Teaching and Using Analogy in Law

Dan Hunter*

> And I cherish more than anything else the Analogies, my most trustworthy masters. They know all the secrets of Nature, and they ought to be least neglected.
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> - Johannes Kepler

I. Introduction

Analogy plays a central role in legal reasoning, yet how to analogize is poorly taught and poorly practiced. We all recognize when legal analogies are being made: when a law professor suggests a difficult hypothetical in class and a student tentatively guesses at the answer based on the cases she read the night before, when an attorney advises a client to settle because a previous case goes against him, or when a judge adopts one precedent over another on the basis that it better fits the present case. However, when it comes to explaining why certain analogies are compelling, persuasive, or better than the alternative, lawyers usually draw a blank. They have little idea how to create an analogy, what an analogy is, or why one analogy might be more effective than any other. The teaching of analogy reinforces this sense that analogies are a mystery: the teacher suggests that the student will learn what is a good analogy only through experience. If law professors try to teach analogy construction at all, they usually choose one of two approaches. They might teach the "LSAT Model" of analogies: "Arm is to Leg as Hand is to What?" The student should answer "Foot," but even so, what has the student learned? At best, this model suggests that an analogy is some kind of relationship, but it doesn't give much guidance beyond that. Alternatively, the professor might adopt the theories of a number of legal philosophers[1] and teach analogies as a type of rule. In this model, the student takes a case, renders the case down into a holding, and then applies the holding to the undecided case. This model has the benefit of teaching the student that analogies actually matter in law, but it suggests that the only trick of legal analogies is to find the appropriate rule that explains a case. Yet, as students quickly realize, cases

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* Robert F. Irwin IV Term Assistant Professor of Legal Studies, Wharton School, University of Pennsylvania (hunterd@wharton.upenn.edu). This is an edited version of an earlier article, Dan Hunter, *Reason is Too Large: Analogy and Precedent in Law*, 50 Emory L.J. 1197 (2001). Used with the permission of Emory Law Journal.

1. *See* Hunter, biographical footnote *supra*, at 1239-43.

cannot be easily boiled down to a simple rule, and they often may be used to support quite conflicting principles.

One of the main problems with both these models[2] is that, while they contain a grain of truth, they are so general as to be of no practical use in explaining to students or lawyers how to use analogies effectively. It *must* be the case that some analogies are better than others, but neither of these models explains why some are better than others, or how a student or a lawyer can learn to distinguish good analogies from mediocre ones.

The purpose of this article is to provide a simple model that can be used to teach and to learn how analogy actually works, and what makes one analogy superior to a competing analogy. The model is drawn from a number of theories of analogy-making in cognitive science. Cognitive science is the "long-term enterprise to understand the mind scientifically."[3] The field studies the mechanisms that are involved in cognitive processes like thinking, memory, learning, and recall; and one of its main foci has been on how people construct analogies. The lessons from cognitive science theories of analogy can be applied to legal analogies to give students and lawyers a better understanding of this fundamental process in legal reasoning.

II. The Cognitive Science of Analogy

> There is no word which is used more loosely, or in a greater variety of senses, than Analogy.
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> - John Stuart Mill

The term "analogy" is used in so many different ways, especially within law, that it is difficult to define it accurately, let alone comprehensively. Furthermore, legal commentators have caused enormous problems by failing to explain how analogy differs from the related inference processes of induction and metaphor. This has led to sloppy thinking, and poor analysis. It is important to define analogy and analogical reasoning, and to show how they are different from both inductive inference and metaphor.

An analogy is a non-identical or non-literal similarity comparison between two things, with a resulting predictive or explanatory effect.[4] This means that two items are compared, and the outcome, result or determination of one of these items is predicted or explained to be the same as the other. Typically, we compare items where we know the outcome of one, and we suggest that the outcome of the other will be the same.

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2. The other main problem is that these theories are also wrong. *See id.* at 1243-45.
3. David W. Green et al., *Cognitive Science — An Introduction* 2 (Blackwell Publishers 1996).
4. This definition is adapted from Dedre Gentner et al., *Viewing Metaphor as Analogy*, in *Analogical Reasoning: Perspectives of Artificial Intelligence, Cognitive Science, and Philosophy* 171 (Daniel H. Helman ed., Kluwer 1988) [hereinafter *Analogical Reasoning*].

The obvious example of legal analogy is case law reasoning: prior analogs, called precedents, are used to predict, explain or justify the outcome of the currently undecided case.[5] An example will be useful here to explain the mechanism. Let us say a judge is faced with a case in which a man is suing for the loss of his luggage while he was traveling onboard an overnight ferry. The luggage was stolen from an overhead rack in the plaintiff's compartment. The plaintiff is suing the ferry company on the theory that it was the bailee of his bags and therefore liable for their loss. Let us assume that there is no statutory pronouncement on the subject, and there are only two precedents that might be relevant to the decision. The first precedent involved a hotel proprietor who was found liable for a guest's stolen luggage because part of the contract of hospitality involved reasonably safe storage of the guest's belongings. The second precedent involved a railroad company, which was found not liable for the loss of the luggage of a passenger who traveled in a sleeper berth because the contract was primarily for travel and not for lodging.[6]

Plaintiff's counsel will suggest that the ferry is a "floating hotel": it has cabins like hotel rooms, it has restaurants and other hotel-like facilities, and passengers almost inevitably spend the night onboard. Therefore, the judge should follow the hotel precedent and find for Plaintiff. Defendant's counsel will suggest that the ferry is a "seagoing train": the intention of the passengers is primarily to travel and not to stay overnight, trains have restaurants and bars, and so forth. Hence, the decision should be against Plaintiff.

The question for the judge is straightforward: Will she opt for the "floating hotel" analogy or the "seagoing train" analogy? In deciding this case, the judge may draw an analogy to a hotelkeeper's duty to protect the bags of a guest, or alternatively, point to the railroad's lack of duty to do the same for a passenger. In each analogy, the judge chooses some non-identical features of the precedent as being sufficiently similar to the current case to warrant the same outcome — perhaps the fact that both the train and ferry involve transportation or alternatively that both the hotel and ferry have sleeping quarters. Having drawn the comparison between the precedent and the undecided ferry case, the judge uses the precedent's outcome to decide the new case. Whether the judge chooses the train or hotel precedent as analogous, the analogy has a strongly constraining, predictive effect on the outcome of the undecided ferry case.

Inductive inference or induction is related to analogy. Induction is, generally, the process of taking a number of specific cases or instances, classifying them into categories according to relevant attributes and outcomes,

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5. Edward Levi, *An Introduction to Legal Reasoning* 9-15 (U. of Chi. Press 1949).

6. This *Gedanken* experiment is based on the case of *Adams* v. *New Jersey Steamboat Co.*, 151 N.Y. 163 (1896). Thanks go to Martin P. Golding, *Legal Reasoning* (Knopf 1984) for uncovering this gem.

and generalizing an inclusory rule from them.[7] That is, we take a number of isolated experiences and attempt to explain them by a general rule that covers the instances examined. Within law, we can find numerous examples of this: the ability of attorneys to say from experience what particular judges' decisions are likely to be, their ability to fit multiple precedents into a coherent framework of rules and principles, and so on.[8]

Many lawyers fail to recognize that induction requires the generalization of a rule from prior experience, whereas analogy is a one-to-one similarity comparison that requires no generalization to operate effectively. The best example of this is the *ejusdem generis* canon of statutory interpretation.[9] *Ejusdem generis* means "of the same kind, genus or nature"[10] and the canon is invoked when there is a statutory definition of the form "*x*, *y*, *z* or other."[11] The canon is applied to determine whether something that is not defined should be included as "other." That is, it is used to define the scope of general words that immediately follow specific words. So, for example, in a statutory definition that indicated "planes, trains, automobiles, or other," a question might arise whether a skateboard, a solar-powered vehicle, or a snowmobile should be included within the definition of "other."

The *ejusdem generis* rule clearly relies on inductive inference. To determine what the expression "other" encompasses, courts must examine the words that make up the antecedent part of the expression in question, and then decide what the scope of those words incorporates. Courts specifically require the identification of the genus as the first step in the interpretive process. It will therefore always be necessary to create an inductive generalization about the set of concepts that the legislature intended to be included.[12]

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7. *See* John H. Holland et al., *Induction: Processes of Inference, Learning, and Discovery* (MIT Press 1986); Keith J. Holyoak & Paul Thagard, *Mental Leaps: Analogy in Creative Thought* 19-20 (MIT Press 1995); L. Jonathan Cohen, *An Introduction to the Philosophy of Induction and Probability* (Oxford U. Press 1989); Nicholas Rescher, *Peirce's Philosophy of Science: Critical Studies in His Theory of Induction and Scientific Method* (U. of Notre Dame Press 1978); Nicholas Rescher, *Induction: An Essay on the Justification of Inductive Reasoning* (Blackwell 1980). For an analysis of the similarities between analogy and induction, see Stuart J. Russell, *Analogical and Inductive Reasoning* (unpublished Ph.D. dissertation, Stanford U. 1997) (microformed on Technical Rpt., Dept. of Computer Sci., STAN-CS-87-1150); Stuart J. Russell, *The Use of Knowledge in Analogy and Induction* (Morgan Kaufman 1989).

8. For an analysis of inductive inference in law, see Dan Hunter, *No Wilderness of Single Instances: Inductive Inference in Law*, 48 J. Leg. Educ. 365-401 (1998); Michael S. Moore, *Precedent, Induction, and Ethical Generalization*, in *Precedent in Law* 183 (Laurence Goldstein ed., Oxford U. Press 1987).

9. The rule applies also in interpretation of other documents, but is at its most powerful in statutory interpretation. *See generally* J. Bell & G. Engle, *Cross on Statutory Interpretation* 135-37 (3d ed., Butterworths 1995); F.A.R. Bennion, *Statutory Interpretation: A Code* 858-64 (2d ed., Butterworths 1992).

10. Roger Bird, *Osborn's Concise Law Dictionary* (7th ed., Sweet & Maxwell 1983).

11. Under some conditions, the *ejusdem generis* canon will be applied even where there is no specific reference to "other." *See* Bell & Engle, *supra* n. 9, at 135-37.

12. Scott Brewer wrongly suggests that the rule is analogical. Scott Brewer, *Exemplary Reasoning: Semantics, Pragmatics, and the Rational Integrity of Legal Analogy* 937 (U. of Toronto 1995).

Analogy is different from induction. It does not rely on any generalization of prior experience. However, it is related to induction in that both rely on similarity comparisons of prior experience.

Analogical inference also shares a number of features with metaphorical inference. Metaphors have a less constraining effect on reasoning than do analogies, but they operate in a similar fashion. Metaphor is an expression forming a non-literal similarity comparison between two things, which has an expressive or affective content and thereby carries meaning.[13] Unlike analogies, metaphors do not have a predictive content and do not strongly constrain the outcome of the reasoning process.[14] Thus, in Shakespeare's *Romeo and Juliet*, Romeo's metaphor "Juliet is the sun" contains an explicit similarity comparison between "Juliet" and the "sun": in comparing Juliet and the sun, the intent is to convey the expressive meaning that, to Romeo, she is the light of his world, she provides life and energy. Metaphors within the legal sphere operate in a similar way. To use the metaphor of the "corporate veil" — to say for example that "Company directors are protected by the corporate veil" — conveys the expressive meanings that the corporation is a separate entity from the directors, the directors are shielded behind some kind of protection, the directors are somehow "unseen" while behind the veil, and so on.[15] However, the metaphor does not strongly direct or predict the outcome of a case in the way that a legal analogy does. In contrast, for example, if our judge decides that a ferry is just the same as a train, the "train" precedent controls the outcome of the undecided ferry case.

The definitions given above are derived from cognitive science approaches to metaphor and analogy,[16] and they are useful in both developing the connection between the two concepts and explaining their differences. Both analogy and metaphor involve a similarity relation between two objects, and the similarity relation transfers meaning from one object (the source) to another (the target).[17] The major difference between the two is that an analogy has an explicit explanatory or predictive component which metaphors lack.

For a longer discussion of the *ejusdem generis* rule and its inductive character, see Hunter, *supra* n. 8.

13. Again adapted from Gentner et al., *supra* n. 4, at 171.

14. *Id.*

15. This example stems from the general metaphor of the "The Corporation is a Person," a metaphor analyzed by Sanford A. Schane, *The Corporation is a Person: The Language of a Legal Fiction,* 61 Tul. L. Rev. 563 (1987). Schane's exemplary study demonstrates that the metaphor is not merely a fiction, created out of legal "whole cloth." Instead, the metaphor accords with generally held conceptions that humans have about institutions. Through linguistic examples, he traces how we refer to institutions made up of a number of individuals as though they were a single unit or person. *Id.* at 595. For an earlier formulation of a similar proposition, see A.W. Machen, Jr., *Corporate Personality*, 24 Harv. L. Rev. 253, 263 (1911).

16. Gentner et al., *supra* n. 4, at 171.

17. Bipin Indurkhya, *Metaphor and Cognition: An Interactionist Approach* 14-17 (Kluwer 1992); Gentner et al., *supra* n. 4.

This explanation is not intended to articulate completely the relationship between metaphor and analogy.[18] Instead it is offered to show that both are similarity-matching processes which introduce a constraint upon human thinking, and moreover to provide some guidance about the difference between "analogies," "metaphors," and "induction." With these definitions out of the way, let us look at how humans make analogies.

A. Analogy theories in cognitive science

> And remember, do not neglect vague analogies. But if you wish them respectable, try to clarify them.
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> - George Polya

Analogy has been the subject of a significant body of research within cognitive science, where much of the emphasis has been on how humans think creatively. Most researchers agree that analogy is fundamental — or at least very significant — in creative thought.[19] Though there are various competing models that differ in their minutiae[20] cognitive scientists generally agree on the fundamentals. The main features are the concept of mapping, the role of source and target domains, and the operation of the parts of the process.

Both analogical and metaphorical reasoning involve a mapping of concepts from one set of ideas (the source domain) to another set of ideas (the target domain). The approach can be demonstrated by seeing how it is used to explain metaphor. *Target* and *source* are sometimes described as the "two halves of metaphor."[21] In any given metaphor, the target is the

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18. For more detailed examination of this point, see (amongst others) Dedre Gentner and M. Jeziorski, *The Shift from Metaphor to Analogy in Western Science*, in *Metaphor and Thought* 447 (Andrew Ortony ed., 2d ed., Cambridge U. Press 1993); Indurkhya, *supra* n. 17, at 315-56; Earl R. MacCormac, *A Cognitive Theory of Metaphor* 23 (MIT Press 1985); Mark Johnson, *Some Constraints on Embodied Analogical Understanding*, in *Analogical Reasoning*, *supra* n. 4 at 25.

19. M.W. Eysenck & M.T. Keane, *Cognitive Psychology: A Student's Handbook* 392-94 (Hillsdale 1995); A. Garnham & J. Oakhill, *Thinking and Reasoning* 215-17 (Blackwell 1994).

20. The most interesting and thought-provoking of all theories of analogy differs in its larger features. This is the work of Douglas Hofstadter and his students. *See e.g.* Douglas R Hofstadter, *Fluid Concepts and Creative Analogies: Computer Models of the Fundamental Mechanisms of Thought* (Basic Books 1995); Douglas R Hofstadter & Melanie Mitchell, *An Overview of the Copycat Project* (microformed on Technical Rpt. CRCC-52-1991, Ctr. for Research on Concepts and Cognition, Indiana U., Bloomington); Melanie Mitchell, *Analogy-Making as Perception: A Computer Model* (MIT Press 1993). Hofstadter and his team use computational modeling of very low-level processes in analogy from toy domains such as letter-strings, number sequences and alphabet designs. An early research model of his was adopted in a prototype teaching tool for law students. Peter Suber, *Analogy Exercises for Teaching Legal Reasoning*, 17 J. Leg. Stud. & Educ. 91 (1988).

21. I.A. Richards, *The Philosophy of Rhetoric* 95 (Oxford U. Press 1936). Richards uses *tenor* and *vehicle* for *target* and *source*. *Id.* at 96. I prefer the use of target and source used by Indurkhya, *supra* n. 17, at 14-17; and George Lakoff & Mark Johnson, *More Than Cool Reason: A Field Guide to Poetic Metaphor* 38 (U. of Chi. Press 1989).

underlying idea or principal subject. The source, which carries the metaphor, is the domain from which the salient features are drawn and then attributed to the target. So, in the simple metaphor "lawyers are pigs," "lawyers" is the target and "pigs" is the source. The source imports a host of features associated with "pigs" without seeking to draw an identity-relation between lawyers and pigs. The associations here might include "rapacious appetite," "non-discriminating appetite," "eating at the trough," "growing fat," "failing to do any work," and even perhaps "absence of personal hygiene." Analogies work in the same way: features from the source are mapped onto the target, importing a series of elements that are not present in the target.

One of the first studies of analogical mapping between domains was Gick and Holyoak's reinterpretation[22] of Duncker's early radiation problem.[23] In Duncker's experiment, subjects were asked to solve the problem of curing a cancerous tumor by radiation therapy. The constraints on any solution were:

> High energy radiation would damage the patient's tissues.
> Low energy rays would not kill the tumor.

The solution lay in directing a number of low energy rays from different positions on the body, but which intersected at the tumor site and created a point of high energy. In this way the two constraints were satisfied. Few subjects solved the problem when presented in this way.

Gick and Holyoak[24] adapted this problem to investigate analogical reasoning. Their new experiment included a number of stories that the subjects read prior to tackling the radiation problem. One story involved an army of men which sought to overthrow a tyrannical ruler who was hiding in a fortress. Unfortunately for the rebels, the roads leading to the fortress were all mined, such that if a large number of men walked over any one road a mine would explode. The solution was to break the men into small groups and send them down different roads to converge on the fortress at the same time. The analogy between the fortress and the tumor was now obvious, and the number of subjects solving the problem rose dramatically, especially when the subjects were prompted that the solution to the radiation problem might lie in one of the previous stories. This demonstrated the power of analogical mapping from the source (tyrant story) to the target (cancer story), where the structural elements were the same and where the outcome of the source story was the same as the desired one for the target.

Though research has shown that analogical reasoning involves some kind of mapping between domains, this is only the start of any model of analogy.

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22. M.L. Gick & Keith J. Holyoak, *Analogical Problem Solving*, 12 Cognitive Psychol. 306 (1980) [hereinafter Gick & Holyoak, *Analogical Problem Solving*]; M.L. Gick & Keith J. Holyoak, *Schema Induction and Analogical Transfer*, 15 Cognitive Psychol. 1 (1983) [hereinafter Gick & Holyoak, *Schema Induction*].

23. Karl Duncker, *On Problem-Solving* (Lynne S. Lees trans., Am. Psychol. Assn. 1945).

24. Gick & Holyoak, *Analogical Problem Solving, supra* n. 22, at 306; Gick & Holyoak, *Schema Induction*, *supra* n. 22, at 1.

First, the question arises as to *what* is mapped from source to target. The mapping seems to involve some structural elements rather than merely surface features. Thus, in the radiation problem, the important concepts seem to be the structural concepts of attack (by ray or soldiers), the concept of splitting the attack (ray or soldiers), and the concept of the attacked item being malignant (cancer or tyrant). The surface features can be (and indeed must be) ignored: one story involved the body of a patient and the other involved a fictitious country, one story involved soldiers and the other radiation rays; and so forth.

Notwithstanding that structure seems to be the key to mapping here, it cannot be the entire solution to the question of how analogy operates. Research into the retrieval of analogs indicates that humans find retrieval of structural analogs very difficult, and find analogs based on surface features much easier to recall.[25] In studies on the radiation problem, subjects more often recalled an analog about a doctor using rays for some non-therapeutic reason than they recalled the tyrant analog, even though the doctor story was not helpful in solving the problem. Structural isomorphism, or the need to see structural similarities between the source and the target is an important constraint upon analogical inference, but other constraints exist, as I shall shortly explain.

The second question is *why* certain features are mapped. In another famous example,[26] students learned more readily about the mechanics of the atom by using the analogy of the solar system. In this analogy, the student mapped the known concept of the sun being at the heart of the solar system, onto the unknown world of the atom. Thus, the atom's nucleus became the "sun," and the electrons became the circling "planets." The known concept of attraction between sun and planets was used as an analog for the attraction between nucleus and electrons. Both of the features mapped are structural features of the source. However, other equally plausible structural features of the source are not mapped onto the target. Thus, the information that the third planet from the sun has life on it is not mapped onto the third electron in an atom; the fact that the sun is largely gaseous is not mapped onto the nucleus; and so on. To find out why some features are chosen while others are ignored, we need some account of what constraints influence the mapping procedure. This leads to the multiple-constraint model.

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25. Gick & Holyoak, *Analogical Problem Solving, supra* n. 22, at 306; Dedre Gentner et al., *The Role of Similarity in Transfer*, 25 Cognitive Psychol. 431 (1993); Keith J. Holyoak & K. Koh, *Surface and Structural Similarity in Analogical Transfer*, 15 Memory and Cognition 332 (1987); Mark T. Keane, *On Retrieving Analogues When Solving Problems*, 39A Quarterly J. of Experimental Psychol. 29 (1987). *Cf.* C.M. Wharton et al., *Below the Surface: Analogical Similarity and Retrieval Competition in Reminding*, 14 Cognitive Psychol. 246 (1994).

26. Dedre Gentner, *Structure Mapping: A Theoretical Framework for Analogy*, 7 Cognitive Sci. 155 (1983); Dedre Gentner & D.R. Gentner, *Flowing Water or Teeming Crowds: Mental Models of Electricity*, in *Mental Models* 99 (Dedre Gentner & A.L. Stevens eds., Lawrence Erlbaum Assocs. 1983).

B. The multiple-constraint model

Keith Holyoak and Paul Thagard[27] have presented a "multi-constraint" model of analogy. They suggest that various constraints influence the generation and perception of analogies. They suggest three basic kinds of constraints in analogical thinking:[28] constraints at the surface level, at the structural level, and at the purposive level. In the sections that follow I outline these levels and demonstrate how they apply to analogies in law.

1. The surface constraint

The surface-level constraint suggests that an analogy is guided by the *direct similarity* in the surface-level elements in the source and target domains. Thus, in the example of the atom-solar system analogy, there are directly similar features present in both domains. In each domain, something lies in the center of the system, and other things revolve around this central body. Thus, it is immediately possible to establish a one-to-one mapping between surface-level objects within the two domains.[29]

How does this apply to law, and in particular, to the ferry example? Surface-level similarities are obvious between the ferry case and the train: both involve travelers moving between two places. Alternatively, the similarities between the ferry and the hotel cases are obvious: both cases involve locked rooms (whether hotel room or ferry stateroom) from which the bags were taken, both have restaurants, bars; and so on. Surface similarity exists in both cases.

Having suggested that the surface-level similarity constraint might operate in the ferry example, the question is whether there is stronger evidence that it is manifested in legal reasoning. There are two strong pieces of evidence for this. For a start, there is the obvious application of this constraint when a judge assesses two cases as analogous based on surface-level features. Say, for example, we are considering lower-court decisions on the distribution of property between spouses after divorce. Let us say a precedent is similar to the current case — in both cases there are three children of the marriage, the wife has custody of them, the major asset is the house, the wife sued for divorce based on the husband's adultery, and so forth. It is likely that the judge will, without examining any deeper structural features or principles,

27. Keith J. Holyoak & Paul Thagard, *A Computational Model of Analogical Problem Solving*, in *Similarity and Analogical Reasoning* 242 (Stella Vosniadou & Andrew Ortony eds., Cambridge U. Press 1989); Holyoak & Thagard, *supra* n. 7; Paul Thagard, *Dimensions of Analogy*, in *Analogical Reasoning*, *supra* n. 4 at 105.

28. Holyoak & Thagard, *supra* n. 7, at 5.

29. This type of similarity matching is often called "propositional" similarity because matching occurs between propositions rather than between the relations that operate on the domains. *See id.* at 24-31.

award a property division based on the surface-level similarity in the cases.[30] This is more likely if, as commonly happens, the judge is faced with many cases to decide in a limited time frame. We should expect to see broadly similar results in the sentencing of convicted criminals, the assessment of liability in automobile accidents, and other areas where lower-level courts are dealing with run-of-the-mill actions.[31]

Surface-level similarity matching has also been demonstrated by Alan Tyree. Tyree reported on a study of the decision making of law students in the field of trover, that is, the property law domain dealing with ownership of lost chattels.[32] He asked upper-level law students to predict the outcome of an undecided case based on a set of appellate decisions.[33] He showed that law students' judgments of similarity were not based on high-level analysis of policy considerations or on legal doctrine, but rather on matching surface-level facts.[34] He was then able to use this information to build a simple computer-based expert system that accurately predicted the outcome of cases based on simple fact matching.[35] James Popple later adopted this approach and showed that it was a generalizable methodology in a number of different legal domains, including copyright and employment law.[36] Popple also built an expert system based on this methodology, and showed that it had a high degree of accuracy in predicting the outcome of cases. These two studies in law, together with the many other cognitive psychological studies, give strong initial indications that surface-level mapping is almost certainly undertaken in precedential reasoning and legal analogy-making generally.[37]

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30. Knowledge engineering exercises have shown this occurs in low level domains such as divorce proceedings. *See* John Zeleznikow, Andrew Stranieri & Mark Gawler, *Split-Up: A Legal Expert System Which Determines Property Division Upon Divorce*, 3 Artificial Intelligence and L. 267-275 (1996).

31. For examination of these types of commonplace cases and the role that they play in knowledge engineering, see Dan Hunter, *Near Knowledge: Inductive Learning Systems in Law*, 5 Va. J.L. & Tech. 9 (2000).

32. Alan L. Tyree, *Fact Content Analysis of Case Law: Methods and Limitations*, 22(1) Jurimetrics J. 1 (1981).

33. These cases were all drawn from the English House of Lords, and High Court of Appeals. *See* Alan L. Tyree, *Expert Systems in Law* 161-75 (Prentice Hall 1989); Tyree, *supra* n. 32.

34. Amos Tversky, *Features of Similarity*, 84 Psychol. Rev. 327 (1977); Tyree, *supra* n. 32.

35. Alan L. Tyree, *Finder: An Expert System*, in *The Proceedings of the Fortieth Annual Conference of the Australasian Universities Law Schools Association* (AULSA 1985); Tyree, *supra* n. 33.

36. James Popple, *Shyster: A Pragmatic Legal Expert System* (unpublished Ph.D. dissertation, Dept. of Computer Sci., Australian Natl. U. 1993) (copy on file with author); James Popple, *A Pragmatic Legal Expert System* (Dartmouth 1996).

37. These two studies have significant problems for my purposes: they are based only on law student prediction and not actual adjudication. There is also the concern about what "accurate predictions of outcomes" means and whether it is a good basis for a theory of analogy in law. However, these concerns can be answered by suggesting that the process of student reasoning is consistent with advanced legal reasoning by judges and attorneys. *See* Gary L. Blasi, *What Lawyers Know: Lawyering Expertise, Cognitive Science, and the Function of Theory*, 45 J. Leg. Educ. 313 (1995).

Moreover, surface-level similarity depends on context. Holyoak and Thagard note that similarity is not a fixed concept, especially surface-level similarity. The perception of similarity differs depending on the background information which is provided, the "context effect." In classic studies undertaken by Tversky,[38] subjects were asked which one of a group of countries was most similar to Austria. When asked which country was most similar to Austria from a group including Sweden, Hungary, and Poland, subjects generally chose Sweden. However, when presented with the group of Sweden, Hungary, Norway and asked which was most similar to Austria, subjects usually chose Hungary. Keeping two of the possibilities constant, Sweden and Hungary, but changing one possibility, Poland swapped for Norway, was enough to change the assessment of similarity even though the changed country was not deemed to be the closest.

The explanation is simple: in the first test, the similarities between Poland and Hungary (at the time both were Eastern Bloc communist under Soviet control) grouped them together, leaving Sweden to appear more like Austria — emphasizing their similarity in terms of their being Western European in orientation and capitalist. In the second test, the similarities between Sweden and Norway (similar language and both being Scandinavian/Nordic countries) grouped them together, leaving Austria to appear more like its old imperial ally, Hungary. Thus, human assessment of similarity on surface features has been shown to be context-dependent.

Do we see similar context dependence in law? There are three pieces of evidence affirming this. First, Kelman, Rottenstreich, and Tversky undertook a study of the effect of context dependence in legal decision making.[39] Though they were looking for slightly different effects from the one posited here, they demonstrated that people generally displayed the same context effects when making legally oriented decisions. They concluded that whether intended or not, adding alternatives "will not only introduce what may seem a substantively plausible decision option but will alter the choice patterns among other options."[40]

This doesn't explain every part of the analogy-making process in law, since these studies did not examine judges' decision making, nor were they looking at analogical reasoning. However, their results are extremely suggestive. Indeed it would be remarkable if context effects found in one type of legal reasoning were not also present in precedential reasoning.

Following on from this, I suggest that the process of advocacy before a judge is, in part, an attempt to introduce this context effect. Recall the ferry example. Counsel for Plaintiff, seeking to advance the "floating hotel" theory, with its attendant liability outcome, will presumably highlight the factual

38. Tversky, *supra* n. 34. This has been replicated in many different studies, and in different fields.

39. Kelman, Rottenstreich, and Tversky, *Context-Dependence in Legal Decision Making*, 25 J. Leg. Stud. 287 (1996).

40. *Id.* at 310.

similarities between the ferry and a hotel and may introduce other examples that make the "seagoing train" theory less palatable. Thus, a good lawyer might introduce another example where a metropolitan trolley-car company was held not liable for theft committed on its trolleys.[41] Thus, the context effect experiment becomes: "Out of (hotel, train, trolley car) which is a ferry more like?" The answer is, presumably, the hotel. Defendant's counsel might counter by introducing another example, where the owners of a permanently berthed cruise-liner were found liable for water damage to a guest's luggage. The context effect experiment then becomes: "Out of (hotel, berthed liner, train) which is a ferry more like?" In introducing these new examples, the attorney endeavors to force a new classification of similarity on the problem, in the same way that introducing "Poland" or "Norway" affects our view of Austria. The best trial lawyers are able to influence judicial assessments of similarity by a skillful manipulation of the context effect.

Finally, the context effect explains an observation made in the early work on legal reasoning by Edward Levi. In his seminal study, Levi charted the development of the doctrine of inherently dangerous goods.[42] It began with the single decision that an exploding lamp was dangerous, eventually expanded to included things "imminently" dangerous if defective, and eventually became things "inherently" dangerous. He concluded:

> [The concept of inherently dangerous goods] . . . has the capacity to suggest by the implication of hypothetical cases which it carries and even by its ability to suggest other categories which sound the same. The phrase 'imminent danger," for example, suggested immediacy, inherence, and eminence. To this extent, the phrase suggests the instances to be included under it . . . .[43]

The context effect of similarity seems to be operating here, though this time the features making up the context are not other cases but the words of the doctrine. "Imminent" suggests "immediacy" and "inherent" and thus the context affects the articles that subsequently are included in the category. I do not present this evidence as incontrovertible, as no studies on this point in law have been made. However, it seems, like the evidence above, to point to the same effect in legal analogical inference.

As a final observation on surface-level similarity, it is important to bear in mind that this type of similarity is only an initial constraint and can often be satisfied by many things. For example, as an analog of the atom, we could suggest a ball on a string whirled above our heads or cars circling the outside

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41. It should not matter whether this is an actual precedent or merely an example provided by counsel. Note also that this is introducing a notional "point for the other side" by providing an example that refutes liability. It is also possible to introduce examples that point to liability, but this is a less interesting effect than the one described here.

42. Levi, *supra* n. 5, at 9-27.

43. *Id.* at 27.

lane at Dupont Circle in Washington D.C. For the constraint of surface-level similarity, these analogs are almost as good as the solar-system analog. However, we immediately recognize that the *ball-on-a-string* analog and the *car-in-Dupont-Circle* analog are somehow less compelling or useful than the solar system analogy; so some other constraints must be operating here. Equally in the legal ferry example, many other cases with surface similarity may exist, none of which make good analogies. What of cases where a passenger on a cruise-liner is killed by another passenger or where a hotel-keeper has discriminated against female staff? These are precedents which contain certain surface-level similarities to the target (undecided) case, but which are obviously poor analogies. We can see therefore that this type of similarity is not the complete answer; other constraints must be operating to influence our assessment of whether the analogy is a very good one.

2. The structure constraint

Holyoak and Thagard's second constraint is *structure*. This constraint involves the pressure to identify consistent structural parallels between the two domains. Consider the solar-system example again. We have the following mappings at the surface level:

Source: Solar system	maps	Target: Atom
Sun	→	Nucleus
Planets	→	Electrons
HAS_VELOCITY (planet)	→	HAS_VELOCITY (electron)
TENDS_TO_FLY_OUT (planet)	→	TENDS_TO_FLY_OUT (electron)

The surface level is sometimes called the propositional level because it operates on the propositions that describe the source.[44] HAS_VELOCITY (x) is a proposition describing an aspect of the solar system. Propositions are predicates that have only one slot. For example, the predicate HAS_VELOCITY (x) is a proposition indicating that a body, x, has a velocity; the slot x can be filled with planet, electron, Boeing_747, or President_Bush_in_a_calvacade_driving_down_Connecticut_Avenue. Thus, there is similarity at propositional level of these four things: they all have velocity.

In the solar system-atom analogy, there is a basic mapping between the objects at propositional level. However at the structural level, where we describe the relationships between objects, similarity is more obvious:

44. Holyoak & Thagard, *supra* n. 7, at 24-31.

Source: Solar system	maps	Target: Atom
ATTRACTS (sun, planet)	→	ATTRACTS (nucleus, electron)
ORBITS (planet, sun)	→	ORBITS (electron, nucleus)

This is called the relational level. ATTRACTS (x, y) is a basic relation of the system.[45] Relations are predicates that have more than one slot. They are called "relations" because they relate one or more of the slot-fillers to the other or others. So, the predicates IS_PART_OF (a, b) or ORBITS (x, y) are relations, indicating that an entity a is part of b, or that an entity x orbits y, respectively. Structural mapping involves a mapping of relations, not propositions.

There is a strong structural mapping in the atom-solar system analogy in that: (1) the outer bodies have a velocity, (2) and a tendency to move outwards, (3) but the attraction pulls them inwards, (4) and as a consequence of this the outer bodies orbit the inner one, and so forth. Thus, there is close structural similarity between the relations of the objects. This is not the case with the analogy of the car circling Dupont Circle: apart from the surface level similarity, there is little in the relations that map from the source to the target. Perhaps we could suggest that the relation ORBITS is the same, but even this is stretching the natural meaning of "orbits."

Within law we see the structure constraint give rise to an important characteristics of legal reasoning. Relational similarity typically occurs when we compare legal principles or concepts in two different cases. In the example of the ferry and the missing bags, we can draw an analogy with the hotel-keeper precedent by reference to the isomorphism at the relational level as well as at the propositional level shown here:

Source: Hotel Precedent	Maps to	Target: Ferry Case
liable_in_bailment (hotel_keeper, guest)	→	liable_in_bailment (ferry_line, passenger)?
owes_duty_to (hotel_keeper, guest)	→	owes_duty_to (ferry_line, passenger)?
standard_breached (hotel_keeper)	→	standard_breached (ferry_line)?
sleeps_over (guest)	→	sleeps_over (passenger)?
has_restaurant (hotel)	→	has_restaurant (ferry)
missing (bags)	→	missing (bags)
Etc…	→	Etc…

45. *Id.*

Alternatively, we could suggest the analogy to the railroad by reference to the different relational structure that is possible to project onto the ferry case. The adequacy of the analogy is dependent on our ability to fit the target within the relational structure of the source. However, the constraint is not absolute, for it is possible to project a number of mappings onto the target: either of the "floating hotel" or "seagoing train" analogies is structurally as coherent as the other. This seems to accord with the feeling that in the ferry case both analogies are good ones, and the outcome could go either way.

This gives rise to the question of why we focus on the structural aspects we do, and not on an infinity of other structural features. Answering this question will explain why we find the solar system analog better than the car-in-Dupont-Circle analog. Equally, we need an explanation why other relational features between the solar system and the atom are not preserved, such as distance between planets or the relative sizes of planets and the sun. Or within the legal example, why we chose the features explained above, rather than any other potentially relevant feature of other precedents.

One answer to this problem is that the other constraints — surface and purpose level — operate in conjunction with the structure constraint. But within the structure constraint itself, there is also another mechanism that affects the choice of analogs. Dedre Gentner's model of the structural constraint suggests that relational mapping at the structural level relies on the principle of "systematicity." This is the idea that people prefer to map systems of predicates that contain higher-order relations with inferential import rather than to map isolated predicates. That is, we pick clustered groups of relations which are able to explain why the system works as it does, rather than pick isolated predicates which may be similar but which are singletons and do not help to explain the system. In this, she expresses what she calls "our tacit preference for coherence and deductive power in interpreting analogy."[46] In the solar system-atom analogy, the relations which explain why the system operates as it does are the ones which are mapped. Thus, the relation ATTRACTS in both the source and target explains why the outer bodies (having a VELOCITY) end up ORBITing the inner body.

This principle of systematicity is important in legal analogies. This principle encodes the human predilection for choosing structural mappings which are higher-order and which are explanatory of the entire system. We should therefore expect to see certain analogies preferred if they operate at a higher, causative level than the alternatives. Take our ferry example again, but change the precedents slightly. Let us assume that the reason the train precedent was decided against the plaintiff was not because of bailment law, but rather because of some other policy limiting liability of state-run industries.[47] The highest-level, causative relation in the ferry case would probably be LIABLE_IN_BAILMENT_LAW (ferry_line, passenger)? But in the train example, the highest relation is NOT_LIABLE_IN_PUBLIC_LAW

46. Gentner et al., *supra* n. 4, at 172.

47. In the days when railroad companies were often or usually a state-run industry.

(railway, passenger) or some similar relation. Notwithstanding the propositional level and lower-level relational similarities, at the highest level there is a mismatch between the ferry case and the new railway precedent. We are therefore less likely to find this new railway precedent as useful an analogy as the old precedent.

3. The purpose constraint

Holyoak and Thagard's third constraint on the analogy is the *purpose* for considering the analogy at all. In adopting the solar system-atom analogy, we have a number of purposes, including trying to understand why the atom remains intact, rather than collapsing inwards on itself or flying outwards in all directions. The solar system analogy provides the basis for this understanding. The planets would fly out to the far reaches of the galaxy were it not for the ATTRACTing effect of gravity

However, this does not explain other features of the atom, such as the nature of the nucleus or certain quantum mechanical features of the atom. In order to understand these features, the solar system analogy is useless, and we must find other analogies to explain the process. For example, there is an analogy of the atom to a "cloud of electrons," which is useful to explain some electro-valency concepts, and which is certainly better than the solar-system analogy for this purpose.

Within law, the purpose constraint clearly applies. Take the ferry case as an example. The purpose of the attorney for Plaintiff is to make the most plausible case for Plaintiff. Hence an analogy that operates against Plaintiff's interest — such as the train analogy — is clearly less desirable and less compelling than the alternative hotel analogy. The opposite is true for Defendant's counsel. Thus, the purpose for which lawyers wish to use an analogy will influence their perception of it; and as a consequence the purpose constraint will determine the analogy is a particularly good one or bad one for any given party.

The purpose constraint also applies to judicial adjudication. Since the introduction of American Legal Realism[48] and Critical Legal Studies[49] it has

48. American legal realism began in the late nineteenth and early twentieth centuries as an attack on formalism, which until then, was the predominant approach of judicial thought. In some sense it was a reaction to the efforts of legal theorists like Christopher Columbus Langdell or Roscoe Pound to make law more like an abstract science. *See* Margaret Davies, *Asking the Law Question* 94-119 (Sweet & Maxwell 1994). The American legal realism school represented a forceful and influential reaction against this trend, and indeed against all the legal theories which emphasized the analytical and abstract over the descriptive and the concrete. *See* Hilaire McCoubrey & Nigel D. White, *Textbook on Jurisprudence* 187-88 (Blackstone Press 1993); J.G. Riddall, *Jurisprudence* 153-54 (Butterworths 1991); J.W. Harris, *Legal Philosophies* (Butterworths 1980).

49. The movement began at Madison, Wisconsin, in 1977 at the portentously named "Conference on Critical Legal Studies." *See* J.H. Schlegel, *Notes Towards an Intimate, Opinionated, and Affectionate History of the Conference on Critical Legal Studies,* 36 Stan. L. Rev. 391 (1984);

become a commonplace to suggest that laws do not completely determine legal outcomes and that judges have considerable leeway in their decision making. Justice Oliver Wendell Holmes famously remarked:

> General propositions do not decide concrete cases . . . . I always say . . . that no case can be settled by general propositions, that I will admit any general proposition you like and decide the case either way.[50]

This is often characterized as an example of Holmes's rule skepticism:[51] that is, the notion that legal rules do not entail particular legal results.[52] However it is not hard to see this as an example of the analogical purpose constraint, working within judicial decision making.[53]

More recently, we have seen the Critical Legal Studies movement introduce related, but more politically charged, approaches to legal reasoning. For example, Duncan Kennedy examined how he might decide a case in which the precedents were arrayed against the outcome he preferred.[54] He discussed the approach of a judge by examining the internal conversation a judge has with herself. His conclusion about legal reasoning provides a clear example of the purpose constraint in operation:

Legal reasoning is a kind of work with a purpose, and here (in adjudication) the purpose is to make the case come out the way my sense of justice tells me it ought to, in spite of what seems at first like the resistance or opposition of "the law."[55]

We can see the purpose constraint operating in legal settings when an attorney is presenting an argument in favor of her client; but equally we see it in theories of adjudication such as those presented by the Realists and the proponents of Critical Legal Studies.

Roberto Mangabeira Unger, *The Critical Legal Studies Movement* (Harvard U. Press 1986); Roberto Mangabeira Unger, *The Critical Legal Studies Movement*, 96 Harv. L. Rev. 561 (1986).

50. *See* W. E. Rumble, *American Legal Realism: Skepticism, Reform and the Judicial Process* 39-40 (Cornell U. Press 1968).

51. Jerome Frank, *Law and the Modern Mind* xi (Doubleday & Co. 1963).

52. *Cf.* the position expressed by a noted Realist, who was also a contemporary of Holmes. Karl N. Llewellyn, *The Common Law Tradition: Deciding Appeals* 38 (Little, Brown 1960) ("[R]ules which make sense on their face, and which can be understood and reasonably well applied even by mediocre men . . . have a fair chance to get the same results out of different judges, and so in truth hit close to the ancient target of a government of laws and not men.").

53. Equally, the fact skepticism championed by Jerome Frank has certain features in common with the analogical purpose constraint. *See* Frank, *supra* n. 51, at xviii.

54. Duncan Kennedy, *Freedom and Constraint in Adjudication: A Critical Phenomenology*, 36 J. Leg. Educ. 518 (1986).

55. *Id.* at 526 (emphasis removed).

III. Conclusion

Given the cognitive science account of analogy, and the evidence presented above that the multiple constraint model applies in law, what lessons might we apply to the teaching of analogy in law schools and the use of analogy by practicing lawyers?

First, I suggest that this model provides a more detailed picture of what is happening when lawyers construct analogies and of what judges are doing when they adopt a particular precedent. Students and lawyers can better critique cases, as well as individual analogies, if they understand that there are multiple levels at which an analogy can be constructed and analyzed.

Second, the model provides a framework to generate interesting and more compelling analogies by students and lawyers. Beginning law students and less experienced lawyers tend to construct analogies that are based on surface-level similarities. As they become more practiced, both start to recognize that the most powerful analogies operate across multiple levels and they learn to rely on Gentner's systematicity principle, most likely without ever realizing that such a concept exists and has been documented elsewhere. Recognizing as early as possible in their careers that they need to construct these sorts of layered analogies can only speed their development towards becoming expert users of analogical reasoning.

Finally, numerous findings of cognitive science can be used to generate more persuasive analogies (and indeed more persuasive arguments in general). One example of this, discussed above, is Tversky's context effect. By careful manipulation of hypothetical situations, a lawyer can make a good analogy appear even more compelling.