KNOWING WHAT TO ASK NEXT AND WHY:
Asking Pertinent Questions Using Cases and Hypotheticals [1]

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1. Introduction

In this paper, we outline a program, **HYPO**, that models reasoning with cases and hypotheticals. HYPO works in the task domain of the law, in particular, the area of trade secret protection of software. As illustrated below with actual examples, experts in the law use cases and hypotheticals as primary tools for analyzing fact situations and making arguments about them.

HYPO uses a Case Knowledge Base ("CKB") of actual legal cases to perform its basic tasks of *Analysis, Fact-gathering, Argument, Explanation* and *Hypothetical Generation.* Given a fact situation, the CASE-ANALYSIS module locates cases in the CKB that are relevant, or potentially relevant, to a legal analysis of the fact situation. HYPO's other modules use this information as follows:

- FACT-GATHERING asks the user about significant additional facts;
- ARGUMENT makes and responds to points from a legal argument about the fact situation;
- EXPLANATION explains with case examples the argument exchanges and factual queries; and
- HYPO-GEN generates hypothetical fact situations tailored to the needs of argument making and explanation.

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This paper focusses on how HYPO analyzes a fact situation, its heuristic method for deciding what factual questions are important to ask and which question to ask next, and how it explains questions with examples, real and hypothetical.

2. Examples of How Experts Reason with Cases and Hypotheticals

People expect human experts to be able to explain by giving examples, to pose hypotheticals to demonstrate the consequences of contemplated actions, to think up counterexamples of proposed rules, and to learn from past cases. People assess an expert's understanding of a domain in part by how effectively the expert uses examples and hypotheticals.

Experts reason with cases and hypotheticals in many fields such as mathematics, medicine, and business management, but particularly in law and especially in legal argument.

Oral arguments before the United States Supreme Court illustrate the uses that attorneys make of cases and hypotheticals as tools in argument. To the chagrin of counsel before the bar of the Supreme Court, the Justices frequently interrupt an attorney's presentation to pose hypotheticals. For example, in *Lynch v. Donnelly*, a case involving the constitutionality of the Christmas creche display of the City of Pawtucket, Justices posed the following hypotheticals:

> To the attorney for the City:
>
> Q: Do you think ... that a city could 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?
>
> To the attorney opposing the display:
>
> 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 wisemen 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 toward an establishment of religion violative of the religion clauses? ... Then you think it would be all right 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 policemen on duty, streets closed for traffic control purposes, and all that sort of thing. That was a considerable governmental involvement, was it not? [*SUP, Lynch v. Donnelly*, Case No. 82-1256, Fiche No. 5, pages 9,11,32,37–45].

In the above questions, one can see the Justices modifying the fact situation along various dimensions: changing the location, focus, size, and symbolic religious content of the display, the nature of the viewer, and the degree of government involvement. Sometimes the purpose of the modifications is to compare the fact situation to actual cases previously decided by the court to test whether the current situation presents stronger or weaker facts. [3] Or the actual "case", like the Mall example, may be significant because it did *not* give rise to litigation.

Frequently, the Justices use the hypothetical to apply pressure to the rule proposed by an attorney for deciding the case. That can be seen in the Mall example above and in the following example from *New Jersey v. T.L.O*, a case involving the constitutionality of a high school vice principal's search of a female student's handbag for cigarettes after a teacher reported that she had been smoking in the girls room. A Justice asked:

> Q: Do you think then that a male teacher could conduct a pat-down search of a young woman at age sixteen to find the cigarettes?

In response, the attorney for the state took the position that the Fourth Amendment of the United States Constitution, which has been interpreted as prohibitting unreasonable searches by law enforcement authorities, does not apply to high school administrators. The Justice rejoined:

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[3] 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.

> Q: And does that mean that their authority then to make searches, if the Fourth Amendment is completely inapplicable, extends to any kind of search, strip search or otherwise? [*SUP, New Jersey v. T.L.O.*, 1984 Term, Fiche No. 5, pages 13–22].

In the last example, although the altered fact situation posed by the Justice is still covered by the proposed rule, it is increasingly harder for the attorney to justify applying the rule to the hypothetical because the latter presents progressively weaker facts. The Justice "stacks" the hypothetical with more extreme facts that weigh against the party in the hypothetical who corresponds to the attorney's client. The attorney is forced to distinguish the hypothetical, to come up with some alternative explanation for why the hypothetical and the current fact situation need not be decided the same way.

To summarize, the above examples show how cases and hypotheticals are used as rhetorical tools in argument:

- To present, support and attack positions in an argument (e.g. by testing 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 cases from past experience.
- To factor a complex situation into component parts (e.g. by exaggerating strengths, weaknesses or by hypothetically eliminating features.)
- To control the course of an argument (e.g., by focusing attention of participants in a discussion on particular issues.)

3. The Problem – Asking the Right Questions

As suggested by the above examples, one way of making a legal argument is to cite prior cases as precedents. [4] In urging a court to decide for her client, a lawyer frequently cites a favorable prior case, one whose holding is in favor of a similar party on the same kind of claim. The lawyer will argue that the facts of the precedent are similar in a relevant

[4]For purposes of this research, legal *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 holdings. The *facts* of the case 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 courts will grant relief. Examples of claims are breach of contract, negligence, trade secrets misappropriation, or patent infringement. 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 the defendant, is called a *holding*.

sense to those involving her client. Her opponent naturally will try to distinguish the cited case by pointing out some significant difference between the two fact situations.

HYPO needs to perform roughly the same tasks. It analyzes a fact situation describing a legal dispute between a plaintiff and defendant, determines what claims the plaintiff can assert and makes and responds to legal points on behalf of one or other of the parties. To make a point for the plaintiff, the program selects the most relevant pro-plaintiff case from the CKB, and cites it with a description of the important facts that the case has in common with the current fact situation. To respond to a point, the program may, among other things, distinguish the cited case by pointing out facts in the current situation that favor the defendant.

At various stages, HYPO must decide when and what questions to ask the user about additional facts that may be true of the fact situation. If a particular fact would allow the program to cite a good precedent case for a party, the program should ask the user about the fact.

The research problems addressed in this paper are how the program, given a fact situation, can decide what are the pertinent questions and explain why it asks a question. The problems are important because the user's faith in the program depends, in part, on how well the program asks questions: how many questions it asks, whether the questions evidence an understanding of the legal implications of the fact situation, and whether it has a good explanation of why it asks a question.

4. How HYPO Analyzes a Fact Situation

HYPO employs hierarchical clusters of frames for representing the features of actual legal cases (plaintiff, defendant, claim, facts, etc.) [Rissland, Valcarce, & Ashley, 1984]. The CKB contains about twelve of the leading cases involving protection of trade secrets. Four of the cases are described briefly in Appendix Table 1.

In addition to cases, HYPO has domain-specific knowledge about what clusters of facts are relevant to the legal merits of a claim (i.e., for a particular kind of case, what collections of facts represent strengths or weaknesses in a party's position.) The short answer is that facts are relevant to a claim if a court has decided such a claim in a real case having expressly noted in its opinion the presence or absence of such facts. **Dimensions** represent that knowledge in the HYPO program. Examples of dimensions in HYPO's area of trade secret law are: *Secrets-voluntarily-disclosed*, *Disclosures-subject-to-restriction*, *Competitive-advantage-gained*, *Vertical-knowledge*. These dimensions are summarized in Appendix Table 2.

Each dimension is a frame with the following slots:

Prerequisites
Focal-slots
Ranges
Direction-to-strengthen-plaintiff
Significance
Cases-indexed

As an example, the prerequisites of the dimension called **Secrets-voluntarily-disclosed**, set forth in Appendix Table 2, 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 the 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 would be 0 disclosees. The significance of the dimension is that courts have found the prerequisites and certain focal slot values are a reason for deciding a claim of trade secrets misappropriation in favor of the defendant. The dimension indexes at least two cases: *Midland-Ross* [5] in which the court held for defendant where plaintiff disclosed the secret to 100 persons and *Data-General* [6] in which the court held for plaintiff where plaintiff disclosed to 6000 persons. We have identified some thirty dimensions in the trade secrets domain (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 perform a legal analysis of a fact situation, HYPO determines which dimensions apply to the 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. This process, depicted in Figure 1, is performed by the CASE-ANALYSIS module. 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. As a first approximation, the cases indexed by the

[5] *Midland-Ross Corp. v. Sunbeam Equipment Corp.*, 316 F.Supp. 171 (W.D. Pa., 1970), Appendix Table 1.

[6] *Data General Corp. v. Digital Computer Controls, Inc.*, 357 A.2d 105 (Del. Ch. 1975), Appendix Table 1.

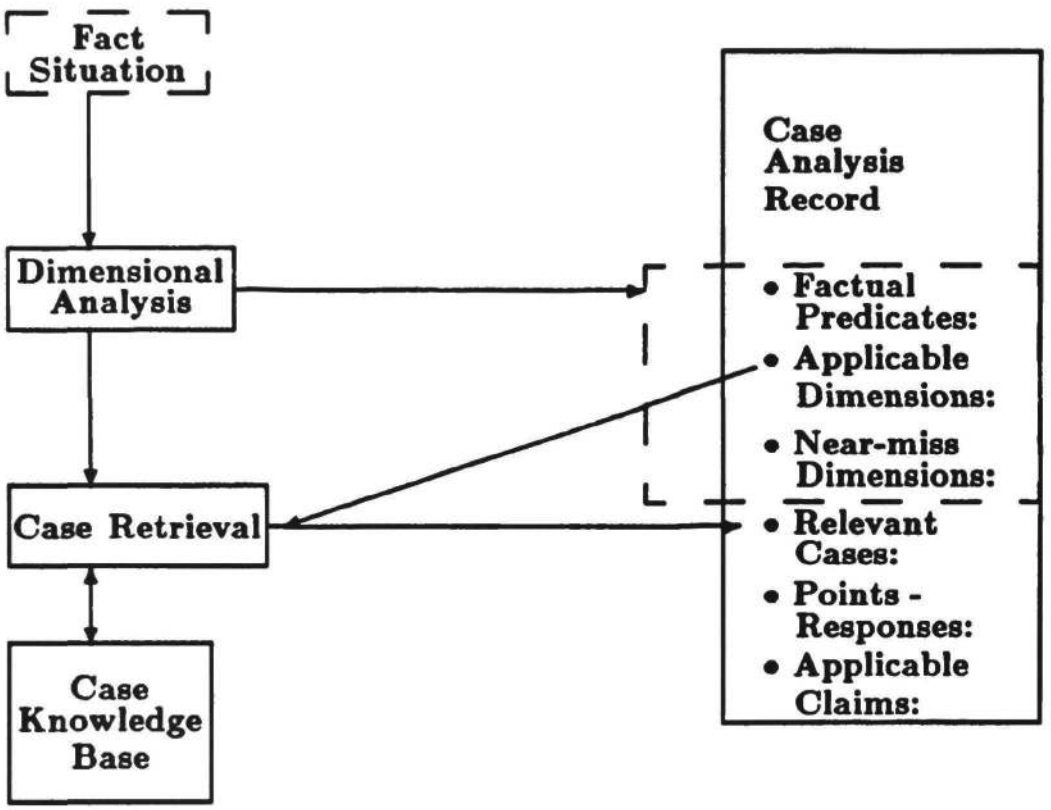

Figure 1: HYPO's CASE-ANALYSIS Module.

applicable dimensions are **relevant** to the fact situation. **Near-miss** dimensions are those for which the particular prerequisite associated with the focal-slot is the only prerequisite left to be satisfied by the fact situation. In *secrets-voluntarily-disclosed*, for example, the prerequisite associated with the focal-slot, number of disclosees, is whether the plaintiff made some disclosures.

5. How HYPO Asks a Question

Basically, what HYPO does is to start with a given fact situation and ask questions about possible facts that would make precedent cases apply in favor of or against various claims of the plaintiff. Since the space of possible facts known to the system is large, it needs to be searched heuristically so that the system asks only those questions which directly pertain to making an argument about the claim.

In effect, HYPO locates the fact situation in the CKB and incrementally moves out from it in various directions toward cases that would be useful for arguing in favor of a party. Dimensions provide the guidance for directing this search.

The process takes place in the following steps:

1. Analyze the fact situation to identify the near-miss dimensions.
2. Select the near-misses that are most *pertinent* to the argument goal.
3. Ask questions to see if the near-miss dimension applies and to determine where the fact situation lies on the dimension.

The first step is performed by the CASE-ANALYSIS module and results in the case-analysis-record described in the last section.

The second step is performed by the FACT-GATHERING module. In essence, the near-miss dimensions are ordered according to their utility in satisfying the current argument goal of the user/system interaction. There are two possible goals:

1. To "build a case" in favor of a plaintiff's claim, by turning up facts upon which a strong pro-plaintiff precedent case involving the claim can be cited;
2. To advise the user of weaknesses, real or potential, by finding facts that the defendant could use to cite a strong pro-defendant case or to distinguish a pro-plaintiff case. In other words, to play Devil's Advocate;

As illustrated below in an extended example, each goal guides the FACT-GATHERING module in selecting near-miss dimensions to ask about. If the program needs to build a case in favor of a claim of the plaintiff, then it screens dimensions that index pro-plaintiff cases involving that claim. If it is playing Devil's Advocate, it (a) screens dimensions that index pro-defendant cases or (b) screens dimensions that lead to facts that distinguish the plaintiff's cases.

The third step is performed in part by the FACT-GATHERING module. The module initiates a question about the missing prerequisite of the selected near-miss dimension. [7] If the dimension is found to apply, the module inquires about the dimension's focal slot value in the fact situation. The program compares the focal slot value in the fact situation with that of a real case indexed by the dimension. The relative values of the

[7] As part of the COUNSELOR project, the HYPO program has been designed to motivate the system to generate natural language questions and explanations by example and to understand the user's answers but it does not itself express or understand natural language outputs or inputs.

focal slots determine whether the fact situation is stronger or weaker than the real case along that dimension and whether the case can be cited on behalf of a party's claim in the fact situation.

In order to illustrate this process, 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. [8]

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

applicable dimensions: nil
near-miss dimensions:
competitive-advantage-gained
secrets-voluntarily-disclosed;
vertical-knowledge
relevant CKB cases: nil

The FACT-GATHERING module uses the goal and the kinds of cases indexed by the near-miss dimensions to select among them. Of the three near-miss dimensions, *competitive-advantage-gained* indexes only a pro-plaintiff case (i.e., a case that the plaintiff won), *vertical-knowledge* indexes only a pro-defendant case and *secrets-voluntarily-disclosed* indexes both a pro-defendant and pro-plaintiff case. Although the number of cases in this example is very small, as the number of cases in the CKB increases, some dimensions will continue to index only cases that favor the plaintiff or the defendant, but not both. Others will index cases of both types.

[8] Another aspect of fact gathering is guiding the user through the process of providing an initial description of the fact situation. In the COUNSELOR project, we are experimenting with using scripts about stereotypical legal disputes involving trade secrets and about attorneys' representing clients to guide the initial questioning and understanding.

If the goal is to build a favorable argument for plaintiff Widget-King, the program will select ***competitive-advantage-gained*** as the first dimension to ask about. This is the first choice because the dimension indexes only pro-plaintiff cases. The CKB contains no case in which the advantage conferred on the plaintiff by virtue of the defendant's having saved development expense was so overshadowed by facts favoring the defendant that the defendant won. If the goal were to build an argument for defendant, ***secrets-volutarily-disclosed*** would be the near-miss dimension of choice.

If ***competitive-advantage-gained*** is selected, the program first asks about the missing prerequisite, whether defendant Cupcake saved any time or expense developing its competing product. If so, the program asks how much time or expense had been saved. If the relative amount of the savings is comparable to or greater than that in *Telex*, that case can be cited in favor of plaintiff Widget-King.

The ***secrets-voluntarily-disclosed*** dimension is the program's second choice in trying to build an argument for the plaintiff. The program needs to find out if Widget-King disclosed its secrets to anyone and whether there were 6000 or fewer disclosures. If so, the *Data-General* case, with its pro-plaintiff holding despite 6000 disclosees can be cited in favor of Widget-King. The dimension is the second choice because it also indexes a pro-defendant case, *Midland-Ross*. In other words, participation in this dimension does not necessarily help the plaintiff. The same dimension might have been selected by the program acting on a goal to build an argument for the defendant. In that event, the program needs to determine if there are 100 or more disclosures. Then *Midland-Ross* could be cited on behalf of defendant Cupcake.

Assume that in response to its questions, the program is told that Widget-King made 110 disclosures. The new fact has a number of effects. The ANALYSIS module updates the case-analysis-record to reflect that ***secrets-voluntarily-disclosed*** is now an ***applicable*** dimension. *Data-General* and *Midland-Ross* are added as relevant cases. The former can be cited in favor of the plaintiff; the latter can be cited in favor of the defendant. Significantly, with the addition of disclosures to the fact situation, the ***Disclosures-subject-to-restriction*** dimension becomes a ***near-miss***.

Switching to Devil's Advocate mode, the program tries to poke holes in the plaintiff's argument by distinguishing the *Data-General* case. That is, it tries to find some fact that makes the *Data-General* case stronger for the plaintiff than the fact situation. There is such a fact. In *Data-General* all of the disclosees were subject to the restriction that they would not tell the secret to anyone else. The dimension ***Disclosures-subject-to-restriction*** captures this information and indexes the *Data-General* case. If Widget-King's disclosees are not similarly restricted, *Data-General* does not really help Widget-King's argument; it is distinguishable.

The possibility of distinguishing *Data-General* makes it important for HYPO to ask the user whether any of Widget-King's disclosures were subject to restriction and how many. Remember that the *Disclosures-subject-to-restriction* dimension has just become a near-miss dimension and also applies to *Data-General*, the case the program is trying to distinguish. On that basis, the program asks about the dimension's missing prerequisite, whether any of Widget-King's disclosures are subject to restriction and if so how many. If the *Widget-King* case is weaker along *Disclosures-subject-to-restriction*, or if that dimension does not apply at all because none of Widget-King's disclosures are subject to restriction, then *Data-General* is distinguishable.

6. Explaining a Question

It is one thing to ask a question and another to explain why the question has been asked. In HYPO, the EXPLANATION module generates explanations of, among other things, requests for additional facts.

HYPO explains a factual query to the user by posing a case example, real or hypothetical, that illustrates the reason for the request. The examples are derived from the cases indexed by the near-miss dimension that motivates the question.

In the above example, if the user demands to know why the program asked whether Widget-King had made any disclosures, the program responds, for example, that it is trying to build an argument for the defendant, that in the *Midland-Ross* case, where plaintiff had disclosed the trade secrets to 100 people, defendant won. In giving the explanation, the program summarizes only the parts of the example case that are relevant to illustrating the significance of the solicited fact by referring to the prerequisites and focal slots of the near-miss dimension that motivated the question.

Since explanations of factual queries are made with examples, the query need not be expressed as a question. Instead of asking whether the trade secret information was disclosed to anyone and then waiting for the user to ask why, the COUNSELOR system could pose a hypothetical: "**What if** Widget-King disclosed the confidential information to 100 people? In the *Midland-Ross* case, the court held for the defendant where...." In so posing the query, the system takes the initiative, retains control over the question-asking process and asks a more meaningful, pointed question initially.

In the above example, HYPO creates a hypothetical fact situation to use as part of its question and explanation. The HYPO-GEN module constructs the hypothetical by modifying a seed case, the current fact situation, to include features of a real pro-defendant target case. The heuristics employed by the HYPO-GEN module to create hypotheticals, in this case making a hypo to which a near-miss dimension applies, are described in detail in [Rissland & Ashley, 1986].

With a specification provided by the EXPLANATION and FACT-GATHERING modules and its own heuristics for building hypos, the HYPO-GEN module constructs a hypothetical that is not only legally sensible but tailored to the needs of explaining a particular question. In the above example, the specification tells HYPO-GEN to build a hypo based on the current fact situation as seed to which the near-miss dimension ***secrets-voluntarily-disclosed*** applies and to make the hypo as weak for the plaintiff along that dimension as the target case, *Midland-Ross*. HYPO-GEN makes the near-miss dimension apply to the hypo by adding facts to the seed case corresponding to the dimension's missing prerequisite (i.e., 100 disclosures, as in *Midland-Ross*.) The hypo can be made stronger or weaker for the plaintiff by modifying the facts of the seed case corresponding to the focal slot of the dimension (e.g., increasing the number of disclosees.) The dimension's focal-slot, range and direction-to-strengthen-plaintiff slots contain the information necessary for making the hypo stronger or weaker along the dimension.

HYPO's facility for generating hypotheticals allows the program to guide the user through the space of possibly significant facts and precedent cases and to explain their significance.

7. Conclusion

In this paper, we have illustrated with examples of oral arguments before the Supreme Court how case examples and hypotheticals are primary tools for analyzing and making arguments about fact situations. We have described HYPO, a program that models reasoning with cases and hypotheticals, and shown how the program analyzes a fact situation, how it decides what are important questions to ask and which question to ask next, and how it explains questions with examples, real and hypothetical.

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 it's 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; P made 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.

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