x* [[BREACH_DAMAGES: ∗*x*]←(OBJL)←[ARISE]–

(AMBP)→[NATURAL]]←(DATPSYL)←[CONSIDER: ∗]–

(ACTS)→[JURY: ∗]

(AMBP)→{[FAIR][REASONABLE]},.

[FORESEEN_DAMAGES]=

lambda *x* [[BREACH_DAMAGES: ∗*x*]←[(PAST)←[(DATPSYL)←[CONTEMPLATE]–

(ACTS)→[PARTY: ∗*x*][PARTY: ∗*y*]

(TEMPL)→[TIME: makecontract∗],]].]]

←(DATPSYL)←[SUPPOSE: ∗]–

(ACTS)→[JURY: ∗]

(AMBP)→[REASONABLE].

[SPECIAL_CIRCUMSTANCES]=

lambda *x* [SPECIAL_CIRCUMSTANCES: ∗*x*]←(TEMPL)←[MAKE: ∗]–

(OBJG)→[CONTRACT: ∗],.

[GENERAL_DAMAGES]=

lambda *x* [BREACH_DAMAGES: ∗*x*]←(ACTG)←[BREACH]–

(AMBL)→[SPECIAL_CIRCUMSTANCES: ~]→(ACCM)→[CONTRACT-n],.

[BREACH_TERMS]=

lambda *x* [TERMS: ∗*x*]→(CHRC)→[APPLY_TO]–

[ESTIMATE]=

lambda *x* [ESTIMATE: ∗*x*]→(OBJG)→[BREACH_DAMAGES: ∗].

[EXCEPT]=

lambda *x y* [BREACH: ∗*x*]←(OBJL)←[GOVERN]→(ACTP)→[CONVENTIONAL_RULE: ∗*y*].

[EXCEPT1]=

lambda *x* [EXCEPT: ∗*x*]→(ACTP)→[~PAYMENT].

[EXCEPT2]=

lambda *x* [EXCEPT: ∗*x*]→(ACTP)→[[~MAKE]→(OBJG)→[GOOD_TITLE]].

[CONPARTY]=

lambda *x* [PARTY: ∗*x*]←(ACTS)←[CONTRACT-v].

[ENGINEER]=

lambda *x y* [PERSON: ∗*x*]←(ACTS)←[MAKE]→(OBJG)→[MILL_SHAFT: ∗*y*].

```
[CLAIM: #4]→(INCL)→[
   (~PSBL)→[[CONTEMPLATE: #H1]–
                  (ACTS)→[A: Baxendale][R: Hadley]
                  (DATPSYL)→[[LOSS: #H1]←(AMBG)←[BREACH: #H1]]
                  (AMBP)→[FAIR: #H1][REASONABLE: #H1]
                  (TEMPL)→[TIME: makecontract#H1].]
   (OUGHT)→[[TELL: #H1]–
                   (ACTS)→[TRIAL_JUDGE: #H2]
                   (DATPOSSG)→[JURY: #H2]
                   (AMBS)→[GROUNDS: #4]
                   (DATPOSSL)→[(OUGHT)→[~[CONSIDER: #H1]–
                                                    (ACTS)→[JURY: #H2]
                                                    (DATPSYL)→[LOSS: #H1]
                                                    (TEMPL)→[TIME: estimate#H1],]].]
]  ;end of [CLAIM: #4]
```

[GROUNDS: #4]→(INCL)→[

```
 [OWN: #H1]–
    (DATPOSSG)→[P: Hadley]
    (DATPOSSL)→[MILL: #H1]–
                  (CHRC)→[STEAM_POWERED_MILL: #H1]
                  (LOCL)→[CITY: Gloucester],.
[MILL: #H1]←(PART)←[MILL_SHAFT: #H1]
[BREAK: #H1]–
   (OJBL)→[MILL_SHAFT: #H1]
   (TEMPL)→[TIME: break#U1].
[AGREE_TO: #H1]–
   (ACTS)→[P: Hadley][D: Baxendale]
   (OBJG)→[PRICE: #H1].
[MAKE: #H1]–
    (ACTS)→[P: Hadley][D: Baxendale]
    (OBJG)→[[CONTRACT-n: #H1]→(CONT)→[TERM:
                 if    [CARRY: #H1]–
                          (ACTS)→[D: Baxendale]
                          (OBJG)→[MILL_SHAFT: #H1]
                          (LOCS)→[CITY: Gloucester]
                          (LOCG)→[CITY: Greenwich].
               then    [PAY: #H1]–
                          (ACTS)→[P: Hadley]
                          (DATPOSSG)→[D: Baxendale]
                          (DATPOSSP)→[PRICE: #H1],]].
[SEND: #H1]–
   (ACTS)→[P: Hadley]
   (ACTP)→[CARRIER: #H1]–
```

(EQUIV)→[D: Baxendale],

(OBJG)→[MILL_SHAFT: #H1]

(LOCS)→[CITY: Gloucester]

(DATPOSSP)→[PRICE: #H1]

(LOCG)→[CITY: Greenwich]

(TEMPL)→[TIME: send#H1]

(ACTG)→[SERVE_AS: #H1]–

(OBJS)→[MILL_SHAFT: #H1]

(OBJL)→[PATTERN: #H1]

(ACTG)→[MANUFACTURE: #H1]–

(OBJG)→[MILL_SHAFT: #H2],,.

[DELIVER: #H1]–

(ACTS)→[CARRIER: #H1]

(DATPOSSL)→[MILL_SHAFT: #H1]

(LOCS)→[CITY: Gloucester]

(LOCG)→[CITY: Greenwich]

(TEMPG)→[TIME: deliver#H1].

[DELAY: #H1]–

(ACTS)→[D: Baxendale]

(OBJL)→[TIME: deliver#H1]

(AMBP)→[~REASONABLE: #H1].

[DELIVER: #H2]–

(ACTS)→[D: Baxendale]

(DATPOSSL)→[MILL_SHAFT: #H2]

(LOCG)→[P: Hadley]

(TEMPG)→[TIME: deliver#H2].

[DELAY: #H2]–

(OBJL)→[TIME: deliver#H2]

(AMBS)→[DELAY: #H1].

[~[HAVE: #H1]–

(DATPOSSG)→[P: Hadley]

(DATPOSSL)→[MILL_SHAFT: ∗]→(ATTR)→[SPARE].

[STAND_IDLE: #H1]–

(OBJL)→[MILL: #H1]

(TEMPS)→[TIME: break#H1]

(TEMPG)→[TIME: deliver#H2].

[LOSE: #H1]–

(ACTS)→[P: Hadley]

(OBJG)→[PROFITS: #U1]

(TEMPP)→[[TIME: break#H1]-<>-[TIME: deliver#H2]].

[SUE: #H1]–

(ACTS)→[P: Hadley]

(DATPOSSS)→[D: Baxendale]

(DATPOSSL)→[DAMAGES]=[LOSS: #H1]–

(OBJP)→[DELAY: #H2],.

[TRIAL_DECISION: #H1]–

(ACTS)→[JURY: #H1]

(OBJG)→[AWARD-n: #H1]–

(DATPOSSG)→[P: Hadley]

(DATPOSSL)→[MONEY: @?],

(AMBS)→[LOSS: #H1]–

(OBJP)→[DELAY: #H2],.

[SEEK: #H1]–

(ACTS)→[A: Baxendale]

```
  (OBJL)→[RULE: #H1]–
              (AMBG)→[TRIAL: #H1]→(ATTR)→[NEW: #H1],.
]  ;end of GROUNDS

[REASONS: #4]→(INCL)→[
(ACJ)→[[RULE: #H1]→(CONT)→[
          if     [MAKE: ∗]–
                    (ACTS)→[PARTY: ∗x][PARTY: ∗y]
                    (OBJG)→[CONTRACT: ∗].
        then if   [BREACH: ∗]–
                    (ACTS)→[[BREACHER]→(EQUIV)→[[[PARTY: ∗x]or[PARTY: ∗y]]
                                                 [~[PARTY: ∗x][PARTY: ∗y]]]].
    then (OUGHT)→[[RECEIVE: ∗]–
                      (DATPOSSG)→[[PARTY: ∗x] or [PARTY: ∗y]]→(~EQUIV)→[BREACHER: #]
                      (DATPOSSL)→[NATURAL_DAMAGES: ∗]
                                 [FORESEEN_DAMAGES: ∗].]
]; end of RULE
  (OUGHT)→[[DIRECT: #H1]–
                  (ACTS)→[TRIAL_JUDGE: #H2]
                  (OBJG)→[GOVERN: #H1]–
                             (OBJL)→[JURY: #H2]
                             (ACTP)→[RULE: #H1],
                  (LOCL)→[TRIAL: #H1]→(ATTR)→[NEW: #H1].]
if     [COMMUNICATE: #H3]–
          (ACTS)→[P: Hadley]
          (DATPOSSG)→[D: Baxendale]
          (DATPOSSL)→[SPECIAL_CIRCUMSTANCES: #H1]→(CONT)→{
```

```
                                   [STAND_IDLE: #H1][HAVE: #H1]}.
    [KNOW: #H1]–
      (DATPSYG)→[PARTY: Hadley][PARTY: Baxendale]
      (DATPSYL)→[SPECIAL_CIRCUMSTANCES: #H1].
then  [BREACH: #U4]–
        (ACTG)→[NATURAL_DAMAGES: #H2][FORESEEN_DAMAGES: #H2].
if    [~[KNOW: #H2]–
        (DATPSYG)→[BREACHER: #H1]
        (DATPSYL)→[SPECIAL_CIRCUMSTANCES: #H1].]
then  [SUPPOSE: #H2]–
        (ACTS)→[JURY: *]
        (DATPSYL)→[[CONTEMPLATE: #H2]–
                     (ACTS)→[BREACHER: #H1]
                     (DATPSYL)→[GENERAL_DAMAGES: #H1],].
(PAST)→[if  [KNOW: #H3]–
              (DATPSYG)→[P: Hadley][D: Baxendale]
              (DATPSYL)→[SPECIAL_CIRCUMSTANCES: #H1]
              (TEMPL)→[TIME: makecontract: #H1].
        then (PSBL)→[[PROVIDE: #H1]–
                       (DATPOSSL)→[BREACH_TERMS: #H1]
                       (TEMPL)→[TIME: makecontract#H1].]]
if        [DEPRIVE: #H1]–
            (ACTS)→[TRIAL_JUDGE: #H2]
            (DATPOSSS)→[P: Hadley][D: Baxendale]
            (DATPOSSL)→[[ADVANTAGE: *]→(CONT)→[[PROVIDE: *]–
                          (DATPOSSL)→[BREACH_TERMS: *]
                          (TEMPL)→[TIME: makecontract*]
```

(AMBL)→[SPECIAL_CIRCUMSTANCES: ∗],]].

then [DECIDE: #H1]–

(ACTS)→[TRIAL_JUDGE: #H2]

(AMBP)→[~JUST: #H1]→(ATTR)→[VERY: #H1],.

(OUGHT)→[[GUIDE: #H1]–

(ACTP)→[RULE: #H1]

(OBJL)→[JURY: ∗]

(TEMPL)→[ESTIMATE: #H1].]

if [BREACH]→(EQUIV)→[EXCEPT]

then (OUGHT)→[[SUPPOSE]–

(ACTS)→[COURT]

(DATPSYL)→[[KNOW: ∗]–

(DATPSYG)→[CONPARTY: {2}]

(DATPSYL)→[CONVENTIONAL_RULE]],.

[TREAT]–

(ACTS)→[COURT]

(OBJL)→[CONVENTIONAL_RULE]→(ACCM)→[SPECIAL_CIRCUMSTANCES]

(AMBS)→[(PSBL)→[[PRESUME]–

(ACTS)→[COURT]

(AMBP)→[REASONABLE]

(DATPSYL)→[CONTEMPLATE]–

(ACTS)→[CONPARTY: {2}]

(DATPSYL)→[ESTIMATE]–

(ACTP)→[CONVENTIONAL_RULE

[COMMUNICATE: #H1]–

(ACTS)→[P: Hadley]

(DATPOSSG)→[D: Baxendale]

```
 (DATPOSSL)→[CIRCUMSTANCES: #H1]→(CONT)→[
                    [OWN: #H1]–
                       (DATPOSSG)→[P: Hadley]
                       (DATPOSSL)→[MILL: #H1],
                    [CARRY: #H1]–
                       (ACTS)→[D: Baxendale]
                       (OBJG)→[MILL_SHAFT: #H1]
                       (LOCG)→[CITY: Greenwich],].
[~[COMMUNICATE: #H2]–
     (ACTS)→[P: Hadley]
     (DATPOSSG)→[D: Baxendale]
     (DATPOSSL)→[SPECIAL_CIRCUMSTANCES: #H1].]
if        [HAVE: #H2]–
            (DATPOSSG)→[P: Hadley]
            (DATPOSSL)→[[MILL_SHAFT: #H3]→(ATTR)→[SPARE: #H1]].
          [SEND: #H2]–
            (ACTS)→[P: #]
            (DATPOSSL)→[MILL_SHAFT: #H1]
            (DATPOSSG)→[ENGINEER: #H1]
            (ACTG)→[REPAIR: #H1]–
                          (ACTS)→[ENGINEER]
                          (OBJG)→[MILL_SHAFT: #H1],.
then if     [DELIVER: #H2]–
              (ACTS)→[CARRIER: ∗]
              (DATPOSSL)→[MILL_SHAFT: #H2]
              (LOCG)→[CITY: Gloucester]
              (TEMPL)→[DELAY: #H3]–
```

(ATTR)→[~REASONABLE: #H2],.

then [~[LOSS: #H2]–

(AMBS)→[DELAY: #H3].]

if [DEFECTIVE: #H1]–

(OBJL)→[MILL: #H1]

(TEMPL)→[TIME: send#H1]

(AMBS)→[MILL_SHAFT: ~].

then if [DELIVER: #H3]–

(ACTS)→[CARRIER: ∗]

(DATPOSSL)→[MILL_SHAFT: #H2]

(LOCG)→[CITY: Gloucester]

(TEMPL)→[DELAY: #H4]–

(ATTR)→[~REASONABLE: #H7],.

then [~[LOSS: #H4]–

(AMBS)→[DELAY: #H5].]

[STOP: #H1]→(OBJL)→[MILL: #H1].

{[STOP: #H1][STAND_IDLE: #H1]}→(AMBL)→{[DELAY: #H2][SPECIAL_CIRCUMSTANCES: #H1]}

[~[COMMUNICATE: #H2]]

(~PSBL)→[[CONSIDER: #H2]–

(ACTS)→[COURT]

(AMBP)→[REASONABLE]

(DATPSYL)→[[LOSS: #H1]→(<)→[FORESEEN_DAMAGES: #H1] or

[LOSS: #H1]→(<)→[NATURAL_DAMAGES: #H1]].]

(PAST)→[(OUGHT)→[[TELL: #H2]–

(ACTS)→[TRIAL_JUDGE: #H2]

(DATPOSSG)→[JURY: #H2]

(DATPOSSL)→[(OUGHT)→[[~[CONSIDER: #H3]–

(ACTS)→[JURY: #H2]

(DATPSYL)→[BREACH_DAMAGES: #H1]

→(PART)→[LOSS: #H1]

(TEMPL)→[ESTIMATE: #H1],]]].]]

(OUGHT)→[[ORDER-v: #H1]–

(ACTS)→[JUDGE: Alderson]

(OBJG)→[TRIAL: #H1]→(ATTR)→[NEW: #H1].

] *;end of (ACJ)*

] *;end of REASONS*

] *;end of ARGUMENT*

Fig. 6.7 Argument #4

Hadley v. *Baxendale*

CHAPTER 7

The retrieval mechanism

7.1. Introduction

Chapter 6 showed how the conceptual content of text could be expressed in a knowledge representation (kr). Now in this chapter we show how the conceptual content could be accessed in the proposed intelligent retrieval system. In the introductory chapter, a number of general objectives for conceptual retrieval were discussed. To review briefly, they included the capabilities of:

- giving specific information, that is, answers to simple questions;
- identifying situations described by complex facts;
- processing abstractions;
- finding ideas not explicitly named.

It is time now to take another, closer look at the retrieval ideal that is the ultimate goal.

7.2. Objectives revisited

7.2.1. A realistic model of search behaviour

Ideally a retrieval system should enable the lawyer to search cases with minimal intrusion on his thinking. His ideas should be allowed to flow as he searches rather than be channelled to serve the system's functional needs. It follows that the system must be capable of replicating a model of simple legal reasoning, the kind of reasoning done in case-law research.

There is a dramatic contrast between the style of formal argument in the law reports and the seemingly haphazard way in which the search for an argument progresses. In a law report, reasons are marshalled to justify a conclusion. When reading a well-reasoned case, the logic of the argument stands out and appears very clear and simple. Progression from the initial problem to the solution provided by the court often appeals to one as a matter of common sense. However, the search that precedes achievement of such a solution is frequently tangled and seemingly directionless. The searcher's journey, although rationally directed toward his projected conclusion, often takes him through intricate detours on his way to his goal. The clarity of the reasoning to the conclusion is manifest only at the finish. As Dewey remarked,

> The logic of exposition is different from that of search and inquiry. In the latter, the situation as it exists is more or less doubtful, indeterminate, and problematic with respect to what it signifies. It unfolds itself gradually and is susceptible of dramatic surprise; at all events it has for the time being, two sides. (Dewey 1927, p. 545)

As discussed in §2.2.3.2 the HYPO system developed by Rissland and Ashley (Rissland 1982, 1983, 1985; Rissland and Ashley 1987; Ashley 1990) is a particularly insightful attempt at modeling the search process. Judging by the response it gets it is an approach intuitively acceptable to lawyers. HYPO works by iteratively constructing hypotheses about the problem at hand. Although the HYPO knowledge base is a representation of case law, the focus of its processing is legal reasoning, that is, problem resolution in a single narrow subject.

The point of this research is the *retrieval* of legal information, which is to say that it is a pattern matching process rather than a theorem-proving one. Although the system is prepared for the lawyer's need to peruse arguments and to search with a goal in mind, it does not attempt to ensure logical correctness. Answers are intended to be consistent within the local context of a given question. In this system, the degree of relevance of each answer may be determined objectively by calculating the number of concepts in the question that have been matched during the search.

7.2.2. Retrieving concepts

Something further must be said also about 'concepts' at this point. Although conceptual retrieval was discussed at some length in §2.2.3.3, the word 'concept' has been used in many senses throughout this dissertation, as indeed it is in the literature. The most common use of the term 'concept' here is in relation to conceptual graphs (cgs), wherein a 'concept' is an object, or an idea. In that sense, any term that appears in square brackets, '[ ]', within a graph, is a 'concept'. That is, all predicates in the kr are concepts, as are all arguments entailed by the predicates. It follows, then, that 'conceptual retrieval' *can* mean simply a means of accessing the information described in cgs, or by any predicate and argument combination.

However, as we saw in §2.2.3.3, conceptual retrieval should mean more. Salton uses the example of apples. As he says, IR systems can identify documents about a subject, say apples, presenting the subject from divergent points of view, but they are, nevertheless, *about* apples. In order to answer a question about apples, it is necessary to express the conceptual content, or meaning, of text, that is, the system must know ‘‘what the concept of ‘apple’ actually entails’’ (Salton and McGill 1983, p. 267).

The objective of this module is to demonstrate the ability to access information about ‘what a concept actually entails’. It is essential, therefore, for the system to be able to ‘understand’ what a concept entails. To begin then, questions about the conceptual entailment of simple objects, like ‘apples’, or, more to the point, ‘contracts’, can be answered. The system needs to know that a contract is an agreement that is legally binding, resulting from an appropriately accepted offer, and so on. It must also access that information and match the related concepts in the question. The system ‘understands’ and answers questions about the generic concept ‘contract’ in this limited sense.

However, the system should go further. It has been shown in §6.8 how unnamed ideas can be represented conceptually, for example, the putative offers in the cases of *Weeks* and *Stamper*. But we shall see in §7.4.5.1 below that later such an ‘offer’ came to be known as a ‘mere puff’. It is the task of a conceptual retriever to find and relate such ideas.

The retriever should also locate abstractions, ideas, which may or may not be named. To return to the example given earlier (§1.2) of the Vermont justice trying the case in which one farmer was accused of breaking another farmer’s churn, recall that the judge had looked under ‘churns’ for his law, as perhaps a keyword system might do. He reported that he had been unable to find any. The humour of the anecdote arises from the incongruity of the search strategy—that is, looking under the term ‘churns’ for law regarding willful damage to property!

As Holmes pointed out, ‘‘Applications of rudimentary rules . . . are *tucked away* under the head of . . . or go to *swell treatises* on historical subdivisions . . . or are gathered under the *arbitrary* title . . . .’’ (Holmes 1897, p. 59, emphasis added). If the judge had gone further and tried to find something concerning the legal concepts involved, he would not readily have come upon the concept he needed. In short, Holmes in 1897 was telling us something about a problem that has since worsened. He was describing the difficulty of retrieving conceptual information, now even more difficult because of the increased volume of cases. Like the Vermont judge, the retriever needs to be able to access the reasons for judgement. Not only must the conceptual retrieval system make possible the true expression of conceptual entailments, it must make access to them possible as well. The rest of this chapter is a descriptive demonstration of how that could be done.

7.3. An overview of the search process

The proposed searching process is described from the top down in an effort to make the operations of the frame matcher intelligible.

7.3.1. Using the argument structure

Returning to the question of how the lawyer searches, it is anticipated that the lawyer in attempting to build his own argument, will test it against the rules he finds as he searches. He will test and retest until he is satisfied as to the strength of his argument. In this way, he works, as reflected by HYPO, iteratively devising and testing and adapting parts of his nascent argument until it supports a suitable claim.

There is a commonly used analogy in which a legal argument is compared to a pile of building blocks. As the blocks are arranged to support a roof, so the argument is constructed to support a claim. If one of the building blocks is removed, the remaining blocks must be rearranged in order to continue to support the roof. So also, when a component of the argument is defeated, or damaged, the argument must be reconstructed to support the claim.

The parts of the argument were made explicit in the kr by means of the Toulmin model. The model accommodates the analogy by displaying the structure of the pile of building blocks, that is to say, of the list of argument parts. It indicates how relating the argument sections to each other helps to keep the story together, helps to show how the blocks are used to support the claim.

An intelligent retrieval system would *help* the searcher to develop his argument. It stands to reason that if the kr has made explicit the links in the legal argument of the reported cases in its kb then a searcher bent on building an argument of his own would find it profitable to follow the argument links attached to the strongest concepts (objects) in his hypothesis. In building his own argument, he might be able to use some of the argument someone else had used in connection with the same concepts even if not in the same domain.

For the present, the retriever is limited to a very restricted model of legal argument. Nevertheless, the kb contains the analyzed arguments. The argument types are recognizable and can be classified in the Perelman categories, as shown in the example in §6.8.4.3, so as to further explicate the nature of the reasoning used. The lawyer may be able to retrace the rhetorical reasoning of the judge in his own search, even though the system will not aid him by performing reasoning.

The building-block analogy helps to illustrate the function of the search mechanism. If a match fails, the bad block is discarded and the argument is rebuilt. The user may look in the vicinity of the good blocks for other, similar blocks to help him reconstruct his pile. He might use a good match with a legal concept as a link to a description of facts he might more fruitfully use. Alternatively, he may have a good match with a fact and use the matched fact to direct him to a more useful legal concept than the one he tried first. He might profitably examine the bad block—the concept in the question that the system has been unable to match in its kb—and, by careful **failure analysis**, find a better, more appropriate match.

As well as the Arguments, the kb includes legal concepts (lconcs), which are focal points of legal reasoning. They are connected to the Arguments in which they are used. Each lconc has explicit links to the cluster of facts that delineates its meaning. The reasoning associated with any lconc or group of lconcs can be derived from the system, with a little effort, by following the connections to the facts and cognitively placing each of them in the context of its own argument. The result will be a fragmentary exposition of the possible arguments rather than an explicit exposition of a full argument from a single perspective. It will form a cluster of ideas that delineates the meaning of the open-textured lconc.

In summary, the retriever should correctly identify complex objects and ‘understand’ the meanings of the concepts in its kb. The system described in this work is not a legal reasoning system. It is a system that ‘understands’ well enough to exhibit an awareness of rhetorical reasoning, but its priority function is retrieving ideas. It could not reason with the arguments in its kb, but it could display them in an organized manner. In accomplishing retrieval, it operates in a primitive manner on large blocks of Argument, coarse-grained reasoning components. The argument structure is used to aid the searcher in his work, to make the reasoning in the text available to him and to accommodate the flow of his thinking in a natural way.

7.3.2. Questions

Several times the word ‘question’ has been used in the section above more or less casually allowing for intuitive interpretation. With an understanding of the goals of the retrieval module in mind, it is time to specify what a question is, as compared with a search strategy in a keyword Boolean system.

Questions, of the type this system is intended to answer, arise in response to problems encountered. The asker brings to the problem his knowledge and experience. The collection of concepts most meaningful to him may be quite different from that of any other asker or of any point-of-view expressed within the kb. We take it for granted that his way of describing one aspect of reality, his question, will be the one most useful to him at the time. His question is not something we would presume to anticipate with our limited knowledge of the workings of his mind.

In particular, the questions express variant points of view. They may be simple information requests. They may be descriptions of fact situations of greater or lesser complexity, or they may be requests for conceptual searches. They all derive from a need to formulate an argument. The questions submitted to the retriever would normally require matches that fall into one of the following categories.

Fact to fact—matching one frame expressing a factual concept in the question to one frame in the kb. A simple match.

Facts to facts—matching multiple factual concepts from the question against multiple concepts in the kb. The difficulty would be in matching frames with some slot values that were identical and some that were not. Not all slot values would be supplied by the question.

Legal concept named—The name of an lconc is input and matched against the name of an lconc in the lexicon. The whole frame describing the lconc would be retrieved if the name was matched. One might go further and retrieve instances of the lconc’s use in the kb proper for a fuller answer.

Legal concept by definition—The user would have a fairly clear idea of the conceptual content of the lconc, but could not name the precise legal principle. He would provide a description. The name and slot values of the best match(es) would be retrieved from the lexicon. He might go further and attempt to identify the lconc from its use, by attempting to match an instance in the kb proper. If he had retrieved a name from the lexicon, he could simply survey the cluster of instances defining the use of that lconc. If he had not retrieved a name, he might use the elements of his descriptive definition to locate a similar concept, by means of a partial match.

Legal concept by description—The user would submit a vague description of a situation or an event with fragments of information but no matchable lconcs. The search would bring recognition of the most appropriate potential match whether total or partial.

Pattern-matching in a human judgement situation—The user would describe a situation requiring what appeared to be a question of human judgement. For example, a question as to whether or not intention had been displayed. The matcher would check the input for situations with similar properties and report its findings. The user could decide whether the partially matched situations were suitably analogous to the problem.

Associating legal concepts—A well-known lconc would be named and/or described, for example a limitation on riparian rights[1] passing with a deed. The searcher would request a conceptual match with another lconc of a similar nature, that is to say, a concept known to have a particular configuration in its description that could be matched to similar concept from another subject. For example, mineral rights might be compared with riparian rights. A corresponding limitation on the transfer of mineral rights might be located. This kind of match is most effective in determining how like tests are applied in different areas of law. A larger kb covering several topics would be necessary to really demonstrate this capability, but it is one of the attractions of frame-based retrieval.

Fact and legal concept—A straightforward match, useful for determining the components of an lconc. The fact information might be matched either by the slots of an lconc's definition or in one or more of its

[1]Rights relating to the bank of a river.

instances. The kb itself could easily be searched.

Facts and legal concept—If the fact frames successfully matched properties associated with the lconc, the results would be reported. Confusion would arise if some of the properties of the different facts interacted. Constraints restrict some interactions, but it might not be possible to decide definitely whether or not the match was appropriate.

Fact and legal concepts—If the fact's description was specific enough, it would be possible to determine which lconcs were associated with it.

Facts and legal concepts—The usual question input would consist of a single Argument including facts and reasons. The system would have to be considerably refined before a search for a complete argument could be done adequately. The problems of interacting properties and of interacting facts, add complexity. Nevertheless, this is the optimal match.

Free-ranging search—Usually the input would be an assortment of fragmentary ideas, which someone is attempting to relate to legal concepts, and perhaps a couple of solid facts, perhaps not. The question would not come from someone with a problem rather than a well-developed argument. The goal would be to locate as many associations among the input concepts as possible. It is a fishing expedition for ideas before attempting to construct an argument. This search is the widest ranging and requires the least precision in matching. All partial matches and combinations would be duly reported.

7.3.3. Frame matching

Frame matching allows more flexibility in search than is apparent at first glance. Unlike a structured database record, a frame can readily be disassembled and each expression used as an indexing key. There is no requirement to specify keys ahead of time. Although there are several methods for indexing frames, they are normally used with other types of deductive retrieval mechanisms. In our proposed intelligent retriever, each concept in the kb is accessible to the matcher. Moreover, the relationships among the concepts are sustained.

The algorithm used for demonstrating frame matching **Lexical option generator (LOG)**, was written by Miezitis (1988). It was designed as part of a language generation system. LOG, when given an assertion or set of assertions, processes each item and produces a selection of **lexical options** or terms with appropriate conceptual content. It functions as a literary thesaurus, by producing alternatives for concepts. LOG is adapted to demonstrate a plausible method for conceptual retrieval.

7.3.4. Why use LOG?

LOG produces all the lexical alternatives the system knows for the input concept. It also handles idiomatic phrases and partial matches, an essential for conceptual retrieval. Legal concepts are similar to **idioms**, in that they function as lexical units. Their meanings may be distinct from the composite literal meaning of the words they include. In order to understand idioms one must have knowledge of their conventionalized meanings. Furthermore, they function as syntactic units and often are not subject to common transformations. LOG is capable of handling either a phrase or a word as a lexical unit and can make use of some of the syntactic idiosyncrasies typical of idioms. It can cope with the transformational limitations of particular idioms, and can bind variables within idioms. For instance, using Miezitis's example, LOG can instantiate the variable *x* when matching, 'the apple of *x*'s eye'.

LOG negotiates difficult partial matches. A **full match** occurs when a **pattern** is matched against a **target** with the following results:

- both the pattern and the target exhibit the same structure;
- each constant in the pattern matches a constant in the target;
- all variables within the pattern are bound during the match.

A **partial match** occurs when some but not all of the above results are achieved in the match. The part of a pattern that is successfully matched is the **abstraction**. The remainder of the pattern, the unmatched portion, is the **residual**. LOG does not discriminate among input objects. It treats all parts of a pattern as equally important. As a result, each concept in the pattern is a candidate for a match. All the concepts input are subject to matching. Moreover, the relations expressed in the pattern among the input concepts are maintained throughout the process.

When LOG has made a partial match at a particular node, it assumes that other nodes may match the residual of the pattern and so continues to try to make matches with the related concepts in the input in an effort to cover the entire pattern. If a full match is achieved, all the lexical options entailed by the target nodes are reported. Partial matches are optimized in the overall process. If a partial match is achieved, then the lexical options entailed by the partially matched target or targets are reported. This makes partial matches very useful. information.

7.3.5. Adapting LOG to use in IR

As stated, LOG was designed as a part of a translation project, to assist in generation. It expects to receive frames and provide options for a generator. In adapting LOG to IR, the input frames represent questions.

The output of LOG was intended to be lexical options (words, phrases, and idiomatic expressions) a generator could use to construct sentences that convey the input information in the target language. In adapting LOG to intelligent retrieval, the output is conceptual information from the kb. LOG requires as input a semantic representation scheme, an ‘ample vocabulary of generic frametypes’ (Miezitis 1988, p. 7). Our Arguments along with the lconc lexicon fulfill that requirement.

The LOG matcher is principally concerned with meaning. Lexical options are chosen, not by character string matches, but by matching concepts. The meanings of the words in the questions are matched against concepts in the kb in order to find information related to the questions.

7.3.6. The LOG lexicon

To enable LOG to make matches, the frames in our system are restructured to form a concept lexicon. Each entry is a node with a conceptually specified **situation** and a lexical realization. A situation is a description of a ‘state of affairs’ which, when matched, licenses the use of the lexical item or items attached to it in the node. Each situation is a conceptual representation that delineates an equivalence class of lexical units. Each node contains only one situation, but one or more lexical options. The situations constitute a switching language that allows the recognition of correspondences between different lexical units where they share elements of meaning. There will be one situation for each frame, each sense that LOG receives. Within the LOG lexicon, further specification may be made since additional semantic links and structure are added.

Each LOG node has a **situation template**, which contains restrictions on the inheritance of properties (§2.3.1.2) and some essential semantic connections. The source-goal designators would normally be a part of the situation template but, because of the use of Somers's grid, have been specified at an earlier stage.

Each LOG node also has a **syntactic template**, which accommodates the structural information embodied in the case frames and in idiomatic constructions like the lconcs. The syntactic template contains the lexical options made available when the situation is matched. The LOG lexicon is a fine-grained representation of the less complex entities in the kb. Like primitives, they are the components of more complex structures in the represented Arguments.

Within the lexicon, the nodes are arranged in a hierarchical network with taxonomic, role, restriction, instantiation and differentiation links. The **taxonomic links** are the 'is-a' links that order the typeframes within the hierarchy. **Role links** are derived from the frame slots of the kb and the lconc vocabulary. **Restriction links** make explicit the relationships of subsumers with their specializations. Finally, **instantiation links** connect numbered instances to their subsumer types. The information in these links is available within the kr as described in chapter 6. However, there is one additional type of link that requires further information, that is, the differentiation link.

Differentiation links contain additional semantic information that constrains the selection of lexical units under stated circumstances. For example, the kb may have a generic frametype 'love'[2] with slots for 'agent' and 'patient'. The LOG lexicon may have a node 'love' with unspecified agent and patient slots. It may have, as well, an additional node for a situation 'narcissism' one level lower in the type hierarchy. Like 'love', 'narcissism' has slots for an agent and a patient, but, in this instance, they must be the same individual. The representation of the situation in 'narcissism' is exactly the same as the representation in 'love'. However, a condition is added that checks to see that the fillers for the agent and patient slots are identical, and so 'narcissism' is differentiated from 'love'.

[2]This example is taken from the LOG specifications.

7.3.7. The semantic selection

It may be seen from the preceding example that semantic information, additional to the kb frames, is needed for LOG to perform meaningful matches. The representations in the kb are not enough. Semantic information is added to the lexicon in the form of **selectional constraints**. The constraints were compiled after the construction of the kr and are to be found in Appendix D. Semantic constraints limit the domain of a given predicate by specifying some semantic requirements, as in the above example of ‘narcissism’ where the semantic requirement was that one individual must be both agent and patient.

The predicates with which we are dealing constitute categorial presuppositions.[3] The **domain** of a predicate is the set of *possible* argument values for that predicate. Possible argument values or individuals that make the assertion of the predicate meaningful are those for which it is **well-defined**, that is, for which it is possible to determine whether the assertion is true or false. For example, a semantic constraint limiting the type of agent that ‘speak’ may take to include only animate humans would show which of the following sentences was meaningful and which was not.

(7-1) Mohawks speak an Iroquoian language.
(7-2) *Hawks speak an Iroquoian language.

In (7-1) it is **presupposed** that Mohawks ‘speak’ a ‘language’. Since Mohawks are both animate and human, the use of the predicate ‘speak’ with the agent ‘Mohawks’ falls within the constraint and the sentence is known to be *meaningful*. Whereas, (7-2) is *not meaningful* in the most usual interpretation. ‘Hawks’ are animate but not human (unless of course they are members of a sports team).

With an ill-defined predicate, on the other hand, it is quite impossible to know whether or not the proposition is true. For example,

(7-3) Mohawks stopped terrorizing Québec.

In (7-3), there is a difficulty, since it is presupposed that the Mohawks were at some earlier time ‘terrorizing’ Québec. If the sentence is given any truth value, the presupposition is assumed to have been true. Whether it is true or false that the Mohawks ‘stopped’, it is presupposed that they were ‘terrorizing’. Since

[3] A categorial presupposition is ‘‘a sentence whose logical form contains *P(t)* for some predicate *P* and term *t*, presupposes that *t* is in the domain of *P*.’’ (Grishman and Kittredge 1986, p. 113).

we cannot determine the truth of the proposition associated with ‘terrorizing’, the predicate is not well-defined.

Arguments to any categorial or sortal predicate may fall into one of three categories:

• its extension—designating arguments describing things in the real world to which the predicate *applies*;

• its domain—designating arguments to which it is *possible* for the predicate to apply;

• outside its domain—designating the remaining arguments that might possibly be formed; but to which it is *not possible* for the predicate to apply.

True assertions are found within the *extension* of a predicate; and **false** assertions are found within its *domain excluding its extension*. (Note that the domain includes the extension of the predicate, both true and false assertions.) **Meaningless** assertions are found outside the domain of a predicate. Semantic constraints are designed to select a subset of arguments from the universe of possible arguments that will be appropriate to the domain of each predicate; that is, they delimit the domains of predicates.

Semantic constraints operate locally, on only their own individual predicates. There is no interaction among predicates. However, where constraints are similar, predicates may be grouped for greater effectiveness. For example, all psychological verbs relate to animate entities. Furthermore, the subset of cognitive verbs may, be defined to apply to all animals, or to humans only. In other domains, both might be allowed to apply to human-like machines.

It is possible also that arguments of the same predicate might be constrained not to interact. For instance, a constraint might be written so as to obviate the occurrence of an NP such as ‘‘colourless green ideas’’, or, in some instances, an objective case (OBJ_) may be usable only with a human agent (ACTS). Some types of argument conflicts have been avoided in this work through the use of the case grid. For example, Somers has distinguished cases to be used with psychological verbs only.

The semantic constraints are included in the LOG lexicon as differentiation links. The lexicon with all its links in place functions as a network. Each node of the lexicon contains conceptual, syntactic and semantic information. LOG has, therefore, put us in a position to retrieve conceptual information by matching frames.

7.3.8. Matching in LOG

In order to retrieve information, a LOG situation must be matched by an input concept. A situation, as noted above, is a part of a node and describes a 'state of affairs'. When an attempted match involves an individual node, the 'state' of the node may undergo a change. The content of any message sent from a node is determined by the state of the node at the time of transmission.

The process of matching involves the use of **spreading activation**, (Quillian 1968; Salton and Buckley 1988) a process for searching memory by propagating markers from two nodes through the network until their paths intersect at some node. In LOG, 'smart' markers carry information about their paths and report details of local matches including bindings. Each marker engages in matching and binding, at every node it encounters. The local matching is a protection against **false positives** or meaningless results coming from intersections between unrelated search components. In other words, it is protects against silly hits, which might occur if the activation were allowed to spread without constraint.[4]

7.3.9. 'Magnetization'

Spreading activation is further constrained by having significant nodes in the network rigged to act as **magnets** to attract information. The magnets are the highest generic nodes matched in the initial search attempt. All frametypes in a situation template must be present in the input for a node to be **distinguished** as a magnet. Every input will have at least one distinguished node for each of the generic frametypes in it in order to initiate the activation. Creating a magnet may be thought of as marking the right chapter in a book, but not yet finding the right answer. Magnets are the nodes which show early promise in directing the search to a match.

Once again, using the example 'love' as above, assuming that our question is whether it is true that 'John loves Mary',

(7-4) (love (agent john1) (patient mary1))

when 'love' in (7-4) is matched, it is the magnet. A magnet initiates marker propagation. When the situa-

[4] For example, when dumb markers are used, there is inevitably a false positive at the top of the hierarchy where all of the markers come together.

tion template in the 'love' node is matched, an 'I-AM-A' marker is sent to the magnet itself, to 'love', which then traverses the is-a links up the type hierarchy.[5] Since the 'I-AM-A' marker carries the address of its origin, it leaves a trail right back to 'love'. The area covered by markers sent from a magnet node is *activated*, and forms a **magnetic field**. Information located in the field is attracted by the magnet. An 'I-AM-A' message is sent only if the situation in the node is matched or if the input has an instance. 'I-AM-A' messages are always propagated up the is-a links by the matched, or partially matched, nodes. As each node receives 'I-AM-A' messages from below, it passes them up.

When matched, the situation template of 'love' reads as follows in (7-5):

(7-5) ((animate-being agent ?agent love)(person patient ?patient love))

Therefore, the 'I-AM-A' marker, showing a partial match of 'love', reports that it is looking for information from 'animate-being'. In this way, the smart marker functions as a dynamic saliency indicator and also expedites the match.

Because the question contains '(patient mary1)', a match occurs with the situation at the 'person' node for the instance 'mary1'. As a result, the following 'I-AM-A' message is sent from 'person' to 'mary1' and up all the is-a links through 'animate-being' to 'thing'.

(7-6) (42 mary1 person patient love <1.2>)

The first item in (7-6), '42', is the reference number of the question. It is followed by the matched information, 'mary1'. 'Person' is the node that originated the message and 'patient' is the name of the slot for which 'mary1' is the value. 'Love' is the inframe value and <1.2> is the pointer showing the slot of the input frame '(patient mary1)'—frame 1, slot 2.

The second type of marker, an 'I-HAVE-A' message, is sent to nodes that might need to know about matched information. Any recipient of an 'I-AM-A' message may transmit an 'I-HAVE-A' message. 'I-HAVE-A' markers are sent backwards along the role links. We can assume, given the '(agent john1)' slot in the question, that a match was made with 'john1' at 'person' as it was with 'mary1'. The *john1* information is sent from 'animate-object' to 'abstract2'. Recall that 'abstract2', since it is in the magnetic field of

[5] Note that the markers are propagated only *up* the hierarchy and not down. Thus the spread of activation is controlled.

'love', has been alerted to look for information from 'animate-object'. 'Abstract2', therefore, upon receiving an 'I-AM-A' message, sends a new 'I-HAVE-A' marker to the magnet 'love', saying that it has a match for the agent of 'love'. The question is partially answered since we know that 'John loves'. The 'I-HAVE-A' message expedites the process by making the transmission as if it were direct from 'animate-object' to 'love', that is, no matches are attempted en route. The *john1* information would be immediately incorporated in the 'love' situation template match and the state of 'love' would change again.[6] The question is partially answered since we know that 'John loves'.

The *mary1* information is similarly transmitted by 'person' directly to 'love'. Since it comes from the anticipated source, the information is incorporated in the match. Once the situation template has been matched, the question is answered. In this instance, the mapping is complete; the pattern is completely covered and there is no residual. We find out that 'John loves Mary'.

It is possible that a different question produced another result, that the match at 'love' is only a partial match, and that there is another part to answer. To guard against a failure to answer fully, 'love' propagates an 'I-AM-A' marker, telling about its new state, a full match, up the is-a links to all its subsumers. And it sends 'I-HAVE-A' markers backwards along its role links to see if the match can participate in any other situations. In the above example the question is a simple one and was answered by matching a single predicate. However, it is obvious that the majority of useful questions asked would consist of several predicates.

Lastly, in order to ensure the precision of the response, 'love' sends a **subsumer-matches** message, down the hierarchy, backwards via the is-a links to its subsumed nodes. It is possible that the concept matched at 'love' is broader than the concept in the question, causing a related, but inexact answer. Precision is ensured by checking all the semantic constraints associated with 'love'. A match is attempted at 'narcissism'; however, the node contains the restriction in (7-7):

(7-7) (equal ?agent ?patient)

[6] Only the relevant role links have been named for simplicity and clarity in this example. Note though that the *john1* information would also have been sent by 'person' backwards along the links to 'love'. However, that message would have been discarded by 'love' since the situation template requires the agent information to come from 'animate-object'.

If the original query had been about whether John loved himself or Mary loved herself, then the concept of 'narcissism' would have been matched. As it is, the constraint cannot be satisfied and the matching process terminates. If the constraint on narcissism might have been matched later, the subsumed node would absorb the new information, the detail about the match at 'love', and stand pat until it received more. For example, if either the agent or patient had been matched by a variable of the type '?*x*', which might later have been instantiated with the same value as its alternate, the subsumed node would wait for an instantiation of the variable which would either confirm or deny a match.

Magnetization directs the search. It chooses a direction for pursuing the question and enables us to avoid trying paths blindly. For example, in matching 'love', we have not sent any markers to 'hate' or 'fear', although 'emotion' has been marked. Magnetization constrains marker, from unnecessarily propagating to middle-level nodes on a trial-and-error basis. It has the effect of checking paths. Foolish choices are avoided, since markers are drawn to the magnetized nodes.

Finally, LOG's housekeeping is impeccable. Each search is given an individual reference number so that the network is effectively cleared after each question. There is no interaction with matches from earlier searches. Duplicate markers are destroyed whenever they arrive at a node so that the network is uncluttered.

7.3.10. LOG+

LOG is exactly the sort of frame matcher that is required for conceptual retrieval. However, it has some limitations which should be noted. For instance, a concept must be located near a magnet to become involved in a search. Once 'love' has been matched, only those concepts subsumed by it or directly linked as roles are checked for further matches. Because of this limitation, the topology of the type hierarchy must be carefully considered. This trait is characteristic of many AI systems. It is obviously advantageous to have near-synonyms close to each other, in relatively contiguous search space.

LOG does not provide a **partonomic match**. Since there are only a few 'part-of' relations in the kb, this has not been considered a major drawback. 'Part-of' relations make possible identification of the whole but are not significant in semantic analysis. For example, knowing that an object is 'finger' would let us identify the whole of which it is a part as a ‘hand’, but it would not tell us what a ‘hand’ is. A supplementary list of parts with their wholes must be added, in order to search ‘part-of’ relations. The (PART) conrels appear in the case-id frames and point to the Argument frames. However, the numbering system links Argument parts appropriately as well. A few other instances occur in *Hadley* v. *Baxendale* such as the shaft being a (PART) of the mill.

LOG handles idiomatic concepts but not metaphors or indirect speech acts. In this dissertation, coping with the idiomatic lconcs has been important. A number of the judges’ reasons are metaphoric. The capability of a matcher to handle indirect speech acts would be necessary if the retrieval module ultimately had a reasoning component.

LOG’s limited inference capability and its failure to use contexts are important. LOG might later be extended to include contextual matches, for the present we do not intend to undertake reasoning. The focus now is on retrieving concepts rather than reasoning with them. Therefore, in the remainder of the chapter, retrieval is described as a product of the proposed LOG+ which would indeed be capable of contextual retrieval. Furthermore, inference capability will be assumed. LOG was based on the assumption that a language generator would be implemented to piece together its partial syntactic output. Since such a system would require reasoning capability, it will again be assumed in describing retrieval with LOG+ that there is reasoning capability, for example, if the question was ‘Is Mary the apple of John’s eye?’ If we were able to discover by inference within the context of John’s family that Mary is John’s mother, we would be less likely to regard the Mary in the question as a match for John’s mother than we would have been if the Mary in the family had been John’s daughter.

Also, when LOG allows matches with the lexical options of a concept, it allows the options of only the node matched. In some instances, it would be very useful to have access to its subsumers and to their lexical options. The value of using a more general option may be seen in relation to an example used in §1.3.1.1.5. Recall that Ronald was a the ward of the court and it was necessary to identify the legal ‘role’ Alfred was playing as before it could be determined whether or not his case was relevant to Ronald’s. It was possible that Alfred could have been playing any one of the roles of ‘youth, son, minor, plaintiff, witness, or someone’s ward’. By making use of inference and multiple inheritance of the alternative lexical options for each of the roles Ronald could play, one could effectively resolve a large part of what is sometimes regarded as the problem of synonymy. For this reason, LOG+ will be assumed to be able to draw on subsumer options. It is recognized that, as Miezitis suggests (1988, p. 69), some priming is necessary. Concepts in the input will indicate which subsumers to chose. The legal privileges and obligations entailed in each of the roles are suitable candidates.

7.4. A detailed view of the search process

7.4.1. Introduction

Our objective is to retrieve conceptual information. Holmes's anecdote of the judge looking under 'churns' for information on property damage (§1.2) describes conceptual retrieval problem. The reader will kindly bear in mind that that is a solution to that type of problem I am attempting. The purpose of these examples is to show that frame matching can put us on the road to the retrieval of conceptual information. The matches described are matches of ideas entailed by the questions rather than matches of terms in the questions. Showing the value of matching concepts rather than character strings is my prime interest.

The following searches emulate legal research in the way they combine facts and legal concepts in the analysis of issues. The focus is on open-textured legal concepts, continually being redefined by the addition of new facts. A problem occasionally arises of whether the concept is becoming more narrowly defined or whether conflicting meanings are in confrontation. It is the same problem of interpretation that occurs in legal research when an attempt is made to distinguish a precedent. Shifting the focus of a question, understood here to indicate a shift of argument strategy, is the user's privilege, so the system must provide flexibility.

Marker passing makes it possible to attempt matches of several patterns simultaneously, so one can apply LOG+'s action to a full question at one try. Reports of partial matches, and other functional information from incompletely answered questions, are used to redirect the search. Some suggestions for failure analysis are made. In this way a procedure for conducting complex searches suitable to the construction of arguments is demonstrated.

The matches described above (§7.3.2) are all possible. Examples of many of them will be given below; the method of performing others is apparent. In general, LOG+ operates generating additional word choices so as to make it possible to answer a question, whether or not the question is asked using the same lexemes as those in the kb. Names of lconcs are accommodated because of LOG+'s ability to handle idiomatic expressions.

The described searches gradually increase in complexity. The first questions are simple patterns constructed to demonstrate the operation of the retrieval mechanism. Care has been taken to make the questions realistic facsimiles of legal research queries. They range from requests for single-fact answers to questions that ask whether a given fact situation is analogical to the case at hand. Some questions are derived from comments in the casebook on the cases represented in the kb. These questions are representative of the kinds of questions asked by potential users, because the casebook comments were written as an aid to instruction. The patterns may be regarded as queries.

More complex questions have been derived from reported cases which followed these in the kb. Their problems are the basis of the questions. In some instances, part of the argument is also used. The complex questions, therefore, are real. They represent problems that legal researchers at some time encountered.

7.4.2. Frame matching as conceptual retrieval

The rest of the chapter describes a proposed implementation. The issues here are a little different from the representational issues previously discussed. Conceptual differences are important, not because of their ontological significance, but for making choices. A question is a **fetch pattern**, a combination of propositions or predicates, which, if matched, are known to be true. A match of a fetch pattern to a target pattern occurs when any variables in the fetch pattern are bound to constants in the kb under the entailed constraints; and when, furthermore, there are no conflicts between the slot values of the fetch pattern and those of the target, including inherited values. Where a number of frames match the target, the most precise pattern that matches is reported.

Since a question typically consists of more than one predicate, it is necessary to define the **best match**. The match that covers the greatest number of objects in the fetch pattern is the best match. When such a match is made, the target frame becomes the preferred interpretation of the event in the question. **Preference matches** may be designated by the user. For example, where looking for information with a question that contains three lconcs, the user has the right to decide which predicate match is the best, or which lconc he prefers to emphasize. This choice is tantamount to allowing him to choose the strategy his argument will support. For example, he may chose between suits in contract and tort. More problematic is deciding among a number of partial matches which he prefers (Hayes-Roth 1978). He may show a preference for a case or cases among the cases found on the same point. Several partial matches may each contribute a little to an answer, making it difficult to find the most useful knowledge at hand (Rau 1988). The retrieval mechanism works on the kr described in chapter 6, with the addition of a lexicon and rules for semantic selection.

7.4.2.1. The lexicon

The lconcs in the lexicon are largely derived from the cases represented in the kb. Definitions for lconcs are found in the *Glossary of legal terms*, Appendix B. Definitions have been drawn from legal dictionaries. Some basic lconcs were derived from the definitions of the chosen lconcs and were themselves represented, for clarity. Such lconcs may not be in the *Glossary*. Their inclusion is often a matter of notational efficiency—building complex descriptions from primitive ones.

The lconc representations in cgs may be found in Appendix C, *Lexicon of legal concepts (lconcs)*. The lconcs are presented in a simplified form. The first attempt at preparing the kr resulted in highly abstract, vague lconcs, which were difficult to interpret within the context of the present work. The present, version is the result of considerable re-working in order to keep the lconcs consistent with the case representations as they developed. The lconcs became steadily simpler, more compact, and more sharply focused. The added, definitional information became the core of the type description of each lconc. Recall that each item is recorded only once. Any duplicate occurrence is replaced by a pointer.

7.4.2.2. Semantic constraints

Rules have been included in the kb as well. They control the choice of semantic objects in matching. They may be found in *Rules for semantic selection*, Appendix D. Each object description includes a list of the slots expected in a frame with that name. Some slots are marked ‘R’, for ‘required’, as noted in the key. The remaining slots are optional. Required slots *must* be matched during an attempted match, or the match fails.

Some syntactic information is included as well, for example, whether a verb is intransitive, transitive or ditransitive and whether a noun is concrete or abstract. The verb type is stated—motion, process and psychological are the three predominant choices. It was intended originally to group the verbs according to type in order to examine more closely their functions in relation to case. This seemed to me an approach more likely to be fruitful than classifying prepositions as case markers, in the light of Somers’s work, to which this representation owes so much. However, the rules have not developed that way.

The evolution of the rules, like the definitions of the lconcs, was from complexity to simplicity. At first, each frame had many ‘R’ marked slots, very closely restricting its use. I soon found that to be a impractical and overcompensated, by making all slots optional in order to be able to accomplish even *some* matches. Then ‘R’s were added again, slowly and carefully, one by one.

The rules are incorporated into the kb. They take their place as constraints in the nodes. They constitute the same kind of constraint as we saw in the example of LOG’s match at the ‘narcissism’ node, where the agent and patient were required to be the same person.

7.4.2.3. The type hierarchy

Physically, the kb is a list with many embedded contexts. Logically, the kb is a hierarchy of types. A conceptual shift is required to comprehend the hierarchical arrangement of the kb. The informational content is not affected. It’s rather like coming to understand a piano evolving from a harp. The kb is a graph, in which the concepts are nodes and conrels are arcs. In it, searching is constrained by the need for a logical progression of the match and inference process.

Although the hierarchy describes a model of the real world, or at least of the domain, its significance is implementational rather than ontological. It contains background knowledge for interpretation. The information is abstracted from the linguistic representation. It will not work if it is too far removed from reality. Nor will it work if it reflects an attempt to show everything. The choice of types, like the granularity of the kr, is largely determined by the nature of the domain and the need.

The text analysis involves logic, conceptual and linguistic knowledge. If the logic is too rigid, the semantic selection will not work. The abstract concepts make it possible to constrain the terminological variations for the objects in the kb. The interface between the higher level abstraction and the lower level, semantic selection, is a place of active information interchange. Ultimately, conceptual meanings are mapped to lexical elements, more or less rigorously, depending on the implementation.

Types are categories delineated by descriptive characteristics, essential to the entities in the category. There is normally an inverse relationship between the number of characteristics a concept type has and the number of entities to which it applies (Sowa 1984, p. 384). Statements about types are *analytical* and relate to the problem of distinguishing types from each other by reference to their characteristics. Types must be terms by *intension*.

Roles, in contrast to types, are categories delineated by accidental relationships, rather than by essential characteristics. Roles are artifacts of the world in which we live. For example, [HUSKY] is a type (or natural kind), while [PET] is a role.

Sets must be distinguished from types, especially since they are often lexically similar and are often confused with types. Sets must be *extensional* terms. Statements about sets are *synthetic*, since they describe groups of individuals with regard to their being a group, rather than with regard to an abstraction of their common essential characteristics, their type. The difference may be illustrated by an example. [HUSKY] and [WOLF] are types, which when united in a supertype might be called [CARNIVORA]. However, if the sets [HUSKY: {∗}] and [WOLF: {∗}] were joined, the result would be a set called something like [HUSKY_&_WOLF: {∗}].

A set is the **denotation** of a type. The denotation of the type [HUSKY] is the set [HUSKY: {∗}]. An entity may be an instance of a type and a member of a set. Howler is the name of a dog of the type

[HUSKY] as in (7-8).

(7-8) [HUSKY: Howler]

And Howler is a member of the set (7-9) of sled dogs.

(7-9) [HUSKY: Howler]←(MEMB)←[SLED_DOG: {*}]

[HUSKY] is a type, and expresses a concept of a natural kind, while [SLED_DOG] is a role. [HUSKY] inherits some characteristics from its subsumer [DOG]. [DOG] has associated with it the role [SLED_DOG]. [HUSKY] shares the role [SLED_DOG] with the type [MALAMUTE], also a specialization of [DOG]. These distinctions among entities are important when interpreting the concepts in the kb, especially when making inferences.

7.4.2.4. Generalized inference

Ability to inference enhances the power of the retrieval mechanism. It uses the hierarchical organization to reach related concepts, thereby accessing information additional to that provided by the query. It makes implicit information explicit. It is a technique for moving in a logical fashion from one concept to another along the arcs and, ultimately, drawing reasonable conclusions from facts. Because the hierarchy is partially ordered, deductive inference is possible. If the kr has suitably represented the content of the text, inference greatly improves the retrieval potential.

The most primitive match criterion is that, if the 'R' slots are filled, the entity exists. When a match occurs, but is not complete, we follow along the arcs to find a better match, a tighter fit. For example, when trying to interpret what Howler is, we know he is an instance of the type [HUSKY], which we know to be a subtype of [DOG]. By following the role associations of [DOG], we also find [PET] and [SLED_DOG]. After attempting to match the remaining slots in Howler's frame, we might decide he is not a [PET]. He may match [SLED_DOG]'s requirements wholly, or partially, or not at all. Nevertheless, we have retrieved quite a bit of information about him, by transforming the information we received about Howler through transitive inference, moving in serial order along the arcs. Another descriptor in the representation or additional information from the user may clinch the decision as to whether or not he is a [SLED_DOG].

By enabling the transformation of information, inference strengthens the retrieval process. For example, it is a way of dealing with the problem of what is called **synonymy**. Recall that in §1.3.1.1.1 the conjecture that there is no synonymy was stated. Nevertheless, the same object may be designated by different terms, loosely called ‘synonyms’. Since, within a given context, they share the same meaning, they may be related by inference in accord with semantic constraints within their context. For example, it might be possible to call a ‘Husky’ a ‘sled dog’ correctly in many circumstances. That is, under constraint, terms can function in a limited way as synonyms and often do.

However, care must be taken when analyzing ‘synonyms’. For example, it is less likely that a ‘sled dog’ could correctly be called a ‘Husky’, since the type [SLED_DOG] subsumes the type [HUSKY], along with the type [MALAMUTE] and some others. A less easily remedied problem occurs when terms from the same hierarchic level are used as ‘synonyms’. For example, ‘man’ is often used as synonymous with ‘woman’ in describing legal rights. It is one thing for ‘man’ and, therefore, ‘woman’ to have a right to the pursuit of happiness; it is quite another to deduce by inference the number of ‘man-hours’ the ‘man’ may have for maternity leave!

In general, this type of inference involves a change in information, a modification of the conceptual description as further nodes are matched, followed by an adaptation of the entailed semantic constraints on lexical selection. The value of the precise distinctions made in the kr is seen now in producing unambiguous output.

Inference also makes it possible to combine information from distinct sources. [HUSKY] can inherit attributes from both supertypes [DOG] and [PET]. Since other types of animals also may be specializations of [PET], it may be a very general type. It might be viable to add to the network at some point a supertype [PET_DOG] if the traffic in that part of the net was heavy enough to warrant the addition. [HUSKY] may inherit from both [PET] or [PET_DOG] and the [SLED_DOG] role types and so combine a variety of characteristics, if that is realistic according the prevailing worldview, so long as restrictions do protect against incoherent results.

Combining information works especially well in spatial inferences; for example, it would be correct to draw the conclusion as in (7-10):

(7-10) Toronto is in Ontario,
Ontario is in Canada,
therefore, Toronto is in Canada.

But, if we know too little about the nature of the spatial relationship, we might draw a faulty conclusion (7-11) such as:

(7-11) The blue car is next to the red car,
the red car is next to the green car,
therefore, the blue car is next to the green car.

Nothing can be inferred about the relative positions of the blue and green cars, without more knowledge about the meaning of ‘next’. Or, as you might recall from the case of *Upton*, the Powell farm was in the jurisdiction of the police of the District of Upton, but could not correctly be inferred to be in the jurisdiction of the fire brigade of the District of Upton. It was instead in the ‘next’ jurisdiction, that of the District of Pershore fire brigade.

Problems of interpretation extend to many conrels, connectives, and quantifiers as well as modifiers, when attempting to represent the logical content from the linguistic expression of meaning in text. The representation must be accurate if the inference is to yield meaningful results. When inference is applied to more abstract concepts, like ‘intention’, another dimension is added, increasing the difficulty tremendously but also increasing the potential for conceptual retrieval.

7.4.3. Examples—the test patterns

7.4.3.1. Foreword

Each search begins at the top of the hierarchy. The first decision is how to find the structures, the parts of the hierarchy, it is appropriate to search. As soon as the process encounters nodes in which the R slots are matched, those nodes are ‘magnetized’ and the search becomes localized and intensified, in the manner described above in §7.3.9. From there, the direction of the search depends on the content of the question.

Our first questions are utterances containing simple patterns. If a pattern is matched, the statement is true within the context of the kb, and the answer is positive. These matches demonstrate the operation of the retrieval mechanism at the simplest level. They show as well the fundamental interaction between the system and the user.

7.4.3.2. Search 1—legal concept named, followed by free-ranging search

(7-12) ‘‘What is intention to contract?’’

(7-12)R [INTENTION_TO_CONTRACT]→(DEFN)→[*x*?]

The first question (7-12) asks for a definition. The type hierarchy is entered at the root, the universal type, ‘T’. Having traversed the type hierarchy from the top, down through [MENTAL_WORLD], [ACT], [PSYCH_ACT], [COGNITION], through [INTEND] to the specific kinds of intending to [INTENTION_TO_CONTRACT] there is a complete match with the name of the frame. Since the concept name is searched as a unit, in this search, the other object [CONTRACT] would not have been marked. A definition of the concept is in the lexicon. The definitional information in the frame of the lconc [INTENTION_TO_CONTRACT], that is, the value of the slot (DEFN), is fetched and reported to the requester. Characteristically, the node inherits from both [INTENT] and [CONTRACT-v] nodes.

The search may be carried on a little further. The second stage involves the user asking a slightly more complex query. Having seen the definition, he may wish some concrete examples of proof. He might ask for statements that were considered to be evidence of intention to contract (7-13).

(7-13) [INTENTION_TO_CONTRACT]←(EVID)←[PROPOSITION: {*}?]

The same procedure of searching the hierarchy for the type node would be followed. But the search would go further. Each instance of the use of the lconc or type would be examined for the presence of the conrel (EVID). In *Weeks* we find a match for the conrel as a slot in the instance, and the filler is [PROMISE-n: #W1]. Similarly, in *Stamper* [PROMISE-n: #S1] is found. Both cases involve evidence of intention to contract, although in both decisions it was lacking. The system would report to the user that the two promises were the result of two successful matches, even though, the existence of the intention was negative. The representation of the negative is as in (7-14) following.

(7-14) [INTENTION_TO_CONTRACT: ˜]

As discussed in §4.1.3, the position of the negation symbol means that this entity is not an intention to contract. The match will take place because the type field is matched. Negative information represented in the referent field is reported and does not negate the match. This sort of ‘negative information’ is very useful in legal research. It may be possible to determine what is required in a specific case by knowing what the courts have determined is insufficient.

The user receives the representation of the promises as the answer he requested. It is a set of propositions showing the relevance of the concept. The system has been able to answer his question directly, insofar as it contains the information he seeks.

Furthermore, he has accessed an argument. If he wishes, he may indulge in ‘free ranging search’, the most general match strategy, that is, not a match, strictly speaking, but a fishing expedition. He could read the entire argument or he could get the case report itself, having found the document and citation as well as the specific argument. He might proceed a step further with his research with ease and see the lconc, the type definition of [PROMISE], as well. So long as neither suffix ‘-n’ nor ‘-v’ was specified, both would be retrieved. He could also broaden his search by moving up the is-a hierarchy from [INTENTION_TO_CONTRACT] to [INTENTION] or to [INTEND], from which [INTENTION_TO_CONTRACT] inherited the slot requirement for an agent (ACTS). He would get a full description of the type of agent required, that is that the agent must be ‘+animate’, specifically a [PERSON] and ‘+volitive’. Now our user has quite a bit of information, useful in the interpretation of the concept of [INTENTION_TO_CONTRACT] and helpful in determining whether the assertion he is confronted with demonstrates intention. All of this information has been gathered in an orderly examination of case material that is factual. The argument structure as a whole has not been involved in the search but has made it possible for the user to categorize his lconc conceptually. The combination of legal concept and factual examples has contributed significantly to the analysis of this issue of what kind of assertion shows intention to contract.

7.4.3.3. Search 2—legal concept by definition

(7-15) ‘‘Should an assertion be directed to someone for it to
constitute an intention to offer?’’

(7-15)R [INTENTION_TO_OFFER]-
←(EVID)←[PROPOSITION]→(DATPOSSG)→[PERSON].

The second simple question (7-15) is a request for verification that a statement is true. The search fails on the first attempt, as there is no concept [INTENTION_TO_OFFER] in the kb. A second attempt to match [INTENTION] and [OFFER] is successful on both accounts. Since we have a definition for [INTENTION] in the lexicon we know that it is a determination to do (OBJG)→[ACT-v], and that [OFFER-v], which has been matched, is a subtype of that object [ACT-v]. In the (DEFN) of [OFFER-v] we learn that the purpose is to allow the making of a contract. From here, we may be able to take advantage of the [INTENTION_TO_CONTRACT] match, since LOG+ would send out a subsumer message from [INTENTION], and an ‘I-HAVE-A’ message coming back up from [OFFER-v] would report the existence of the object [CONTRACT-n]. And both the cases *Weeks* and *Stamper* would be accessible to the requester who originally asked quite a different question about intention, relating it to an *offer* rather than to a *contract* or even to a *promise*.

Furthermore, within the definition, an offer should be made to some [PERSON]. The statement (7-15)R is true. It has been matched by a type definition and by a factual situation. The match type is ‘legal concept by definition’, but note that it has been possible to retrieve the cases containing related facts about utterances and intention to contract, as well as the concept, [INTENTION_TO_CONTRACT] unnamed in the query.

7.4.3.4. Search 3—legal concept by description

The third question is slightly more complex. The facts are presented in figure 7.1. Following the facts, there is a question (7-16) about a legal concept.

(7-16) ‘‘Does the promise constitute an offer?’’

(7-16)R [PROMISE-n: #t1] < [OFFER]

Lastly, it is asked (7-17) whether or not the facts fall within the definition of that concept.

(7-17) ‘‘Is there a contract between Jack and Johnny?’’

(7-17)R [PROMISE-n: #t1] < [CONTRACT]

The story about Jack and Johnny is enclosed in a single context. The question bears on that same context. Although it has been shown separately for the reader’s convenience.

Jack promised Johnny to buy a dog if he agreed to stop fighting.
Johnny agreed to stop fighting.

```
[PROMISE-v: #t1]–
   (ACTS)→[PERSON: Jack]
   (DATPOSSG)→[PERSON: Johnny]
   (DATPOSSL)→[PROMISE-n: #t1]→(CONT)→[TERM:
                          if     [AGREE_TO: #t1 ]–
                                    (ACTS)→[PERSON: Johnny]
                                    (OBJG)→[~[FIGHT: #t1]],
                          then   [BUY: #t1]–
                                    (ACTS)→[PERSON: Jack]
                                    (OBJG)→[DOG: ∗],],
[AGREE_TO: #t1]–
   (ACTS)→[PERSON: Johnny]
   (OBJG)→[~[FIGHT: #t1]].
```

Fig. 7.1 Jack and Johnny

This match is an attempt to find a legal concept by matching a given factual situation against the lconc's definition. Jack is offering to buy something for Johnny. [OFFER] is a suitable match for [OFFER-n] in the kb, as [BUY: #t1] will satisfy the need to match the [DO] concept specified under [ACT-v]. We don't yet know whether or not there is a contract. The first concept matched is [PROMISE-v]. From the content of its definition, we know that it is an expression of [INTENTION]. We know that this promise fulfills the first part of the (DEFN) of [CONTRACT-n]; it is an agreement to do something. However, there is no clear expression of whether or not intent exists in this situation to make it certain that the contract is legally binding. We cannot tell if intention exists by simply matching the words. Our kb lacks the information to allow us to determine any more about the nature of evidence of intention in such situations. Within the narrow bounds of our definition of contract and the limits of our kb, we cannot determine whether or not the evidentiary requirements of contractual intention have been satisfied. We do see of course, that unlike the situations in the *Weeks* and *Stamper* cases, an offeree has been designated.

We can go back to the description of [AGREEMENT], since we have learned from the match at [CONTRACT-n] that the part of the (DEFN) that our [PROMISE-n: #t1] corresponds to is the concept of [AGREEMENT]. We would also have reached [AGREE_TO] in matching the concepts in the original question. We know that the promise is an offer and that the parties have an agreement; but unfortunately, the search stops there. There are no instances of [AGREEMENT] in the kb. We know that the situation described is an agreement, and we are certain that the kb contains no cases on such agreements. Our search is finished at this point. We can go no further even though we have not achieved a definite answer.

Note that in doing this search, one of the principal criteria of conceptual retrieval has been satisfied: we have been able to put a name to an idea unnamed in the question, here [AGREEMENT], and to search the kb for information on that concept.

7.4.3.5. Search 4—facts and legal concept

Next, in figure 7.2, a slightly more complex situation is shown. The question is to determine whether or not the agreement is really enforceable. Clearly, the concept [ENFORCE] is our best clue. We find that, to be enforceable, [PROMISE: #t2] has to qualify as an [OBLIGATION], [CONTRACT-n] or [LEGAL_DUTY] within the terms of our lexicon. We know that Fifi and Fiorello agreed in a manner that was legal, or, as the definition of [LEGAL] explains to us, in conformity to law. All the qualifying concepts have a component which involves not just legal acts, but legally binding ones. So far we are not sure

---

Fifi agreed to rent a flat from Fiorello for a song, in a legal manner, but without benefit of covenant.

```
[AGREE_TO: #t2]–
   (ACTS)→[PERSON: Fifi]
          [PERSON: Fiorello]
   (OBJG)→[PROMISE-n: #t2]→(CONT)→[TERM:
            if     [RENT: #t3]–
                      (ACTS)→[PERSON: Fiorello]
                      (DATPOSSL)→[FLAT :#t1]
                      (DATPOSSG)→[PERSON: Fifi],
            then   [PAY: #t4]–
                      (ACTS)→[PERSON: Fifi]
                      (DATPOSSP)→[SONG: #t1]
                      (DATPOSSG)→[PERSON: Fiorello],
   (AMBP)→[LEGAL]
   (ACTP)→[COVENANT: ~].
[AGREE_TO: #t2]→(CHRC)→[ENFORCE].
```

Fig. 7.2 Fifi and Fiorello.

---

this instance of [PROMISE] is legally enforceable. Once again, we need fuller conceptual information about agreements to be sure.

It is possible to go further. We could look at the definition of [AGREEMENT]. Even if it had not been included in the representation, having matched [AGREE_TO], it is possible to send a subsumer message to [AGREEMENT] since [AGREE_TO] has an (ACTG), an intended result, an [AGREEMENT] in this instance. With some effort we can go forward and verify that it fits the requirement of having mutual promises, since they agreed that Fiorello would rent the flat, and Fifi would pay a song. A conceptual definition of [MUTUAL] is included among the lconcs as it is fundamental. It requires that each party [GIVE] something to the other. The concepts [RENT] and [PAY] are both specializations of [GIVE] a higher concept in the hierarchy subsuming many acts of transfer of possession.

Nevertheless, we still lack the representation of any idea that the agreement is intended to be legally binding. It is not clear within the limits of our knowledge, that [AGREE_TO] is enforceable. We need to have encoded fuller knowledge about the nature of legally binding agreements. However, we have seen nothing to indicate that the intention is not there, nor have we ruled out the possibility of a legally enforceable relation. We have simply seen demonstrated the need for more knowledge. Once again, we are secure in knowing that we have seen everything in the kb that has any relevance to the question. Nothing that is irrelevant has been retrieved.

7.4.4. Examples—medium complexity

7.4.4.1. Search 5—facts to facts

The next question once again displays greater complexity. It is a familiar episode, although not taken from a reported decision. In the situation described in figure 7.3 the underlying idea is that the king may have offered his favour to any subject who would do his bidding. It is questionable whether or not the king is to show favour to the subjects who did his bidding. The implication seems to be that anyone who killed the priest would gain his favour. It is possible that the king did make an enforceable agreement. Note that the situation has not been represented, only the apparent offer and the subsequent killing. The question is,

(7-18) ‘‘Does the king’s statement show evidence of intention to contract?’’

The king said in open court, ''Will no one rid me of this priest?''

Three of his subjects rode away and killed the priest. They returned and presented themselves to king to receive his favour.

The king claimed not to have commissioned the murder of the priest.

```
[PROPOSITION: [WANT: #U1]–
                (ACTS)→[KING: #M1]
                (DATPSYL)→[RID: #t1]–
                           (ACTS)→[PERSON]
                           (DATPOSSG)→[KING: #M1]
                           (OBJG)→[PRIEST: #M1].

[KILL: #t]–
  (ACTS)→[SUBJECT: {*}@3]←(POSS)←[KING: #M1]
  (OBJG)→[PRIEST: #M1].
```

Fig. 7.3 The murder situation.

(7-18)R [PROPOSITION]→(EVID)→[INTENTION_TO_CONTRACT]

Question (7-18) starts a search that begins with a match like the first one, of the [INTENTION_TO_CONTRACT] evidentiary assertions. Both *Weeks* and *Stamper* cases would be retrieved, as shown above, as would the definition of the lconc. However, in this more complex example, there is a set of facts to be compared with those in the retrieved cases. It is clear that the statement in this case, like the one in *Weeks*, is not made to a particular person, although it is said to have been made in the confines of the court. There is no named recipient, and he speaks of an anomalous [PERSON].

Retrieval of the *Stamper* argument would bring up the issue of emotional content. In *Stamper*, there are predicates dealing with state of mind and anxiety. In the murder situation, the concept [KILL] and terms like [RID] when read in textual context are fraught with emotion. However, in our representation of the question there is no attempt to show the emotional impact conceptually. If the terms were known to the system, then the emotional content might be entailed by the question in further searching. Although the conceptual representation of the expression of emotions is not precise, it is clear that, on comparison, this is a similar sort of statement to that in *Stamper*. It might be possible, if more cases of this type were available, to classify statements, such as the king's, for the semantic analysis of emotional expressions. The limitations of this representation with regard to emotional expression is suitable for our purposes, but indicates room for further work in domains where psychological concerns are of greater interest. Also, to attempt to matching variant emotions would entail more reasoning capability.

The next question on this situation (7-19) is easier.

(7-19) ‘‘Is it a promise?’’

(7-19)R [PROPOSITION] = [PROMISE]

There is no indication whatsoever that the [PROPOSITION] could pass as a promise, since there is no expression of intention to do or not do something. Finally, there is another question (7-20),

(7-20) ‘‘Does the king's statement, and the action of
the subjects constitute an agreement?’’

(7-20)R [[PROPOSITION] [KILL]] < [AGREEMENT]

Again we strike out since an agreement is an exchange of mutual promises, and we have no indication here of a promise existing at all. A constraint might be added to the [PROMISE-n] node to require that a promise take the form of an ‘if. . . then’ statement. If there were no definite answer then by form alone we could limit our search. Such a constraint would also operate to exclude statements like the king's from categorization as a promise. A more sophisticated constraint is desirable.

In this kb, the best answer we have is to find the situation in the story analogous to the statement in *Stamper* v. *Temple*. We clearly can do that, if we are given the name of the concept [INTENTION_TO_CONTRACT] or, as shown above, an indication of the idea that is substantive enough to let us find our way to the concept through a match in its descriptive representation. The relevant example above is Search 2 (§7.4.3.3) the ‘intention to offer’ to someone example.

7.4.4.2. Search 6—difficult legal concept by description

The objective is the retrieval of information concerning the lconc of contractual acceptance. ‘Acceptance’ is a positive response of the offeree to the offeror when a contract is made. A (DEFN) is easily retrieved from the lexicon by matching the concept name; however, that's as far as the matching process is able to go. There are no instances of [ACCEPTANCE] in the kb to be uncovered.

In the first pattern match, in Search 1 (§7.4.3.2), a match is made with the name of the lconc type, yielding the definition, and then a search of the related instances is made. Previous descriptions of lconcs have stated that there are pointers from a type description to clusters of instances. It should be noted here that the conceptual description of an lconc's instance does not always involve the attachment of a pointer to a specific concept name. It would result in too fine an analysis. Every case involving a completed contract would have a pointer attached to the concept [ACCEPTANCE]. The representation would then fail to convey significant meaning. Where [ACCEPTANCE] is plainly mentioned, or where it is an issue in the reasoning of a case there is a pointer from the lconc type. Where the acceptance is simply a normal part of a contract, and neither the word nor the concept is discussed as a part of the case, there is no pointer.

The first attempt to locate instances of the concept [ACCEPTANCE] in this kb fails. [ACCEPTANCE] is not matched in any of the cases in the kb. Inferentially, using concepts found in the definition of [ACCEPTANCE], we find that in *Hadley* v. *Baxendale* the parties agree on a price and [MAKE] a [CONTRACT-n]. This information is derived from the [GROUNDS] section of the Argument. In a situation such as this match attempt, the [GROUNDS] section yields factual information. We know that any proposition matched in that section is something that actually happened, that has been determined to be true. We know from the conceptual definition of [CONTRACT-n], that the making of the contract involves [INTEND] on the part of both parties. Also it is a fact that the contract was made. Its existence is not a matter of speculation, or a hypothetical proposition. So, there is a simple, factual example of an acceptance, which we can retrieve even though it is not discussed, and is not an issue in the case. This demonstrates a useful characteristic of conceptual retrieval in even such a limited kb as ours

For the sake of interest, let us look at what has happened to the attempted match in the other representations. In both *Weeks* and *Stamper*, there is neither agreement nor the expression of intention to contract. The conflicts have involved the [PROMISE] propositions, that is the statements attempting to induce contracts. In both cases, the responding party performed the condition in the promise. The [GROUNDS] section of each case contains a statement of fact stating the occurrences. At present, with this representation, we cannot retrieve those statements as acceptances. It is possible that they could be retrieved if the reasoning capability of the system was developed and if more information about acceptance was available. However, for the present, the structure of the Argument is used to demonstrate retrieval capability. In both *Weeks* and *Stamper* the resulting situation was judged by the court not to bind D to perform the consequent. The conflicts were over the offering statement. There was no discussion of acceptance. Yet it is sensible to assume that an acceptance is not possible if an offer does not exist.

Nevertheless, this situation brings to light a significant weakness in the representation. It is likely that there will be cases in which a true contractual relationship *is* formed without a formal acceptance being recorded in the case report. For example, we will see below (§7.4.5.1) how like the *Carbolic Smoke Ball* case is to *Weeks* and *Stamper*. In the judgement of the *Carbolic Smoke Ball* case, it was decided that P, Carlill, had accepted the offer by following the directions for use on the smoke ball. In other similar cases, it would be necessary to recognize such an action as an acceptance. This conceptual representation of acceptance does not make such recognition possible. The kr would have to be extended if the case and the line of cases following it are to be included in the kb.

The situation in the *Upton* case is even more difficult for the matcher to retrieve. The formal niceties of presenting an offer to a particular recipient and of the offeree accepting in specific terms are not evident. In the [CLAIM], which may be regarded as the conclusion of the Argument, we see that there is a contract and that it is based upon an implied promise. In a way, the [CLAIM] creates a new reality. It is the statement of the result of the [REASONS] in the case, which are governed by modal operators. Statements in the [CLAIM] are not limited by modals.

The promise in *Upton* is made by D or his agent, but there is no indication of a recipient. If there had been, perhaps it would have been helpful in determining exactly which act was the acceptance.

The meaning of [IMPLIED] tells us further that the promise was not clearly communicated and that the recipient ‘understands’ it from the circumstances, in other words, the offer is not explicitly stated. Since we know, from attempting to pattern-match among the reasons, that the judge has not designated any [ACT] as acceptance, we might assume that the acceptance is not explicit as well.

It appears that the contract is a legal construction. In the [REASONS], the judge points out that D’s mental reservations do not prevent an [OBLIGATION] from being formed with the Upton Fire Brigade, or the District Council. Yet we are not quite sure of the nature of that [OBLIGATION], nor of which acts correspond to the requisite elements of a contractual relationship.

The *Upton* case has been discussed as a quasi-contract.[7] A further interesting demonstration of the nature of conceptual retrieval may be made in this respect. Quasi-contract is similar to an implied promise in that there is no formal agreement. As can be readily understood, cases involving quasi-contract are difficult to locate because of the informal nature of the agreements. This kb knows about quasi-contract. However, the concept has a condition (AMBL), its value is that the parties do not have an agreement. It is clear, that since the [CLAIM] in this case has to do with the establishment of [CONTRACT-n: #U2] and the [CLAIM] is not rebutted, *Upton* does not allow a match with [QUASI_CONTRACT]. A condition (AMBL), is a prescriptive slot. If there is a concept in the context of the case argument that conflicts with the required value of the slot, a match cannot occur.

The failure to retrieve *Upton* as a quasi-contract case shows an aspect of the difficulty of representing abstractions. Here we have an implied promise that is said to constitute a contract, to be an agreement in some sense and not in others. The promises in *Weeks* and *Stamper* were difficult to represent as contracts since they were inchoate entities. Similarly, the difficulty of representing the equitable principles of quasi-contract and unjust enrichment have highlighted these formidable ideas. The problem not only shows a limitation of the representation but brings to light an interesting aspect of the reasoning in the case. The related ideas of quasi-contract and unjust enrichment are relevant to the matter but not openly dealt with, yet the search reveals their relationship. This is yet another indication that conceptual retrieval can be directly useful in the development of legal arguments.

7.4.5. Examples—from reported cases

7.4.5.1. Search 7—*Carlill* v. *Carbolic Smoke Ball Co.*

The more complex questions are derived from judicial decisions made after those in the kb. These later cases are similar in content to the searches already discussed. For example, an abstract of the report of

[7] ‘‘Case and comment’’ (1942) 20 C.B.R. 557.

Carlill v. *Carbolic Smoke Ball* appears in figure 7.4.

Carlill v. *Carbolic Smoke Ball Co.*
England. Court of Appeal. [1893] 1 Q.B. 256.

The defendants, who were the proprietors and vendors of a medical preparation called ‘‘The Carbolic Smoke Ball’’, inserted in the *Pall Mall Gazette* of November 13th 1891, and in other newspapers, the following advertisement:

‘‘£100 reward will be paid by the Carbolic Smoke Ball Company to any person who contracts the increasing epidemic of influenza, colds, or any disease caused by taking cold, after having used the ball three times daily for two weeks according to the printed directions supplied with each ball. £1000 is deposited with the Alliance Bank, Regent Street, shewing our sincerity in the matter.

‘‘During the last epidemic of influenza many thousand carbolic smoke balls were sold as preventives against this disease, and in no ascertained case was the disease contracted by those using a carbolic smoke ball.

‘‘One carbolic smoke ball will last a family several months, making it the cheapest remedy in the world at the price, 10s. post free. The ball can be refilled at a cost of 5s. Address, *Carbolic Smoke Ball* Company, 27 Princes Street, Hanover Square, London.’’

The plaintiff, a lady, on the faith of this advertisement, bought one of the balls at a chemist’s, and used it as directed three times a day, from November 20, 1891, to January 17, 1892, when she was attacked by influenza. Hawkins, J. held that she was entitled to recover the £100. The defendants appealed. (Milner 1984, 350)

Held, affirming the decision of Hawkins, J., that the above facts established a contract by the defendants to pay the plaintiff £100, in the event which had happened; that such contract was neither a contract by way of wagering within 8 & 9 Vict. c. 109, nor a policy within 14 Geo. 3, c. 48, s. 2; and that the plaintiff was entitled to recover. ([1892] 1 Q.B. 256.)

Fig. 7.4 *Carlill* v. *Carbolic Smoke Ball*

Fig. 7.5 The Carbolic Smoke Ball

The representation of the *Carlill* case is shown in figure 7.6. Question (7-21), asked regarding the *Carlill* case, is whether or not the promise is a ‘mere puff’.

(7-21) ‘‘Is this promise a mere puff?’’

```
 [PROMISE-v: #Q1]–
   (ACTS)→[D: Carbolic]
   (DATPOSSL)→[PROMISE-n: #Q1]→(CONT)→[TERM:
                    if    [USE]–
                             (ACTS)→[PERSON: *x]
                             (OBJL)→[CS_BALL]
                             (AMBP)→[AS_DIRECTED: #Q1]–
                                          (LOCL)→[CS_BALL],,
                          [CONTRACT-v]–
                             (DATPOSSG)→[PERSON: *x]
                             (DATPOSSL)→[INFLUENZA],
                    then   [PAY]–
                              (ACTS)→[D: Carbolic]
                              (DATPOSSG)→[PERSON: *x]
                              (DATPOSSP)→[REWARD]–
                                              (MEAS)→[MONEY: @L100],
                              (DATPOSSS)→[MONEY: @L1000]–
                                              ←(OBJG)←[DEPOSIT-v: #Q1]–
                                                            (ACTS)→[D: Carbolic]
                                                            (LOCL)→[BANK: Alliance]
                                                            (ACTG)→[SHEW: #Q1]–
                                                                        (ACTS)→[D: Carbolic]
                                                                        (OBJL)→[SINCERE: #Q1],,,,.
[DEPOSIT-v: #Q1]–
   (ACTS)→[D: Carbolic]
   (OBJG)→[MONEY: @L1000]
   (LOCL)→[BANK: Alliance].
[USE: #Q1]–
   (ACTS)→[P: Carlill]
   (OBJG)→[CS_BALL: #Q1]
   (AMBP)→[AS_DIRECTED: #Q1].
[CONTRACT-v: #Q1]–
   (DATPOSSG)→[P: Carlill]
   (DATPOSSL)→[INFLUENZA: #Q1].
[~[PAY: #Q1]–
     (ACTS)→[D: Carbolic]
     (DATPOSSG)→[P: Carlill]
     (DATPOSSP)→[REWARD: #Q1]–
                     (MEAS)→[MONEY: @L100],.]
```

Fig. 7.6 Representation of *Carlill* v. *Carbolic Smoke Ball*

(7-21)R [PROMISE-v: #Q1] < [MERE_PUFF]

An attempt is made to match the concept [MERE_PUFF], which fails. The system does not know the concept. The same result is reached by trying to match [PUFF]. A second attempt is made with a conceptual definition of [MERE_PUFF] provided.[8] The representation of the lconc [MERE_PUFF] appears in figure 7.7.

In attempting to match the conceptual definition of [MERE_PUFF] we will find the promise in *Weeks* that was said to be stated in ‘general words’. [TERM] and [WORD] come together as ‘synonyms’ under the common parent [LEXEME]. They will inherit the same principal attributes. There is nothing in the context of [MERE_PUFF] or in the context of the promise in *Weeks* to distinguish the use of either. It is possible, therefore, to match [TERM] with [WORD]. Although the phrasal description of the promise in *Weeks* does not match exactly, the first (CHRC) of [MERE_PUFF], a partial match will be reported as any type [PHRASE] will have its type label subjected to a string match. From the concept [WORD] in the hierarchy, there is a pointer to the use in the [PHRASE].

Furthermore, it is to be expected that [VAGUE] would be associated in a full lexicon with ‘general’ and ‘meaningless’. Only legal definitions of concepts have been included here. The natural language

```
[MERE_PUFF]–
   (DEFN)→[[PROMISE-n]–
                 [(CHRC)→[TERM]→(ATTR)→[GENERAL] or
                  (CHRC)→[VAGUE] or
                  (CHRC)→[OPINION] or
                  (CHRC)→[PROMISE]→(ATTR)→[~SPECIFIC] or
                  (CHRC)→[PRECISE][~SERIOUS] or
                  (CHRC)→[ASSERTION: {*}]→(OBJG)→[FACT: {*}]→(ATTR)→[VERIFIABLE]]
                 (~EVID)→[INTENTION_TO_CONTRACT]
                 (~EQUIV)→[OFFER],].
```

Fig. 7.7 Mere puff

[8] The definition is derived from a discussion of the concept in Treitel (1979), where it is said that, ‘‘A statement inducing a contract may be so vague, or so clearly one of opinion, that the law refuses to give it any contractual effect.’’ (1979, p. 107). And later, ‘‘These are statements which are so vague that they have no effect at law or in equity. . . The distinction is between indiscriminate praise, and specific promises or assertions of verifiable facts.’’ (Treitel 1979, p. 244).

usages have been omitted as they are not the subject of investigation. It may be assumed that this term would be matched in the normal operation of a system in this domain. The phrases ‘vague terms’ and ‘general words’ would be taken as synonymous.

Furthermore, we find that a mere puff is *not evidence* of intention to contract and is not equivalent to an offer. In *Weeks*, the promise is evidence that there is no intention to contract.[9] The matcher can relate the two variant negative structures to produce matching meanings insofar as the promises are concerned.

The user wants to know if his [PROMISE] is a [MERE_PUFF]. We can compare his promise to those retrieved as mere puffs. If he is to argue that the *Carlill* promise is not a puff, he will have to show how it is unlike them. One of the (CHRC)s of mere puff is that the promise is [~SPECIFIC]. There is no meaning defined for that concept. However, we do know that one of the judge’s reasons in *Weeks* for deciding that the promise was not legally binding was that Tybald did not direct his promise to a particular person. Similarly, in *Carlill* the promise is made in a newspaper advertisement. Once again, there is no (DATPOSSG), no individual recipient to whom the statement inducing a contract is made. There is little in *Weeks* to make it clear what else characterizes the [PROMISE] as ‘general words’. So far, the statement in *Carlill* appears to be as general as the one in *Weeks*.

In the same way that *Weeks* is retrieved, so *Stamper* is found. We find that the promise in *Stamper* is very similar to the promise in *Carlill*. There is even a specific reward offered. However, in the [REASONS], the judge states that the promise is not equivalent to an offer because it was motivated by D’s anxious state of mind. One thing that appears not to put the promise in *Carlill* in jeopardy is that it does not result from emotion. There is no indication in the story that the promise is a reaction to an emotional situation. It is instead a serious business proposition.

Now, it might have been argued that, in stating the precise amount of the reward, D avoided the potential claim that the promise was imprecise or not specific. However, the reward in *Stamper* is similarly spelled out, and that promise was judged as not binding. In *Stamper* as well, no offeree is designated. The characterization of the nature of the reward as a sort of published offer is repugnant to the judge as his

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[9] *Weeks* may be said to be relevant as Treitel cites it as an example of mere puff (1979, p. 107).

hypothetical promises indicate. These two [HYPO] promises would also be retrieved in the process of the match. Their truth value is of course limited to the possible world delineated by the modal operators in whose scope they are found.

Something quite different about the *Carlill* promise is the designation of the source of the reward. This frame in the (DATPOSSS) slot cannot be matched within the kb. However, there are several things to be noted about the representation as they themselves would involve some difficulties in making a match. In matching the [PROMISE-v: #Q1], the matcher has some trouble with [CONTRACT-v]. It has (DATPOSSG), representing the traditional benefactor, here a person, and a (DATPOSSL) slot, indicating the entity that affects the benefactor, here influenza. The semantic constraint in the kb for the sense of [CONTRACT-v] specifies only an agentive role, (ACTS), which may be repeated. [CONTRACT-v] is, within our kb, an intransitive verb (Vi). It is possible that the verb 'to contract' could be represented as having a 'factitive' type of object (OBJG), a [CONTRACT-n]; however, that use is not required and in fact does not occur in the kb. It is clear that the sense of 'contract' used in the question from *Carlill* is different from the one we already know. The semantic constraint has made it possible to deal with the ambiguity caused by the variant senses of ''contract''.

Ideally in a modern retrieval system, especially one constructed in a small, intensive domain, this information would be collected and 'learned', or at least put under inventory control. LOG+ develops an inventory associated with failed searches. This new sense of [CONTRACT-v], along with its slots, would become a part of the inventory; the knowledge of 'contract' in the sense of 'contracting a disease' would be acquired. If other instances of the use of the verb 'to contract' having to do with becoming ill were added, they might be appropriately grouped and added to the lexicon. However, since it is unlikely that there will be such occurrences, this example might be saved as an exception that is potentially useful in establishing the meaning of unusual occurrences of [CONTRACT-v] in incoming queries.

The kb does not know what [DEPOSIT] is. When there is no match for a concept like [DEPOSIT], the first attempt to reconcile the conflict will involve generalizing to the next higher node. In this situation that is [GIVE]. [DEPOSIT] has the same syntactic characteristics as [GIVE] and does match the required slots for that concept. [DEPOSIT] might at some point be added as a useful specialization of [GIVE], or it might just be left as a partial match that is reported to the user. The decision depends on need.

Another problem arises with the attempt to match [SHEW], an archaic form of the verb ‘to show’ which is commonly used in British law reports, regardless of their vintage. The alternative choice of [SHEW] for ‘show’ is another example of the use of constrained synonyms. In this case, the words *are* considered to be exactly equivalent, and are represented as alternative lexical choices for the same conceptual representation. They will be adjacent nodes on the same level of the hierarchy, the ideal situation for functional synonyms. If terms suitable for use as system synonyms are too widely separated, LOG+ will not find them because of the magnetization procedure which primes a generic node early in the process narrowly channelling the search. If ‘shew’ for some reason had been placed far away, perhaps in a section of the hierarchy having to do with obsolete terms, it would have been missed entirely in this search.

Money is deposited to ‘shew sincerity’, as a source (DATPOSSS) of reward money.[10] Furthermore, the fact that the money has actually been deposited in the Alliance Bank makes a verifiable fact of that part of the promise. The antecedent has been performed.

In the type hierarchy, it will be noted that ‘serious’, and ‘sincere’ are synonyms. They are commonly applied to business matters, matters of a grave or sober nature, that is, in contexts where behaviour is serious in the sense of not frivolous. If it were necessary to fetch *Carlill* in response to a request for mere puff cases, it would be possible. However, for our purposes the facts constitute a test and the judge has yet to determine whether or not the promise is a mere puff. The point is that the offer here is sincere; there is a demonstration of intention to contract, since the reward money has been deposited. The lconc for [OFFER-n] fits the [PROMISE] in *Carlill.*

Finally, we see that a [MERE_PUFF], even if it happens to be ‘precise’, is said not to be ‘serious’. And that it is not, whether vague or precise, evidence of an intention to contract and it is not an [OFFER]. Because we have been able to query the kb successfully about the [INTENTION_TO_CONTRACT] cases, it is clear that they could be retrieved as well.

[10]‘Reward’ here is actually a compensation, but is indeed called ‘reward’ in the case report.

Something new has happened in this case. The term ‘mere puff’ is a relatively modern lconc. It would not have been derived from the early cases we have discussed but, in standard indexing practice it might be added by a human indexer at a later date. It is an indication of a change in the language. ‘Mere puff’ came into the language as a term for this lconc in the *Carlill* case. It is possible to find cases on ‘new’ legal concepts if their meaning is appropriately represented. At this point, the definition of the lconc ‘mere puff’ could be added to the lexicon for future use. It is, after all, a nominalization for a previously unnamed concept.

7.4.5.2. Search 8—*Cory* v. *Thames Ironworks Co.*

In our next case, figure 7.8, we are presented with a breach of contract. Our attention is directed to the problem of determining how far D is liable for the excessive loss of profits P suffered. The key fact is that P was going to use the hull in an unusual way and D had no knowledge of that fact. Since D did more damage by breaching then he expected to, can it be argued that, since P did not apprise him of their plans for use, they must share the liability for the loss? The representation of the facts is shown in figure 7.9.

The searcher will need to look for arguments about the liability of breachers who lack some information about P’s position. It is difficult to know how to ask the question. We might ask what the breacher must know to be liable. Need he have complete knowledge of the facts or circumstances? A cursory scan of the concepts in the lexicon is not rewarding. Concepts related to ‘breaching’ and ‘breach’ are limited. The concept [KNOW] defines the term in isolation from events. So we will ask, in (7-22),

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Cory v. *Thames Ironworks Co.*,
1868, L.R. 3 Q. B. 189.

In this case, D agreed to sell the hull of a floating boom derrick to P. The hull was the first of its kind ever built. P intended to use the hull to transship coals from colliers to barges by means of hydraulic cranes they themselves would install in the completed hull after delivery. D did not know of P’s intention, and assumed that the hull would be used to store coal. D did not deliver the hull until six months after the specified date. The delay in delivery caused P to lose considerably more money than they would have had the hull been used for the storage of coal.

Fig. 7.8 Abstract of *Cory* v. *Thames Ironworks Co.*

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[PROBLEM:[DELAY] =
   ∗l x y [DATE: ∗x]→(>)→[DATE: ∗y]→(MEAS)→[MEASURE: @6mon]

[CONTRACT-v: #Q6]–
   (ACTS)→[P: Cory] [D: Thames]
   (OBJG)→[CONTRACT-n: #Q6]→(CONT)→[TERM:
                    if     [SELL: #Q6]–
                              (ACTS)→[D: Thames]
                              (DATPOSSL)→[HULL: #Q6]
                              (DATPOSSG)→[P: Cory],
                           [DELIVER: #Q6]–
                              (ACTS)→[D: Thames]
                              (DATPOSSG)→[P: Cory]
                              (DATPOSSL)→[HULL: #]
                              (TEMPL)→[DATE: spec#Q6],
                    then   [PAY: #Q6]–
                              (ACTS)→[P: Cory]
                              (DATPOSSP)→[PRICE: #Q6].
[DELIVER: #Q6]–
   (ACTS)→[D: Thames]
   (DATPOSSG)→[P: Cory]
   (DATPOSSL)→[HULL: #]
   (AMBL)→[[DELAY: #Q6] = [[DATE: deliver#Q6]→(>)→[DATE: spec#Q6]]].
[DELIVER: #Q6] = [BREACH: #Q6]
   [~[TELL: #Q5]–
        (ACTS)→[P: Cory]
        (DATPOSSG)→[D: Thames]
        (DATPOSSL)→[INFO:[INTEND: #Q5]–
                              (ACTS)→[P: Cory]
                              (DATPSYL)→[USE: #Q5]→(CHRC)→[~USUAL: #Q5]–
                                            (OBJL)→[HULL: #Q6],,].]
   [~[KNOW: #Q5]–
        (DATPSYG)→[D: Thames]
        (DATPSYL)→[INTEND: #Q5]–
                     (ACTS)→[P: Cory]
                     (DATPSYL)→[USE: #Q5]→(CHRC)→[~USUAL: #Q5],.
   [LOSS: #Q6]–
      (ACTS)→[P: Cory]
      (OBJG)→[PROFITS: #Q6]→(ATTR)→[LARGE: #Q6]
      (AMBS)→[DELAY: #Q6].
   [~[KNOW: #Q6]–
        (DATPSYG)→[D: Thames]
        (DATPSYL)→[[DELAY: #Q6]←(AMBS)←[LOSS: #Q6]].]
```

Fig. 7.9 Representation of *Cory* v. *The Thames Ironworks Co.*

(7-22) What circumstances or facts are relevant to the
estimate of damages arising from a breach of contract?

(7-22)R [BREACH_OF_CONTRACT]←(AMBS)←[DAMAGES]-
(EVID)->[FACT: {*}?] or [CIRCUMSTANCE: {*}?].

Both [FACT] and [CIRCUMSTANCE] are in our lexicon. Had they not been, the subsumer, [PROPOSITION] would have served the purpose. Through the use of the first two concepts, *Hadley* v. *Baxendale* is retrieved. Note that the conrel (AMBS) is used here with the arrows showing that the breach is the reason for the damages. The conrel (AMBG) might instead be used to show that the damages were the consequence of the breach, in which case, the arrows would have pointed in the opposite direction. It is possible to negotiate matches correctly where one graph designates a cause and the other an effect. So long as the relationship between the objects involved is consistent. Here, the first line of the fetch pattern (7-22R) matches [BREACH_DAMAGES].

[GENERAL_DAMAGES] are also of interest, being those damages that arise when there are no ‘special circumstances’ accompanying the contract. The concept [GENERAL_DAMAGES] appears in the judge’s reasons—they are what a breacher would contemplate resulting from a breach if there were no ‘special circumstances’ related to the contract. The concept is used only once in the representation, in the consequent of a conditional. The antecedent says that the consequent follows only if the breacher *did not know* of the special circumstances. [SPECIAL_CIRCUMSTANCES], within the context of the case, are defined as circumstances that prevail at the time of contracting. Certainly, in the *Cory* case, P had the unusual use in mind at the time of contracting. Furthermore, according to *Hadley* v. *Baxendale*, the special circumstances create liability in the breacher only if they are communicated and both parties know about them. [GENERAL_DAMAGES], that is, the damages that would normally arise from a breach, are those presumed to have been contemplated by the breacher at the time of breach. In short, the breacher cannot be held liable for aggravated loss in the wake of a breach if he was not aware of the circumstances that caused the aggravation.

It would seem that these are the concepts on which an argument in the *Cory* case could be based. Although one would want to read the text of *Hadley* to take full advantage of the reasoning and to comprehend the rule of the case, [RULE: #H1]. Still the information retrieved directly from the representation of the argument would contribute greatly to the development of an argument applicable to the Cory problem.

As well as [GENERAL_DAMAGES], the two type definitions [NATURAL_DAMAGES] and [FORESEEN_DAMAGES] contribute information. Since they are built on the concept of [BREACH_DAMAGES], they will be retrieved in connection with that fundamental concept. Neither definition can be matched with the represented facts in the *Cory* case. However, the informational content is important. It is clearly significant that damages must arise naturally from the situation, and that both parties must be able to anticipate, at the time of contracting, probable damages in the event of breach. By tracking the occurrences of these two concepts through the context of [ARGUMENT: #4] we can get an understanding of how they are developed in the judge's reasoning. There is little else in the problem at hand that can be matched. We have after all only one case in our kb concerning damages.

Many of the terms, such as [FAIR] and [REASONABLE], may require human intervention to determine how they can be useful in making decisions. Nevertheless, the user is given the information that these terms are employed in testing the foreseeability of the parties. They may be defined in restricted terms elsewhere or in the future. For the present, we leave them aside. Our goal is IR, not precise legal decision-making and we have been able to lay the groundwork for an argument on point.

7.4.5.3. Search 9—*Lilley* v. *Doubleday*

In the next case, figure 7.10, the problem concerns the remoteness of the damage from the contract. There is no question of liability for negligence on the part of D, Doubleday. There appears to be an intentional breach of contract. There is no indication that the question of intention on the part of the breacher should

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Lilley v. *Doubleday*,
1881, 7 Q.B.D. 512.

P contracted with D, promising to pay for his drapery material to be stored in a specifical warehouse. D did store some of the goods in that warehouse. However, he also stored some in a second warehouse, without informing P. Fire destroyed the second warehouse and P's goods within it. P sued D for the value of the goods destroyed by fire.

Fig. 7.10 Abstract of *Lilley* v. *Doubleday*

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be raised with regard to the breach, as the representation in figure 7.11 reflects. Considerations affecting the assessment of liability for damages resulting from a breach are the subject of inquiry (7-23).

(7-23) ‘‘What is breach of contract?’’

(7-23)R [BREACH_OF_CONTRACT]

First, LOG+ retrieves the conceptual definition of breach of contract. The definition tells us simply that it involves not doing what was agreed upon, without a legal reason. If we attempt to match the definition to the [PROBLEM], the results are not desirable. [DO] is a high level concept, a subsumer of [CONTRACT-v]. In this attempt, either [˜[PERFORM]] or [˜[DO]] would cause a failure to match [CONTRACT-v: #Q7], although the slot (OBJG) would match the same slot and value [CONTRACT-n: #Q7].

```
[PROBLEM: [CONTRACT-v: #Q7]–
   (ACTS)→[P: Lilley][D: Doubleday]
   (OBJG)→[CONTRACT-n: #Q7]→(CONT)→[TERM:
                    if     [STORE: #Q7]–
                              (ACTS)→[D: Doubleday]
                              (OBJL)→[MATERIAL: #Q1]
                              (LOCL)→[WAREHOUSE: #Q7],
                    then   [PAY: #Q6]–
                                (ACTS)→[P: Lilley]
                                (DATPOSSP)→[PAYMENT: #Q7]
                                (DATPOSSG)→[D: Doubleday],].
 [STORE: #Q8]–
    (ACTS)→[D: #]
    (OBJL)→[BOLT: {∗}#Q1]→(MEMB)→[MATERIAL: #Q1]
    (LOCL)→[WAREHOUSE: #Q7].
 [STORE: #Q9]–
    (ACTS)→[D: #]
    (OBJG)→[BOLT: {∗}#Q2]→(MEMB)→[MATERIAL: #Q1]
    (LOCL)→[WAREHOUSE: #Q8].
 [BURN: #Q8]–
    (OBJL)→[WAREHOUSE: #Q8] [BOLT: {∗}#Q2].
 [LOSS: #Q8]–
    (DATPOSSG)→[P: #]
    (OBJG)→[BOLT: {∗}#Q2]
    (AMBS)→[BURN: #Q8].]
```

Fig. 7.11 Representation of *Lilley* v. *Doubleday*.

Both [PERFORM] and [DO] are subsumers of the verb ‘to contract’. The system knows [PERFORM] in connection with the carrying out of terms in a contract or other agreement. However, the meaning is not correct. Making a contract is not the same thing as performing it! Some further interpretation is necessary. A procedural attachment is to be added to the concept of [BREACH_OF_CONTRACT] to allow for attempts to match the definition against the representation to determine whether or not the contract had been performed. Contracts are represented as conditions in this kb. Performed contracts, are presented as occurrences. In order to determine whether there is a breach in a situation, the matcher would, when performing the procedure attached to the (DEFN), match the antecedent of the condition with the facts reported in the problem. In this instance, they would not match. Some of the [MATERIAL], not all, is stored in [WAREHOUSE: #Q7]. Moreover, the other part of it is stored in another warehouse. We know, therefore, that the contract has not been perfectly performed.

[MATERIAL] is a mass noun and as discussed in §6.8.3.1 there is some difficulty in representing segments of the volume of matter for which a mass noun stands. Here the style of representation, using two distinct sets to represent parts of the entity [MATERIAL] is suggested by Sowa (1988, p. 2-20).

We have not found anything in the problem to show that there is a substantive reason for the difference between the terms of the contract and the actual performance. The system cannot make a judgement as to whether the incomplete match means a breach has occurred. It can report only the differences. A person would have to make that decision, but he would have the option of examining all the instances of breach in the kb in order to help him make his decision. Obviously, the best way to help him is by retrieving instances of breach most like his problem. We proceed now to attempt to show how that may be done.

The researcher would be concerned about finding legal justification for deviating from the terms of the contract. However, it is quickly determined, by spreading markers from
[REASON]→(CHRC)→[LEGAL] in the (DEFN), that the kb has no further information
about such reasons. The system can report that to the user with certainty.

The next step is to attempt to find some reason why D should not pay damages. So, just in case of trouble, the good searcher is likely to ask for all information available on damages resulting from breach of contract (7-24).

(7-24) ‘‘What damages may result from breach of contract?’’

(7-24)R [DAMAGES]←(AMBG)←[BREACH_OF_CONTRACT]

In looking for this information, the matcher would first locate the definition for [DAMAGES]. Nothing there is really very helpful. It might be noted that the lexicon has entries for [BREACH-v] and [BREACH_OF_CONTRACT]. These are the two breach concepts it was necessary to include in our lexicon because of the content of the kb. There are other types of breach. They are not excluded here, merely not ‘known’, not in this kb.

It would be possible to do an intersection of the sets of arguments in which both [DAMAGES] and [BREACH_OF_CONTRACT] appear, a technique similar to a Boolean search with ‘and’. If that were done, it would be efficient to mark the set with the fewest members and check those first. The search results would include some items of interest and others whose coverage is too broad. Instead, markers are passed throughout the network of concepts. We are attempting to match first the names of the frames—that is, the names of the concepts—then the conceptual content, the slots and values of those frames.

In this kb, a match is made in [ARGUMENT: #4], in the case of *Hadley* v. *Baxendale*, using the lambda (λ) expressions at the beginning of the Argument. [BREACH_OF_CONTRACT] is abbreviated to [BREACH] for convenience. The vocabulary used in this representation is slightly different from the one authorized by the lexicon. While we are searching within the *context* of Argument #4, its specialized vocabulary *must*, be used.

[BREACH] in this context *means* [BREACH_OF_CONTRACT]. We go on from there to a complete match of the fetch pattern with the lambda expression defining [BREACH_DAMAGES]. Both are [DAMAGES]<-(AMBG)<-[BREACH], that is, damages following as a consequence of a breach. Once again, our term changes. Now we are looking for [BREACH_DAMAGES]. Now it is possible to find by inference further information previously unavailable to our matcher.

First we find that there are other types of [BREACH_DAMAGES] discussed. They are [NATURAL_DAMAGES], [FORESEEN_DAMAGES] and [GENERAL_DAMAGES]. We are not hoping to match the definitions of these. They are specialized types of damages. When the finds are reported to the user, they supply him with the lines of reasoning along which he may develop arguments. For the present, we lack the factual information to refine the concept of [BREACH_DAMAGES] further.

We still continue, as the good researcher will doubtless want to hear everything the court has to say about these [BREACH_DAMAGES]. He is finding material relevant to his problem and will most likely want to read the full case report himself. But first, he will try to find an argument that is directly on point.

[BREACH_DAMAGES] is included in the other definitions and is also a part of the concepts [ESTIMATE] and [BREACH_TERMS], relating to the control of the damages. These must be searched as well to get the full range of information. Let us assume that the user wants to pursue the line of reasoning in [ARGUMENT: #4] that relates to [NATURAL_DAMAGES] and [FORESEEN_DAMAGES]. Most significantly, he will retrieve the [RULE: #H1], the general rule to be given to the jury in determining damages arising from a breach of contract. The user may go on to peruse the reasoning in the application of that rule within the case of *Hadley* v. *Baxendale*, but note that he has already retrieved, a definition of the essential types of damages the court is likely to consider and the rule that is to be applied in breach of contract cases. He has not had to make his way through a selection of cases on breaches of various kinds of damages cases with tenuous connections to the concepts that interest him, and he can be certain that he has not missed any material on the concepts whose definitions he has selected that is within the kb.

7.4.5.4. Search 10—*Baxendale* v. *London, et al*

The final search again relates to a breach of contract as described in figure 7.12. This is a 'split-level' contract situation. One party, Baxendale, is caught as D in one contract action and then is P in another. The

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Baxendale v. *London, Chatham, and Dover Railway Co.*,
1874, L.R. 10 Q.B. 117.

One, Harding, contracted with P Baxendale, to carry two pictures from London to Paris. P then contracted with another carrier, D, to carry the pictures from London to Calais. During the course of D's performance of his contract, the pictures were damaged due to D's negligence. Harding sued P for damages and for costs and won. P demanded that D pay the damages and the court costs. D willingly gave the damages to P, but refused the costs of the previous court case, which they felt P should not have fought.

Fig. 7.12 Abstract of *Baxendale* v. *LCD*

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same goods are the subject of both actions. The contracts both deal with parts of a single task. Representing the facts brings the challenge of showing the pivotal position of Baxendale. Undoubtedly the questions will have to deal with the problem of whether or not D in the second contract can be placed in the position of D with regard to the first contract, by P of the second action. The representation appears in figure 7.13 below.

In this problem, there is need to go back and forth between two contracts that share a party. Also, for the first time, two contracts share the same context. This makes a tremendous difference in the complexity of the representation. We have two Ps and two Ds in the same context. For the benefit of the reader, I have refrained from so representing the parties to the two actions. It is necessary to show that the problem exists.

Our kb lacks a number of lconcs that would be useful in finding information about this *Baxendale* situation. We have nothing about costs or about subcontracts, for example. However, there are other concepts that may be helpful. The question (7-25) might be asked as follows:

(7-25) ‘‘Is LCD an agent of Baxendale?’’

(7-25)R [BAXENDALE]→(POSS)→[AGENT: LCD]

According to the (DEFN) of [AGENT], a principal authorizes an agent to represent him or act for him. The contract between Baxendale and LCD has to do only with hiring a carrier. There is no agency relationship there, within our definition. We might pursue the matter and look at the case of *Upton* which contains an instance of [AGENT] with a pointer to it from the lconc. However, we have no reason to believe that any further revelations about agency would help.

(7-26) ‘If so, what is their relationship to Harding?’’

(7-26)R if [BAXENDALE]→(POSS)→[AGENT: LCD]
then [AGENT: LCD]→(LINK)→[HARDING]

(LINK) in (7-26)R is the generic specification for an arc. It will be able to match any conrel. Since we have no information about any dealings between Harding and LCD, nor any detail of a relationship, there is nothing to go on for the second question, so far.

(7-27) ‘‘Is there a contractual relationship between LCD and Harding?’’

```
[PROBLEM: [CONTRACT-v: #Q10]–
   (ACTS)→[PARTY: Harding][PARTY: Baxendale]
   (OBJG)→[CONTRACT-n: #Q10]→(CONT)→[TERM:
                  if     [CARRY: #Q10]–
                            (ACTS)→[PARTY: Baxendale]
                            (OBJG)→[PICTURE: {∗}∗x]
                            (LOCS)→[CITY: London]
                            (LOCG)→[CITY: Paris],
                  then   [PAY: #Q10]–
                            (ACTS)→[PARTY: Harding]
                            (DATPOSSG)→[PARTY: Baxendale]
                            (DATPOSSP)→[PRICE: #Q10],.
[CONTRACT-v: #Q11]–
   (ACTS)→[P: Baxendale][D: LCD]
   (OBJG)→[CONTRACT-n: #Q11]→(CONT)→[TERM:
                  if     [CARRY: #Q11]–
                            (ACTS)→[D: LCD]
                            (OBJG)→[PICTURE: {∗}∗x]
                            (LOCS)→[CITY: London]
                            (LOCG)→[CITY: Calais],
                  then   [PAY: #Q11]–
                            (ACTS)→[P: Baxendale]
                            (DATPOSSG)→[D: LCD]
                            (DATPOSSP)→[PRICE: #Q11],.
[CARRY: #Q11]–
   (ACTS)→[D: LCD]
   (OBJG)→[PICTURE: {∗}∗x]
   (LOCS)→[CITY: London]
   (LOCG)→[CITY: Calais].
[DAMAGE: #Q11]–
   (ACTS)→[D: LCD]
   (OBJG)→[PICTURE: {∗}∗x]
   (ACTP)→[NEGLIGENCE: #Q11]
   (AMBG)→[LOSS: #Q10]→(OBJG)→[MONEY: ∗v].
[SUE: #Q10]–
   (ACTS)→[PARTY: Harding]
   (DATPOSSS)→[PARTY: Baxendale]
   (DATPOSSL)→[DAMAGES: #Q10]
                        [COSTS: #Q10].
[WIN: #Q10]–
    (ACTS)→[PARTY: Harding]
    (DATPOSSL)→[DAMAGES: #][COSTS: #]
    (DATPOSSS)→[PARTY: Baxendale].
[SUE: #Q11]–
   (ACTS)→[P: Baxendale]
   (DATPOSSS)→[D: LCD]
   (DATPOSSL)→[DAMAGES: #][COSTS: #].]
```

Fig. 7.13 Representation of *Baxendale* v. *London, Chatham, and Dover Railway Co.*,

(7-27)R [CONTRACT: ?]-
(PARTY)→[LCD]
(PARTY)→[Harding].

An attempt to match here (7-27) returns nothing about a contract existing. We might look at the definition for [CONTRACT] to see if there is a construction we could use to relate LCD to Harding. However, the (DEFN) is replete with terms expressing the essence of an agreement. We have no information at all about any relationship between these two, except that one damaged the other's property.

(7-28) ''Did LCD breach the contract with Harding?''

(7-28)R [BREACH]-
(ACTS)→[LCD]
(OBJG)→[CONTRACT]-
(PARTY)→[HARDING],.

The above question (7-28), results in another failure.

It appears from our representation of the facts in the case that LCD performed the contract with Baxendale as it was written. They did indeed carry the goods from London to Calais. In addition, they damaged the goods. However, our system knows nothing about any duty of care associated with a contract. Although the (DEFN) of [BREACH] does say that a breach may involve doing something as well as not doing something, we have no details as to what specific acts might constitute breach. This example shows how difficult it would be to include the full meaning of a concept like [BREACH], which has both a positive and a negative aspect. As the cases accumulate, so will the [BREACH] acts. It would be futile to attempt a further refined conceptual list, except to categorize, those acts.

(7-29) ''Did Baxendale breach the contract with Harding?''

(7-29)R [BREACH]-
(ACTS)→[BAXENDALE]
(OBJG)→[CONTRACT]-
(PARTY)→[BAXENDALE]
(PARTY)→[HARDING],.

Finally, we cannot tell from the facts whether or not Baxendale breached the Harding agreement. We don't know whether or not the goods reached Paris, and we still don't know whether [DAMAGE] constitutes a [BREACH] in answer to (7-29).

In the actual decision of the case, the two contracts were kept strictly separate. This our representation accomplishes. However, the exception proves the rule. The case on which retrieval falters shows the limits of the system. We are able to distinguish between two interacting contracts. With a little care, we could also show the interrelationship of the contracts. However, it would require more detail than we now have to resolve the questions raised by this complex problem.

CHAPTER 8

Conclusions and afterword

8.1. Significance of the research

The work in the previous chapters has demonstrated that the retrieval of conceptual information from legal text is entirely possible. However, it is highly dependent upon the construction of a conceptual knowledge representation (kr). In our present state of knowledge, a suitable kr for text which is to be used for information retrieval (IR) must be coarse-grained. In this research, the coarse-grained kr is heavily reliant upon Harold Somers's case grammar.

It has been shown that it is possible to retrieve information without being limited to matching combinations of input terms. Answers are relevant, since the kr and the question probes are meaning oriented, dependent on the semantic content of the words rather than on their character string patterns. Relevancy was not judged by user preference, but by the quality of the conceptual match. Our goal has been to find all and only the meaningful text.

Conceptual retrieval of common law cases is possible. Although the texts are written in variant styles with different terminology demonstrating the extreme variability of natural language expression. The technical language has recognizable terms, a commonly agreed-upon vocabulary, but it has little distinctive syntax at this high level of analysis.

An attempt has been made to place the research in a realistic framework; it is modeled on the activity of lawyers and legal researchers in retrieving information. The analysis of the cases is based on the development of their major arguments. It is a natural analysis and leads directly to a method for searching for argument oriented information. Issues are analyzed in terms of the interaction of facts and legal concepts (lconcs). Within the representation of each argument, the facts are separated from the reasons for judgement, making it possible to answer questions about different kinds of issues with a minimum of ambiguity. Open-textured lconcs have been used as centres of clusters of related information. The clusters are allowed to grow naturally as knowledge accumulates, in a multi-dimensional fashion.

The goals set out at the beginning have been satisfied within the limits of the knowledge base (kb). It is possible to answer specific questions, to give simple, factual answers. Sometimes it is possible to identify the relevant legal concept when a fact situation is described. It is clear that this can be done. Adding information to the kr would give greater scope for concept recognition in these contexts. Abstractions can be processed insofar as they can be defined and faithfully represented. The tests using ‘intention’ worked within the limits of the knowledge in the system. Where it was clear that there is a rule for determining what constituted evidence, we were able to recognize the existence of intention where it occurred. Where the law is not clear, or the knowledge not available, for example, with regard to the expression of emotion, the proposed retrieval mechanism would also have some difficulty. In some instances, where it is clear that their conceptual representation is adequate and the question is sufficiently detailed, we can retrieve concepts not explicitly named. Once again, success in all these areas requires a conceptual kr suitable to the domain and the task.

Tests of the retrieval capability were performed using situations from real cases. Simple questions, used to demonstrate pattern matching, were designed to emulate legal reference questions as far as possible.

8.2. Incomplete tasks

The system has a number of significant limitations. First, the kb consists of four cases. Moreover, those four cases fall within a single domain. Although the questions are taken from real cases, the implementation is proposed. A traditional users study, with calculations of recall and precision, based on individual decisions has not been done. We would prefer to demonstrate relevancy less subjectively and concerned about the principles underlying recall and precision. We should like to retrieve all and only the information related to the objects in the questions.

The potential of the Argument structure has not been exploited in the work of retrieval. The route to strong, natural retrieval is to make the necessary relations among appropriate units of information. Analysis of rhetorical reasoning is still the key to finding the correct linkages. At present, the Argument structure affords some control with its characteristic cyclical development from Claim through Reasons resulting in to a conclusion identical to the Claim. In order to fully realize the potential for retrieval, the Arguments must be more precisely honed. It was clear in chapter 7 that some repetition of facts was desirable for clarity. The amount of reasoning power required might be balanced with repetition. The ground work having been laid, it is possible to get on with enhancing the use of these Arguments to augment the retrieval process.

The Arguments have yet to be categorized by type. Classifying them will suggest additional ways of searching for related information. It will as well provide fuller information about their relationships to specific lconcs. The underlying assumption of this project is that decisions in common law cases are in fact made in a limited number of ways, and that pronounced patterns in argument and decision making will emerge after analysis of a suitably large volume of cases.

8.3. Future research

The research described in this dissertation is in the nature of a scouting expedition in new territory. In part, questions which would have arisen using the standard IR test methodology had to be answered. In part, the nature of the experiment did not lend itself to that style of testing. Because this research is exploratory, it has produced additional questions. Only a few of them will be suggested here.

The first problem is the size of the kb. Anyone interested in conceptual retrieval must concern himself with the problem of text analysis. Assuming that we attempt to limit the problem by staying within a single domain, there are still the complications of volume and of language variation. It is significant that it was necessary to reduce the complexity of the lconcs representation repeatedly in order to achieve greater consistency.

The next question that arises is whether or not there is some viable half-way measure between indexing and full textual analysis that would facilitate retrieval. This kr, although hand-crafted, is a compromise in that it is coarse-grained and does not fully represent the text. Valency is the fulcrum. The construction of syntactic templates for various classes of verbs suggests itself as a step toward automatic textual analysis. The syntactic description of each semantic constraint was included with this in mind. Along with syntactic development must come some semantic comprehension. Attention will have to be paid to the semantics of the NPs attaching to the various predicates in the templates.

Still nothing has been said about pragmatics and the difficulties of interpreting individual texts. These are subjects of much research activity currently and available techniques could be applied to legal text in a particularly interesting way. It has been the tradition of the law to interpret the written word in accordance with a number of guiding principles. Application of principles from pragmatics in computational linguistics would be particularly interesting if applied to legal text, especially to common law cases.

Along with the problem of handling larger volumes of text comes the difficulty associated with abstract subject matter. It was stated earlier, in §3.2 that the subject of contracts was chosen as it began very simply and later became more complex. I found in writing the kr that the simplest matters were the most challenging to handle. It is necessary to look into the problem of complex objects for the future. Equitable concepts such as ‘unjust enrichment’ and ‘quasi-contract’ were mentioned in the commentaries of the *Upton* case and so were included in the *Glossary*. However, they were all but impossible to represent meaningfully, when considered in relation to other lconcs used. ‘Unjust enrichment’ and ‘quasi-contract’ were distinctive. It was difficult to integrate their complex and dissociated meanings in the kb. Because there were no more meaty equitable problems to deal with among the cases examined, I left the difficulty there, but it should be examined further.

This is but one aspect of dealing with abstractions. Most krs describe concrete objects. Representing the concept of ‘arch’, even ‘arch’ with many variations, cannot approach the difficulty of dealing with the problem of representing the meaning of ‘justice’ or of ‘reasonably’, or of ‘the ordinary man’, or even of a concept such as ‘local’ as it is used in *Upton*. Also awkward in *Upton* is the expression of the idea that something should ‘not be possible’ when what was apparently meant was that something should not *legally* be possible. If we are to express intricate meanings adequately, we must learn more about abstract expression.

Although the clustering of knowledge about the lconcs is psychologically satisfying, it is an awkward solution in view of the growth potential of any legal text kb. The complexity of the definitions of some lconcs will require segmentation in order to place the pointers. However, I maintain that the basic description of the lconc structure and function is correct. If the lconcs were appropriately handled, the retrieval mechanism could be robust as well as flexible. Associated with the lconc design is the appropriate handling of newly acquired knowledge, updates.

The problem of deciding how close it was possible to stay to the the text without distorting the meaning was with me from beginning to end. The difficulty of staying true to the language varied in intensity. The problem of deciding how close one could stay to the text without distorting meaning persisted throughout the project. Remaining true to the language was a problem that varied in intensity. Usually it varied proportionally to the degree of abstraction of the subject matter. One of the most significant deviations was the restructuring or shuffling of negatives in order to make the propositions represent meaning properly. Another deviation had to do with simplifying the semantics. Expressive natural language sentences when corseted in propositions always leave a considerable amount of living language hanging out. A reader's interpretation would likely be affected by the same phrases that were eliminated as literary, superfluous or repetitious. It would be interesting to try to produce guidelines about limiting the danger of misleading in editing. The problem of what to put in and what to leave out literally haunted this research.

More work must be done on the inadequacies of set representations of mass nouns. Brendan Gillon (1990) and others present possibilities.

Tense has not been adequately handled in this representation, in particular, the use of the future in *Hadley* v. *Baxendale*. It is possible to employ indexicals for future time; however, a brief sortie in that area quickly bogged down. An appropriate analysis even of *some* future time problems, would help.

Categorization of verbs by type and number of attachments is a typical syntactic approach. Insofar as it is possible it helps to regularize representation and increase predictability. No single list appears to have all the answers, although each provides some insights. I have not collected enough information to support any point of view. More verb categorization, especially with regard to the semantics of noun attachments, is being done in many areas.

Psychological verbs have appeared as precocious in their behaviour. A number of very interesting verbs describing cognition or emotion, verbs with variant transitivity fall into the category. Current research focuses on dealing with the experiencer role. Almost by definition, the psychological verb must have an experiencer case. The Somers correlative is dative-psychological-goal. However, the issue of intentionality, particularly in relation to legally significant acts, is obscured if every act of a psychological nature is regarded as involuntary. Some verbs appear to be entirely involuntary, like ‘know’. Others definitely require volitivity or agency, like ‘learn’. Still others express more than one sense, some agentive, some not, for example, ‘want’. If the verb is said to be psychological then in some instances, a subject may be both agent and experiencer, for example, one who learns. The volitional element must be expressed where it is of importance. A number of psychological acts may be regarded as verbs of action or process rather than psychological verbs, or they may be regarded as atypical psychological verbs, nevertheless, the volitive element must be expressed. The experiencer role is regarded as less important here. However, our representation is not accurate in totally ignoring it. Unfortunately, the grid gives us no option that combines the experiencer and the agent, as it gives us no (DATPOSSS) and agent combination. As discussed above the agentive role was always be preferred in case of conflict. Of course the question of intentionality is eminently interesting in analyzing legal text and is related to causality.

Representing possessory issues is another problem that is highlighted in legal text. The designation of property rights always entails an issue of possession. The weakest element of this kr is the representation of the concepts associated with ‘possession’. The Sowa conrel (POSS) for ‘possession’ is a very general concept. Unfortunately, the Somers and Sowa relations were not as expressive as they might have been. The (DATPOSSG) with −dynamic feature marked, expresses the concept of ‘possessor’. There is no representation of a true genitive, if in fact the appropriate expression of the idea in English is through that case. The derivation of the genitive seems to be lost in the mists swirling about the history of the dative case among others. The dative case has clouded a number of syntactic dependency issues for many. It may be that the correct analysis of possessory relations cannot be accomplished by means of case assignments. Like time and space, the semantics of possession may extend beyond the syntactic bounds of case. The Sowa conrel for possession is a very simple, general concept.

In reality, possession is not adequately described as a single faceted concept. In this kr I have followed the now not-uncommon practice of making a branch at the top of the type hierarchy to deal with possession. Note that the differentiation is so marked that the world model is divided into only three categories of entities, physical, mental, and possessory. It is not an idea that commonly occurs on first consideration, but clearly demonstrates how pervasive is our concept of ownership. Understanding the ramifications of our concept of 'property' is fundamental to an analysis of legal text.

Part of the reason for using an Argument schema was to clearly distinguish facts from reasons. Within the Reasons there are a number of fanciful devices of argumentation. Hypothetical examples, various figures of speech, implicit analogies, and comparisons of all kinds occur as well. I isolated them as not factual and allowed them to figure in the matching process under restricted conditions. The solution was expedient; it should not remain unchanged. Developing techniques for handling any of these appropriately in order to make greater use of them in inference would bring intelligent retrieval closer.

The proximate cause of the damages in the breach cases was superficially handled, as indeed was causation throughout. I could not help wondering how *Palsgraff* v. *Long Island Railroad*[1] would have turned out using our limited causal relations. Both Somers's and Sowa's work have relations expressing causation. They are defined in too general terms to allow for distinctions to be made where necessary. The linguistic and legal problems again come together on a single issue. An analysis of the components of causation in legal text with reference to linguistic variation, not disregarding the logical implications for kr, would be another worthwhile subject of study.

Particles, of all the lexical elements, have caused the most trouble. Although some work has been done on them, their behaviour is not yet fully understood. The dramatic affect they have on the meaning of the verbs to which they attach themselves is enough motivation to provoke curiosity and investigation.

One of the most interesting problems the kr brought to light, and one about which I found very little information, was the interpretation of sentential adverbs. When a judge's description of a fact situation begins with 'apparently' we want to know whether we can treat those facts as true at least within the possible world of his reasoning. It may mean, however, that he is setting up a situation which he will counter with a contradictory description a little later on. When a judge says 'certainly', the context implies more than dramatic emphasis. Not only the syntactic position of the words but their dynamic semantics, were

[1](1928) 162 N.E. 99

noticed but uncertainly interpreted. Invariably these adverbs had a bearing on the truth of the following utterances. And sometimes they came in combination! Certainly they are intended to persuade the reader. Whether they are stylistic conceits, or reasoning devices is not clear.

Other modifiers that were particularly difficult to handle conceptually were the descriptors of the consequences in *Hadley* v. *Baxendale*, the consequences that arose ‘naturally’ or ‘according to the usual course of things’. The idea of events arising naturally occurred also in *Upton*, a double occurrence making it even more important to deal with. Nevertheless, a reasonably strong conceptual representation is still a problem.

Recent activity in the use of cgs would of course make it very interesting to look into the automatic analysis of text using some newly developed software. If a simplified parse of cases were undertaken where the discussions involve relatively concrete matters, the results might be rewarding.

8.3.1. Somers’s cases

Somers’s cases have been invaluable. However, the case grid does not solve all problems. It does address some of the major difficulties identified as being related to case, such as the principal dual-role conflicts and the source-goal directional problems. Nevertheless, the grid itself is a rigid structure and one finds oneself forcing NPs into the most appropriate cells in spite of the intuition that none of the available ones quite fit.

The genitive problem seems to be in a class by itself. The dative possessive cases have been used for most genitive and possessory relations, but there are some possessory relations outside their range. Something is missing here. The instances have been identified even though the problem has not been solved. It is not entirely clear that the two rows of dative cases, psychological and possessive, exhaust the uses of what has come to be called ‘dative’. The conrel (POSS) has been used for the fallout.

The objective goal (OBJG) and objective local (OBJL) cases have been exceptionally difficult to apply. The distinguishing characteristic is aspectual. The ‘goal’ is the object of something completed, while the ‘local’ is the object of something ongoing. The (OBJL) undergoes a process. Furthermore, each cell is subdivided by the feature ‘concrete’. Where the NP is –concrete, the goal case designates a final state, while the local case means ‘undergoing’. Where the NP is +concrete, the goal case is factitive and the local means a change-of-state. These last two considerations made what at first appears to be a clear-cut distinction less easy to apply. They appear to be an attempt to accommodate the semantics of the following NPs in the construction of the case-slots. The source of the difficulty is in the nature of complements. Any object of a verb can be said to be undergoing in a sense and it is often quite unclear as to whether an action is completed or whether a change of state occurred within the temporal bound delimited by the predicate’s semantics. Instances were corrected over and over again to make the analysis consistent and to accommodate new insights into the semantics of a given verb and its attachments. In general, the goal cases were used where the event could be limited in effect or duration. Where the verb, as well as could be determined, expressed a state or an ongoing process, the local cases were used. The application is not ideal; it is only reasonable.

The agentive, that is Active, cases work very well. The semantics of initiating objects are well described by the phrases in the grid cells. It was sometimes difficult to make use of the finely differentiated agentive cases comfortably within a coarse-grained representation. In spite of Somers’s arguments, I am not convinced that an object that initiates action but not willfully should be classed in the same category as willful initiators. In addition the objective source case, (OBJS), is to be used for an original state or process undergoing yet another process designated by the verb. It was seldom used.

The cause and effect cases, the ambient source and the active and ambient goal relations, were not differentiated precisely. I interpreted the case descriptions as literally as I could and so applied the analysis. Predicate adjectives and stative verbs took cases as their semantics seemed to require, but the choices were never unquestionable. Somers dealt with these in passing. A sprinkle of pithy examples would have made his intention in defining the cases clearer, certainly to me.

He did, however, include two very powerful relations that could be more finely analyzed. The first, ambient path (AMBP), takes manner or ‘-ly’ adverbs as fillers. The semantics of the manner adverbs are lost. The individual adverbs cannot be interpreted but are lumped together as instruments. The path cases, often instrument cases, indicate that this is *how* an action was done. It would be useful to know a little more about ‘how’.

The other powerful case is the ambient local case (AMBL), which takes a condition as a filler. It was used on occasion, to avoid the problem of placing a conditional within an already complex propositional context. And it was used as if it were the antecedent, and the main clause were the consequent. Note too that the (AMBL) slot is commonly prescriptive. This slot provides a place for constraints. The use was a nice dodge in a tricky place but hardly what Somers must have intended. Nevertheless, the attachment is interesting and his analysis of case relations enabled me to recognize and show an important relationship among sentence components.

8.3.2. Sowa's conceptual graphs

Overall, Sowa's cgs worked better than other notations for the chosen problem. A few limitations are obvious. Complex graphs are unwieldy and occasionally awkward to construct. Context dividers, from the simple period to end a graph to the bracketed propositions and situations, were not as facile in application as one might hope. The system was originally designed for visual accessibility. The linear version, when extended to include large and difficult contexts loses the crispness of the visual model. The comma marking for embedded graphs had been used casually in the examples. Complex graphs do not combine easily within their respective contexts without adjustments.

Constructing graphs for complex sentences was similarly difficult. Embedded clauses and any sentential complement with complex relations proved difficult. Sowa recommends using lambda expressions for the construction of relative clauses, and of course it helps, but the problem of being able to express intricate ideas and to control several related propositions was not solved. Solutions for some problems were contrived using the Somers grid, others grew out of the recognition of a pattern in representational problems. More knowledge about sentence complements could be applied to this problem also to advantage.

As discussed earlier, in §4.3, the conceptual relations (conrels) with which Sowa started us off are most useful, but limited and occasionally imprecise. A detailed description of the Sowa conrels we started with, and of those we finished with, including Somers's cases, appears as the *Catalogue of conceptual relations*, Appendix A.

8.4. The next step

The goal of continuing research is still conceptual retrieval of ideas from law cases. The two problems vying for first place are the need to implement the kr already written and the need to further analyze legal arguments.

A simple implementation of LOG+ using our kb would be a first step. Another interesting project would be to proceed with the representation of arguments, making them suitable for use in inference and simple reasoning. The argument krs should be classed by type and developed so as to show their rhetorical characteristics as we began to do with *Hadley* v. *Baxendale*. The greatest problem is adjusting the level of the kr. Clearly the present kr would have to be refined. For example, although the judges hypotheticals are represented, they are isolated from the facts and they do figure in the reasoning and the evaluation of fact situations. In general, uses of the Reasons should be explored and patterns of rhetorical reasoning in the Arguments exploited for better retrieval.

There is an established body of cg users, and a developing software base as is apparent from the *Proceedings* of the Annual Workshops on Conceptual Graphs. Ultimately we anticipate the user querying the kb in everyday language and having his question symbolized automatically. A responsive interface is expected to be the cornerstone of a successful retrieval system.

The automatic production of kr from text, especially from text in volume, is of course anxiously anticipated. We look forward to attempts to derive cgs from sentences in text of any kind, but are most anxious to see experiments in the analysis of case reports.

8.5. Hope for the future?

It was anticipated at the design stage of the research that the proposed system would aid in rhetorical reasoning, making use of the stored Arguments. As the searcher sought to produce his own, new argument, he could retrieve the arguments of others on similar issues and use or dispose of their reasoning, wholly or in part, as he wished. This part of the work has not been done; however, the underlying structure has been prepared. It has been shown that conceptual retrieval is possible when a suitable kr is available for legal text.

It may be argued that constructing a kr is slow, requires human intervention, and is not possible or at the least is impractical for large-scale implementation. Nevertheless, given the instruments used in this research and the high level of analysis, such work can reasonably be expected to be automatic in the future. We are, after all, not expecting to be able to write language in logic, just yet, but to model conceptual content to effect the retrieval of information. It has been demonstrated that retrieval based on semantic analysis and inference can be perceptive and powerful.

APPENDIX A

Catalogue of conceptual relations (conrels)

above. (ABOV) links [ENTITY: *x*] to [ENTITY: *y*]. ‘‘The definition says that *x* is above *y* if *x* is at a higher place than the place *y*.
relation ABOV(*x*,*y*) **is**
[T: *x*]→(LOC)→[PLACE]→(ATTR)→[HIGH]→(COMP)→[PLACE: *y*].’’ (Sowa 1984, 226)

abut. (ABUT) links [ENTITY: *x*] to [ENTITY: *y*] where *x* adjoins *y* at one end. (~ABUT) appears in Fig. 3.2, the conceptual graph for an arch, and is mentioned in the text without discussion. (Sowa 1984, 71)

accompaniment. (ACCM) ‘‘links [ENTITY: *x*] to [ENTITY: *y*], where *y* is accompanying *x*.
Example: *Ronnie left with Nancy.*
[LEAVE]→(AGNT)→[PERSON: Ronnie]→(ACCM)→[PERSON: Nancy].’’ (Sowa 1984, 415)

action. (ACTN) links a [JUDGE] to an [ACT] where the act indicates the course of action recommended by the judge.
Example: *ATKIN, J.: Appeal allowed.*
[JUDGE: Atkin]→(ACTN)→[ALLOW]→(OBJG)→[APPEAL].

active-goal. (ACTG) links an [ENTITY] or an [ANIMATE] to an [EVENT] where the entity or animate designates the end point of the act. (Somers 1987, 202, 206)
Example: *John is buying a car.*
[PERSON: John]←(ACTG)←[BUY]→(OBJG)→[CAR].

active-local. (ACTL) links an [ANIMATE] to an [EVENT] where the animate is the non-passive patient, or the co-agent of the event. The case is often marked by the preposition ‘with’. (Somers 1987, 203, 206)
Example: *Aronstad rules with the Blue Dragons.*
[ARONSTAD]←(ACTS)←[RULE]→(ACTL)→[BLUE_DRAGON: {*}].

active-path. (ACTP) links an [ENTITY] to an [EVENT] where the entity is the instrument or means by which the event is effected. (Somers 1987, 203, 206)
Example: *A big bang produced the world.*
(PAST)→[[BIG_BANG]←(ACTP)←[PRODUCE]→(OBJG)→[WORLD]]
Note: This case corresponds roughly to the traditional ‘instrument’ case, and to Sowa’s ‘instrument. (INST)’ conceptual relation, *q.v.*

active-source. (ACTS) links an [ENTITY] or an [ANIMATE] to an [EVENT] where the entity or animate is the instigator of the event. (Somers 1987, 202, 206)
The instigator may be an entity.
Example: *An earthquake shatters glass.*
[EARTHQUAKE]←(ACTS)←[SHATTER]→(OBJG)→[GLASS].
Or it may be an animate and intentional. Example: *Adelana distorts reality with her slack tongue.*
[DISTORT]–
(ACTS)→[ADELANA]
(ACTP)→[[TONGUE]→(ATTR)→[SLACK]]

(OBJL)→[REALITY].
Note: This case corresponds roughly to the traditional ‘agent’ case. See also, Sowa’s ‘initiator. (INIT)’, *q.v.*

after. (AFTR) is suggested as an intersentential relation, which can be defined in terms of more primitive relations, as is ‘before. (BFOR)’, *q.v.* (Sowa 1987, 8)

agent. (AGNT) ‘‘links [ACT] to [ANIMATE], where the ANIMATE concept represents the actor of the action.
Example: *Eve bit an apple.*
[PERSON: Eve]←(AGNT)←[BITE]→(OBJ)→[APPLE].’’ (Sowa 1984, 415)
Note: This case corresponds roughly to the traditional ‘agent’ case. Sowa also defines an ‘initiator. (INIT)’ conceptual relation, *q.v.* In this dissertation, agency is expressed by Somers’s active cases.

ambient-goal. (AMBG) links an [EVENT: *x] to an [EVENT: *y] where *y is an intended aim or an unintended consequence of *x. (Somers 1987, 205, 206) The goal may be an intended aim.
Example: *John eats to live.*
[JOHN]←(ACTS)←[EAT]→(AMBG)→[LIVE].
The goal may be an unintended consequence. Example: *The student failed so he left.*
[STUDENT]←[FAIL]→(AMBG)→[LEAVE].
Note: Ambient cases are typically more abstract and distant from the verb than the active and objective cases. (Somers 1987, 205, 206) This case may be compared with Sowa’s conceptual relations ‘consequence. (CNSQ)’ and ‘result. (RSLT)’, *q.v.*

ambient-local. (AMBL) links an [ENTITY] to an [EVENT] where the entity is a condition under which the event occurs. (Somers 1987, 205, 206)
Example: *Upton gives service upon request.*
[GIVE]–
(ACTS)→[UPTON]
(OBJL)→[SERVICE]
(AMBL)→[REQUEST].

ambient-path. (AMBP) links a [PROPERTY] to an [EVENT] where the property describes the way in which the event happens. (Somers 1987, 205, 206)
Example: *Dulcie told Juan the truth, remorselessly.*
[TELL]–
(ACTS)→[DULCIE]
(OBJL)→[TRUTH]
(DATPOSSG)→[JUAN]
(AMBP)→[REMORSELESS].
Note: This case corresponds roughly to Sowa’s conceptual relation, ‘manner. (MANR)’, *q.v.*

ambient-source. (AMBS) links an [ENTITY] to an [EVENT] where the entity designates a reason or abstract cause for the event. (Somers 1987, 205, 206)
Example: *Time flies, spurred by the moments.*
[FLY]–
(ACTS)→[TIME]
(AMBS)→[[SPUR]ACTS)MOMENT: {∗}].
Note: Causation is commonly taken to be a case of instrumentality, rather than of agency. Sowa defined a conceptual relation, ‘cause. (CAUS)’, *q.v.*

argument. (ARG) ‘‘links [FUNCTION] to [DATA], which is input to the function. If the function takes more than one input, the arguments may be distinguished as ARG1, ARG2, ARG3, ... This

relation is used primarily for representing mathematical expressions, not for natural language.
Example: *SQRT(16)=4.*
[NUMBER: 16]←(ARG)←[SQRT]→(RSLT)→[NUMBER: 4].'' (Sowa 1984, 415)

attribute. (ATTR) ''links [ENTITY: *x] to [ENTITY: *y] where *x has an attribute *y.
Example: *The rose is red.* [ROSE: #]→(ATTR)→[RED].'' (Sowa 1984, 415)
Note: That is to say, (ATTR) links [ENTITY: *x] to [ENTITY: *y] where *x has the entity *y as an attribute.

before. (BFOR) links [ENTITY: *x] to [ENTITY: *y] where *y occurs at a point in time later than the point in time of the occurrence of *x. Suggested as an intersentential relation.
''relation BFOR(x,y) **is**
[*x]→(PTIM)→[TIME]→(SUCC)→[TIME]←(PTIM)←[*y].'' (Sowa 1987, 8, 11)

beneficiary. (BENF) ''As an example, consider the sentence
Every employee works for some company.
[EMPLOYEE: ∀]←(AGNT)←[WORK]→(BENF)→[COMPANY].'' (Sowa 1987, 14)
Note: 'Benefactive' is a traditional case that indicates who or what benefits from something. 'Benefit' may mean receiving either a positive or a negative effect. Sowa defined as well, a 'recipient. (RCPT)' conceptual relation, *q.v.*

between. (BETW) ''has three arcs: its first two arcs are linked to the things on either side of the third. The next graph shows a person located between a rock and a hard place.
[PERSON]BETW)–
ROCK]
PLACE]→(ATTR)→[HARD].''
Note: However, the first time (BETW) appears was in Sowa 1984.
Example: ''*A space is between a brick and a brick.*
[SPACE]BETW)–
BRICK]
BRICK].''
(Sowa 1984, 72)

cause. (CAUS) ''links [STATE: *x] to [STATE: *y], where *x has a cause *y.
Example: *If you are wet, it is raining.*
[STATE: [PERSON: You]←(EXPR)←[WET]]→(CAUS)→[STATE: [RAIN]].'' (Sowa 1984, 415-416)
Note: CAUS is an intersentential relation (Sowa 1988, 9).

cause-of-action. (CSACT) links an [ENTITY] to a [CASE] where the entity is the name of the legal action used to initiate the law case.
Example: *Breach of contract is the cause in Snodgrass.*
[SNODGRASS]→(CSACT)→[BREACH_OF_CONTRACT].

characteristic. (CHRC) ''links [ENTITY: *x] to [ENTITY: *y] where *x has a characteristic *y.
Example: *Eubie was 100 years old.*
(PAST)→[PROPOSITION: [PERSON: Eubie]→(CHRC)→[AGE: @100yrs]].''
(Sowa 1984, 416)
Note: A CHRC is an inalienable feature that cannot be taken away without a fundamental change occurring in the entity (Sowa 1984, 111).

child. (CHLD) ''links a [PERSON] to another [PERSON], who is a child of the former.
Example: *Lillian is Katie's mother.* [MOTHER: Lillian]→(CHLD)→[PERSON: Katie].''
(Sowa 1984, 416)

Note: Child is an example of the correct form for the definition of other conceptual relations dealing with familial relationships.

citation. (CITE) links a [NAME] to a [CASE] where the name is an identifying bibliographic citation for the case.
Example: *Weeks* v. *Tybald, (1605) Noy 11; 74 E.R. 982.*
[WEEKS_v._TYBALD]→(CITE)→[[(1605) Noy 11] [74 E.R. 982]].

color. (COLR) links an [ENTITY: **x*] to an [ENTITY: **y*], where **y* is the name of a color.
Example: ‘‘*Colorless green ideas sleep furiously.*
[SLEEP]→(AGNT)→[IDEA]→(COLR)→[GREEN].’’ (Sowa 1984, 90)

comparison. (COMP) links [ENTITY: **x*] to [ENTITY: **y*], where **x* is said to be as or like **y*. Sowa’s only use is in the definition of ‘above (ABOV)’, above.
‘‘**relation** ABOV(*x*,*y*) **is**
[T: **x*]→(LOC)→[PLACE]→(ATTR)→[HIGH]→(COMP)→[PLACE: **y*].’’ (Sowa 1984, 226)

consequence. (CNSQ) is an intersentential relation, which may be defined in terms of more primitive relations (Sowa 1987, 8).
Note: Sowa gives neither a definition of this relation, nor an example of its use. It is not clear how it relates to ‘result. (RSLT)’, *q.v.* The correlative Somers case is ‘ambient-goal. (AMBG)’.

content. (CONT) ‘‘links [ENTITY: **x*] to [ENTITY: **y*], where **x* has content **y*. It may be defined in terms of the relations LOC and PART.
Example: *A baby is in a pen.* [PLAYPEN]→(CONT)→[BABY].’’ (Sowa 1984, 416)
Note: i.e. **x* physically contains **y*.

date. (DATE) links an [ENTITY] to a [TIME], where the time is a calendar date.
Example: *Weeks* v. *Tybald, 1605.* [WEEKS_v._TYBALD]→(DATE)→[1605].

dative-possessive-goal. (DATPOSSG) links an [ENTITY] or an [ANIMATE] to an [EVENT], where the entity or animate is the benefactor of the event. The benefactor may be a recipient of a positive or of a negative affect. (Somers 1987, 205, 206)
Example: *Congress passed the buck to the president.*
[PASS]–
(ACTS)→[CONGRESS]
(DATPOSSL)→[BUCK]
(DATPOSSG)→[PRESIDENT].
Note: This case corresponds roughly to the traditional ‘benefactive’ case, and to Sowa’s ‘beneficiary. (BENF)’ and ‘recipient. (RCPT)’ conceptual relations, *q.v.*

dative-possessive-local. (DATPOSSL) links an [ENTITY] to an [EVENT], where possession of the entity is transferred by the event. (Somers 1987, 205, 206)
Example: *The president takes the buck.*
[PRESIDENT]←(ACTG)←[TAKE]→(DATPOSSL)→[BUCK].

dative-possessive-path. (DATPOSSP) links an [ENTITY] to an [EVENT] where the entity is the medium of exchange or the price of an object transferred by the event. (Somers 1987, 205, 206)
Example: *Solomon buys a wife from Uhuru for twelve cows.*
[BUY]–
(ACTG)→[SOLOMON]
(DATPOSSL)→[WIFE]
(DATPOSSS)→[UHURU]

(DATPOSSP)→[COW: {∗}@12].

dative-possessive-source. (DATPOSSS) links an [ANIMATE] to an [EVENT], where the animate is the original possessor of an entity affected by the event. The animate cannot be the agent of the act. (Somers 1987, 205, 206)
Example: *Eunice copies Unix from the eunuchs.*
[COPY]–
(ACTG)→[EUNICE]
(DATPOSSS)→[EUNUCH: {∗}]
(DATPOSSL)→[UNIX].
Note: Sowa defined a conceptual relation, 'source. (SRCE)', *q.v.*, associated with the preposition, 'from'.

dative-psychological-goal. (DATPSYG) links an [ANIMATE] to a [PSY_EVENT] where the animate is the experiencer of the psychological event, which may be a cognitive, sensory, or perceptual phenomenon. The event may be dynamic or static as a process or a state. The experiencer may not be agentive (Somers 1987 205, 205). The experience may be cognitive, so long as there is no intention, that is agency, on the part of the animate.
Example: *Ed knows German intimately and he learns French avidly.*
[KNOW]–
(DATPSYG)→[PERSON: Ed]
(DATPSYL)→[GERMAN]
(AMBP)→[INTIMATE].
[LEARN]–
(ACTG)→[PERSON: Ed]
(DATPSYL)→[FRENCH]
(AMBP)→[AVID].
The experience may be sensory or perceptual.
Example: *She died disdainfully in solemn silk.*
(PAST)→[[DIE]–
(DATPSYG)→[WOMAN]–
(IN)→[[SILK]→(ATTR)→[SOLEMN]],
(AMBP)→[DISDAIN]].
Note: This case corresponds to the traditional 'experiencer' case, and to Sowa's 'experiencer. (EXPR)' conceptual relation, *q.v.*

dative-psychological-local. (DATPSYL) links an [ENTITY] to a [PSY_EVENT], where the entity is the content of the psychological event or experience. (Somers 1987, 204, 206)
Example: *He never understands good intentions.*
[~[MAN]ACTS)UNDERSTAND]–
(DATPSYL)→[INTENTION: {∗}]–
(ATTR)GOOD],.]

dative-psychological-path. (DATPSYP) links an [ENTITY] to a [PSY_EVENT] where the entity is the medium of the psychological event (Somers 1987, 204, 206)
Example: *Merry Shelley understood the moral of the story.*
[[UNDERSTAND]–
(ACTS)→[PERSON: MerryShelley]
(DATPSYL)→[MORAL]
(DATPSYP)→[STORY]].

dative-psychological-source. (DATPSYS) links an [ENTITY] to a [PSY_EVENT] where the entity is the stimulus that causes the psychological event. With regard to cognition, the stimulus of the experience can be co-referential with the content, the 'dative-psychological-local. (DATPSYL)'

case. (Somers 1987, 204-205, 206)
Example: *Lapinette understands the problem of Canis.*
[LAPINETTE]←(ACTS)←[UNDERSTAND]–
(DATPSYL)→[PROBLEM]
(DATPSYS)→[CANIS].

definition. (DEFN) the relation between a word or phrase and the propositions that define it.
Example: *Bug:—an undesirable (f)law.*
[BUG]→(DEFN)→[[LAW] or [FLAW]]→(CHRC)→[~DESIRABLE].

description. (DSCR) ''the relation between a situation and the propositions that describe it.''
Example: ''*The cat on the mat.*
[SITUATION]→(DSCR)→[PROPOSITION: [CAT]→(ON)→[MAT]].''
(Sowa 1988, 2-7)

destination. (DEST) ''links an [ACT] to an [ENTITY] towards which the action is directed.
Example: *Bob went to Danbury.*
[PERSON: Bob]←(AGNT)←[GO]→(DEST)→[CITY: Danbury].''
(Sowa 1984, 416)
Note: The correlative Somers case is 'locative-goal (LOCG)', *q.v.*

different. (DFFR) ''shows that two concepts refer to different individuals. It can apply to two things of any type.
relation DFFR(*x*,*y*) **is**
[T: **x*] ~[[T: **x*=**y*]] [T: **y*].''
(Sowa 1987, 12)

disposition. (DISP) links a [PARTY] to an [EVENT] where the judicial decision is in favour of the event argued for by the party.
Example: *Plaintiff McGregor recovers.* [RECOVER]→(DISP)→[P: McGregor].

duration. (DUR) ''links a [STATE] to a [TIME-PERIOD] during which the state persists.
Example: *The truck was serviced for 5 hours.*
[TRUCK]←(OBJ)←[SERVICE]→(DUR)→[TIME-PERIOD: @5hrs].''
(Sowa 1984, 416)

equivalent. (EQUIV) links [ENTITY: **x*] to [ENTITY: **y*] where both entities refer to the same object, or to objects of equal value with regard to an aspect of the context. The symbol '=' may also be used.
Example: *The defendant Baxendale is the carrier.*
[D: Baxendale]→(EQUIV)→[CARRIER].

evidence. (EVID) links [PROPOSITION: **x*] to [PROPOSITION: **y*] where **y* bears evidence in relation to **x*.
Example: *The evidence that Jonathan is a female cat is that Jonathan has kittens.*
[PROPOSITION: [CAT: Jonathan]→(ATTR)→[FEMALE]]–
(EVID)→[HAVE]–
(ACTS)→[CAT: Jonathan]
(OBJL)→[KITTEN: {∗}],.

experiencer. (EXPR) ''links a [STATE] to an [ANIMATE] who is experiencing that state.
Example: *Clara is cold.* [PERSON: Clara]←(EXPR)←[COLD].'' (Sowa 1984, 416)
Note: This case corresponds roughly to the traditional 'experiencer' case, and to Somer's case 'dative-psychological-goal. (DATPSYG)' *q.v.*

frequency. (FREQ) ‘‘links an [EVENT] to a set of [TIME]’s at which it occurs.
Example: *Packages are sent on Mondays.*
[PACKAGE: {*}]←(OBJ)←[SEND]→(FREQ)→[MONDAY: {*}].’’
(Sowa 1984, 416)

goal. (GOAL) Sowa gives no definition. The relation appears in a complex graph that illustrates use of anaphora and quantifiers in which it links one embedded graph to the verb ‘try’ in another (Sowa 1987, 26).
Note: In Somers, ‘goal’ is a parameter along which there are six cases.

head. (HEAD) ‘‘This definition says that a LIST is a type of DATA, which is linked via the relation (HEAD) to something of type DATA and via the relation (TAIL) to another LIST. The conceptual relations (HEAD) and (TAIL) have no primitive meaning in the theory of conceptual graphs, but their names were chosen to reflect their use in building list structures.
type LIST(*x*) **is**
[DATA: ∗*x*]–
(HEAD)→[DATA]
(TAIL)→[LIST].’’
(Sowa 1984, 121)
Note: Head is like the *car* function in LISP.

identity. (IDNT) This relation appears only once in Sowa, without definition or discussion. Its full name is not specified. It is used as a part of the prototype for ELEPHANT. It is not clear why the relation ‘name. (NAME)’ would not suffice.
Example: *A nose with the attribute prehensile is identified as a trunk.*
‘‘[NOSE]–
(ATTR)→[PREHENSILE]
(IDNT)→[TRUNK].’’
(Sowa 1984, 136)

includes. (INCL) links an [ENTITY: **x*] to an [ENTITY: **y*] where **y* is included in **x*.
Example: *Argument number 1 includes Claim number 1.*
[ARGUMENT: #1]→(INCL)→[CLAIM: #1].

initiator. (INIT) ‘‘links an [ACT] to an [ANIMATE] who is responsible for initiating it, but who does not perform it directly.
Example: *Tony boiled the potatoes.*
[PERSON: Tony]←(INIT)←[BOIL]→(OBJ)→[POTATO: {*}].’’
(Sowa 1984, 416)
Note: This relation expresses a part of the meaning of the traditional case, ‘agent’.

instrument. (INST) ‘‘links an [ENTITY] to an [ACT] in which the entity is causally involved.
Example: *The key opened the door.*
[KEY: #]←(INST)←[OPEN]→(OBJ)→[DOOR: #].’’ (Sowa 1984, 416)
Note: This is the traditional ‘instrument’ case. Somers’s ‘path’ parameter is a set of six instrumentality cases.

judge. (JUDGE) links a [NAME] to a [CASE] where the name is the appellation of an individual judge who presided during the case.
Example: *Fairgrief* v. *Ellis, McDonald, J. presiding.*
[FAIRGRIEF_v._ELLIS]→(JUDGE)→[McDonald].

judicial-decision. (JD) is a monadic relation that links to a [PROPOSITION] stating the judge’s opinion.
Example: *The judge said that the recipient was neither averred nor declared to whom.*

(JD)→[PROPOSITION: ~[AVER] ~[DECLARE]–
(RCPT)→[PERSON: {*}]].
Note: This relation is a modal operator. It is a model for the formation of modal operators for other kinds of judges as well.

judicial-history. (HIST) links an [EVENT] to a [CASE] where the event is a happening of legal consequence in the judicial history of the case.
Example: *The discovery in the Smith case.*
[SMITH_v._SMITH]→(HIST)→[DISCOVERY].

jurisdiction. (JURIS) links a [COURT] to a [CASE] where the court is the name of the legal jurisdiction in which the case was heard.
Example: *The jurisdiction of the Bronfman trial was Peel County Court.*
[TRIAL: Bronfman]→(JURIS)→[COUNTY_COURT: Peel].

kind. (KIND) ''Allows the type label of one concept to be expressed in the referent field of another concept.
Example: *The elephant Clyde is of type elephant.*
[ELEPHANT: Clyde]→(KIND)→[TYPE: elephant].'' (Sowa 1987, 16)
Note: 'subtype. (SUBT)' is also defined.

level. (LEVEL) links a [NAME] to a [COURT] where the name describes the precise level of the jurisdiction.
Example: *The George case was appealed in the Supreme Court of Canada (SCC).*
[CASE: George]→(LEVEL)→[APPEAL: SCC].

link. (LINK) ''links [T] to [T]. It is used primarily as a primitive in terms of which all other relations can be defined. The relation type AGNT may be defined in terms of a concept type AGENT:
relation AGNT(*x*,*y*) **is**
[ACT: **x*]→(LINK)→[AGENT]→(LINK)→[ANIMATE: **y*].''
(Sowa 1984, 417)

location. (LOC) ''links a [T] to a [PLACE].
Example: *Vehicles arrive at a station.*
[VEHICLE: {*}]←(AGNT)←[ARRIVE]→(LOC)→[STATION].''
(Sowa 1984, 417)
''Spatial relations include the simple location (LOC) as well as more specific ones that correspond to spatial prepositions such as (IN), (ON), and (ABOV).'' (Sowa 1987, 6).
Example: *''A cat is on the mat.*
[CAT]→(ON)→[MAT].'' (Sowa 1988, 2-14)
Note: This case corresponds to the traditional 'locative' case. The locative is represented by Somers as a parameter including four cases. The case most similar to the traditional locative case is 'locative-local (LOCL)' *q.v.*

locative-goal. (LOCG) links a [PLACE] to an [EVENT], where the place is the spatial end, the final destination of the event. (Somers 1987, 202, 206)
Example: *Cunard ships the rat from the old world to the new.*
[SHIP]–
(ACTS)→[CUNARD]
(OBJG)→[RAT]
(LOCS)→[OLD_WORLD]
(LOCG)→[NEW_WORLD].

locative-local. (LOCL) links a [PLACE] to an [EVENT] where the place is a static position at which the

event occurs. (Somers 1987, 202, 206)
Example: *Fire breaks out in The Cat's Pajamas.*
[FIRE]←(ACTS)←[BREAK_OUT]→(LOCL)→[RESTAURANT: The_Cat's_Pajamas].
Note: This case corresponds roughly to the traditional 'locative' case, and to Sowa's conceptual relation, 'locative. (LOC)', *q.v.*

locative-path. (LOCP) links a [PLACE] to an [EVENT] where the place designates a space that is traversed by the event. (Somers 1987, 202, 206)
Example: *Sam threw the watermelon over the fence to Jim.* (Somers 1987, 157)
[THROW]–
(ACTS)→[SAM]
(OBJG)→[WATERMELON]
(LOCP)→[OVER_THE_FENCE]
(RCPT)→[JIM].

locative-source. (LOCS) links a [PLACE] to an [EVENT] where the place is the spatial starting point of the event. (Somers 1987, 202, 206)
Example: *The shuttles go from Cape Canaveral.*
[SHUTTLE: {*}]←(ACTS)←[GO]→(LOCS)→[CAPE_CANAVERAL].
Note: Sowa has defined a conceptual relation, 'source. (SRCE)', *q.v.*

manner. (MANR) ''links an [ACT] to an [ATTRIBUTE].
Example: *The ambulance arrived quickly.*
[AMBULANCE]←(AGNT)←[ARRIVE]→(MANR)→[QUICK].''
(Sowa 1984, 417)
Note: Somers's correlative case is 'ambient-path. (AMBP)' *q.v.*

material. (MATR) ''links an [ACT] to a [SUBSTANCE] used in the process.
Example: *The gun was carved out of soap.*
[GUN]←(RSLT)←[CARVE]→(MATR)→[SOAP].'' (Sowa 1984, 417)
Note: However, it is unclear if MATR would be the correct relation if the sentence were restated as follows, *The soap was carved into a gun.* Furthermore, 'carve' is described as both an 'act' and a 'process'. Elsewhere it appears that Sowa intends 'process' to apply. It appears probable also that he regards 'act' as equivalent to 'verb' as there is no formal specification for the differentiation of verbs, although he is clearly aware that there are different kinds of verbs.

may. (MAY) is a monadic relation that links to a [PROPOSITION] which constitutes a permission.
Example: If Mikey eats his liver, he may go out.
If [PERSON: Mikey]<-(AGNT)←[EATS]→[LIVER]
then (MAY)→[[PERSON: Mikey]←[GO]→(LOC)→[OUT]].

measure. (MEAS) ''links a [DIMENSION] to a [MEASURE] of that dimension.
Example: *The ski is 167cm long.*
[SKI]→(CHRC)→[LENGTH]→(MEAS)→[MEASURE: 167cm].''
Note: By measure contraction (Section 3.3), the MEAS relation can be contracted to form the concept [LENGTH: @167cm.].'' (Sowa 1984, 417)

member. (MEMB) links an individual to a set to which it belongs.
Example: *''The word ''elephant'' is a name of a species whose members are a set of elephants.*
[''elephant'']←(NAME)←[SPECIES]→(MEMB)→ [ELEPHANT: {*}].'' (Sowa 1984, 89)
Note: There is neither a definition nor a discussion of this relation.

method. (METH) ‘‘links an [ACT: **x*] to a [SITUATION: **y*] that shows how the act **x* is accomplished.
Example: *Larry caught the crook with a mighty leap.*
[ACT: [PERSON: Larry=∗*x*]AGNT)CATCH]→(OBJ)→[CROOK]]–
(METH)→[ACT: [PERSON: ∗*x*]AGNT)LEAP]→(MANR)→[MIGHTY]].
(Sowa 1984, 417)
Note: Suggested as an intersentential relation (Sowa 1987, 8).

modality. (MODE) ‘‘is a dyadic relation that links a context to a concept that expresses its modality or likelihood.’’ (Sowa 1987, 7)
Note: No further use or mention of this relation is made. This is apparently a generalized definition allowing for the definition of additional modal operators. Sowa includes ‘necessary. (NECS)’ and ‘possible. (PSBL)’ *q.v.*

name. (NAME) ‘‘links an [ENTITY] to a [WORD], which is a name of the entity.
Example: *Cicero is named Tully.*
[PERSON: Cicero]→(NAME)→[‘‘Tully’’].
Example: *‘‘4’’ and ‘‘IV’’ are names for the same number.*
[‘‘4’’]←(NAME)←[NUMBER]→(NAME)→[‘‘IV’’]. (Sowa 1984, 417).
Example: *The person #3776 named John.*
[PERSON: #3776]→(NAME)→[WORD: ‘‘John’’].’’
(Sowa 1987, 3).
Note: cf. also ‘identity. (IDNT)’.

necessary. (NECS) ‘‘is a monadic relation that links to a [PROPOSITION], which is necessarily true.
Example: *It is necessarily true that a woman is female.*
(NECS)→[PROPOSITION: [WOMAN]→(ATTR)→[FEMALE]].’’
(Sowa 1984, 417)
Note: (NECS) is a modal operator.
In accordance with Sowa 1984, (ATTR) should be (CHRC).

negation. (NEG) ‘‘is a monadic relation that links to a [PROPOSITION], which is asserted to be false.
Example: *Kirby did not eat an apple.*
(NEG)→[PROPOSITION:[PERSON: Kirby]←(AGNT)←[EAT]→(OBJ)→[APPLE]].’’
(Sowa 1984, 418)
Note: May be replaced by ¬ or or by ~ (Sowa 1984, 139). NEG is also a universal quantifier.

object. (OBJ) ‘‘links an [ACT] to an [ENTITY], which is acted upon.
Example: *The cat swallowed the canary.*
[CAT: #]←(AGNT)←[SWALLOW]→(OBJ)→[CANARY: #].’’
(Sowa 1984, 418)
Note: This corresponds to one of the traditional cases. Sowa replaced it in 1987 with ‘patient. (PTNT)’, *q.v.* Somers has an ‘objective’ parameter consisting of four cases, however, the content of the traditional objective case falls into other categories as well, for example, those cases along the ‘goal’ and ‘local’ parameters.

objective-goal. (OBJG) links a [STATE] or an [ENTITY] to an [EVENT] where the state or entity is the end of the event. (Somers 1987, 204, 206) If it is a state, it will be the terminal state in a change of state, an abstraction.
Example: *Lazarus becomes an object of charity.*
[LAZARUS]←(ACTS)←[BECOME]→(OBJG)→[OBJECT_OF_CHARITY]
If an entity, it will be the concrete result of a process, something made, a factitive result.
Example: *Tridel is building a tower.*
[TRIDEL]←(ACTS)←[BUILD]→(OBJG)→[TOWER].

Note: Objective cases are typically passive, tending to be accidental or coincidental. (Somers 1987, 204, 206) Sowa's conceptual relation 'object. (OBJ)' is similar in some respects.

objective-local. (OBJL) links an [ENTITY] to an [EVENT] where the entity is something affected by the event. (Somers 1987, 204, 206) The entity may be undergoing a process or enduring a change of state.
Example: *Man seeks happiness.*
[MAN]←(AGNT)←[SEEK]→(OBJL)→[HAPPINESS].

objective-path. (OBJP) links an [ENTITY] to a [EVENT] where the entity is the passive means that enables the event to take place. (Somers 1987, 204, 206)
Example: *The villain survives by means of a strong will.*
[VILLAIN]←(ACTS)←[SURVIVE]→(OBJP)→[WILL]→(ATTR)→[STRONG].

objective-source. (OBJS) links a [STATE] or a [MATR] to an [EVENT] where the state designates the original state in a change-of-state, an abstraction, and material designates a substance which undergoes some change. (Somers 1987, 203, 206)
Example: *Water becomes ice because of the cold.*
[WATER]←(OBJS)←[BECOME]→(OBJG)→[ICE]→(AMBS)→[COLD].

ought. (OUGHT) is a monadic relation that links to a [PROPOSITION] which constitutes an obligatory duty to obey.
Example: *If Cassandra breaks something, then she ought to repay.*
if [PERSON: Cassandra]←(AGNT)←[BREAK]→(OBJG)→[THING]
then (OUGHT)→[[PERSON: #]←(RCPT)←[REPAY]].

part. (PART) ''links an [ENTITY: **x*] to an [ENTITY: **y*] where **y* is part of **x*.
Example: *A finger is a part of a hand.*
[HAND]→(PART)→[FINGER].''
(Sowa 1984, 418)
Note: '(~PART)' is defined (Sowa 1988, 2-5), as a typical example of a negative relation to serve as a model for the definition of additional negative relations as needed.

party. (PARTY) links [ANIMATE] to an [EVENT] where animate is a party to an event.
Example: *Plaintiff Weeks and Defendant Tybald are parties to the case.*
[CASE]–
  (PARTY)→[P: Weeks]
  (PARTY)→[D: Tybald].

past. (PAST) ''is a monadic relation that links to a [PROPOSITION] that was true at some time preceding the present.
Example: *Judy left.*
(PAST)→[PROPOSITION: [PERSON: Judy]←(AGNT)←[LEAVE]].
Note: Most of the sample sentences in this book are stated in the past tense, but the relation (PAST) is often omitted when it is not important to the discussion. In effect, one could assume that all of the sentences were asserted in one large context to which the relation (PAST) is linked.'' (Sowa 1984, 418)
''*Tense and aspect.* Various relations for tenses and aspects can be defined in terms of the more primitive relations for point in time (PTIM), successor (SUCC), and duration (DUR).'' (Sowa 1987, 7)
''relation PAST(*x*) **is**
    [**x*]→(PTIM)→[TIME]→(SUCC)→[TIME: #now].'' (Sowa 1987, 12)
Note: Sowa does not define a future tense.

path. (PATH) ‘‘links an [ACT] to a set of [PLACE]’s along which the action occurs.
Example. *The pizza was shipped via Albany and Buffalo.*
[PIZZA: #]←(OBJ)←[SHIPMENT]→(PATH) →[CITY: {Albany, Buffalo}].’’
(Sowa 1984, 418)
Note: Somers ‘locative-path (LOCP)’ case *q.v.* corresponds roughly to this relation.

patient. (PTNT) ‘‘The conceptual relation OBJ for *object* has been dropped in favor of PTNT for *patient.*
Example: *Sam thinks that the car is safe.*
[PERSON: Sam]AGNT)THINK]–
(PTNT)→[PROPOSITION: [CAR: #]→(ATTR)→[SAFE]].’’
(Sowa 1987, 7)
Note: ‘Patient’ is one of the traditional cases. The correlative cases in Somers are to be found along the ‘objective’, ‘goal’, and ‘local’ parameters.

point-in-time. (PTIM) ‘‘links [T] to a [TIME] at which it occurs.
Example: *At 5:25 pm, Erin left.*
[TIME: 5:25pm]←(PTIM)←[PROPOSITION:[PERSON: Erin]←(AGNT)←[LEAVE]].’’
(Sowa 1984, 418)

possession. (POSS) ‘‘links an [ANIMATE] to an [ENTITY], which is possessed by the animate being.
Example: *Niurka’s watch stopped.*
[PERSON: Niurka]→(POSS)→[WRISTWATCH]←(OBJ)←[STOP].’’
(Sowa 1984, 418)

possible. (PSBL) ‘‘is a monadic relation that links to a [PROPOSITION], which is possibly true.
Example: *The baby can talk.*
(PSBL)→[PROPOSITION: [BABY: #]←(AGNT)←[TALK]].’’
(Sowa 1984, 418)
Note: One of the modal operators defined by Sowa.

purpose. (PURP) links an [EVENT] to an [ENTITY] where the entity is the reason for the event. Sowa includes the relation without name, definition or discussion. The following example is found in a schema for the concept ‘DEMONSTRATE’, and says that the purpose of the act of demonstrating is a set of demands.
‘‘ [DEMONSTRATE]→(PURP)→[DEMAND: {*}].’’ (Sowa 1984, 262)
Note: It is not clear how this relation is used in comparison with the conceptual relations ‘cause. (CAUS)’ and ‘goal. (GOAL)’. It is possible that Somers’s ‘ambient-source. (AMBS)’ is a correlative case.

quantity. (QTY) ‘‘links a set of [ENTITY: {*}] to a [NUMBER] that indicates the number of entities in that set.
Example: *There are 50 passengers on the bus.*
[BUS: #]←(LOC)←[PASSENGER: {*}]→(QTY)→[NUMBER: 50].
By quantity contraction (Sowa 1984, 117), the QTY relation can be contracted to form the concept [PASSENGER: {*}@50].’’ (Sowa 1984, 418-419)

recipient. (RCPT) ‘‘links an [ACT] to an [ANIMATE], which receives the object or result of the action.
Example: *Diamonds were given to Ruby.*
[DIAMOND: {*}]←(OBJ)←[GIVE]→(RCPT)→[PERSON: Ruby].’’
(Sowa 1984, 419)
Note: Somers’s correlative case is ‘dative-possessive-goal. (DATPOSSG)’ *q.v.*,

result. (RSLT) ‘‘links an [ACT] to an [ENTITY] that is generated by the act.
Example: *Erich built a house.*

[PERSON: Erich]←(AGNT)←[BUILD]→(RSLT)→[HOUSE].''
(Sowa 1984, 419)
Note: It is not clear how this relates to 'consequence. (CNSQ)' *q.v.* In accordance with the example, Somers's correlative case is the factitive sense of 'objective-goal. (OBJG)', *q.v.*

right. (RGHT) links [ENTITY: **x*] to [ENTITY: **y*] where **y* is physically located to the right of **x*. (RGHT) appears in Fig. 3.2, the conceptual graph for an arch, and is mentioned in the context without discussion.
Example: *One brick has another brick to its right.*
[BRICK]→(RGHT)→[BRICK]. (Sowa 1984, 71).

source. (SRCE) ''links an [ACT] to an [ENTITY] from which it originates.
Example: *The pail was carried from the shed.*
[PAIL: #]←(OBJ)←[CARRY]→(SRCE)→[SHED].''
(Sowa 1984, 419)
Note: Somers distinguishes seven cases along his 'source' parameter.

state. (STAT) predicates ''being in a state''. It is also used as the subject of a stative verb, and said by Sowa to be a case, (Sowa 1987, 6).
Example: ''*Sam owns a car.*
[PERSON: Sam]→(STAT)→[OWNS]→(PTNT)→[CAR].''
(Sowa 1987, 8)

statement. (STMT) ''links the relation between a proposition and the conceptual graph that states it. The graph shows a proposition that has a statement that is a conceptual graph that expresses the sentence, *'A cat is on a mat'.*
[PROPOSITION]→(STMT)→[GRAPH: [CAT]→(ON)→[MAT]].''
(Sowa 1988, 2-7)

style-of-cause. (STYLE) links a [NAME] to a [CASE] where the name is the formal designation of the case.
Example: *Case 1 is Weeks* v. *Tybald.*
[CASE: #1]→(STYLE)→[WEEKS_v._TYBALD].

subtype. (SUBT) ''can be used to state that one type is a subtype of another.
Example: *Elephant is a subtype of animal.*
[TYPE: elephant]←(SUBT)←[TYPE: animal].'' (Sowa 1987, 16)
Note: Compare with 'kind. (KIND)'.

successor. (SUCC) ''links a [T] to another [T], which follows the first one.
Example: *After Billy ate the pretzel, he drank some beer.*
[EVENT: [PERSON: Billy=∗*x*]AGNT)EAT]→(OBJ)→[PRETZEL: #]]–
(SUCC)→[EVENT: [PERSON: ∗*x*]AGNT)DRINK]→(OBJ)→[BEER]].''
(Sowa 1984, 419)

support. (SUPP) ''links an [ENTITY: **x*] to another [ENTITY: **y*] where **x* has support **y*.
Example: *The frost is on the pumpkin.*
[FROST]→(SUPP)→[PUMPKIN].'' *[sic]*
(Sowa 1984, 419)
Note: Presumably a physical support is meant.

tail. (TAIL) Like the 'cdr' function in LISP. *Cf* 'head. (HEAD)'.

temporal-goal. (TEMPG) links a [TIME] to an [EVENT] where the time designates the end of the event,

the time ‘until’. (Somers 1987, 204, 206)
Example: *Darlington does not go online until it is safe.*
~[[DARLINGTON]←(ACTS)←[GO_ONLINE]→(TEMPG)→[SAFE]].
Note: Sowa includes a definition for the conceptual relation, ‘until. (UNTL)’ *q.v.*

temporal-local. (TEMPL) links a [TIME] to an [EVENT] where time designates a time when the event occurs. (Somers 1987, 203, 206)
Example: *She strikes when the water boils.*
[WOMAN: #]←(ACTS)←[STRIKE]→(TEMPL)→[[BOIL]→(OBJL)→[WATER]].

temporal-path. (TEMPP) links a [TIME] to an [EVENT] where the time describes the duration of the event. (Somers 1987, 203, 206)
Example: *Felicity’s fantasies flourish in adolescence.*
[FLOURISH]–
(ACTS)→[FANTASY: {∗}]POSS)FELICITY]
(TEMPP)→[ADOLESCENCE].
Note: This case corresponds to the conceptual relation, ‘duration. (DUR)’ *q.v.*

temporal-source. (TEMPS) links a [TIME] to an [EVENT] where the time is the temporal starting point of the event, the time ‘since’. (Somers 1987, 203, 206)
Example: *The year begins at midnight.*
[YEAR: #]←(OBJS)←[BEGIN]→(TEMPS)→[MIDNIGHT].

title. (TITLE) links a [NAME] to a [JUDGE] where the name is the designation for the judge’s judicial rank.
Example: *Green, Master of the Rolls.*
[JUDGE: Green]→(TITLE)→[MR].

type. (TYPE) Sowa gives no definition but illustrates its use by example.. The example says that for all cars, each car has one and only one model.
‘‘[CAR: ∀]→(TYPE)→[MODEL: @1].’’
(Sowa 1987, 32)

until. (UNTL) ‘‘links a STATE to a TIME at which the state ceases to exist.
Example: *The ticket is valid until 1 am.*
[STATE: [TICKET]→(ATTR)→[VALID]]→(UNTL)→[TIME: 1am].’’
(Sowa 1984, 419)
Note: This relation corresponds to Somers’s case ‘temporal-goal (TEMPG)’, *q.v.*

APPENDIX B

Glossary of legal terms

This glossary includes definitions of legal terms used in chapter 3 and throughout the dissertation. The definitions are taken from law dictionaries commonly used in Canadian courts. *Jowitt's* (1977) is a British dictionary, *Black's* (1990) an American, and *The Canadian law dictionary* (CLD 1980) and Yogis's dictionary (Yogis 1983) were published in this country. The definitions have been shortened, that is, only sentences relevant to the domain have been included; and references to cases have been removed.

The purpose of this glossary is to provide the reader with basic definitions, but not necessarily all facets of concepts as interpreted by the courts. For example, the definition of 'arrest' explains the detainment of an accused, but not the details related to the detainee's deprivation of liberties are included.

Some but not all definitions, are represented in the lexicon. The unrepresented definitions have been included for the convenience of the reader.

ACCEPTANCE:— **1.** In its widest sense it is the act of assenting to an offer; in other words the expression of a unity of intention with the person making the offer. There must be **consensus ad idem** *(q.v.)*. The offeree must know of the offer and the offer must be still subsisting. Acceptance may be by words or conduct. The terms of the offer or the circumstances in which it is made may indicate that the offeror does not require notification of acceptance. (Jowitt's 1977) **2.** Compliance by offeree with terms and conditions of offer would constitute an ''acceptance''. (Black's 1990)

AGENCY:—A relationship between two persons, by agreement or otherwise, where one (the agent) may act on behalf of the other (the principal) and bind the principal by words and actions. Relation in which one person acts for or represents another by the latter's authority, either in the relationship of principal and agent, master and servant, or employer or proprietor and independent contractor.

Agency is the fiduciary relationship which results from the manifestation of consent by one person to another that the other shall act on his behalf and subject to his control, and consent by the other so to act. *Restatement, Agency* §1. (Black's 1990)

AGENT:—A person authorized by another (principal) to act for or in place of him. One who represents and acts for another under the contract or relation of agency. One who acts for or in place of another by authority from him; a substitute, a deputy, appointed by principal with power to do the things which principal may do. One who deals not only with things, as does a servant, but with persons, using his own discretion as to means, and frequently establishing contractual relations between his principal and third persons. (Black's 1990)

AGREEMENT:**—**The consent of two or more persons concurring respecting the transmission of some property, rights or benefits with the view of contracting a mutual obligation. (Black's 1990)

APPLY:**—**To put, use or refer, as suitable or relative; to coordinate language with a particular subject-matter. (Black's 1990)

ARGUMENT:**—1.** In reasoning, Locke observes that men ordinarily use four sorts of arguments. The first is to allege the opinions of men whose parts and learning, eminency, power, or some other cause, have gained a name, and settled their reputation in the common esteem, with some kind of authority; this may be called *argumentum ad verecundiam.* The second is to require the adversary to admit what they allege as a proof, or to require a better; this he calls *argumentum ad ignorantiam.* The third is to press a man with the consequences drawn from his own principles, concessions or actions; this is known as *argumentum ad* *hominem.* The fourth is the using of proofs drawn from any of the foundations of knowledge or probability; this he calls *argumentum ad judicium,* and he observes that this is the only one of all four that brings true instruction with it, and advances us in our way to knowledge. (Jowitt's 1977) **2.** An effort to establish belief by a course of reasoning. In rhetoric and logic, an inference drawn from premises, the truth of which is indisputable, or at least highly probable. (Black's 1990) **3.** Persuasion by giving reasons; a connected series of statements intended to establish or subvert a position and to induce belief. Often refers specially to an oral argument in appellate advocacy. (Yogis 1983)

ARREST:**—**To deprive a person of his liberty by legal authority. Taking, under real or assumed authority, custody for the purpose of holding or detaining him to answer a criminal charge or civil demand. (Black's 1990)

AUTHORIZE:—To empower; to give a right or authority to act. To endow with authority or effective legal power, warrant or right. (Black's 1990)

AWARD:—To grant, concede, or adjudge, to give or assign by sentence or judicial adjudication or after careful weighing of the evidence. (Black's 1990)

BARGAIN:— 1. An agreement between two or more persons, intended to be enforceable at law. Bargain and contract express the same legal concept. The term also expresses negotiation over the terms of an agreement. (Yogis 1983) **2.** A mutual undertaking, contract, or agreement. (Black's 1990)

BREACH:—The breaking or violating of a law, right, obligation, engagement or duty, either by commission or omission. (Black's 1990)

BREACH OF CONTRACT:**—**Failure, without legal excuse, to perform any promise which forms the whole or part of a contract. (Black's 1990)

CIRCUMSTANCES:**—**Attendant or accompanying facts, events or conditions. (Black's 1990)

COMMUNICATE:—To bestow, convey, make known, recount, impart; to give by way of information; to talk over; to transmit information. (Black's 1990)

CONSENSUS AD IDEM:—An agreement of parties to the same thing; a meeting of minds. (Black's 1990)

CONSENT:—A concurrence of wills. Voluntarily yielding the will to the proposition of another; acquiescence or compliance therewith. Agreement; approval; permission; the act or result of coming into harmony or accord. (Black's 1990)

CONSIDER:**—**To fix the mind on with a view to careful examination; to examine; to inspect. To deliberate about and ponder over. To entertain or give heed to. (Black's 1990)

CONSIDERATION:**—1.** The consideration in a contract, conveyance, or other legal transaction is an act or promise by which some right, interest, profit or benefit accrues to one party, or by which some forbearance, detriment, or loss, or responsibility is given, suffered, or undertaken by the other and in return for which the party who receives the benefit, or for whom the detriment is suffered, promises or conveys something to the other. (Jowitt's 1977) **2.** Consideration is necessary to support a contract unless the same be under seal. In addition, the consideration should be valuable. A contract founded on an illegal or immoral consideration is void. Consideration also means an act of deliberation. (CLD 1980)

CONSTRUE:—To put together; to arrange or marshal the words of an instrument, statute, regulation, court decision or other legal authority. To ascertain the meaning of language by a process of arrangement, interpretation and inference. (Black's 1990)

CONTEMPLATE:—To view or consider with continued attention; to regard thoughtfully; to have in view as contingent or probable as an end or intention. To ponder, study, to plan, to meditate, to reflect. (Black's 1990)

CONTRACT-n:— **1.** The three essential elements of a simple contract are often said to be offer, acceptance and consideration. In addition, the parties must have the capacity to contract, an intention to create legal relations, and a legal purpose, and the terms of the contract must be sufficiently certain. (Yogis 1983) **2.** A contract is a deliberate engagement between competent parties upon a legal consideration to do or abstain from doing some act. It is essential to the creation of a contract that the parties shall have intended that their agreement shall have legal consequences and be legally enforceable. (CLD 1980)

COVENANT:—An agreement, convention, or promise of two or more parties, by deed in writing, signed, and delivered, by which either of the parties pledges himself to the other that something is either done or shall be done, or shall not be done, or stipulates for the truth of certain facts. (Black's 1990)

DAMAGES:—A pecuniary compensation or indemnity, which may be recovered in the courts by any person who has suffered loss, detriment, or injury, whether to his person, property, or rights, through the unlawful act of omission or negligence of another. (Black's 1990)

DECIDE:—To ''decide'' includes the power and right to deliberate, to weigh the reasons for and against, to see which preponderate, and to be governed by that preponderance. (Black's 1990)

DECISION:—A judgment, decree or order, pronounced by a court in settlement of a controversy submitted to it by way of authoritative answer to the questions raised before it. (Black's 1990)

DEED:—At common law, a *sealed* instrument, containing a contract or covenant, delivered by the party to be bound thereby, and accepted by the party to whom the contract or covenant runs. 2Bl Comm 295. (Black's 1990)

DELAY:—To retard; obstruct; put off; postpone; defer; procrastinate; prolong the time of or before; hinder; interpose obstacles. (Black's 1990)

DEMAND:—The assertion of a legal right; a legal obligation asserted in the courts. (Black's 1990)

DEPRIVE:—To ''deprive permanently'' means to: (a) Take from the owner the possession, use or benefit of his property, without an attempt to restore the same. (Black's 1990)

DIRECT:—To point to; guide; order; command; instruct. To advise; to suggest; request. (Black's 1990)

DISMISS:—To send away; to discharge; to discontinue; to dispose of; to cause to be removed temporarily or permanently; to relieve from duty. (Black's 1990)

ENFORCE:—To put into execution; to cause to take effect. (Black's 1990)

ENTITLE:—In its usual sense, to entitle is to give a right or legal title to. To qualify for; to furnish with proper grounds for seeking or claiming. (Black's 1990)

EQUITY:—Justice administered according to fairness as contrasted with the strictly formulated rules of common law. It is based on a system of rules and principles which originated in England as an alternative to the harsh rules of common law and which were based on what was fair in a particular situation. One sought relief under this system in courts of equity rather than in courts of law. The term ''equity'' denotes the spirit and habit of fairness, justness and right dealing which would regulate the course of men with men. (Black's 1990)

ESTIMATE-n:—A valuing or rating by the mind, without actually measuring, weighing, or the like. A rough or approximate calculation only. (Black's 1990)

EXCEPT:—Best for; only for; not including; other than; to leave out of account or consideration. (Black's 1990)

EXPECT:—To await; to look forward to something intended, promised, or likely to happen. (Black's 1990)

FACT:—A thing done; an action performed or an incident transpiring; an event or circumstance; an actual occurrence; an actual happening in time or space or an event mental or physical; that which has taken place. (Black's 1990)

FORESEEABILITY:—The ability to see or know in advance, *e.g.*, the reasonable anticipation that harm or injury is a likely result from certain acts or omissions. (Black's 1990)

FORESIGHT:—Heedful thought for the future; reasonable anticipation of result of certain acts or omissions. (Black's 1990)

GOOD TITLE:—One free from reasonable doubt, that is, not only a valid title in fact, but one that can again be sold to a reasonable purchaser or mortgaged to a person of reasonable prudence. (Black's 1990)

GOVERN:—To direct and control, rule, or regulate, by authority. (Black's 1990)

IMPLIED:—This word is used in law in contrast to ''express''; *i.e.* where the intention in regard to the subject-matter is not manifested by explicit and direct words, but is gathered by implication or necessary deduction from the circumstances, the general language, or the conduct of the parties. (Black's 1990)

INFORMER:—An undisclosed person who confidentially discloses material information of a law violation. (Black's 1990)

INJURE:—To do harm to, damage, or impair. To hurt or wound, as the person; to impair the soundness of, as health; to damage. (Black's 1990)

INTEND:—To design, resolve, purpose. (Black's 1990)

INTENT:—Design, resolve, or determination with which person acts. Intent refers only to the state of mind with which the act is done or omitted. (Black's 1990)

INTENTION:—Determination to act in a certain way or to do a certain thing. Meaning; will; purpose; design. (Black's 1990).

ISSUE OF FACT:—An issue of fact arises when a fact is maintained by one party and is controverted by the other in the pleadings. (Black's 1990)

ISSUE OF LAW:—An issue of law arises where evidence is undisputed and only one conclusion can be drawn therefrom. (Black's 1990)

JUSTIFIABLE:—Rightful; defensible; warranted or sanctioned by law; that which can be shown to be sustained by law. (Black's 1990)

KNOW:—To have knowledge; to possess information, instruction or wisdom. To perceive or apprehend; to understand. (Black's 1990)

LEGAL:—Conforming to the law; according to law; required or permitted by law; not forbidden or discountenanced by law; good and effectual in law; of or pertaining to the law; lawful. (Black's 1990)

LEGAL DUTY:—An obligation arising from contract of the parties or the operation of the law. (Black's 1990)

LIVE:—To live in a place is to reside there, abide there, to occupy as one's home. (Black's 1990)

LOSE:—To bring to destruction; to ruin; to destroy; to suffer the loss of; to be deprived of; to part with, especially in an accidental or unforeseen manner. (Black's 1990)

LOSS:—Loss is a generic and relative term. It signifies the act of losing or the thing lost; it is not a word of limited, hard and fast meaning and has been held synonymous with, or equivalent to ''damage'', ''damages'', ''deprivation'', ''detriment'', ''injury'', and privation. (Black's 1990)

MARRIAGE PORTION:—Dowry; a sum of money or other property which is given to or settled on a woman on her marriage. (Black's 1990)

MARRIED MAN:—A man who has a wife living and not divorced. (correlative derived from 'married woman', *q.v.*:)

MARRIED WOMAN:—A woman who has a husband living and not divorced. (Black's 1990)

MUTUALITY:—In every agreement the parties must, as regards the principal or essential part of the transaction, intend the same thing; that is, each must know what the other is to do: this is called mutuality of assent. (Jowitt's 1977)

OBLIGATION:—That which a person is bound to do or forbear; any duty imposed by law, promise, contract, relations of society, courtesy, kindness, etc. (Black's 1990)

OBTAIN:—To get hold of by effort; to get possession of; to procure; to acquire, in any way. (Black's 1990)

OFFER:—A proposal to do a thing or pay an amount, usually accompanied by an expected acceptance, counter-offer, return promise or act. (Black's 1990)

ORDER:—A mandate; precept; command or direction authoritatively given; rule or regulation. (Black's 1990)

OWN:—To have a good legal title; to hold as property; to have a legal or rightful title to; to have, to possess. (Black's 1990)

PARTY:—A person concerned or having taken part in any affair, matter, transaction, or proceeding, considered individually. (Black's 1990)

PAY:—To discharge a debt by tender of payment due; to deliver to a creditor the value of a debt, either in money or in goods, for his acceptance. (Black's 1990)

PERFORMANCE:—The fulfillment or accomplishment of a promise, contract, or other obligation according to its terms relieving such person of all further obligation or liability thereunder. (Black's 1990)

PREVENT:—To hinder, frustrate, prohibit, impede, or preclude; to obstruct; to intercept. To stop or intercept the approach, access, or performance of a thing. (Black's 1990)

PRINCIPAL:—The term ‘‘principal’’ describes one who has permitted or directed another (*i.e* agent or servant) to act for his benefit and subject to his direction and control, such that the acts of the agent become binding on the principal. (Black's 1990)

PROMISE:— **1.** An engagement for the performance or non-performance of some particular thing, which may be made either by deed, or without deed, when it is said to be by parol; ‘‘promise’’ is usually applied when the engagement is by parol only, for a promise by deed is technically called a covenant. A promise, not under seal, made voluntarily and without valuable consideration is not binding either at law or in equity. Promises are of two kinds. A true promise is an expression of an intention to do or forbear from some act, made by one person (the promisor) to another (the promisee). Expressions in the form of promises, but reserving an option as to their performance, and illusory promises (*e.g.*, a promise by A to pay B such a sum as A thinks proper), are not true promises. Promises are either express or implied; thus if A requests B to lend him £50, and he does so, a promise by A to repay it is implied. To have a legal effect, a promise must either be under seal, when it forms a covenant *(q.v)*, part of a contract, that is, be made in consideration of something done or to be done in return by the promisee. When that consideration consists of another promise, each party is both a promisor and a promisee, and the contract consists of mutual promises. (Jowitt's 1977) **2.** A declaration that binds the person who makes it, either in honour, or conscience or law, to do or forbear a certain specific act, and that gives the person to whom it is made a right to expect or claim performance of the thing promised. It is an essential element of an **offer** in contract. Act, made by one person to another. Where such a promise is made by deed, it is called a covenant. It necessarily involves an engagement or assurance as to the future. In law, a representation or an expression of intention that creates no engagment or legal obligation is not a true promise. (CLD 1980)

PROVIDE:—To make, procure, or furnish for future use, prepare. To supply; to afford; to contribute. (Black's 1990)

QUANTUM MERUIT:—‘‘As much as deserved’’ and measures recovery under implied contract to pay compensation as reasonable value of services rendered. (Black's 1990)

QUASI-CONTRACT:—An obligation which law creates in absence of agreement; it is involved by courts where there is unjust enrichment. (Black's 1990)

REASON:—An inducement, motive, or ground for action. (Black's 1990)

REBUT:—To defeat, refute, or take away the effect of something. (Black's 1990)

RECEIVE:—To take into possession and control; accept custody of, collect. (Black's 1990)

REMEDY:—The means by which a right is enforced or the violation of a right is prevented, redressed, or compensated. Remedies are of four kinds: (1) by act of the party injured, the principle of which are defense, recaption [the injured party takes back], distress, entry, abatement, and seizure; (2) by operation of law, as in the case of retainer and remitter; (3) by agreement between the parties, *e.g.*, by accord and satisfaction and arbitration; and (4) by judicial remedy, *e.g.*, action or suit. (Black's 1990)

REMOTE DAMAGES:—The unusual and unexpected result, not reasonably to be anticipated from an accidental or unusual combination of circumstances—a result beyond which the negligent party has no control. (Black's 1990)

RENDER:—To give up; to yield; to return; to surrender. Also to pay or perform; used of rents, services, and the like. (Black's 1990)

REPAIR:—To mend, remedy, restore, renovate. To restore to a sound or good state after decay, injury, dilapidation, or partial destruction. (Black's 1990)

REQUEST-v:—To ask for something or for permission or authority to do, see, hear, etc., something to solicit. (Black's 1990)

REQUEST-n:—An asking or petition. The expression of a desire to some person for something to be granted or done; particularly for the payment of a debt or performance of a contract. Also direction or command in law of wills. (Black's 1990)

REWARD:—A recompense or premium offered or bestowed by government or an individual in return for special or extraordinary services to be performed, or for special attainments or achievements, or for some act resulting to the benefit of the public; as a reward for useful inventions, for the discovery and apprehension of criminals, for the restoration of lost property. (Black's 1990)

SPECIAL:—Relating to or designating a species, kind, individual, thing, or sort; designed for a particular purpose; confined to a particular purpose, object, person, or class. Unusual extraordinary. (Black's 1990)

STAND:—To cease from movement or progress; to pause, remain stationary or inactive. (Black's 1990)

SUE:—To commence or to continue legal proceedings for recovery of a right; to proceed with an action, and follow it up to its proper termination; to gain by legal process. (Black's 1990)

TAKE OVER:—To assume control or management of. (Black's 1990)

THINK:—To believe, to consider, to conclude, to esteem; to recollect or call to mind. (Black's 1990)

TITLE:—The means whereby the owner of lands has the just possession of his property. The union of all the elements which constitute ownership. Full, independent and fee ownership. (Black's 1990)

UNDERSTAND:—To know; to apprehend the meaning; to appreciate; as, to understand the nature and effect of an act. To have a full and clear knowledge of; to comprehend. (Black's 1990)

UNJUST:—Contrary to right and justice, or to the enjoyment of his rights by another, to the standards of conduct furnished by the laws. (Black's 1990)

UNJUST ENRICHMENT, DOCTRINE:—General principle that one person should not be permitted unjustly to profit or enrich himself inequitably at the expense of another but should be required to make restitution of or for property or benefits received, retained or appropriated, where it is just and equitable that such restitution be made, and where such action makes no violation or frustration of law or opposition to public policy, either directly or indirectly. (Black's 1990)

APPENDIX C

Lexicon of legal concepts (lconcs)

[ACCEPTANCE]–
(DEFN)→[[HAVE]–
(ACTG)→{[OFFEROR][OFFEREE]}
(OBJL)→[CONSENSUS_AD_IDEM],
[ASSENT_TO] or [AGREE_TO]–
(ACTS)→[OFFEREE]
(OBJG)→[OFFER-n]
(ACTP)→[WORD: {∗}] or [ACT: {∗}],
[INTEND]–
(ACTS)→[OFFEROR][OFFEREE]
(DATPSYL)→[INTENTION_TO_CONTRACT],]
(EQUIV)→[COMPLY_WITH]–
(ACTS)→[OFFEREE]
(OBJG)→[TERM: {∗}]←(PART)←[OFFER],.

[AGENCY]–
(DEFN)→[[RELATION]–
(CHRC)→[FIDUCIARY]
(BETW)←[AGENT]
→[PRINCIPAL]
(ACTP)→[AGREEMENT] or [~[AGREEMENT]],
[[REPRESENT] or [ACT_ON_BEHALF_OF]]–
(ACTS)→[AGENT]
(OBJL)→[PRINCIPAL]
(ACTP)→[AUTHORITY]←(POSS)←[PRINCIPAL],
[(PSBL)→[LEGAL_BIND]–
(ACTS)→[AGENT]
(OBJL)→[PRINCIPAL]
(ACTP)→[WORD: {∗}] or [ACT: {∗}],]
[CONSENT_TO-v]–
(ACTS)→[PRINCIPAL][AGENT]
(OBJG)→[AGENCY],].

[AGENT]–
(DEFN)→[[PERSON: ∗*x*]–
←(ACTS)←[[REPRESENT] or [ACT_FOR]]–
(OBJL)→[PERSON: ∗*y*]
(ACTP)→[AUTHORITY]←(POSS)←[PERSON: ∗*y*]
(OBJP)→[AGENCY] or [[CONTRACT-n]→(CHRC)→[AGENCY]],,]
(EQUIV)→[[DEPUTY] or [SUBSTITUTE]]–
(CHRC)→[AUTHORIZED],.

[AGREE-TO]–
(DEFN)→[[[CONSENT_TO-v] or [ASSENT_TO] or [CONCUR]]–

```
                 (ACTS)→[PERSON: ∗x]
                 (ACTL)→[PERSON: ∗y]
                 (OBJG)→[ACT] or [PROPOSITION]
                 (AMBG)→[AGREEMENT],].

[AGREEMENT]–
   (DEFN)→[[PROMISE-n]→(CHRC)→[MUTUAL]
              [CONSENT_TO-v]–
                 (ACTS)→[PERSON: ∗x]
                 (ACTL)→[PERSON: ∗y]
                 (OBJG)→[PROMISE-n],].

[APPLY_TO]–
   (DEFN)→[[[USE-v] or [REFER_TO]–
                (OBJL)→[THING]
                (AMBP)→[SUITABLE] or [RELATIVE],] or
              [RELATE]→(BETW)→[[WORD: {∗}]→(ATTR)→[DESCRIBE]]
                                 ←[THING]].

[ARREST-v]–
   (DEFN)→[[DETAIN]–
                 (ACTS)→[PERSON: ∗x]–
                              (CHRC)→[AUTHORIZED],
                 (OBJG)→[PERSON: ∗y]
                 (ACTG)→[PROSECUTE].

[AUTHORIZE]–
   (DEFN)→[[GIVE]–
                 (OBJG)→[RIGHT] or [AUTHORITY] or [LEGAL_POWER]
                 (DATPOSSG)→[PERSON]
                 (ACTG)→[ACT-v: {∗}]–
                              (ACTS)→[PERSON: ∗x],,].

[AWARD-v]–
   (DEFN)→[[[GRANT] or [CONCEDE] or [ASSIGN] or [ADJUDGE] or [DETERMINE]]–
                  (ACTS)→[JUDGE]
                  (ACTP)→[WEIGH]→(OBJL)→[EVIDENCE]
                  (OBJG)→[CONTROVERSY],].

[BARGAIN-n]–
   (DEFN)→[[[AGREEMENT] or [CONTRACT-n] or [UNDERTAKING]]–
                  (CHRC)→[MUTUAL]
                  (BETW)→[PARTY: ∗x]
                          ←[PARTY: ∗y],
              [INTEND]–
                (ACTS)→[PARTY: ∗x][PARTY: ∗y]
                (OBJL)→[[AGREEMENT] or [CONTRACT-n] or [UNDERTAKING]]–
                             (CHRC)→[LEGAL_BIND],,].

[BREACH-v]–
   (DEFN)→[[[BREAK] or [VIOLATE]]–
                  (ACTS)→[PERSON]
                  (OBJG)→[LAW] or [RIGHT] or [DUTY] or [OBLIGATION] or
                          [PROMISE] or [AGREEMENT] or [COVENANT] or [ENGAGEMENT]
```

(ACTP)→[ACT-v] or [OMISSION],].

[BREACH_OF_CONTRACT]–
(DEFN)→[[[BREAK] or [~[PERFORM]] or [~[DO]]]–
(ACTS)→[PERSON]
(OBJG)→[CONTRACT-n] or [AGREEMENT]
(AMBL)→[REASON]→(~CHRC)→[LEGAL],].

[CIRCUMSTANCE: {*}]–
(DEFN)→[[FACT: {*}]–
(ACCM)→[ACT-v: {*}] or [EVENT: {*}],].

[COMMUNICATE]–
(EQUIV)→[CONVEY] or [TELL] or [SAY] or [RECOUNT] or [IMPART] or [BESTOW] or
[INFORM] or [MAKE_KNOWN] or [GIVE] or [TRANSFER-v].

[CONSENSUS_AD_IDEM]–
(DEFN)→[[AGREE_TO]–
(ACTS)→[PARTY: *x][PARTY: *y]
(OBJG)→[PROPOSITION],]
(EQUIV)→[PHRASE: ‘‘meeting of minds’’].

[CONSENT-n]–
(DEFN)→[[[CONCURRENCE] or [AGREEMENT]]–
(ACTS)→[PARTY: *x][PARTY: *y], or
[[ACT-n]–
←(ACTG)←[ACCORD]→(ACTS)→{[PARTY: *x][PARTY: *y]},]].

[CONSENT_TO]–
(DEFN)→[[[YIELD] or [COMPLY_WITH] or [ACQUIESCE_TO]]–
(ACTS)→[PARTY: *x]
(OBJG)→[[PROPOSITION]←(DATPOSSS)←[PERSON: *y]]
(AMBP)→[VOLUNTARILY],].

[CONSIDER]–
(DEFN)→[THINK_ABOUT] or [[EXAMINE]→(AMBP)→[CAREFUL]
or [INSPECT] or [CONTEMPLATE] or [DELIBERATE_ABOUT]
or [PONDER_OVER] or [ENTERTAIN] or [GIVE_HEED_TO].

[CONSIDERATION]–
(DEFN)→[[[[ACT-v] or [EVENT]]→(CHRC)→[VALUE]]–
←(DATPOSSL)←[[GIVE] or [LOSE]]–
(ACTS)→[PARTY: *x]
(DATPOSSG)→[PARTY: *y]
(AMBS)→[CONTRACT],,].

[CONSTRUE]–
(DEFN)→[[[PUT_TOGETHER] or [ARRANGE] or [MARSHALL]]–
(DATPSYL)→[[WORD: {*}] or [LANGUAGE]]←(PART)←[LEGAL_INSTRUMENT: *x]
(AMBS)→[[UNDERSTAND] or [ASCERTAIN]]–
(DATPSYL)→[LEGAL_INSTRUMENT: *x],,].

[CONTEMPLATE]–
(DEFN)→[[[CONSIDER] or [REGARD] or [VIEW] or [PONDER] or [STUDY]

or [PLAN] or [MEDITATE] or [REFLECT]]–
(AMBP)→[ATTENTIVE] or [THOUGHTFUL],].

[CONTRACT-v]–
(DEFN)→[[MAKE]–
(ACTS)→[PARTY: ∗*x*]
[PARTY: ∗*y*]
(OBJG)→[CONTRACT-n],
[AGREE_TO]–
(ACTS)→[PARTY: ∗*x*]
[PARTY: ∗*y*]
(OBJG)→[DO] or [~[DO]]–
(OBJG)→[THING],
(ACTG)→[AGREEMENT],
[INTEND]–
(ACTS)→[PARTY: ∗*x*]
[PARTY: ∗*y*]
(OBJG)→[AGREEMENT: ∗]–
(CHRC)→[LEGAL_BIND]
(CHRC)→[ENFORCE],
(ACTP)→[CONSIDERATION] or [SEAL],,].

[CONTRACT-n]–
(PART)→[OFFER][ACCEPTANCE][[CONSIDERATION] or [SEAL]]

[COVENANT]–
(DEFN)→[[[AGREEMENT] or [CONTRACT]]–
(ACTS)→[PARTY: ∗*x*]
(ACTL)→[PARTY: ∗*y*]
(ACTP)→[DEED] or [[ENTITY]→(CHRC)→[WRITTEN]]
(OBJG)→[[[DO]→(OBJG)→[ACT-v: {∗}]] or
[[BE_TRUE]→(OBJL)→[FACT: {∗}]],].

[DAMAGES]–
(DEFN)→[[COMPENSATION] or [INDEMNITY]]–
←(DATPOSSL)←[GET]–
(ACTP)→[COURT]
(ACTG)→[PERSON: ∗*x*]
(AMBS)→[SUFFER]–
(DATPSYG)→[PERSON: ∗*x*]
(DATPSYL)→[INJURY] or [LOSS]
(ACTP)→[PERSON: ∗*y*],,,].

[DECIDE]–
(DEFN)→[[[CONSIDER] or [CONSTRUE]]–
(OBJL)→[REASON: {∗}*x*]→(SUPPORT)→[PROPOSITION: ∗*x*]
[REASON: {∗}*y*]→(~SUPPORT)→[PROPOSITION: ∗*x*]
(AMBS)→[[MAKE] or [DECLARE]]–
(OBJG)→[JUDGEMENT] or [AWARD]
(ACTP)→[WEIGH]–
(OBJG)→[REASONS: {∗}*x*]→(COMP)→[REASON: {∗}*y*],,,].

[DECISION]–
(DEFN)→[[[JUDGEMENT] or [DECREE] or [ANSWER]]–

```
                  ←(OBJG)←[MAKE]–
                                   (ACTS)→[COURT]
                                   (AMBP)→[AUTHORITATIVE]
                                   (AMBL)→[CONTROVERSY],,].

[DEED]–
   (DEFN)→[[DOCUMENT] or [INSTRUMENT]]–
                  (CONT)→[CONTRACT-n] or [COVENANT]
                  (CHRC)→[SIGNED][SEAL]
                  (AMBL)→[DELIVER]–
                              (ACTS)→[OFFEROR]
                              (DATPOSSL)→[CONTRACT-n] or [COVENANT]
                              (DATPOSSG)→[OFFEREE],
                           [ACCEPT]–
                              (ACTG)→[OFFEREE]
                              (DATPOSSL)→[CONTRACT-n] or [COVENANT],,].

[DELAY]–
   (DEFN)→[[[[RETARD] or [OBSTRUCT] or [PUT_OFF] or [POSTPONE] or [DEFER]]–
                    (TEMPG)→[TIME],] or
                 [[[PROCRASTINATE] or [HINDER] or [PROLONG]]–
                    (TEMPP)→[TIME],] or
                  [[MAKE]–
                     (OBJL)→[OBSTACLE: {*}]
                     (TEMPP)→[TIME],]].

[DEMAND]–
   (DEFN)→[[ASSERT]–
                  (OBJG)→[[RIGHT] or [OBLIGATION]]→(CHRC)→[LEGAL]
                  (LOCL)→[COURT],].

[DEPRIVE]–
   (DEFN)→[[TAKE_FROM]–
                  (ACTS)→[PERSON: x]
                  (DATPOSSS)→[PERSON: y]←(DATPOSSL)←[OWN],].

[DIRECT-v]–
   (DEFN)→[POINT_TO] or [GUIDE] or [ORDER] or [COMMAND] or [INSTRUCT]
               [ADVISE] or [SUGGEST] or [REQUEST-v].

[DISMISS]–
   (DEFN)→[DISCHARGE] or [SEND_AWAY] or [DISCONTINUE] or [DISPOSE_OF]
                 or [[REMOVE_FROM]→(OBJG)→[DUTY: {*}]].

[ENFORCE]–
   (DEFN)→[[[MAKE] or [CAUSE]]–
                   (DATPOSSG)→[PERSON]
                   (OBJG)→[[[PERFORM] or [DO] or [~[DO]]]–
                                 (OBJG)→[[OBLIGATION] or [CONTRACT-n] or [LEGAL_DUTY]],
                   (ACTP)→[LAW]].

[ENTITLE]–
   (DEFN)→[[GIVE]–
                  (DATPOSSG)→[PERSON: {*}]
```

(DATPOSSL)→[[RIGHT] or [TITLE]]–
(CHRC)→[LEGAL],,].

[EQUITY]–
(DEFN)→[[JURISPRUDENCE][~[COMMON_LAW]]–
(CHRC)→[FAIR]
(CHRC)→[JUST]
(CHRC)→[RIGHT]
(PART)→[RULE_OF_EQUITY: {∗}]
(ACTS)→[COURT_OF_EQUITY: {∗}],].

[ESTIMATE-n]–
(DEFN)→[[[DECISION] or [JUDGEMENT]]–
(DATPSYP)→[CONSIDER]–
(DATPSYL)→[VALUE] or [QUALITY]
(OBJP)→[MEASURE: {∗}~],,].

[EXCEPT]–
(DEFN)→[[[~[INCLUDE]] or [~[CONSIDER]]]–
(OBJG)→[EVENT]].

[EXPECT]–
(DEFN)→[[[AWAIT] or [LOOK_FORWARD_TO] or [ANTICIPATE] or [WAIT_FOR]]–
(DATPSYL)→[EVENT]–
(ATTR)→[INTEND] or [[HAPPEN]→(AMBP)→[LIKELY]],
(AMBS)→[PROMISE],].

[FACT]–
(DEFN)→[EVENT] or [CIRCUMSTANCE] or [OCCURRENCE] or
[HAPPENING] or [GROUND] or [SURROUNDING] or [ACT-v].

[FORESEEABILITY]–
(DEFN)→[[[EXPECT] or [ANTICIPATE] or [KNOW] or [THINK]]–
(TEMPL)→[TIME: foresee]
(DATPSYL)→[EVENT: {∗}]–
(CHRC)→[INJURE] or [HARM]
(TEMPL)→[TIME: event-]>[TIME: foresee+],
(AMBS)→[[ACT: {∗}] or [OMISSION: {∗}]]–
(LOCL)→[TIME: foresee],,,].

[GOOD_TITLE]–
(DEFN)→[[TITLE: ∗*x*]–
(CHRC)→[VALID]
(CHRC)→[LEGAL]
(CHRC)→[(MAY)→[[SELL] or [MORTGAGE]]–
(ACTS)→[PERSON]→(ATTR)→[REASONABLE]
(OBJG)→[TITLE: ∗*x*]
(AMBP)→[LEGAL],,].

[GOVERN]–
(DEFN)→[[[DIRECT] or [CONTROL] or [RULE] or [REGULATE]]–
(ACTP)→[AUTHORITY],].

[IMPLIED]–

(DEFN)→[[COMMUNICATE]–
(ACTS)→[PERSON: ∗*x*]
(DATPOSSG)→[PERSON: ∗*y*]
(OBJG)→[PROPOSITION] or [INTENTION] or [EXPRESSION]
(AMBP)→[~[CLEAR]] or [~[EXPRESS]],
[UNDERSTAND]–
(DATPSYG)→[PERSON: ∗*y*]
(DATPSYL)→[PROPOSITION] or [INTENTION]
(OBJS)→[CIRCUMSTANCE: {∗}] or
[WORD: {∗}] or [ACT-v: {∗}]
(ACTP)→[IMPLICATION] or [DEDUCTION] or [LANGUAGE],].

[INFORMER]–
(DEFN)→[[PERSON]→(ATTR)→[~DISCLOSE]–
←(ACTS)←[DISCLOSE]–
(AMBP)→[CONFIDENTIAL]
(OBJG)→[INFORMATION]–
(OBJL)→[CRIME],,,].

[INJURE]–
(DEFN)→[[[HURT] or [DAMAGE] or [WOUND] or [HARM]]–
(OBJG)→[PERSON: ∗*x*],
[PERSON: ∗*x*]=[VICTIM]].

[INTEND]–
(DEFN)→[DESIGN] or [RESOLVE] or [PURPOSE].

[INTENT]–
(DEFN)→[[[DESIGN] or [RESOLVE] or
[PURPOSE] or [DETERMINATION] or [GOAL]]–
(DATPOSSG)→[PERSON: ∗*x*]
(TEMPL)→[ACT]→(ACTS)→[PERSON: ∗*x*],
[(EQUIV)→[STATE_OF_MIND]–
(DATPSYG)→[PERSON: ∗*x*]
(TEMPL)→[ACT]←(ACTS)←[PERSON: ∗*x*],]].

[INTENTION]–
(DEFN)→[[[MEANING] or [WILL] or [PURPOSE] or [DESIGN] or
[DETERMINATION_TO]]–
(DATPSYL)→[DO]–
(OBJG)→[ACT-v]
(AMBP)→[MANNER: ∗*x*],,].

[INTENTION_TO_CONTRACT]–
(DEFN)→[[INTEND]–
(ACTS)→[PERSON: ∗*x*]
(DATPSYL)→[CONTRACT-v]
(ACTL)→[PERSON: ∗*y*]
(AMBG)→[LEGAL_BIND]–
(OBJL)→[PERSON: ∗*x*][PERSON: ∗*y*],,].

[ISSUE]–
(DEFN)→[[EVENT: ∗*x*]–
←(INCL)←[ARGUMENT]

```
          (CONT)→[FACT] or [[CONCEPT]→(CHRC)→[LEGAL]],
        [ASSERT]–
          (ACTS)→[PARTY: *x]
          (OBJG)→[PROPOSITION: *p]→(DSCR)→[SITUATION: *s],
        [~AGREE_TO]–
          (ACTS)→[PARTY: *y]
          (OBJG)→[PROPOSITION: *q]→(DSCR)→[SITUATION: *s],]].

[JUSTIFIABLE]–
  (DEFN)→[[RIGHT] or [DEFENSIBLE] or [LEGAL] or [WARRANTED] or [SANCTIONED]
          or [SUSTAINED]]→(ACTP)→[LAW].

[KNOW]–
  (DEFN)→[[[HAVE]→(DATPOSSL)→[KNOWLEDGE]] or
          [[POSSESS]→(DATPOSSL)→[[INFORMATION] or [INSTRUCTION] or [WISDOM]]]
          or [PERCEIVE] or [APPREHEND] or [UNDERSTAND]].

[LEGAL]–
  (EQUIV)→[[GOOD] or [EFFECTUAL]]→(ACTP)→[LAW] or
  (EQUIV)→[CONFORM_TO]→(OBJL)→[LAW] or
  (EQUIV)→[[REQUIRE] or [PERMIT]]→(ACTP)→[LAW] or
  (EQUIV)→[~[FORBID] or [DISCOUNTENANCE]]→(ACTP)→[LAW].

[LEGAL_BIND]–
  (DEFN)→[[ARISE]–
            (OBJL)→[OBLIGATION]
            (ACTP)→[CONTRACT-n] or [LAW]].

[LEGAL_DUTY]–
  (DEFN)→[[OBLIGATION]←(OBJL)←[ARISE]–
                                (ACTP)→[CONTRACT] or
                                       [LAW],].

[LIVE]–
  (DEFN)→[[[RESIDE] or [ABIDE]]–
             (LOCL)→[PLACE: *x], or
          [HAVE]–
            (DATPOSSL)→[HOME]
            (LOCL)→[PLACE: *x], or
          [OCCUPY]–
            (ACTS)→[PERSON]
            (OBJL)→[PLACE: *x]→(COMP)→[HOME],].

[LOSE]–
  (DEFN)→[[DESTROY] or [RUIN] or [PART_WITH] or [BE_DEPRIVED_OF] or
          [~[HAVE] or [[SUFFER]→(OBJL)→[LOSS]]–
            (OBJG)→[THING]
            (AMBP)→[ACCIDENTAL] or [UNFORESEEN],].

[LOSS]–
  (DEFN)→[THING]←(OBJG)←[LOSE]
  (EQUIV)→[DAMAGE] or [DAMAGE: {*}] or [DAMAGES] or [DEPRIVATION] or
          [DETRIMENT] or [INJURY] or [PRIVATION].
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[MARRIAGE_PORTION]–
   (DEFN)→[[[MONEY] or [PROPERTY]]–
                  ←(DATPOSSL)←[[GIVE] or [SETTLE_ON]]–
                                      (DATPOSSG)→[WOMAN]
                                      (TEMPL)→[TIME: marry-],,]
   (EQUIV)→[DOWRY].

[MARRIED_WOMAN]–
   (DEFN)→[[WOMAN]←(ACTG)←[HAVE]]–
                 (DATPOSSL)→[HUSBAND]–
                                 (CHRC)→[LIVING]
                                 (CHRC)→[~DIVORCED],,].

[MERE_PUFF]–
   (DEFN)→[[STATEMENT]–
                (CHRC)→[VAGUE] or [~PRECISE] or [IMPRECISE]
              [OFFER-n]–
                (CHRC)→[PUTATIVE],
              [OFFER-v]–
                (AMBP)→[~SERIOUS],].

[MUTUAL]–
   (DEFN)→[[GIVE]–
                (ACTS)→[PARTY: *x]
                (DATPOSSG)→[PARTY: *y]
                (DATPOSSL)→[THING: *a],
              [GIVE]–
                (ACTS)→[PARTY: *y]
                (DATPOSSG)→[PARTY: *x]
                (DATPOSSL)→[THING: *b],].

[MUTUALITY]–
   (DEFN)→[[PROPOSITION]–
                ←(OBJG)←[[INTEND][AGREE_TO]]–
                               (ACTS)→[PARTY: *x]
                               (ACTL)→[PARTY: *y]
                               (TEMPL)→[CONTRACT-v],,].

[OBLIGATION]–
   (DEFN)→[[[LEGAL_BIND] or [OBLIGE]]–
                (ACTP)→[LAW] or [CONTRACT-n] or [COVENANT] or [AGREEMENT]
                (OBJG)→[[DO] or [~[DO]]]–
                             (OBJG)→[ACT-n],,].

[OBTAIN]–
   (DEFN)→[[[GET] or [PROCURE] or [ACQUIRE] or
              [GAIN]]–
                (DATPOSSL)→[THING],].

[OFFER-v]–
   (DEFN)→[[AUTHORIZE]–
                (ACTS)→[PERSON: *x]
                (DATPOSSP)→[OFFER-n: *o]
                (DATPOSSG)→[PERSON: *y]
```

(OBJG)→[MAKE]–
(ACTS)→[PERSON: ∗*y*]
(OBJG)→[CONTRACT-n] or [OBLIGATION]
(ACTP)→[ACCEPTANCE]→(OBJG)→[OFFER-n: ∗*o*],,].

[OFFER-n]–
(DEFN)→[[PROMISE-n]→(CONT)→[TERM:
(DATPOSSL)→[[DO] or [~[DO]]→(OBJG)→[ACT]]
or [[PAY]→(DATPOSSL)→[MONEY]]
(DATPOSSG)→[PERSON]
(ACCM)→[INTENTION_TO_CONTRACT]
[EXPECT]→(OBJG)→[ACCEPTANCE]
(AMBP)→[SERIOUS]
(ACTG)→[CONTRACT-v]]].

[OFFEREE]–
(DEFN)→[PERSON]←(DATPOSSG)←[MAKE]→(OBJG)→[OFFER-n].

[OFFEROR]–
(DEFN)→[PERSON]←(ACTS)←[MAKE]→[OFFER-n].

[ORDER-v]–
(DEFN)→[[[GIVE] or [MAKE]]–
(ACTS)→[PERSON]→(CHRC)→[AUTHORIZE]
(OBJG)→[RULE] or [REGULATION] or [MANDATE] or [PRECEPT] or
[COMMAND] or [DIRECTION],].

[OWN]–
(DEFN)→[[[HAVE]→(DATPOSSG)→[GOOD_TITLE]] or [[TITLE]→(ATTR)→[LEGAL]]
or [[HAVE]→(DATPOSSG)→[PROPERTY]].

[PARTY]–
(DEFN)→[[PERSON: {∗}]–
(ATTR)→[[MAKE] or [TAKE_PART_IN] or [DO] or [ACT-v]]–
(OBJG)→[AFFAIR] or [MATTER] or
[TRANSACTION] or [COVENANT] or
[PROCEEDING] or [CONTRACT] or
[PROMISE] or [AGREEMENT],].

[PAY-v]–
(DEFN)→[[GIVE]–
(DATPOSSL)→[MONEY]→(CHRC)→[OWED]
(DATPOSSG)→[PERSON]→(COMP)→[CREDITOR], or
[[DELIVER]–
(DATPOSSG)→[PERSON]→(COMP)→[CREDITOR]
(DATPOSSL)→[VALUE]→(EQUIV)→[DEBT]
(DATPOSSP)→[MONEY] or [THING: {∗}]
(ACTG)→[ACCEPT]–
(ACTS)→[CREDITOR],,]].

[PERFORMANCE]–
(DEFN)→[[[FULFILL] or [ACCOMPLISH] or [DO] or [ACT-v]]–
(OBJG)→[PROMISE] or [CONTRACT-n] or [OBLIGATION],].

```
[PREVENT]–
  (DEFN)→[[[HINDER] or [FRUSTRATE] or [PROHIBIT] or [IMPEDE] or
           [PRECLUDE] or [OBSTRUCT] or [INTERCEPT]] or
           [STOP] or [INTERCEPT]]–
             (OBJL)→[[APPROACH] or [ACCESS] or [PERFORMANCE]]–
                        (OBJG)→[THING],,].

[PRINCIPAL]–
  (DEFN)→[[PERSON]←(ACTS)←[[EMPLOY] or [CONSTITUTE]]–
                                (OBJG)→[AGENT],
          [PERSON]←(ACTS)←[AUTHORIZE]–
                                (DATPOSSG)→[AGENT]
                                (ACTG)→[PERFORM]→(OBJG)→[ACT: {*}]
                                       [MAKE]→[OBLIGATION: {*}],].

[PROMISE-v]–
  (DEFN)→[[[DECLARE] or [ASSURE] or [COMMUNICATE]]–
             (DATPOSSL)→[INTENTION]–
                           (OBJL)→[[DO] or [~[DO]]]–
                                      (OBJG)→[ACT],,,].

[PROMISE-n]–
  (DEFN)→[[[PROPOSITION] or [STATEMENT] or [EXPRESSION]]–
             (OBJG)→[INTENTION]–
                       (OBJL)→[[DO] or [~[DO]]]–
                                 (OBJG)→[EVENT]
                                 (ACTP)→[ACT: {*}] or [WORD: {*}],,,].

[PROVIDE]–
  (DEFN)→[PREPARE] or [MAKE] or [HAVE]
          [SUPPLY] or [AFFORD] or [GIVE] or [CONTRIBUTE].

[QUANTUM_MERUIT]–
  (DEFN)→[PHRASE: ''AS MUCH AS DESERVED''] or
          [[PAY-v]–
             (ACTS)→[DEFENDANT]
             (DATPOSSG)→[PLAINTIFF]
             (DATPOSSL)→[COMPENSATION]–
                          (COMP)→[VALUE]→(ATTR)→[REASONABLE]
                          (COMP)→[[[LOSS]→(DATPOSSG)→[P]] or
                                  [[SERVICE]←(OBJG)←[GIVE]←(ACTS)←[P]]]
             (AMBS)→[BREACH],].

[QUASI_CONTRACT-n]–
  (DEFN)→[[GIVE]–
            (ACTS)→[COURT]
            (DATPOSSG)→[PARTY: *x][PARTY: *y]
            (DATPOSSL)→[OBLIGATION: {*}]→(CHRC)→[MUTUAL]
            (AMBL)→[AGREEMENT: ~]
            (AMBS)→[(PSBL)→[UNJUST_ENRICHMENT]],].

[REASON-n]–
  (DEFN)→[[PROPOSITION]←(ACTP)←[JUSTIFY]–
                                 (OBJG)→[ACT-v]–
```

(ACTS)→[JUDGE],,].

[REBUT]–
(DEFN)→[[DEFEAT] or [REFUTE]]→(OBJG)→[PROPOSITION].

[RECEIVE]–
(DEFN)→[[TAKE]–
(DATPOSSL)→[THING],
[ACCEPT]→(DATPOSSL)→[ENTITY]].

[REMEDY]–
(DEFN)→[[EVENT]←(ACTP)←[ENFORCE]–
(OBJL)→[RIGHT]
(AMBP)→[LEGAL], or
[[[PREVENT] or [REDRESS] or [COMPENSATE]]–
(OBJL)→[VIOLATION]–
(OBJG)→[RIGHT]
(AMBP)→[LEGAL],,]].

[RENDER]–
(DEFN)→[[[GIVE_UP] or [YIELD] or [RETURN] or [SURRENDER] or
[PAY] or [PERFORM]]–
(DATPOSSL)→[RENT: {∗}] or [SERVICE: {∗}],].

[REPAIR]–
(DEFN)→[MEND] or [REMEDY] or [RESTORE] or [RENOVATE] or [FIX].

[REQUEST-v]–
(DEFN)→[[ASK_FOR]→(OBJG)→[[THING] or
[[[PERMISSION] or [AUTHORITY]]–
(OBJG)→[DO] or [SEE] or [HEAR],]].

[REQUEST-n]–
(DEFN)→[[EXPRESSION]–
(OBJG)→[[NEED] or [WANT]]–
(DATPOSSG)→[PERSON]
(ACTG)→[[[DO] or [PERFORM]]–
(OBJG)→[OBLIGATION]] or
[[PAY]→(OBJG)→[DEBT]],,,].

[REWARD-v]–
(DEFN)→[[THING]–
(CHRC)→[VALUE]]–
←(DATPOSSP)←[GIVE]–
(DATPOSSL)→[[SERVICE]→(ATTR)→[SPECIAL]] or
[[ARREST-v]→(OBJG)→[CRIMINAL]],,,].

[SPECIAL]–
(DEFN)→[[THING]–
(CHRC)→[~USUAL]
←(OBJG)←[MAKE]–
(AMBL)→[PURPOSE: @1] or [REASON: @1],,].

[STAND]–

(DEFN)→[STOP] or [~[DO]] or [~[MOVE]] or [~ACTIVE] or [IDLE].

[SUE]–
(DEFN)→[[[COMMENCE] or [CONTINUE]]–
(OBJG)→[PROCEEDING: {∗}]→(ATTR)→[LEGAL]
(ACTG)→[RECOVERY]–
(OBJG)→[RIGHT: {∗}],,].

[TAKE_OVER]–
(DEFN)→[[ASSUME]–
(DATPOSSL)→[[CONTROL] or [MANAGEMENT]]→(OBJG)→[ENTITY: {∗}],].

[THINK]–
(DEFN)→[BELIEVE] or [CONSIDER] or [CONCLUDE] or
[ESTEEM] or [CONSTRUE] or
[RECOLLECT] or [CALL_TO_MIND].

[TITLE]–
(DEFN)→[[OWN]–
(OBJL)→[PROPERTY]
(AMBP)→[JUST][LEGAL],]
(EQUIV)→[FEE_SIMPLE].

[UNDERSTAND]–
(DEFN)→[KNOW] or [COMPREHEND] or [APPRECIATE] or
[APPREHEND].

[UNJUST]–
(DEFN)→[[~RIGHT] or [~JUST] or [~LEGAL] or
[[~ENFORCE]←(ACTP)←[LAW]] or
[CONTRARY]–
(OBJL)→[RIGHT: {∗}]←(POSS)←[PERSON: {∗}],].

[UNJUST_ENRICHMENT]–
(DEFN)→[[LOSE]–
(ACTS)→[PARTY: ∗*x*]
(DATPOSSL)→[LOSS: ∗*z*],
[GAIN]–
(DATPOSSG)→[PERSON: ∗*y*] or
(ACTG)→[PERSON: ∗*y*]
(DATPOSSL)→[LOSS: ∗*z*]
(DATPOSSS)→[PERSON: ∗*x*]
(AMBP)→[~LEGAL] or [UNJUST] or [~JUST],].

APPENDIX D

Rules for semantic selection

Key

ADJ = adjective
ADJP = adjective phrase
ADV = adverb
ADVP = adverb phrase
AUX = auxiliary verb
DOUBLE = double noun
INF = infinitive
motion = verb of motion
N = noun
Nabst = abstract noun
Nconc = concrete noun
Ndble = double noun
Nmass = mass noun
NP = noun phrase
NTYP = noun type
P = preposition
Part = particle
Poss = possible
process = process verb type
psych = psychological
PP = prepositional phrase
PPART = past participle
PRPART = present participle
R = required
rpt = repetition required
sens = sensory
SYNT = syntax
V = verb
Vdit = verb, ditransitive
Vi = verb, intransitive
Vt = verb, transitive
VP = verb phrase
VTYP = verb type

RULES

[AGREE_TO]–
(SYNT)→[VP[Vt][Part]]
(VTYP)→[PSYCH_COG: R(ACTS)(OBJG)]
(ACTS)→[PERSON: {+volitive|rpt}]

(OBJG)→[ENTITY]
(ACTP)→[ENTITY]
(ACTG)→[EVENT]
(TEMPL)→[TIME].

[ANXIOUS_FOR] –
(SYNT)→[[ADV][P]]
(VTYP)→[PSYCH_SENS: R(DATPSYG)(DATPSYL)]
(DATPSYG)→[PERSON: -dynamic]
(DATPSYL)→[EVENT].

[APPLY_TO]–
(SYNT)→[VP[Vt][Part]]
(VTYP)→[MOTION: R(OBJL)]
(OBJL)→[ENTITY]
(AMBP)→[MANNER]
(LCONC)→[APPLY_TO].

[ARGUMENT]–
(SYNT)→[NP[N]]
(NTYP)→[ABSTRACT: R(INCL)]
(INCL)→[PROPOSITION].

[ARISE]–
(SYNT)→[VP[Vi]]
(VTYP)→[PROCESS: R(OBJL)]
(OBJL)→[ENTITY: ±concrete]
(AMBL)→[CONDITION].

[ARREST-v]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(OBJG)]
(ACTP)→[ENTITY]
(OBJG)→[PERSON]
(ACTG)→[ENTITY]
(LCONC)→[ARREST-v].

[ARRIVE]–
(SYNT)→[VP[Vi]]
(VTYP)→[MOTION: R(ACTS)(LOCG)]
(ACTS)→[ENTITY: {±volitive|±animate}]
(LOCG)→[PLACE]
(TEMPL)→[TIME].

[AS_BE]–
(OBJL)→[PROPOSITION].

[AVER]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[PERSON: +volitive]
(OBJG)→[PERSON]

[AWARD-n]–

(SYNT)→[NP[N]]
(NTYP)→[CONCRETE: R(DATPOSSG)(DATPOSSL)]
(DATPOSSG)→[PERSON]
(DATPOSSL)→[ENTITY]
(LCONC)→[AWARD-v].

[BREACH]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[ACTS: ±volitive]
(ACTG)→[ENTITY]
(OBJG)→[ENTITY]→(CHRC)→[LEGAL]
(AMBG)→[ENTITY]
(AMBL)→[CONDITION]
(LCONC)→[BREACH-v] [BREACH_OF_CONTRACT].

[BREAK]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[ENTITY: {±volitive|±animate}]
(OBJG)→[ENTITY]
(TEMPL)→[TIME].

[BREAK]–
(SYNT)→[VP[Vi]]
(VTYP)→[PROCESS: R(OBJL)]
(TEMPL)→[TIME].

[BREAK_OUT]–
(SYNT)→[VP[V][Part]]
(VTYP)→[PROCESS: R(ACTS)(LOCL)]
(ACTS)→[ENTITY: {-volitive|-animate}]
(LOCL)→[PLACE]
(TEMPL)→[TIME].

[CARRY]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[ENTITY: {±volitive|±animate}]
(OBJG)→[ENTITY]
(LOCS)→[PLACE]
(LOCG)→[PLACE].

[CLAIM]–
(SYNT)→[NP[N]]
(NTYP)→[ABSTRACT: R(INCL)]
(INCL)→[PROPOSITION].

[COMMUNICATE]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(DATPOSSL)(DATPOSSG)]
(ACTS)→[PERSON: +volitive]
(DATPOSSL)→[PROPOSITION]
(DATPOSSG)→[PERSON]

(LCONC)→[COMMUNICATE].

[CONCERN]–
(SYNT)→[VP[Vdit]]
(VTYP)→[PSYCH_COG: R(ACTS)(DATPSYG)(DATPSYL)]
(ACTS)→[PERSON: +volitive]
(DATPSYG)→[PERSON: +dynamic]
(DATPSYL)→[EVENT]
(TEMPL)→[TIME].

[CONNECT_TO]–
(SYNT)→[VP[Vt]]
(VTYP)→[PROCESS: R(OBJG)]
(OBJL)→[ENTITY].

[CONSENT_TO]–
(SYNT)→[VP[Vt][Part]]
(VTYP)→[PSYCH_COG: R(ACTS)(OBJG)]
(ACTS)→[PERSON: +volitive]
(OBJG)→[EVENT]
(AMBP)→[MANNER: +volitive]
(LCONC)→[CONSENT_TO][CONSENT-n].

[CONSIDER]–
(SYNT)→[VP[Vt]]
(VTYP)→[PSYCH_COG: R(ACTS)(DATPSYL)]
(ACTS)→[PERSON: +volitive]
(DATPSYL)→[PROPOSITION]
(TEMPL)→[TIME]
(AMBP)→[MANNER]
(LCONC)→[CONSIDER].

[CONSTRUE]–
(SYNT)→[VP[Vt]]
(VTYP)→[PSYCH_COG: R(ACTS)(DATPSYL)]
(ACTS)→[PERSON: +volitive]
(DATPSYL)→[PROPOSITION]
(AMBP)→[MANNER]
(AMBS)→[EVENT]
(LCONC)→[CONSTRUE].

[CONTEMPLATE]–
(SYNT)→[VP[Vt]]
(VTYP)→[PSYCH_COG: R(ACTS)(DATPSYL)]
(ACTS)→[PERSON: {+volitive|rpt}]
(DATPSYL)→[PROPOSITION]
(TEMPL)→[TIME]
(AMBP)→[MANNER]
(LCONC)→[CONTEMPLATE].

[CONTINUE]–
(SYNT)→[VP[Vt]
(VTYP)→[MOTION: R(OBJL)]
(OBJL)→[ACT]

(LOCL)→[PLACE]
(TEMPP)→[TIME]
(TEMPG)→[TIME].

[CONTRACT-v]–
(SYNT)→[VP[Vi]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[PERSON: {+volitive|rpt}]
(OBJG)→[CONTRACT-n]
(ACTG)→[ENTITY -animate]=[RESULT]
(LCONC)→[CONTRACT-v].

[CONTRACT-n]–
(SYNT)→[NP[N]]
(NTYP)→[ABSTRACT]
(PARTY)→[PARTY: rpt]
(CONT)→[TERM]
(LCONC)→[CONTRACT-n].

[DECIDE]–
(SYNT)→[VP[Vi]]
(VTYP)→[PSYCH_COG: R(ACTS)]
(ACTS)→[PERSON]
(AMBP)→[MANNER]
(LCONC)→[DECIDE].

[DECLARE]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[PERSON: +volitive]
(OBJG)→[PROPOSITION].

[DEFECTIVE]–
(SYNT)→[VP[V][ADJ]]
(VTYP)→[STATE: R(OBJL)]
(OBJL)→[ENTITY]
(TEMPL)→[TIME]
(AMBS)→[ENTITY]=[REASON].

[DELAY]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(OBJL)]
(ACTS)→[PERSON: ±volitive]
(OBJL)→[EVENT]
(AMBP)→[MANNER]
(AMBG)→[CONSEQUENCE: -volitive]
(AMBS)→[ENTITY]
(LCONC)→[DELAY].

[DELIVER]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(DATPOSSL)]
(ACTS)→[PERSON: +volitive]
(DATPOSSG)→[PERSON]

(DATPOSSL)→[ENTITY]
(LOCS)→[PLACE]
(LOCG)→[PLACE]
(TEMPG)→[TIME]
(TEMPL)→[TIME]
(AMBL)→[CONDITION].

[DEMAND]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(DATPOSSL)]
(ACTS)→[PERSON: +volitive]
(DATPOSSL)→[ENTITY]
(TEMPL)→[TIME]
(LCONC)→[DEMAND].

[DEPRIVE]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(DATPOSSS)(DATPOSSL)]
(ACTS)→[PERSON: +volitive]
(DATPOSSS)→[PERSON]
(DATPOSSL)→[ENTITY].

[DIRECT]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[PERSON: +volitive]
(OBJG)→[PROPOSITION]
(LOCL)→[PLACE]
(LCONC)→[DIRECT-v].

[DISMISS]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[PERSON: +volitive]
(OBJG)→[ENTITY]
(LCONC)→[DISMISS].

[ENTITLE]–
(SYNT)→[VP[Vdit]]
(VTYP)→[PROCESS: R(DATPOSSG)(DATPOSSL)]
(DATPOSSG)→[PERSON: +dynamic]
(DATPOSSL)→[PRIVILEGE]
(DATPOSSP)→[ENTITY: +value]
(AMBS)→[ENTITY]
(LCONC)→[ENTITLE].

[ESTIMATE]–
(SYNT)→[VP[Vt]]
(VTYP)→[PSYCH_COG: R(OBJG)]
(ACTS)→[PERSON: +volitive]
(OBJG)→[ENTITY: +value]
(LCONC)→[ESTIMATE-n].

[EXCEPT]–

(SYNT)→[VP[Vt]]
(VTYP)→[MOTION]
(ACTS)→[ENTITY]
(ACTP)→[EVENT]
(OBJG)→[EVENT]
(LCONC)→[EXCEPT].

[EXPECT]–
(SYNT)→[VP[Vt]]
(VTYP)→[PSYCH_COG: R(DATPSYG)(DATPSYL)]
(DATPSYG)→[PERSON: ±dynamic]
(DATPSYL)→[EVENT]
(AMBS)→[EVENT]=[REASON]
(LCONC)→[EXPECT].

[EXPRESSION]–
(SYNT)→[NP[N]]
(NTYP)→[ABSTRACT: R(OBJL)]
(OBJL)→[EMOTION].

[FARM]–
(LOCL)→[PLACE]

[GET]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTG)(DATPOSSL)]
(ACTG)→[PERSON]
(DATPOSSL)→[ENTITY]
(ACTP)→[ENTITY]
(AMBS)→[EVENT]=[REASON]
(AMBP)→[MANNER].

[GIVE]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(DATPOSSL)]
(ACTS)→[PERSON: +volitive]
(DATPOSSG)→[PERSON: +dynamic]
(DATPOSSL)→[ENTITY]
(TEMPL)→[TIME].

[GO]–
(SYNT)→[VP[Vi]]
(VTYP)→[MOTION: R(ACTS)(LOCG)]
(ACTS)→[PERSON: {+volitive}]
(LOCG)→[PLACE]
(TEMPL)→[TIME].

[GOVERN]–
(SYNT)→[VP[Vt]]
(VTYP)→[PROCESS: R(OBJL)(ACTP)]
(OBJL)→[ENTITY]
(ACTP)→[ENTITY]
(LCONC)→[GOVERN].

[GROUNDS]–
(SYNT)→[NP[N]]
(NTYP)→[ABSTRACT: R(INCL)]
(INCL)→[PROPOSITION].

[GUIDE]–
(SYNT)→[VP[AUX][PPART][Part]]
(VTYP)→[STATE: R(ACTP)(OBJL)]
(ACTP)→[ENTITY]
(OBJL)→[ENTITY].

[HAPPEN]–
(SYNT)→[VP[Vi]]
(VTYP)→[PROCESS: R(ACTS)]
(ACTS)→[EVENT: {-animate| -volitive].

[HAVE]–
(SYNT)→[VP[Vt]]
(VTYP)→[STATE: R(DATPOSSG)(DATPOSSL)]
(DATPOSSG)→[PERSON: -dynamic]
(DATPOSSL)→[ENTITY].

[HYPO]

[INFO]

[INJURE]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[ENTITY: {±volitive|±animate}]
(OBJG)→[PERSON]=[VICTIM]
(AMBP)→[MANNER]
(LCONC)→[INJURE].

[INFORM]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(DATPOSSG)(DATPOSSL)]
(ACTS)→[PERSON: +volitive]
(DATPOSSG)→[ENTITY]
(DATPOSSL)→[PROPOSITION]
(TEMPL)→[TIME].

[INTEND]–
(SYNT)→[VP[Vt]]
(VTYP)→[PSYCH_COG: R(ACTS)(DATPSYL)]
(ACTS)→[PERSON: +volitive|rpt]
(DATPSYL)→[PROPOSITION]
(LCONC)→[INTEND][INTENT][INTENTION].

[INTENTION_TO_CONTRACT]–
(SYNT)→[NP[N][INF [P][Vi]]]
(NTYP)→[ABSTRACT: R(ACTS)]
(ACTS)→[PERSON: {+volitive|rpt}]
(LCONC)→[INTENTION_TO_CONTRACT].

[INTENTION_TO_EXCITE]–
(SYNT)→[NP[N][INF[P][Vt]]]
(NTYP)→[ABSTRACT: R(DATPSYG)]
(DATPSYG)→[PERSON].

[JUSTIFY]–
(SYNT)→[VP[Vt]]
(VTYP)→[PSYCH_COG: R(OBJG)]
(OBJG)→[PROPOSITION]
(AMBS)→[EVENT]=[REASON]
(LCONC)→[JUSTIFIABLE].

[KNOW]–
(SYNT)→[VP[Vt]]
(VTYP)→[PSYCH_COG: R(DATPSYG)(DATPSYL)]
(DATPSYG)→[PERSON: -dynamic]
(DATPSYL)→[PROPOSITION]
(TEMPL)→[TIME]
(TEMPG)→[TIME]
(LCONC)→[KNOW].

[LEGAL_BIND]–
(SYNT)→[VP[Adv][V(dit)]]
(VTYP)→[MOTION: R(ACTP)(OBJL)]
(ACTS)→[AGENT]
(ACTP)→[ENTITY]
(OBJL)→[PERSON]
(AMBS)→[EVENT]=[REASON]
(LCONC)→[LEGAL_BIND].

[LIVE]–
(SYNT)→[VP[Vi]]
(VTYP)→[STATE: R(ACTS)(LOCL)]
(ACTS)→[PERSON: ±volitive]
(LOCL)→[PLACE].

[LOSE]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[PERSON: -volitive]
(OBJG)→[ENTITY]
(TEMPP)→[TIME]
(LCONC)→[LOSE].

[LOSS]–
(SYNT)→[NP[N]]
(NTYP)→[CONCRETE]
(OBJG)→[ENTITY]
(OBJP)→[EVENT]
(AMBS)→[EVENT]
(LCONC)→[LOSS].

[MAKE]–

(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(OBJG)]
(ACTS)→[PERSON: {+volitive|rpt}]
(ACTP)→[ENTITY]
(OBJG)→[ENTITY: {factitive|+concrete}].
(AMBP)→[MANNER]
(AMBL)→[CONDITION].

[MANUFACTURE]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(OBJG)]
(ACTS)→[PERSON: +volitive]
(ACTP)→[ENTITY]
(OBJG)→[ENTITY: {factitive|+concrete}].

[MARRY]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(ACTL)]
(ACTS)→[PERSON: +volitive]
(ACTL)→[PERSON]
(TEMPL)→[TIME].

[OBLIGATION]–
(PARTY)→[PERSON: rpt]
(LCONC)→[OBLIGATION]

[OBTAIN]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTG)(DATPOSSL)]
(ACTG)→[ENTITY: +animate]
(DATPOSSL)→[ENTITY]
(LCONC)→[OBTAIN].

[ORDER-v]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[PERSON: +volitive]
(OBJG)→[ENTITY: {factitive|+concrete}]
(LCONC)→[ORDER-v].

[OWN]–
(SYNT)→[VP[Vt]]
(VTYP)→[STATE: R(DATPOSSG)(DATPOSSL)]
(DATPOSSG)→[PERSON: -dynamic]
(DATPOSSL)→[ENTITY]
(AMBP)→[MANNER]
(LCONC)→[OWN].

[PAY]– why not just DATPOSSP? 2 senses?
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)[(DATPOSSP)or(DATPOSSL)]
(ACTS)→[PERSON: +volitive]
(DATPOSSG)→[PERSON: +dynamic]
(DATPOSSS)→[ENTITY]

(DATPOSSP)→[PRICE]
(DATPOSSL)→[ENTITY]
(LCONC)→[PAY-v].

[PAY_FOR]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)]
(ACTS)→[PERSON: +volitive]
(DATPOSSG)→[PERSON]
(DATPOSSL)→[ENTITY]
(AMBS)→[ENTITY]=[REASON]
(TEMPL)→[TIME].

[PREVENT]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(OBJP)(OBJL)]
(OBJP)→[ACT]
(OBJL)→[ENTITY: {result_state|-concrete}]
(LCONC)→[PREVENT].

[PROMISE-v]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(DATPOSSG)(DATPOSSL)]
(ACTS)→[PERSON: +volitive]
(DATPOSSG)→[PERSON]
(DATPOSSL)→[PROPOSITION]
(AMBG)→[EVENT]
(TEMPL)→[TIME]
(LCONC)→[PROMISE-v].

[PROMISE-n]–
(SYNT)→[NP[N]]
(NTYP)→[ABSTRACT]
(ACTS)→[PERSON: +volitive]
(CONT)→[TERM]
(AMBS)→[ENTITY]=[REASON]
(LCONC)→[PROMISE-n].

[PROVIDE]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(DATPOSSL)]
(ACTS)→[PERSON: +volitive]
(DATPOSSL)→[ENTITY]
(DATPOSSG)→[PERSON]
(TEMPL)→[TIME]
(AMBL)→[CONDITION]
(LCONC)→[PROVIDE].

[PUT_OUT]–
(SYNT)→[VP[Vt][Part]]
(VTYP)→[MOTION: R(OBJG)]
(ACTS)→[PERSON: +volitive]
(OBJG)→[ENTITY: +flammable]
(TEMPP)→[TIME].

[REASONS]–
(SYNT)→[NP[N]]
(NTYP)→[ABSTRACT: R(INCL)]
(INCL)→[PROPOSITION]
(LCONC)→[REASON].

[REBUTTAL]–
(SYNT)→[NP[N]]
(NTYP)→[ABSTRACT: R(INCL)]
(INCL)→[PROPOSITION]
(LCONC)→[REBUT].

[RECEIVE]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(DATPOSSG)(DATPOSSL)]
(DATPOSSG)→[PERSON: {+dynamic|rpt}]
(DATPOSSL)→[ENTITY]
(LCONC)→[RECEIVE].

[REMAIN]–
(SYNT)→[VP[Vi]]
(VTYP)→[STATE: R(ACTS)(LOCL)]
(ACTS)→[PERSON: +volitive]
(LOCL)→[PLACE]
(TEMPP)→[TIME].

[RENDER]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(DATPOSSL)(DATPOSSG)]
(ACTS)→[PERSON: +volitive]
(DATPOSSL)→[ENTITY]
(DATPOSSG)→[PERSON]
(LCONC)→[RENDER].

[REPAIR]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[PERSON: +volitive]
(OBJG)→[ENTITY]
(LCONC)→[REPAIR].

[REPAY]–
(ACTS)→[PERSON]
(DATPOSSG)→[PERSON]
(DATPOSSL)→[ENTITY: +value]

[REQUEST-v]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(DATPOSSL)]
(ACTS)→[PERSON: +volitive]
(ACTP)→[ENTITY]
(DATPOSSG)→[PERSON]
(DATPOSSL)→[EVENT]

(TEMPL)→[TIME]
(AMBP)→[MANNER]
(LCONC)→[REQUEST-v].

[REQUEST-n]–
(SYNT)→[NP[N]]
(NTYP)→[ABSTRACT: R(CONT)]
(CONT)→[PROPOSITION]
(LCONC)→[REQUEST-n].

[RESPOND]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)]
(ACTS)→[PERSON: +volitive].

[RIGHT]–
(CONT)→[PROPOSITION: (MAY)]

[RULE]–
(CONT)→[PROPOSITION]

[SAY]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[PERSON: +volitive]
(OBJG)→[PROPOSITION]
(TEMPL)→[TIME].

[SEEK]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(OBJL)]
(ACTS)→[PERSON: +volitive]
(OBJL)→[ENTITY].

[SEND]–
(ACTS)
(OBJG)
(LOCG)

[SEND]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(DATPOSSG)(DATPOSSL)]
(ACTS)→[PERSON: +volitive]
(ACTP)→[ENTITY]
(DATPOSSL)→[ENTITY]
(DATPOSSG)→[PERSON]
(DATPOSSP)→[ENTITY]
(LOCS)→[PLACE]
(LOCG)→[PLACE]
(AMBL)→[CONDITION]
(ACTG)→[PROPOSITION]
(TEMPL)→[TIME].

[SEND]–

(ACTS)
(OBJG)
(LOCG)

[SERVE_AS]–
(SYNT)→[VP[Vdit][Part]]
(VTYP)→[MOTION: R(ACTS)(OBJS)(OBJL)(ACTG)]
(ACTS)→[ENTITY {±volitive|±animate}]
(OBJG)→[ENTITY]
(ACTG)→[PROPOSITION].

[SERVICE-v]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(DATPOSSG)]
(ACTS)→[PERSON: +volitive]
(DATPOSSG)→[PERSON]
(DATPOSSP)→[ENTITY: +value].

[STAND_IDLE]–
(SYNT)→[VP[Vi][ADV]]
(VTYP)→[STATE: R(OBJL)]
(OBJL)→[ENTITY: -animate]
(TEMPS)→[TIME]
(TEMPG)→[TIME]
(AMBL)→[CONDITION]
(LCONC)→[STAND].

[SUE]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(DATPOSSS)(DATPOSSL)]
(ACTS)→[PERSON: +volitive]
(DATPOSSS)→[PERSON]
(DATPOSSL)→[ENTITY: +value]
(LCONC)→[SUE].

[SUFFICE]–
(AMBG)→[EVENT]

[SUPPOSE]–
(SYNT)→[VP[Vt]]
(VTYP)→[PSYCH_COG: R(ACTS)(DATPSYL)]
(ACTS)→[PERSON: +volitive]
(DATPSYL)→[PROPOSITION]
(AMBP)→[MANNER].

[STATE_OF_MIND]–
(SYNT)→[NP[N][PP[P][N]]]
(NTYP)→[ABSTRACT: R(DATPSYG)]
(DATPSYG)→[PERSON: -dynamic]
(AMBL)→[CONDITION]
(TEMPL)→[TIME].

[SUMMON]–
(SYNT)→[VP[Vt]]

(VTYP)→[MOTION: R(ACTS)(OBJG)]
(ACTS)→[PERSON: +volitive]
(OBJG)→[PERSON]
(AMBP)→[MANNER].

[TAKE]–
(ACTG)→[PERSON]
(OBJL)→[PROPOSITION]

[TAKE_OVER]–
(SYNT)→[VP[Vdit][P]]
(VTYP)→[MOTION: R(ACTG)(DATPOSSL)(DATPOSSS)]
(ACTG)→[PERSON: +animate]
(DATPOSSL)→[EVENT]
(DATPOSSS)→[PERSON]
(LCONC)→[TAKE_OVER].

[TELEPHONE-v]–
(SYNT)→[VP[P][Vt]]
(VTYP)→[MOTION: R(ACTS)]
(ACTS)→[PERSON: +volitive]
(DATPOSSG)→[PERSON]
(LOCG)→[PLACE].

[TELL]–
(SYNT)→[VP[Vdit]]
(VTYP)→[MOTION: R(ACTS)(DATPOSSL)(DATPOSSG)]
(ACTS)→[PERSON: +volitive]
(DATPOSSL)→[PROPOSITION]
(DATPOSSG)→[PERSON]
(TEMPL)→[TIME]
(AMBS)→[EVENT].

[TERM]–

[THINK]–
(SYNT)→[VP[Vt]]
(VTYP)→[PSYCH_COG: R(DATPSYG)(DATPSYL)]
(DATPSYG)→[PERSON: -dynamic]
(DATPSYL)→[PROPOSITION]
(TEMPL)→[TIME]
(TEMPS)→[TIME]
(TEMPP)→[TIME]
(AMBP)→[MANNER]
(AMBS)→[EVENT]=[REASON]
(LCONC)→[THINK].

[TREAT]–
(SYNT)→[VP[Vt]]
(VTYP)→[MOTION: R(ACTS)(OBJL)]
(ACTS)→[PERSON: +volitive]
(OBJL)→[ENTITY]
(AMBS)→[EVENT]

(AMBP)→[MANNER].

[TRIAL_DECISION]–
(SYNT)→[NP[N][N]]
(NTYP)→[DOUBLE: R(ACTS)(OBJG)(AMBS)]
(ACTS)→[PERSON: +volitive]
(OBJG)→[ENTITY: {factitive|+concrete}]
(AMBS)→[EVENT]
(LCONC)→[DECISION].

[UNJUST]–
(SYNT)→[ADJ]
(VTYP)→[STATE: R(OBJL)]
(OBJL)→[EVENT]
(AMBS)→[EVENT]
(LCONC)→[UNJUST].

[WANT]–
(SYNT)→[VP[Vdit]]
(VTYP)→[PSYCH_COG: R(ACTS)(DATPSYL)]
(ACTS)→[PERSON: +volitive]
(DATPSYL)→[ENTITY]
(DATPOSSS)→[PERSON]
(AMBP)→[MANNER].

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A CONCEPTUAL, CASE-RELATION REPRESENTATION OF TEXT FOR INTELLIGENT RETRIEVAL

by

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A conceptual, case-relation representation of text for information retrieval

Judith P. Dick

This research demonstrates that intelligent retrieval is possible using a conceptual representation. It is an attempt to move from contemporary IR toward retrieval of ideas through text analysis. Intelligent retrieval systems should help the user find information while allowing him or her to concentrate on the problem that occasioned the search. The user must be free to reason through his or her problem with additional, newly retrieved information. Search operations should be a secondary consideration.

In addition, a conceptual representation enables the user to find information about ideas that he or she cannot name but can outline. Such information can be found even when the stored text does not contain relevant nominals.

In order to accomplish intelligent retrieval, a semantic representation of the text had to be made. The strength of our semantic representation results from the use of Harold Somers's grid of twenty-eight definitive deep cases. The grid is designed to answer the strongest criticisms of case and combines grammatical and semantic roles in each cell. The cases have been developed beyond their original capacity, but the theoretical framework and the grid itself were kept intact.

A knowledge base of contract law cases has been constructed. The principal argument of each case has been analyzed according to Stephen Toulmin's ‘‘good reasons’’ argument model. John Sowa's conceptual graphs have been used as a near-FOL notation. In addition to the semantic representations of each argument, the knowledge base contains a lexicon of legal concepts and rules for semantic selection.

The dissertation concludes with a retrieval demonstration using questions derived from cases following those represented in the knowledge base. LOG+, a frame matching algorithm by Mara Miezitis along with some proposed adaptations, is used. The demonstration focuses on pattern-matching among conceptual definitions using spreading activation. Semantic constraints facilitate inference within a type hierarchy.

A case-law retrieval system would ideally provide the researcher with conceptual access to cases and free him or her to develop arguments. The use of deep cases for the representation of large texts makes conceptual retrieval possible. Employing inference to locate implicit information gives us desirable advantages over contemporary IR system designs.

0. REFERENCES **iv**