

## HYPOTHETICALS AS HEURISTIC DEVICE \*

Edwina L. Rissland and Kevin D. Ashley  
Department of Computer and Information Science  
University of Massachusetts  
Amherst, Massachusetts 01002  
(413) 545-0332

### Abstract

In this paper we examine the use of hypotheticals as a heuristic device to assist a case-based reasoner test the strengths, weaknesses, and ramifications of an analysis or argument by exploring and augmenting the space of known cases and indirectly, the attendant spaces of doctrine and argument. Our program, HYPO, works in the task domain of the law, particularly, the area of trade secret protection for software. We describe how HYPO generates a constellation of legally-meaningful hypothetical fact situations ("hypos") which are "near" a given fact situation. This is done in two steps: analysis of the given situation and then generation of the hypos. We discuss the heuristics HYPO currently uses, which include: (1) make a case weaker or stronger; (2) generate an extreme case; (3) enable a near miss; (4) manipulate a near win; and (5) generate a case on a related "dimension".

### 1. Introduction

In contemplating a course of action, one needs to explore such things as its strengths and weaknesses and the ramifications of pursuing it. In particular, one needs to be able to spot fatal weaknesses (e.g., If one assumed condition does not obtain, then does the entire plan fail?) and implications that set new precedents and/or overturn old ones (e.g., Does it reverse a long line of policy?). Experts in many fields – the law, Talmudic scholarship, medical therapy planning – often make use of hypothetical cases ("hypos"), and other case-based reasoning ("CBR") techniques, in such situations.

In this paper, we concentrate on the use of hypotheticals in the legal domain. A real case is a case that has been litigated and decided; a hypo has not (even though it might be a very slight variation of one that has, or foretells

of cases in the process of coming to light or just "waiting to happen" [Rissland, 1985].) In particular, we focus on the use of a sampling of hypotheticals to explore possible situations and arguments arising from a current fact situation. It is a heuristic technique. Not only does the "constellation" of hypotheticals around a given case effect a heuristic search of the "space" of all possible cases, but also the individual hypos in the constellation are generated using heuristics.

We have implemented these ideas in our case-based reasoning program, "HYPO", which performs CBR tasks in the legal domain. HYPO is based on detailed analysis of case-based reasoning, particularly that involving hypotheticals, as performed by legal experts, particularly the Justices of the United States Supreme Court and professors of law at the Harvard Law School.

In reasoning with cases and hypotheticals, HYPO uses a means of representing and indexing cases in a Case Knowledge Base ("CKB"), a computational definition of relevance in terms of "dimensions" which capture the utility of a case for making a particular kind of argument, a dimension-based method for comparing cases, and methods for generating hypotheticals to help an arguer formulate an argument, gather relevant facts, and explain his argument. HYPO's domain is legal argument where, as illustrated below with examples of oral arguments before the Supreme Court, cases and hypotheticals are primary tools.

In this paper, we concentrate on HYPO's creation of hypothetical new cases to accomplish such tasks as: (1) test the sensitivity of one's argument to absence or presence of certain facts; (2) locate and explore subspaces of relevant cases in the CKB; (3) augment and "flesh out" sparse areas of the CKB; (4) sample the space of implications of a given argument; (5) formulate refinements and refutations of an argument. HYPO generates these hypotheticals heuristically using certain well-known general heuristics (e.g., examine extreme cases) as well as HYPO-specific ones (e.g., examine weaker/stronger cases along a HYPO dimension).

---

\* This work was supported (in part) by: Grant IST-8212238 of the National Science Foundation, the Advanced Research Projects Agency of the Department of Defense, monitored by the Office of Naval Research under contract no. N00014-84-K-0017, and an IBM Graduate Fellowship.

While HYPO is a program whose primary task domain is legal argument, the lessons learned from HYPO should prove useful for other CBR tasks like strategic planning and learning by experimentation. The posing and manipulating of hypotheticals is important in strategic planning where one must examine a proposed plan in light of telling *what if's* – all too often the advocate of a plan only tells of its good points and a devil's advocate is needed to unmask its weaknesses. Also, one cannot afford to wait passively for the right test case to come along before grappling with a potential problem; one must create cases to reason in anticipation.

In learning, the problem of *how to intelligently select training instances* is directly related to our concerns here. In fact, some of the heuristics we discuss here, like those using near misses, are the subject of another on-going project of ours on intelligent example selection [Rissland, Buchanan, Rosenbloom and Ng, 1986] for rule-learning systems like RL [Fu and Buchanan, 1985].

## 2. Examples of How Experts Reason with Hypotheticals

Legal experts reason with hypotheticals in two situations: (1) law school teaching; and (2) aspects of litigation. In law school, hypos are used (sometimes unmercifully) to ferret out unspoken assumptions and prejudices of students, to focus attention on subtle or troublesome points, and to exercise the student's argumentative powers [Gewirtz, 1981; Rissland, 1984]. In litigation, hypos are used primarily at two points: (a) preparation and "debugging" of an argument in the way a strategic planner "dry runs" his plan, and (b) in oral argument.

In oral argument, the hypos usually come from the judges trying to probe an advocate's position and the ramifications of it. The following examples from oral arguments before the United States Supreme Court illustrate how judges use hypotheticals:

- To present, support and attack positions (e.g., by testing the consequences of a tentative conclusion, pressing an assertion to its limits, and exploring the meaning of a concept);
- To relate a fact situation to significant past cases;
- To augment an existing case base with meaningful test or training cases;
- To factor a complex situation into component parts (e.g., by exaggerating strengths, weaknesses or eliminating features);
- To control the course of argument (e.g., by focussing discussion on particular issues).

In *Lynch v. Donnelly*, 104 S. Ct. 1355 (1984), a case involving the constitutionality of a Christmas creche display of a city on municipal land, the Justices posed the following hypotheticals:

Q: Do you think ... that a city should display a nativity scene alone without other displays such as Santa Claus and Christmas trees...?

Q: [C]ould the city display a cross for the celebration of Easter, under your view?

Q: [S]upposing the creche were just one ornament on the Christmas tree and you could hardly see it unless you looked very closely, would that be illegal?

Q: What if they had three wiseman and a star in one exhibit, say? Would that be enough? ... What if you had an exhibit that had not the creche itself, but just three camels out in the desert and a star up in the sky?

Q: Well, the city could not display religious paintings or artifacts in its museum under your theory.

Q: There is nothing self-explanatory about a creche to somebody ... who has never been exposed to the Christian religion.

Q: Would the display up on the frieze in this courtroom of the Ten Commandments be unconstitutional then, in your view?

Q: Several years ago ... there was a ceremony held on the Mall, which is federal property of course. ... [T]here were 200,000 or 300,000 people ... and the ceremony was presided over by Pope John Paul II. Would you say that was a step towards an establishment of religion violative of the religion clauses? ... Then you think it would be alright to put a creche over on the Mall? ... How do you distinguish a high mass from a creche? ... [T]here was a considerable involvement of government in that ceremony, hundreds of extra policeman on duty, streets closed... That was a considerable governmental involvement, was it not?

*SUP, Lynch v. Donnelly*, Case No. 82-1256, Fiche No. 5.

In the above questions, one can see the Justices modifying the fact situation along various dimensions: location, size, and focus of display, religious content of the display, nature of the viewer, and degree of government involvement.

Sometimes the purpose of the modifications (and thus the derivative hypos) is to compare the fact situation to actual cases previously decided by the Court to test whether the current case presents stronger or weaker facts.<sup>1</sup> Or a hypothetical case, like the Mall example, may be significant because it did not give rise to litigation.

Frequently, the Justices use hypotheticals to apply pressure to the rule proposed by an attorney for deciding the case. This is often done by means of a "slippery slope", that is, a sequence of hypotheticals each a little more extreme than its predecessor which ends in an extreme "reductio" case. The changes can be symbolic or numerical. The following example uses a (numerical) slippery slope.

In the argument of *Sony Corp. v. Universal City Studios*, 464 U.S. 417 (1984), while an attorney was advocating the position that if Sony sold video recorders while knowing that consumers would use them to copy copyrighted materials, then Sony should be legally responsible to the owners of the copyrights, the following interchange occurred:

Q: Suppose ... that about 10 percent of all programming could be copied without interference by the producer or whoever owned the program...

A: I don't think that would make any difference. I think 10% is too small of an amount.

Q: Well, what about 50?

At this point the attorney posed his own hypothetical. Even if there were only one television program that was copyrighted, he asserted that if Sony knew the program would be copied, it should be legally responsible. Finally, the Justice asked:

Q: Under your test, supposing somebody tells the Xerox people that there are people who are making illegal copies with their machine and they know it. ... Xerox is a contributory infringer?

A: To be consistent, Your Honor, I'd have to say yes.

Q: A rather extreme position.

*SUP, Sony Corp v. Universal City Studios*, Case No. 81-1687, Fiche No. 2.

---

<sup>1</sup> See e.g., *Stone v. Graham*, 449 U.S. 39 (1980): Posting copies of Ten Commandments in schools held unconstitutional; *Gilfillan v. City of Philadelphia*, 637 F. 2d 924 (CA3, 1980): City-financed platform and cross used by Pope John Paul II to celebrate public mass held unconstitutional; *McCreary v. Stone*, 575 F.Supp. 1112 (SDNY 1983): Not unconstitutional for village not to refuse permit to private group to erect creche in public park.

In these last two questions, although the altered fact situations posed by the Justice are still covered by the proposed rule, it is increasingly harder for the attorney to justify his position because the hypotheticals present progressively *weaker* facts; the Justice has "stacked" the hypothetical with *extreme* facts. The attorney to keep his argument alive must distinguish the current Sony situation and the hypos. Indeed, the attorney failed. The Court held for Sony on the ground that the Betamax was capable of substantial noninfringing use because so many programs were not subject to copyright restrictions, 464 U.S. 417, 456.

Such observations are the basis of HYPO's approach to using and generating hypotheticals.

### 3. The Heuristic Constellation

The technique we describe in this paper is what we call **the heuristic constellation**. It is the generation and use of a cluster of hypothetical cases generated from a given initial "seed" case. The hypos in the constellation are generated by applying certain heuristics to the initial case and are "nearby" the seed in a legally meaningful way. As we said, the effect is a heuristic search of the space of all cases (which is far too large to be searched in a bruteforce manner).

The heuristic constellation can be used to give one a feel for the robustness or vulnerability of a case. For instance, if many of the hypos in the constellation look "bad" viz-a-viz a particular analysis or position, this provides a strong hint that the seed is vulnerable. By assessing the elements of the constellation one creates an evaluation of the initial case that takes into consideration the relation of the case to the case knowledge base.

The constellation can also be used for case retrieval from the case knowledge base. It adds some "jitter" to the seed case and thus might cause some new matches to be made in the CKB. This phenomenon can be seen in our creche example, where the Justices used the hypotheticals to get to other cases in their CKB - like those involving the Pope - which in a straight keyword approach would have been missed. Thus the heuristic constellation can enable one to find new areas of the CKB, which a priori one might not have considered "close" or relevant to the seed. We will see another example of this in our discussion of HYPO's manipulations of a trade secret misappropriation case. At first blush, one might think that the only relevant cases will be about intellectual property law; however, by artful hypothecating, one gets to certain classic cases in contract law which are also directly relevant. These cases would have been missed by a hierarchical retrieval system that used a conceptual hierarchy placing property and contracts on totally different major branches.

#### 4. Background on HYPO: Some definitions.

In order to perform its work, HYPO represents various kinds of domain knowledge. *Cases* are disputes between parties tried by a court, whose decisions are reported in published opinions. The opinion sets forth the facts of the case, the claims made by one party against the other, and the court's holding. *Facts* are statements about events associated with the dispute that were proved at trial or which the court assumed to be true. A *claim* is a recognized kind of complaint for which the courts will grant relief (e.g., breach of contract, negligence, trade secrets misappropriation, copyright infringement). The *holding* is the decision of the court as to the legal effect on each claim of the facts of the case, either in favor of the plaintiff or defendant.

In HYPO, cases are represented by a hierarchical cluster of frames (flavor instances) with slots for relevant features (plaintiff, defendant, claim, facts, etc.). Some features are in turn expanded and represented as frames (e.g., plaintiff) [Rissland, Valcarce, & Ashley, 1984]. The library of cases is called the *Case Knowledge Base (CKB)*. HYPO's current CKB contains a dozen or so of the leading cases for trade secret law for software. See the Appendix Table 1 for a partial list of cases and a very brief indication of their content.

Besides the CKB and the understanding of the legal domain that this case representation implicitly contains, the other major source of domain-specific legal knowledge is in HYPO's *dimensions*. Dimensions capture the notion of legal relevance of a cluster of facts to the merits of a claim: that is, for a particular kind of case, what collections of facts represent *strengths* and *weaknesses* in a party's position. The short answer is that facts are relevant to a claim if there is a court that decided such a claim in a real case and expressly noted the presence or absence of such facts in its opinion. Examples of dimensions in HYPO's area of trade secret law are: *Secrets-voluntarily-disclosed*, *Disclosure-subject-to-restriction*, *Competitive-advantage-gained*, *Vertical-knowledge*. These dimensions are summarized in the Appendix.

As the Appendix indicates, each dimension has several facets. For instance, the prerequisites of the *Secrets-voluntarily-disclosed* dimension are that two corporations, plaintiff and defendant, compete with respect to a product, plaintiff has confidential product information to which defendant has gained access and plaintiff has made some disclosures of the information to outsiders. The prerequisites are stated in terms of factual predicates, which indicate the presence or absence of a legal fact or attribute (e.g., existence of a product, existence of a non-disclosure agreement). The focal slot of this dimension is the number of disclosees and its range is a non-negative integer.

To strengthen the plaintiff's position in a fact situation to which this dimension applies, decrease the number of disclosees; the best case being that with 0 disclosees. The significance of the dimension is that courts have found that the prerequisite facts are a reason for deciding a trade secrets misappropriation claim. This dimension indexes at least two cases in the CKB: *Midland-Ross* in which the court held for the defendant where the plaintiff disclosed the secret to 100 persons, and *Data-General* in which the court held for plaintiff where plaintiff disclosed to 6000 persons. HYPO knows about 30 dimensions in all (some of the others are described in [Rissland, Valcarce & Ashley, 1984]). The dimensions were gleaned from law journal articles describing the state of the (case) law in this area [Gilburne & Johnston, 1982].

In order to reason with a case, HYPO first performs a legal analysis; this is done by a CASE-ANALYSIS module, which in essence works as a diagnostic engine to determine which dimensions apply to a fact situation. The prerequisites, in effect, define antecedent conditions and a dimension (i.e., a possible reason for deciding a claim in a particular way) is the consequent. To make an analogy with the medical domain, the prerequisite facts are like symptomatic features and the dimensions are like intermediate disease classes. The overall structure of HYPO and its internal workings are described in [Ashley and Rissland, 1985; Ashley, 1986].

The output of the CASE-ANALYSIS module is the *case-analysis-record* which contains: applicable factual predicates, applicable dimensions, near-miss dimensions, applicable claims, and relevant CKB cases. Near-miss dimensions are those for which some, but not all, of the prerequisites are satisfied.

#### 5. Heuristics for Generating Hypotheticals

Basically what HYPO does is to start with a given fact situation, or *seed* case, and generate legally relevant or plausible derivative hypotheticals by modifying the seed case. Since one cannot explore all the "legally" possible hypos (in the sense of syntactic legal move), one needs to explore the space heuristically. Dimensions provide a handle on how to do this exploration in a legally meaningful way.

The process occurs in two steps:

- (1) analyze the seed case;
- (2) generate legally relevant derivative hypotheticals.

Step one is accomplished by the CASE-ANALYSIS module and results in the case-analysis-record described in the previous section. To recall, this is like a "legal-diagnosis".

Step two is accomplished by the HYPO-GEN module which given high level argument goals (e.g., generate a slippery slope sequence to refute side 1's position), uses the case-analysis-record, and heuristics like the following to generate hypotheticals derived from the seed case:

H1. Pick a near miss dimension and modify the facts to make it applicable.

H2. Pick an applicable dimension and make the case weaker or stronger along that dimension.

H3. Pick a dimension related to one of the applicable dimensions and apply one of the other heuristics, particularly, 1 or 2.

H4. Pick an applicable dimension and make the case extreme with respect to that dimension.

H5. Pick a target case that is a win and, using 1 and 2, move the seed case toward it to create a near win.

In order to illustrate these methods, we will use the following hypothetical case, *Widget-King v. Cupcake*, whose facts are as follows:

Plaintiff Widget-King and defendant Cupcake are corporations that make competing products. Widget-King has confidential information concerning its own product. Cupcake gained access to Widget-King's confidential information. Cupcake saved expense developing its competing product.

The parts of the case-analysis-record for *Widget-King v. Cupcake* that are relevant for the following discussion are:

applicable dimensions:

*competitive-advantage-gained*

near-miss dimensions:

*secrets-voluntarily-disclosed;*

*vertical-knowledge*

relevant CKB cases: *Telex v. IBM*

**H1. Enable a near miss dimension:** To make a hypothetical out of a fact situation according to this heuristic method, HYPO selects a near miss dimension and "fills in" the missing prerequisites. HYPO instantiates objects and makes appropriate cross references among objects' slots so that the missing factual predicates are satisfied. For example, *secrets-voluntarily-disclosed* would apply to *Widget-King* but for the fact that the confidential information had not been disclosed to anyone. The program instantiates, let us say, five disclosures and sets the subject of the disclosures to be the confidential information. As discussed below, the number of disclosures, five, may be derived from an actual case that the program is considering in the context of making up the hypothetical, or it may be somewhat arbitrarily chosen by the program from within the range of the dimension.

**H2. Make a case weaker or stronger:** HYPO generates a derivative hypothetical weaker/stronger than the seed case by using the information it knows about dimensions. It can make a case weaker or stronger in two ways: (1) independently of the "caselaw" represented by the CKB; or (2) based on the CKB using a weak form of analogy. To accomplish a CKB-independent strengthening/weakening, HYPO simply changes the values of a focal slot in the manner specified by the direction-to-strengthen slot; the amount of change is somewhat arbitrary. To accomplish a CKB-based modification, for instance to strengthen, HYPO first chooses a case that (a) shares the dimension being manipulated, and (b) is further along the dimension in the stronger direction. HYPO then adjusts the values of the focal slots of the seed in the stronger direction so that the derivative case is stronger than the "precedent" chosen from the CKB. These changes can involve numerical, symbolic or Boolean values. For symbolic values, this means using a partial ordering on values.

Modifications can involve more than one focal slot, for instance a ratio. For example, given our fact situation involving Widget-King and Cupcake which involves some expenditure of money by Widget-King for product development, the *Telex v. IBM* case in the CKB is relevant. In *Telex* the ratio of plaintiff's to defendant's expenditures was 2:1 (and the plaintiff won). So to strengthen Widget-King's case, change ratio of Widget-King's to Cupcake's expenses to be at least 2:1. An example of such ratio manipulation can also be found in [McCarty & Sridharan, 1981].

Even a simple change in a single numerical focal slot value can have serious legal implications. Again consider our Widget-King case, as modified by the introduction of 5 disclosees, and make it *weaker* along the *secrets-voluntarily-disclosed* dimension by using cases from the CKB. HYPO *increases* the number of Widget-King disclosees from 5 to 150 based on *Midland-Ross* which was decided for the defendant because there were too many disclosees (100) and now Widget-King has passed the 100-disclosee threshold. Note, Widget-King could still rely on *Data-General* and argue that since the plaintiff won in that case (with 6000 disclosees), it should still win with only 150. HYPO could make the case weaker still by increasing the number of disclosees near or above 6000, the highest value in the CKB or even greater (in a CKB-independent way) to the highest value allowed by HYPO.

**H3. Generate a hypo on a related dimension:** There are certain relations among dimensions in the HYPO program. For example, two dimensions may conflict. That means there is a particular case to which both dimensions apply which would have been decided for the opposing party had only one of the dimensions applied. The dimensions *disclosures-subject-to-restriction* and *secrets-voluntarily-disclosed* conflict with one another in the *Data-General* case. With its 6000 disclosees, the case would have been decided for the defendant but for the fact that the disclosures were subject to restriction.

A hypothetical on a related dimension can be generated by taking the seed case and adding facts sufficient to make the related dimension apply to it in a manner similar to that with heuristic H1. For example, the Widget-King case, as modified by H1 and H2 above, can be further modified so that *disclosures-subject-to-restriction* applies by making all of the disclosures subject to nondisclosure agreements. In this example, the related dimension is also a near miss dimension but that need not always be true.

A hypothetical generated on a conflicting dimension is interesting because it is an example of a case where, at least arguably, facts associated with one dimension can override the effects of the other dimension's facts.

**H4. Examine an extreme case:** To generate an extreme case, HYPO simply changes the value of a focal slot to be an extreme of its range of values. This can also be done in either a CKB-based or CKB-independent manner. The former method pushes the slot value to the extreme actually existing in a case in the CKB, the latter simply pushes the slot value to its permissible extreme.

For instance, the extreme case on the strongest end of the *secrets-voluntarily-disclosed* dimension for Widget-King is the facts as stated above with the exception that there are 0 disclosees. The other extreme is the maximum value for number of disclosees which in the CKB is 6000 and which in HYPO is 10,000,000.

**H5. Manipulating a near win:** A near win hypo is one in which a seed fact situation is weak on behalf of, let us say, the plaintiff. It can be "moved" in the direction of a real target case from the CKB that has been decided in favor of the plaintiff. Using methods H1 through H3, HYPO endows the seed situation with the facts to make the case strong for the plaintiff. As a result, the target case becomes relevant to the seed hypothetical and an argument can be made, based on the pro-plaintiff target case, that the hypo should be decided in favor of the plaintiff. Correspondingly a near win hypo can start with a pro-plaintiff fact situation and be moved in the opposite direction away from the pro-plaintiff seed case or toward a pro-defendant target case.

For example, consider two cases: *Telex*, which we have already seen above, and *Automated Systems*, where court held in favor of the defendant where the confidential information that the plaintiff wanted to protect was about a customer's business operations, that is, the knowledge was about a "vertical market". Using the *Telex* case as a seed, and *Automated Systems* as target, HYPO could make *Telex* a near win by making IBM's confidential information be vertical knowledge (i.e., be about a customer's business operations). As a result, an argument could be based on *Automated Systems* that, in the hypo, defendant *Telex* should win.

## 6. A Heuristic HYPO Exploration

HYPO's heuristically guided generation of hypotheticals makes it possible to explore a fact situation's legal significance in a manner not unlike the sequence of hypotheticals in the creche example from the *Lynch* case oral argument.

To see how this works, let's start with a hypothetical fact situation (a) based on the original *Widget-King* case but modified so that the confidential information is about customer business operations. This modification makes the *Automated Systems* case apply in favor of the defendant. The following hypothetical modifications bolster the plaintiff's position:

Q: Suppose (b) Widget-King's alleged trade secret information, even though it was vertical knowledge, helped it to produce its competing product in half the time like in the *Telex* case?

Q: Suppose (c) the vertical knowledge allowed Widget-King to bring its product to market in one fourth the time and at one fourth the expense.

Q: Suppose (d) that Cupcake paid a large sum to a former employee of Widget-King to use the information to build a competing product, as *Telex* did. Wouldn't the information be protectible as a trade secret then?

In this example, heuristic methods 1,2,3 and 5 are at work. Near miss dimension *vertical-knowledge* is used with 1 to create the initial hypo (a). The modification at (b) is produced by 5 and 2 using the the *Telex* case as the target. Method 2 is used to make the stronger hypo at (c). Methods 5, 1 and 2 are used to create the hypo at (d) where the near miss dimension is *common-employee-paid-to-change-employers*.

Having reached step (d) in the above extended example, a hypothetical has been constructed that is fairly strong for the plaintiff. But plaintiff's position can be eroded by moves along other dimensions:

Q: Suppose (e) that Widget-King made disclosures to 100 outside persons as in the *Midland-Ross* case.

Q: Suppose (f) all of the disclosees entered into nondisclosure agreements as in *Data-General*. Under that case, Widget-King (g) could have made restricted disclosures to as many as 6000 people.

Q: What if (h) Widget-King made restricted disclosures to 10,000,000 people. Is it still a secret? (Not an idle hypothetical in this day of mass marketing of software.)

Q: Are the nondisclosure agreements enforceable? What did all of these people get in exchange for agreeing not to disclose the secret? Suppose (i) that the disclosees did not receive anything of value for entering into the nondisclosure agreements?

With *secrets-voluntarily-disclosed* as near miss dimension and the *Midland-Ross* case as target, the hypo at (e) can be generated from (d) using methods 5, 1 and 2. (f) represents a method 3 move to a conflict dimension, *disclosures-subject-to-restriction*. We assume that the *Data-General* case has been recognized as a conflict-example. Otherwise this could be regarded as a method 5 move with *Data-General* as a target. Using method 4, the hypo at (g) has been moved to the extreme value in *Data-General* and at (h) to the extreme of the range of the dimension. The program does not know that a secret told to 10,000,000 people is not a secret, even if they promise not to tell anyone else, but the program does know that two dimensions conflict and that moving to an extreme on one dimension may cause the conflict to be moot. Having exhausted the possibilities for weakening the case along the *secrets-voluntarily-disclosed* dimension, the program moves, using methods 1 and 2, to a dimension that became a near miss as soon as nondisclosure agreements came into the hypo at (f), *agreement-supported-by-consideration*.

The above line of hypotheticals makes legal sense. One can imagine the scene at 11 p.m. in the oak-paneled library at 14 Wall Street as two first year associate attorneys, assigned to preparing an initial memorandum as to the strengths of Widget-King's claim against Cupcake, play devil's advocate with the facts by spinning off similar hypotheticals. A program that does strategic planning needs to pose and manipulate hypotheticals in just this way and that is what HYPO does.

One can also analyze the sequence of hypotheticals about the civic creche display from the *Lynch* case oral argument in terms of the dimensional model and heuristics for building hypo's. The justices make the basic fact situation weaker and stronger along a dimension that might be called focus-of-attention: they remove all of the secular images leaving only the religious one, they physically shrink the symbol to an extreme and relegate it to a corner, they remove the religious symbols and leave the secular ones. They weaken plaintiff's case along the dimension of civic-content-message by moving it to a municipal art museum or the frieze of a courtroom. They compare the case along the dimension of government-involvement to an extreme example, the Pope's mass on the Mall.

## 7. Conclusion

In this paper, we have discussed an aspect of case-based reasoning (CBR) involving the use of hypothetical cases. In particular, we have discussed how our CBR legal reasoning program HYPO currently uses case examples, "dimensions", and five or so heuristic methods to compare the legal consequences of facts and to generate hypothetical fact situations to augment and explore its case knowledge base (CKB). This is done by consideration of a sampling of hypotheticals, which we have called the "heuristic constellation". The hypotes in the constellation help accomplish analysis tasks, such as testing the sensitivity of positions and relating a fact situation to significant past cases, and argument tasks, such as generating a slippery slope to refine or refute an argument and controlling the course of argument. HYPO generates the hypotes in the constellation with heuristics involving: (1) strengthening/weakening of a case; (2) taking the case to extremes; (3) enabling a near miss case; (4) manipulating a near win; and (5) examining a case along related (e.g., conflicting) dimensions.

## APPENDIX

*Telex Corp. v. IBM Corp.*, 510 F.2d 894 (5th Cir., 1975).

Held for plaintiff IBM on trade secrets misappropriation claim where Telex gained access to IBM's confidential product development information by hiring an IBM employee, paying him a large bonus to develop a competing product. The employee used development notes he brought from IBM. Telex saved time and expense developing the competing product.

*Midland-Ross Corp. v. Sunbeam Equipment Corp.*, 316 F.Supp. 171 (W.D. Pa., 1970).

Held for defendant Sunbeam on trade secrets misappropriation claim where Midland-Ross disclosed its technical product development info to 100 persons.

*Data General Corp. v. Digital Computer Controls, Inc.*, 357 A.2d 105 (Del. Ch. 1975).

Held for plaintiff Data General on trade secrets misappropriation claim where Data General disclosed its technical product development info to 6000 persons, all of whom were subject to nondisclosure agreements.

*Automated Systems, Inc. v. Service Bureau Corp.*, 401 F.2d 619 (10th Cir., 1968).

Held for defendant SBC on trade secrets misappropriation claim where Automated-Systems' confidential info was about customer's business operations (i.e., vertical info).

**Table 1: Sample Cases from Case Knowledge Base.**

**Secrets-voluntarily-disclosed:**

**Significance:** Plaintiff's (P's) position stronger the fewer persons to whom secrets disclosed.

**Prerequisites:** P and Defendant (D) compete; D had access to P's product information and gained some competitive advantage; some disclosures.

**Focal slot:** Number of disclosees. **To Strengthen P:** Decrease number of disclosees. **Range:** 0 to N.

**Cases indexed:** *Midland-Ross, Data-General*

**Disclosures-subject-to-restriction:**

**Significance:** P's position stronger the fewer disclosees not subject to nondisclosure agreements.

**Prerequisites:** Competition; access to info; some disclosures and nondisclosure agreements.

**Focal slot:** Number of disclosees subject to restriction. **To Strengthen P:** Increase percentage of disclosees subject to restriction. **Range:** 0 - 100 %.

**Cases indexed:** *Data-General*

**Competitive-advantage-gained:**

**Significance:** P's position stronger the greater competitive advantage gained by D.

**Prerequisites:** Competition; access to info; D saved some expense.

**Focal slot:** Development expense saved. **To Strengthen P:** Increase expense saved by D.

**Range:** 0 - 100 %. **Cases indexed:** *Telex v. IBM*

**Vertical-knowledge:**

**Significance:** P's position stronger if information technical, not vertical.

**Prerequisites:** P and D compete; D had access to P's product information; info about something.

**Focal slot:** What information is about. **To Strengthen P:** Make information about technical development of product. **Range:** {technical, vertical}

**Cases indexed:** *Automated Systems, et al.*

**Table 2: Sample Dimensions.**

## References

- [1] Kevin D. Ashley. *Modelling Legal Argument: Reasoning with Cases and Hypotheticals - A Thesis Proposal*. Project Memo 10, The COUNSELOR Project, Department of Computer and Information Science, University of Massachusetts, 1986.
- [2] Kevin D. Ashley and Edwina L. Rissland. Toward Modelling Legal Argument. In Antonio A. Martino and Fiorenza Socci Natali, editors, *Atti preliminari del II Convegno internazionale di studi su Logica Informatica Diritto*, pages 97-108, Consiglio Nazionale delle Ricerche, Istituto per la documentazione giuridica, Florence, Italy, September 1985.
- [3] Li-Min Fu and Bruce G. Buchanan. *Inductive Knowledge Acquisition for Rule-Based Expert Systems*. Report KSL-85-42, Knowledge Systems Laboratory, Department of Computer Science, Stanford University, 1985. To Appear in *AI Journal*.
- [4] Paul Gewirtz. The Jurisprudence of Hypotheticals. *American Bar Association Journal*, 67:864-866, 1981.
- [5] M. R. Gilburne and R. L. Johnston. Trade Secret Protection for Software Generally and in the Mass Market. *Computer/Law Journal*, III(3), 1982.
- [6] L. Thorne McCarty and N.S. Sridharan. The Representation of an Evolving System of Legal Concepts: II. Prototypes and Deformations. In *Proceedings of the Seventh International Joint Conference on Artificial Intelligence*, International Joint Conferences on Artificial Intelligence, Inc., Vancouver, B.C., August 1981.
- [7] Edwina L. Rissland. Argument Moves and Hypotheticals. In Charles Walter, editor, *Computing Power and Legal Reasoning*, West Publishing Co., St. Paul, MN, 1985.
- [8] Edwina L. Rissland. Hypothetically Speaking: Experience and Reasoning in the Law. In *Proceedings First Annual Conference on Theoretical Issues in Conceptual Information Processing*, Georgia Institute of Technology, Atlanta, GA, March 1984.
- [9] Edwina L. Rissland, Bruce G. Buchanan, Paul Rosenbloom, and H. T. Ng. *Intelligent Example Selection: Empirical Experiments with Near-Misses*. 1986. Submitted for Publication.
- [10] Edwina L. Rissland, E. M. Valcarce, and Kevin D. Ashley. Explaining and Arguing with Examples. In *Proceedings of the Fourth National Conference on Artificial Intelligence*, American Association for Artificial Intelligence, Austin, TX, August 1984.
- [11] SUP The Complete Oral Arguments of the Supreme Court of the United States. University Publications of America, Frederick, MD.