Interpreting Statutory Predicates*

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Abstract

In this paper we discuss a hybrid approach to the problem of statutory interpretation that involves combining our past approach to case-based reasoning ("CBR"), as exemplified in our previous HYPO and TAX-HYPO systems, with traditional rule-based reasoning ("RBR"), as exemplified by expert systems. We do not tackle the full-blown version of statutory interpretation, which would include reasoning with legislative intent or other normative aspects (the "ought"), but confine ourselves to reasoning with explicit cases and rules. We discuss strategies that can be used to guide interpretation, particularly the interleaving of CBR and RBR, and how they are used in an agenda-based architecture, called CABARET, which we are currently developing in a general way and experimenting with in the particular area of Section §280A(c)(1) of the U.S. Internal Revenue Code, which deals with the so called "home office deduction".

1 Introduction

"Statutory interpretation" is the process of trying to determine the meaning of a legal predicate or rule by analysing it and then applying it to a particular set of facts. The difficulty in this exercise is that critical terms are typically not defined completely (or at all) by a statute and their scope is unclear and open to debate. Furthermore, there may be unspoken qualifications and exceptions. [1] Thus one must look outside a statute to other sources of knowledge for clues to its meaning and the meaning of its constituent elements. In particular, one tries to resolve interpretation problems by considering past applications of the rules and terms in question: by examining precedent cases, comparing and constrasting these with the instant case, and arguing why a previous interpretation can (or cannot) be applied to the new case [2] [Levi, 1949; Llewellyn, 1960; Twining and Miers, 1982]. The intepretation problem demands that one combine reasoning with cases and reasoning with rules (statutes).

The need to combine case-based reasoning ("CBR") and rule-based reasoning ("RBR") is a prototypical feature of legal reasoning in statutory law. Pick any statute and one will discover problems of interpretation. For instance, consider a section of the statute that governs the assessment of Federal income tax, the Internal Revenue Code (sometimes called just the "Code"). In stating the requirements for taking a home office deduction, Section 280A(c)(1) of the Code employs such terms as "principal place of business", "convenience of the employer" and use on a "regular basis":

> [A deduction may be taken for any] item to the extent such item is allocable to a portion of the dwelling unit which is EXCLUSIVELY USED on a REGULAR basis —
>
> (A) [as] the PRINCIPAL PLACE OF BUSINESS for any trade or business of the taxpayer,
>
> (B) as a place of business which is used by patients, clients, or customers in MEETING OR DEALING with the taxpayer in the normal course of his trade or business, or
>
> (C) in the case of a SEPARATE STRUCTURE which is not attached to the dwelling unit, in connection with the taxpayer's trade or business. In the case of an employee, the preceding sentence shall apply only if the exclusive use referred to in the preceding sentence is for the CONVENIENCE OF HIS EMPLOYER. [I.R.C. §280A(c)(1), *capitalization supplied.*]

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[1] A rule that forbids driving though red lights has an unspoken exception for fire trucks, police cars, etc., responding to an alarm.

[2] Note, in the fullest sense, interpretation also requires consideration of whether a term or rule "should" be applied. In this discussion, we leave aside these important normative aspects, which involve reasoning about legislative intent, policy and ethics[Fuller, 1958; Hart, 1958].

Nowhere are the capitalised elements defined in the statute; yet some scope must be afforded them in order to apply the statute to particular cases. While the meaning of such terms and phrases ("statutory predicates") is sometimes elucidated by official regulations issued by the Internal Revenue Service, a clear-cut definition (which does not itself use undefined terms) is almost never to be found. The meaning of such statutory predicates is fundamentally ambiguous, varies greatly according to the factual context in which they are used, and defeats precise definition by rules. Such lack of definitiveness forces practitioners to rely on previously litigated cases that have construed these terms. [3] From the AI point of view, statutory interpretation is an excellent example of a task where explicit rules and explicit cases are present [Skalak, 1988], where the rules and cases both require interpretation, and where one must combine reasoning with rules and reasoning with the cases [Rissland and Skalak, 1989].

While some definitional shortcomings might be remedied by "definitional backchaining", that is, forcing definitions to be made in some set of grounded terms, many – most – cannot be. For instance, terms of the "open-textured" variety cannot. Such concepts cannot be defined by necessary and sufficient conditions; their boundaries can never be made sharp [Hart, 1961; Dworkin, 1977]. Open-textured predicates often give rise to "hard" problems of interpretation, that is, problems over whose resolution experts (judges, scholars, etc.) disagree. They can raise difficult computational problems and as Gardner discussed, their very recognition can be quite tricky [Gardner, 1987]. There is an abundance of such open-textured legal concepts and sometimes even familiar terms reveal a surprising open-textured lining, such as "contract". Concepts like "due care", which are used deliberately to indicate a variable standard of behavior, are clearly of this sort. Just about all the predicates in the home office deduction rule, even "exclusive use", exhibit open texture; their interpretation has been and continues to be the subject of numerous cases.

Note, the need to do statutory interpretation is not necessarily the result of poor legal drafting. Rather it is a persistent problem that resists a legislature's best good-faith efforts at drafting tight statutes. Most generally, the persistence is due to the nature of the law and its relation to society; more particularly, to factual circumstances unanticipated at the time of drafting and a changing legal context [Levi, 1949; Sunstein, 1988]. This was one of the points of one classic discussion of the problem of statutory interpretation known as the "Hart-Fuller debate", between H.L.A. Hart and Lon Fuller in a *Harvard Law Review* dialogue [Hart, 1958; Fuller, 1958]. (There they also discussed, among other things, such deep jurisprudential issues as the nature and status of rules and the role of "ought" – and other normative considerations – in statutory interpretation.) Their famous hypothetical statutory rules from this debate can easily plunge discussants into the thick of interpretation problems: (1) "No vehicles are allowed in the public park." and (2) "It shall be a misdemeanor ... to sleep in any railway station." The interpretation puzzle is how to interpret concepts like "sleeping" or "vehicle", in light of a statute's purposes. Hard cases easily spring to mind. Does a tank which is part of a war veterans memorial statue count as a vehicle? What about a motorised baby carriage or wheelchair? What about a fire engine requiring access to a fire via the park? As for "sleeping", what should we decide about a bum who has obviously bedded down for the night but still has his eyes open? Should the result be any different as to a well-dressed commuter who has clearly dozed off?

The legal realist scholar Karl Llewellyn offered many insights on the problem of statutory interpretation. In a classic article [Llewellyn, 1950] and his well-known book, *The Common Law Tradition* [Llewellyn, 1960], Llewellyn culled from legal opinions a number of pairs of maxims and what might be called "anti-maxims" on how to do interpretation. His 1950 article lists 28 such contradictory "thrusts" and "parries" (e.g., #1 states "A statute cannot go beyond its text", and yet "To effect its purpose a statute may be implemented beyond its text") [Llewellyn, 1950]. Another (#12) states, "If language is plain and unambiguous it must be given effect." and is parried by "Not when literal interpretation would lead to absurd or mischievous consequences or thwart manifest purpose." His book [Llewellyn, 1960] offers 64 more heuristics. Llewellyn's writings on legal reasoning are reminiscent of Polya's on mathematics [Polya, 1965a].

Although law is the focus of this discussion, lawyers are by no means the only ones to grapple with interpretation problems and to combine different modes of reasoning in attempting to solve them. So do doctors, strategic planners, and even mathematicians in certain pliable stages of a mathematical theory's development [Lakatos, 1976]. For instance in medicine, even though expert systems treat concepts like pneumonia as well-defined, such terms really are not so clear-cut as all that — for a large part of their meaning lies in how they were resolved in past cases, particularly difficult ones (e.g., a case of pneumonia masquerading as a common cold). Thus experts in such disciplines interleave case-based and other types of reasoning. Mathematicians regularly interleave reasoning deductively and reasoning with cases in much the same way as do

[3] For instance, a case involving Max Frankel, *The New York Times* Managing Editor, *Max and Tobia Frankel v. Commissioner*, 82 USTC 318 (Filed February 28, 1984), addressed the *meeting or dealing* predicate: Mr. Frankel maintained an office at his home in the Bronx, which he used for reading the morning papers, writing memoranda, clipping materials, and speaking by telephone to his employees, prominent politicians and community leaders. The Tax Court denied that Mr. Frankel met any of the three disjunctive requirements of the statute, (A), (B), or (C). In particular, the use of the telephone to conduct business was held not to satisfy the *meeting or dealing* predicate, which was construed to require the physical presence of business contacts.

lawyers reasoning on an interpretation problem. Polya has given the name "alternating process" to this interleaving:

> A problem to prove is concerned with a clearly stated assertion *A* of which we do not know whether it is true or false: we are in a state of doubt. The aim of the problem is to remove this doubt, to prove *A* or to disprove it .... To prove *A* we should look for some propositions from which, or for some strategy by which, we could derive *A*. To disprove *A* we should look for a counterexample. A good scheme is to work alternatively, now in one direction, then in the other. When the hope to attain the end in one direction fades, or we get tired of working in that direction, we turn to the other direction, prepared to come back if need be, and see, by learning from our work in both directions, we may eventually succeed.
>
> [Polya, 1965b, p. 50]

Amazingly, the same phrase has been used to describe legal reasoning:

> So in the lawyer's working day he is constantly involved in an interplay between emerging facts and constructed theories. The facts which are recited initially suggest theories, which when amplified and modified by thought and work suggest further inquiries concerning facts, which again suggest amplification and modification of theories. The alternating process continues until a solution is recognised and acted on. In the interplay, acceptable descriptions of significant facts and acceptable statements of relevant theories are hoarded: facts without significance and theories without relevance are discarded, until the solution (sometimes, of course, false) emerges. No fact is significant without theory: no theory is relevant without facts.
>
> [Morris, 1937, p. 35]

In mathematics, formal, deductive reasoning typically overshadows reasoning with cases (examples), although examples and example-based reasoning constitute a powerful aspect of expertise [Rissland, 1978]. Few practicing lawyers would be similarly seduced into preferring "theorems" to the exclusion of cases. In both the mathematical and legal reasoning versions of the "alternating process", one combines CBR and RBR, particularly when deductive reasoning stalls. This same sort of "defaulting" to CBR was used by Gardner in her work (e.g., when there was no tentative answer from the CSK rules).

2 An Example of an Interpretation Problem

As an example of the need for statutory interpretation, consider the Mann Act, also known as the "White Slave Traffic Act"[4]:

> Any person who shall knowingly transport or cause to be transported, or aid or assist in obtaining transportation for, or in transporting, in interstate or foregin commerce or in any territory or in the District of Columbia, any woman or girl for the purpose of prostitution or debauchery, or for any other immoral purpose, or with the intent and purpose to induce, entice or compel such woman or girl to become a prostitute, or to give herself up to debauchery, or to engage in any other immoral practice ...shall be deemed guilty of a felony.

The Act was passed after considerable debate to address the perceived condition that ethnic rings were preying upon women newly arrived to this country, pressing them into prostitution and virtual slavery. Critics argued the Act was unconstitutionally vague. In any event, terms such as "debauchery," "immoral purpose," and "entice" present significant problems of statutory interpretation. We shall return to this example to demonstrate our computational approach to interpretation.

3 A Mixed Paradigm Approach to Interpretation

Our approach to building a system to perform statutory interpretation combines case-based reasoning and rule-based reasoning. The CBR component is modelled after the HYPO and TAX-HYPO CBR systems previously build by our group [Ashley, 1988; Ashley and Rissland, 1988; Rissland and Skalak, 1989]. The RBR component is a standard expert system — including both back and forward chaining — but redesigned to allow its internal processing to be observed. These two co-reasoners are embedded in an architecture, called CABARET (CAse-BAsed REasoning Tool), which is controlled by an agenda-based controller using heuristics to post and order interpretation tasks and subtasks. (See *Figure 1.*)

Such a control regime was used by Lenat in his highly interesting AM program [Lenat, 1976]. This sort of hybrid architecture involving CBR and RBR has not been much researched to date so that our work also explores new territory in AI [Goel and Chandrasekaran, 1988; Koton, 1988; Walker *et al.*, 1988]. On the other hand, CBR is a topic of current interest in AI, and a unified understanding of CBR methods is developing steadily [Kolodner, 1988; Rissland and King, 1988].

[4] 36 Stat. 825 (1910), 18 U.S.C.A. § 398 (1927). See [Levi, 1949] for an extended discussion of the Act and the cases referred to below.

CABARET

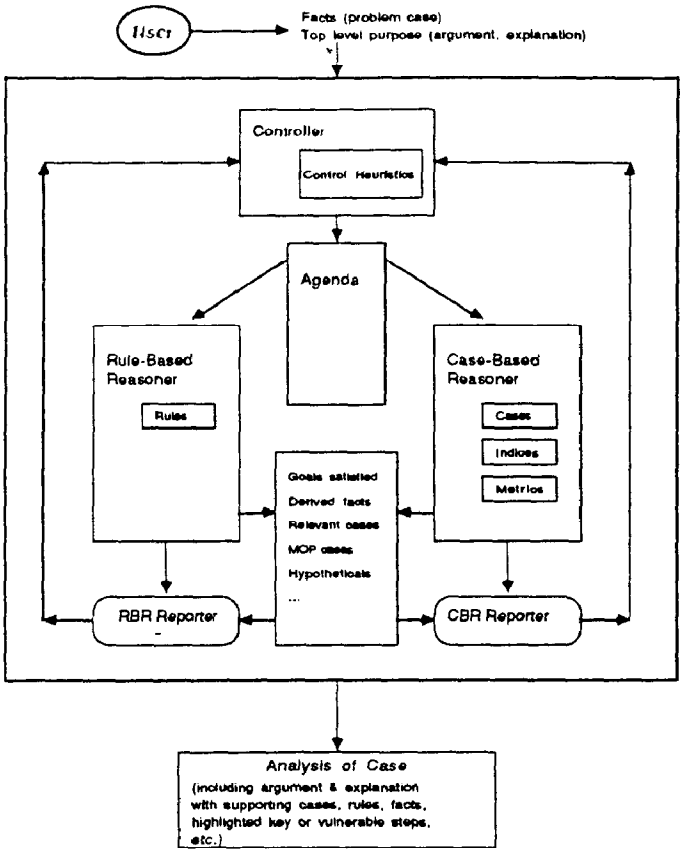

Figure 1.

CABARET's CBR component is a "precedent-based" reasoner (as compared to a "problem-solving" reasoner, the other major type of CBR). As in the previous precedent-based systems of our group, HYPO and TAX-HYPO, the key idea is to reason from cases similar to the current case in order to argue for a particular decision in the current case and to justify the reasoning in terms of the past cases. A large part of the effort concerns fundamental aspects of argument: selecting cases, arguing about the relevancy of cases, showing similarity with supporting cases, distinguishing contrary cases, constructing testing hypotheticals, etc. Precedent-based CBR is distinguished by its focus on the use of past cases ("precedents") to *justify* a solution and explain its rationale. Anglo-American common law with its doctrine of the binding nature of precedent is a paradigm of precedent-based CBR. On the other hand, in problem-solving CBR [Hammond, 1986; Kolodner, 1987; Sycara, 1988], the focus is on using past cases to find a a detailed problem solution (e.g., a plan, a course of action), where the new solution is generated by *adapting* a previous solution. Design and planning are paradigmatic examples of problem-solving CBR [Barletta and Mark, 1988]. Past work of Rissland on "constrained example generation" which used a "retrieve-plus-modify" approach [Rissland, 1980] and of McCarty on legal argument which used a "prototype-plus-deformations" approach [McCarty and Sridharan, 1981] can be viewed as problem solving CBR.

Both types of CBR follow similar steps. Once a new case has been accepted for analysis, CBR proceeds by (1) analysing it (e.g., by computing features, relations and indices) to retrieve relevant cases from case memory; (2) from these selecting a set of best cases from which to craft a solution or interpretation for the problem case; (3) derivation of a solution or intepretation complete with supporting arguments in the case of precedent-based CBR and with implementation details in the case of problem-solving CBR; (4) testing of the the interpretation (e.g., with hypotheticals) or solution (e.g., with simulations) with an eye to assessing its correctness, strengths, weaknesses, generality, etc.; and (5) storing the newly solved or interpreted case into case memory and appropriately adjusting indices and other CBR mechanisms such as similarity metrics.

Note, in assessing relevancy in Step 1, and all the other steps of CBR as well, one must view cases from the point of view of the case and task at hand. So, for instance, just because a known case was a landmark case does not necessarily make it important for the present case since the two might not share any relevant similarities. Furthermore, in statutory interpretation the CBR must address the requirements of the statute. It is not enough simply to argue about the meaning of legal concepts; one must tie the arguments to the statute. This latter remark shows why our past work on HYPO is insufficient in itself for modelling statutory interpretation. [Rissland and Skalak, 1989]

To implement an agenda-based architecture, one needs heuristic control rules; these are used to post and prioriterize tasks on the agenda and thus direct the overall processing of the system. The heuristics couple observations harvested from the processing, particularly that of the RBR and CBR, with tasks to do. In our study of statutory interpretation, we have gathered a collection of 30 or so heuristics that we believe experts use for controlling and interleaving reasoning with rules and reasoning with cases. These heuristics can be divided into a number of categories: [5]

1. *Ways to Begin Reasoning*
2. *Rule-based Near Miss*
3. *Rule-based Near Hit*
4. *Ways to Broaden a Rule*
5. *Ways to Discredit a Rule*
6. *Ways to Confirm a Hit*
7. *Ways to Confirm a Miss*

[5] A *hit* refers to the establishment of the antecedent of a rule, on the rule-based side, or the presence of all the prerequisites of a dimension (index), on the case-based side. A *miss* is the opposite of a "hit". *Near* miss and *near* hit are discussed below.

8. Ways to Confirm Reasoning — "Sanity Checks"
9. Ways to Deal with Results Opposite from that Desired
10. Ways to Deal with Failure of Reasoning to Yield a Definite Conclusion
11. Ways to Focus the Reasoners
12. Open-Textured Elements

Some of our heuristics, like those in groups 8 and 12, are very similar to those employed by Gardner [Gardner, 1987].

We are currently exploring the use of these heuristics in controlling the processing in CABARET. In addition to an agenda-based controller and individual CBR and RBR co-reasoners, CABARET includes two reporting processes which observe the processing of the CBR and RBR and describe them in a language, called the "Control Description Language" (CDL). (See *Figure 1* for a schematic diagram of CABARET.) The CDL, which is also used to encode the heuristics used by the controller, contains descriptors such as: *near miss, near hit* [6] *, open texture, point of view, most on point cases* and primitive task directives, such as *forward chain, backward chain, filter cases, confirm a hit, confirm a miss, broaden, discredit.*

The ultimate goal for the system is to generate arguments and explanations of interpretations and from various points of view, such as pro and con an interpretation. Changing the point of view enables exploration of a situation from various argumentative vantage points.

In fact, consideration of the *point of view*, means that there are a variety of responses the system might make to an occurrence like a hit or miss. For instance, if Rule 1 has fired, but you don't like some consequence of Rule 1, you (and CABARET) may look for ways to discredit that rule. CABARET knows, for example, several ways to "discredit" a rule: find cases where the consequent was deemed not to have been established, even though the rule fired; narrow the reach of the open-textured words in the rule, and so forth. The "near miss" group includes a variety of rules, such as:

- If you have all but one conjunct of the antecedent of a rule, and you want the rule to fire, broaden the rule.
- If you have all but one conjunct of a rule, and you want the rule to fail, confirm the miss.

In turn there are a number of ways to "broaden" a rule:

- Use CBR to find cases where the rule did not fire, but the consequent of the rule still held. (That is, show that the missing conjunct is not necessary to fire the rule.)
- Use CBR to find cases where the rule did fire, and point out the similarities between those cases and the present case. (Show that effectively you have the missing conjunct.)
- Use CBR to find similar cases where the rule did not fire, but the ultimate disposition of the case was consistent with the user's point of view. (Show that the rule firing is not necessary for the ultimate result the user wants.)
- Expand the scope of any open-textured predicates in the missing conjunct. (Show that you have the missing conjunct.)

4 A Detailed Example of Mixed Paradigm Reasoning

Returning to the White Slave Traffic Act, consider the hypothetical case of Benny, a candy store owner in the District of Columbia. Benny's assistant, Alice, a 19-year-old foreign exchange student, suggests to him that they take the afternoon off and go over to 14th Street to see a XXX-rated movie. Benny pays for the Metro ticket for Alice. Benny is charged with violating the White Slave Traffic Act. What result?

4.1 The Case Knowledge Base

Suppose the Case Knowledge Base contains the following cases:

- *Bitty*[7] (importation for the purpose of concubinage is an immoral purpose)
- *Athanasaw*[8] (transport of woman from Georgia to Florida to appear as a chorus girl constitutes debauchery)
- *Mortensen*[9] (interstate vacation by two prostitutes and by husband and wife who operated house of prostitution does not constitute immoral purpose or debauchery)
- *Beach*[10] (Mann Act violation where shop owner paid for taxi ride wholly within District of Columbia by shop assistant to hotel for voluntary prostitution)
- *Adult-Case*[11] (teenager treated as adult for purpose of applying prostitution laws)

[6] The descriptors *near miss* and *near hit* are applicable to both the RBR side and the CBR side. Generally, a near miss is had when a result (say, one that you want) is missing one component in order to obtain. A rule-based near miss occurs when all but one conjunct of a rule can be established. A case-based near miss happens when all but one prerequisite of a dimension (index) are present in the case knowledge base. A "near hit" has analogous meanings: the term generally applies when there are many possible ways to establish a result, and all but one of them have failed.

[7] United States v. Bitty, 208 U.S. 393 (1908)
[8] Athanasaw v. United States, 227 U.S. 326 (1913)
[9] Mortensen v. United States, 322 U.S. 369 (1944)
[10] United States v. Beach, 324 U.S. 193 (1945)
[11] (hypothetical)

4.2 The Rule Base

Suppose, further, that the following domain rules are in the Rule Base for the mixed paradigm reasoner.

- *The White Slave Traffic Act* (See Section 2.)
- *The Concubinage Rule:* Concubinage constitutes an immoral purpose.
- *The Georgia Rule:* An act that can lead to immoral actions is immoral.
- *The Voluntary Rule:* If a woman is more than 21 years old and she travels voluntarily, her actions do not constitute immoral acts and are not debauchery.

4.3 Mixed Paradigm Scenarios

We use this example to detail how a mixed paradigm reasoner like CABARET might deal with the statutory interpretation arising from Benny's allegedly criminal conduct: CABARET is being designed to leave processing traces like the following. For convenience, we bracket control rules and italicize their category.

Reasoning from the District Attorney's Point of View

The DA elects to begin the analysis using rule-based reasoning.

- The Controller begins processing on the RBR side [*Ways to Begin Processing* – Begin with RBR, backward chaining], backward chaining on The White Slave Traffic Act.
- In backchaining, RBR invokes The Georgia Rule to establish immoral purpose (since it would yield a conclusion with the DA's point of view.) But backchaining fails because no rule can be found that has as its conclusion "an act that can lead to immoral actions".
- The control rule [*Ways to Deal with Failure of Processing to Yield a Definite Conclusion* – Toggle] fires to toggle the reasoner to CBR.
- CBR searches for cases dealing with acts that can lead to immoral actions and finds the *Athanasaw* case.
- CBR reports to Controller that it has case-based support for the antecedent in The Georgia Rule.
- The Controller reports that it can establish a White Slave Traffic Act violation using The Georgia Rule and the *Athanasaw* case.
- The control rule *Ways to Confirm a Hit* fires, posting the task for the CBR to find cases where the antecedents of the Act were satisfied in similar circumstances and a violation was found.
- CBR searches for such a case and reports the *Beach* case to the Controller.

Reasoning from Benny's Point of View

Benny elects to begin his analysis using CBR.

- The Controller begins processing on the CBR side [*Ways to Begin Processing* – try to find a case on all fours with the current fact situation]
- CBR reports failure to find a case on all fours.
- The controller posts [*Ways to Deal with Failure of Processing to Yield a Definite Conclusion* – Toggle] to the agenda.
- RBR attempts to backchain on the White Slave Traffic Act.
- In backchaining, RBR tries to show Benny's behavior is not debauchery or an immoral purpose and attempts to use The Voluntary Rule.
- RBR succeeds in establishing from the facts of the case that the conduct of Alice was voluntary, establishing the first conjunct of The Voluntary Rule.
- RBR fails to establish the conjunct that Alice is over 21, since Alice is 19.
- Since RBR missed on only one conjunct of The Voluntary Rule, the heuristic [*Rule-based Near-Miss* – show that you effectively have the missing conjunct] is posted.
- The Controller directs the CBR to find cases that support treating a 19-year-old as a 21-year-old.
- CBR finds *Adult-Case* and reports the find to the Controller. Controller determines that The Voluntary Rule is satisfied, and hence that Benny's conduct is not debauchery.
- The control rule [*Ways to Confirm Reasoning* – toggle to confirm statutory predicate] fires.
- CBR takes up the task of finding cases that support the "not debauchery" conclusion, but are dimensionally similar to the current case.
- CBR finds *Mortensen* and reports the case to the Controller.
- Working now on the statutory predicate "immoral purpose", RBR backchains on that goal and retrieves the chain of reasoning that the DA unearthed.
- The control rule [*Ways to Discredit a Rule*] fires, posting the task for CBR to find similar cases where the antecedents of The Georgia Rule were satisfied, but no violation of the White Slave Traffic Act was found.
- CBR reports that the *Mortensen* case is slightly on point ....

The processing trace for Benny's point of view may continue from this point. These two traces illustrate how case-based and rule-based reasoning could interact to aid interpretation of statutory predicates.

5 Conclusions

In statutory law, the statutes often use words or phrases that cannot be defined precisely. In order to apply a statutory rule, one must reason with past cases in order to clarify ambiguities in the statutory predicates it uses as well as in the rule, itself. We are developing a hybrid CBR/RBR system, CABARET, to perform such statutory interpretation. Our computational approach uses an agenda-based control regime incorporating heuristics determining what reasoning tasks to perform, given the states of the CBR and RBR co-reasoners. We are using CABARET to experiment with heuristic approaches to the interpretation problem and with mixed-paradigm reasoning in general. We foresee that this work will eventually complement work on legal reasoning, like that modelling statutes with expert systems and PROLOG [Sergot *et al.*, 1986] which often must confront difficulties of interpretation.

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