DISCOVERING THE LOGIC OF LEGAL REASONING

*Vern R. Walker**

I. INTRODUCTION

The rule of law rests on the quality of legal reasoning. The rule of law requires that similar cases should be decided similarly, that each case should be decided on its merits, and that decision-making processes should comply with applicable rules of procedure and evidence. Making the reasoning behind such decision-making transparent and open to scrutiny shifts the decisions away from mere subjective preference and toward objective rationale. An important means, therefore, of achieving the rule of law is articulating and evaluating the various elements of legal reasoning—the reasoning involved in interpreting constitutions, statutes, and regulations, in balancing fundamental principles and policies, in adopting and modifying legal rules, in applying those rules to cases, in evaluating evidence, and in making ultimate decisions.

Despite our need for transparent and sound reasoning, we in the legal profession devote surprisingly little research to developing our own general methodology. This is in dramatic contrast to other fields and professions. We are not like mathematicians, whose reflection on their own method has given the world axiomatic proof and modern deductive logic. We are also unlike statisticians, who have developed the analytic methods in use in all areas of empirical research. Nor do we act like natural and social scientists, who carefully combine statistical methods with techniques for measurement and modeling that are tailored to their particular subject matters. Nor do we take the approach of the medical profession, which has refined various methodologies for diagnostic reasoning. We in the legal profession largely content ourselves with "knowing good legal reasoning when we see it." We spend relatively little time refining general methods for discriminating between good patterns of reasoning and bad, or developing theories for explaining precisely *why* good patterns are good and bad patterns are bad. In sum, we do not pay particular attention to the logic of legal reasoning.[1] For a

* Professor of Law, Hofstra University School of Law; Hempstead, New York, USA. The author is grateful for the financial support provided by a research grant from Hofstra University.

1. The word "logic" refers here to "the study of the methods and principles used to distinguish correct reasoning from incorrect reasoning," and to the theories that result from such study. *See* IRVING M. COPI & CARL COHEN, INTRODUCTION TO LOGIC 3 (10th ed. 1998). "Correct" reasoning warrants the conclusion to be true, probably true, or at least plausible. It provides

profession so dependent upon constructing good arguments, we are oddly uninterested in good methodology for argument construction.

There certainly exist isolated pockets of theoretical work on legal reasoning methods. Those involved in criminal law study the probative value of the forensic sciences,[2] and the Supreme Court's trilogy of cases beginning with *Daubert* has spawned extensive research on when expert opinions are good enough to be admissible.[3] A few theorists since Wigmore have also studied general patterns of evidence evaluation.[4] Fields outside of law have also conducted important research on various aspects of legal reasoning—fields such as psychology,[5] rhetoric,[6] informal logic,[7] and artificial intelligence ("AI").[8] What is missing,

---

adequate justification for a reasonable person's adoption of the conclusion. Logic is distinct from the study of methods for discovering correct lines of reasoning (for example, heuristics), although logic can help identify the desired goal or end product of heuristic methods. Logic is also distinct from the study of persuasive use of reasoning in human dialogue (for example, pragmatics, rhetoric, or psychology), although it can help identify a reasonable basis for persuasion. Logic is the study of how we ought to reason, if our goal is to discover truth.

2. *See, e.g.*, DAVID L. FAIGMAN, DAVID H. KAYE, MICHAEL J. SAKS & JOSEPH SANDERS, SCIENCE IN THE LAW: FORENSIC SCIENCE ISSUES (2002).

3. Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579 (1993); Gen. Elec. Co. v. Joiner, 522 U.S. 136 (1997); Kumho Tire Co. v. Carmichael, 526 U.S. 137 (1999).

4. *E.g.*, TERENCE ANDERSON, DAVID SCHUM & WILLIAM TWINING, ANALYSIS OF EVIDENCE (2d ed. 2005); JOSEPH B. KADANE & DAVID A. SCHUM, A PROBABILISTIC ANALYSIS OF THE SACCO AND VANZETTI EVIDENCE (1996); DAVID A. SCHUM, THE EVIDENTIAL FOUNDATIONS OF PROBABILISTIC REASONING (1994).

5. For research on juries, see, for example, INSIDE THE JUROR: THE PSYCHOLOGY OF JUROR DECISION MAKING (Reid Hastie ed., 1993).

6. *See, e.g.*, Kurt M. Saunders, *Law as Rhetoric, Rhetoric as Argument*, 3 J. ASS'N LEGAL WRITING DIRECTORS 166, 166-67 (2006) (discussing law as consisting of pragmatic decisions rather than formally logical ones, in which rhetoric, as opposed to formal logic, influences the conclusions of legal reasoning); Mary Massaron Ross, *A Basis for Legal Reasoning: Logic on Appeal*, 3 J. ASS'N LEGAL WRITING DIRECTORS 179, 181 (2006) (arguing that despite the theory of rhetoric as outcome-determinative of legal decision-making, formal logic can be a possible rhetorical device and a critical element, especially at the appellate level).

7. For research on the "Toulmin Model," see, for example, ARGUING ON THE TOULMIN MODEL (David Hitchcock & Bart Verheij eds., 2006). For research based on argumentation schemes, see DOUGLAS N. WALTON, ARGUMENT SCHEMES FOR PRESUMPTIVE REASONING 13-14, 46 (1996) (stating that the function of an argumentation scheme is to orchestrate a dialogue by use of "appropriate critical question[s]," the asking of which shifts "a burden or weight of presumption to the other side in a dialogue"). For examples of research on argumentation schemes within AI and law, see Henry Prakken, Chris Reed, & Douglas Walton, *Argumentation Schemes and Generalizations in Reasoning About Evidence*, 9 INT'L CONF. ARTIFICIAL INTELLIGENCE & L. PROC. 32 (2003); Henry Prakken & Giovanni Sartor, *The Three Faces of Defeasibility in the Law*, 17 RATIO JURIS 118, 120-23 (2004).

8. *See, e.g.*, BART VERHEIJ, VIRTUAL ARGUMENTS: ON THE DESIGN OF ARGUMENT ASSISTANTS FOR LAWYERS AND OTHER ARGUERS 97-122 (2005); Kevin D. Ashley & Edwina L. Rissland, *Law, Learning and Representation*, 150 ARTIFICIAL INTELLIGENCE 17 (2003) [hereinafter Ashley & Rissland, *Law, Learning*]; Edwina L. Rissland, *Artificial Intelligence and Law: Stepping Stones to a Model of Legal Reasoning*, 99 YALE L.J. 1957 (1990) [hereinafter Rissland, *Artificial Intelligence*]; Edwina L. Rissland, Kevin D. Ashley & R.P. Loui, *AI and Law: A Fruitful Synergy*,

however, is a concerted effort within our profession to articulate the general logic of our method of reasoning, and to do so in a way that is useful in solving legal problems and which provides us a normative ideal of sound reasoning.

If we had such a useful, normative method, it would surely be evident in the classroom, and ultimately in the law office and courtroom. Most legal educators, however, merely illustrate reasoning by exhibiting a stream of examples (both historical and hypothetical), leaving it to the student to abstract from those examples "how to think like a lawyer." We seldom develop general accounts that explain to students how lawyers ought to reason and why. The closest we come to training students in generalized methods of reasoning is probably in the context of legal writing,[9] and perhaps also in some instances of skills training.[10] But these relatively recent developments have not penetrated very far into the "doctrinal core" of the legal curriculum. We do not even instruct students in deductive logic, whose relevance we surely acknowledge,[11] perhaps because we recognize its limited usefulness in solving difficult legal problems.[12] Although traditional logic captures part of legal reasoning, it does not address the most difficult parts, and so its study may not be particularly critical for lawyers. If we had a truly useful theory of legal reasoning, we would surely place it at the center of our legal curriculum.

This Idea begins a discussion about why legal reasoning may exhibit distinctive features that merit logical analysis. It suggests that the demands of the rule of law combine with the pragmatic nature of legal reasoning to evolve distinctive patterns of reasoning. The Idea briefly

---

150 ARTIFICIAL INTELLIGENCE 1 (2003).

9. For an excellent introduction to legal reasoning within the context of legal writing, see RICHARD K. NEUMANN, JR., LEGAL REASONING AND LEGAL WRITING: STRUCTURE, STRATEGY, AND STYLE (5th ed. 2005).

10. *E.g.*, STEFAN H. KRIEGER & RICHARD K. NEUMANN, JR., ESSENTIAL LAWYERING SKILLS: INTERVIEWING, COUNSELING, NEGOTIATION, AND PERSUASIVE FACT ANALYSIS 127-211 (2d ed. 2003) (discussing "persuasive fact analysis").

11. TERENCE ANDERSON & WILLIAM TWINING, ANALYSIS OF EVIDENCE: HOW TO DO THINGS WITH FACTS BASED ON WIGMORE'S SCIENCE OF JUDICIAL PROOF 63–69 (1991) (showing that for Wigmore the principle utility of the deductive form of inference was "to force into prominence the generalization upon which the inference rests"); Mark L. Movsesian, *Rediscovering Williston*, 62 WASH. & LEE L. REV. 207, 241–43 (2005) (describing Williston's view that the use of "analytic logic" in law has pedagogical benefits, "promotes predictability and stability in law," and "makes the legal system more acceptable to the general public").

12. *See, e.g.*, Leonard G. Boonin, *The Logic of Legal Decisions*, 75 ETHICS 179 (1965) (discussing the deductive model of reasoning and the problem of explaining how to apply legal rules in a given case, how to elaborate on rules, and how to create new rules); Jeffrie G. Murphy, *Law Logic*, 77 ETHICS 193 (1967) (arguing that logical and legal validity are different and in some ways incompatible).

discusses three types of legal reasoning. Rule-based reasoning and evidence evaluation, as they are found in law, exhibit distinctive logical features. So does second-order process reasoning, which can modify both rule-based reasoning and evidence evaluation. Taken together, these three types give legal reasoning a complex "default" character that is distinctive to it. In addition, the structure of the legal community promotes the evolution of reasoning patterns that are well-adapted to the task of solving legal problems. Empirical research is needed to discover the actual patterns that have evolved. This Idea cannot of course lay out designs for such empirical research. It must be enough for now to suggest why such research is needed, and why it promises to be a successful means of discovering the logic of legal reasoning.

II. THE PRAGMATIC NATURE OF LEGAL REASONING

The legal profession has not found traditional formal logic very useful because that logic tracks the deductive reasoning of mathematics, and not the practical reasoning we actually employ in law. We are a pragmatic profession. We face an explosion of legal problems that require our attention and we have developed our own techniques to help us think through such problems. We therefore have little time for formal theories that are not tailored to our mode of reasoning or do not make us more effective or efficient at solving our professional problems. We will not adopt any methodology that is not also useful.

The reasoning techniques we employ are pragmatic in at least three senses. The first is that our reasoning is action-oriented. We use it to make legal arguments about the legitimacy of governmental action or inaction. When judges decide cases or administrative agencies adopt new regulations, they must interpret constitutional, statutory, or regulatory texts, and balance legal principles against substantive policies. Before a court can lawfully sentence a defendant or enter a binding judgment, or before an administrative agency can lawfully adopt a rule or issue a permit, it must evaluate the legally available evidence. Legal reasoning is therefore pragmatic in the sense that its ultimate subject matter is governmental action, and is almost always about justifying decisions leading to such action.

Second, legal reasoning is pragmatic in the sense that it balances the "epistemic objective" of law against the applicable "non-epistemic objectives."[13] The epistemic objective is to produce determinations of fact that are as accurate as possible and which are warranted by the

13. Vern R. Walker, *Epistemic and Non-Epistemic Aspects of the Factfinding Process in Law*, 3 APA NEWSL., PHIL. & L., Fall 2003, at 132.

legally available evidence. The epistemic side of law aims at truth, but a truth constrained by reasonable inferences from the evidence. Weighed against this epistemic objective are numerous non-epistemic objectives. Some of them are common across governmental institutions and proceedings (for example, procedural fairness or administrative efficiency), while others are limited to particular institutions and proceedings (for example, achieving an adequate supply of electric power, or increasing economic efficiency within securities markets). Each institution strikes its own peculiar balance of epistemic and non-epistemic objectives. Administrative agencies that have a mandate to protect public health may design their factfinding processes to be as thorough and accurate as possible, but consistent with ensuring the protection of the public. Criminal courts should design their factfinding processes to avoid erroneous verdicts, but must also protect the due process rights of the accused and achieve reasonable levels of judicial efficiency. For any particular institution and substantive mission, the overall goal is to strike the appropriate balance between the epistemic objective and the applicable non-epistemic objectives. Legal reasoning is pragmatic because it must incorporate such balancing and must reason about appropriate balancing.

Third, legal reasoning is pragmatic because legal decision-making occurs in real time, uses limited resources, and is usually based on incomplete information. Legal decision-making is decision-making under uncertainty.[14] The decision-maker has to evaluate, at each stage of the process, whether the evidence is complete enough, whether the residual uncertainty is acceptable, and whether action should be taken or postponed. A prosecutor could always conduct more investigation and a regulator could always obtain more scientific studies. When and how to take which type of action involves an assessment of the current state of uncertainty, of the costs and benefits of obtaining more evidence, and of the risks and benefits of acting without additional evidence. Legal reasoning is pragmatic because it must take into account such resource considerations.

These three pragmatic dimensions of legal reasoning dictate certain features of its logic. Legal reasoning evaluates decisions and actions, balances epistemic and non-epistemic objectives, and occurs under the constraints of limited resources and incomplete information. The logic of legal reasoning must incorporate all of these dimensions. It would go

14. *E.g.*, JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES (David Kahneman, Paul Slovic & Amos Tversky eds., 1982); M. GRANGER MORGAN & MAX HENRION, UNCERTAINTY: A GUIDE TO DEALING WITH UNCERTAINTY IN QUANTITATIVE RISK AND POLICY ANALYSIS (1990).

well beyond deductive logic, and incorporate inductive and abductive logic[15] (what logicians today call nonmonotonic logic[16]). It would draw upon modern decision theory, risk-benefit analysis, and risk analysis. Moreover, to remain useful to the law, such methodologies and theories would not be incorporated entirely or for their own sakes, but only in so far as they improve legal decision-making and do not distort our accepted patterns of reasoning.

It is no surprise then that the profession largely ignores formal systems that are not necessary for solving legal problems. Although logicians and researchers in artificial intelligence regard formal models as benign and useful, legal theorists and practitioners generally regard them with suspicion. Although we all accept the use of basic arithmetic without question, legal decision-makers and stakeholders in the legal process often require considerable explanation before they trust formal systems such as probability theory and statistics. An elegant mathematical proof may be perfectly transparent to a highly educated mathematician, but it is useless as part of legal reasoning unless it is transparent to legal decision-makers and to the parties. Introducing formal complexity into legal reasoning can be inefficient, confusing, and counterproductive, unless that added complexity is essential to solving real legal problems.[17] The same is true of formal logics. Formal theories of legal reasoning are useful only if they accurately capture the distinctive features of such reasoning, provide a useful normative standard for evaluating such reasoning, and solve problems that cannot be readily solved without those theories. Theories about the logic of legal reasoning must be useful in order to be normative.

This pragmatic context therefore strongly influences what we are looking for in the three types or areas of legal reasoning discussed next in this Idea: rule-based reasoning, evidence evaluation, and second-order reasoning about the decision-making process. In each area, the challenge

---

15. For an account of abductive reasoning, see John R. Josephson & Michael C. Tanner, *Conceptual Analysis of Abduction*, *in* ABDUCTIVE INFERENCE: COMPUTATION, PHILOSOPHY, TECHNOLOGY 5, 5 (John R. Josephson & Susan G. Josephson eds., 1994) ("*Abduction*, or *inference to the best explanation*, is a form of inference that goes from data describing something to a hypothesis that best explains or accounts for the data.").

16. *E.g.*, GERHARD BREWKA, JÜRGEN DIX & KURT KONOLIGE, NONMONOTONIC REASONING: AN OVERVIEW (1997); HENRY E. KYBURG, JR. & CHOH MAN TENG, UNCERTAIN INFERENCE 117-51 (2001); ISAAC LEVI, FOR THE SAKE OF THE ARGUMENT 120-59 (1996); HENRY PRAKKEN, LOGICAL TOOLS FOR MODELLING LEGAL ARGUMENT: A STUDY OF DEFEASIBLE REASONING IN LAW 67-100 (1997).

17. Formal systems, such as those employing Bayesian techniques, can create more problems than they solve. *See generally* Vern R. Walker, *Language, Meaning, and Warrant: An Essay on the Use of Bayesian Probability Systems in Legal Factfinding*, 39 JURIMETRICS 391 (1999) (book review) (critiquing generally the use of formalizations in legal factfinding).

is to make transparent those features of reasoning that are useful in solving legal problems.

III. RULE-BASED REASONING

A primary strategy for deciding similar cases similarly is to develop and apply substantive legal rules, which prescribe particular outcomes for particular types of cases. The substantive rules of law state the conditions under which particular types of governmental action are justified. Formal logic represents such rules as "conditional propositions."[18] A "proposition" is the descriptive content of an assertion or statement. It is capable of being either true or false, and is usually expressed in ordinary language by a sentence or a clause. A "conditional" proposition has the logical form "if *p*, then *q*," where *p* and *q* stand for two constituent propositions. In the terms of this conditional schema, a legal rule states that if proposition *p* (the condition) is true, then this fact warrants that proposition *q* (the conclusion) is also true. A warranted conclusion can then warrant additional inferences, based on additional rules, and can ultimately help justify action or inaction.

While traditional logic has focused on propositions as having one of two values ("true" and "false"), the dynamic process of rule-based legal reasoning is better understood as assigning to propositions one of three values ("true" / "undecided" / "false"). When a legal proceeding begins, all propositions that form the conditions of the applicable legal rules are "undecided." Participants in the legal process produce evidence and arguments to persuade the decision-maker (whether judge, regulator, or factfinder) to change the values of those propositions to either "true" or "false." Put another way, the legal rules identify the propositions that are relevant within the type of proceeding, but the particular proceeding begins with the decision-maker being neutral on whether the conditions for applying those rules are satisfied or not.

A major feature of rule-based legal reasoning is the distinction between prima facie case and affirmative defense. Some rules state the conditions under which governmental action is justified (the prima facie case for the proponent of the action), while other rules state exceptions or affirmative defenses—that is, conditions under which the prima facie line of reasoning is defeated. These latter rules, which logicians call

---

18. *See* Scott Brewer, *Exemplary Reasoning: Semantics, Pragmatics, and the Rational Force of Legal Argument by Analogy*, 109 HARV. L. REV. 923, 972 (1996) (defining "rule" in a "logically spare manner, as a prescriptive proposition that has a logical structure the most abstract form of which is reflected in the standard conditional proposition, either propositional ('if *P* then *Q*') or predicate ('for all *x*, if *x* is an *F* then *x* is a *G*')").

"defeaters,"[19] function as a kind of negation. If the defeater condition is determined to be true, then the conclusion is false. Legal rules exhibit defeater logic when they state an exception to a normal rule or an affirmative defense to a prima facie case, and it is common in such circumstances to place the burden of proof for the defeater proposition on the party invoking the exception or raising the affirmative defense. For example, the law of battery has rules governing when the defendant has a privilege to act that constitutes an exception or defense to the prima facie case (for example, when the defendant was acting reasonably in making a lawful arrest or in defending herself from intentionally inflicted bodily harm).

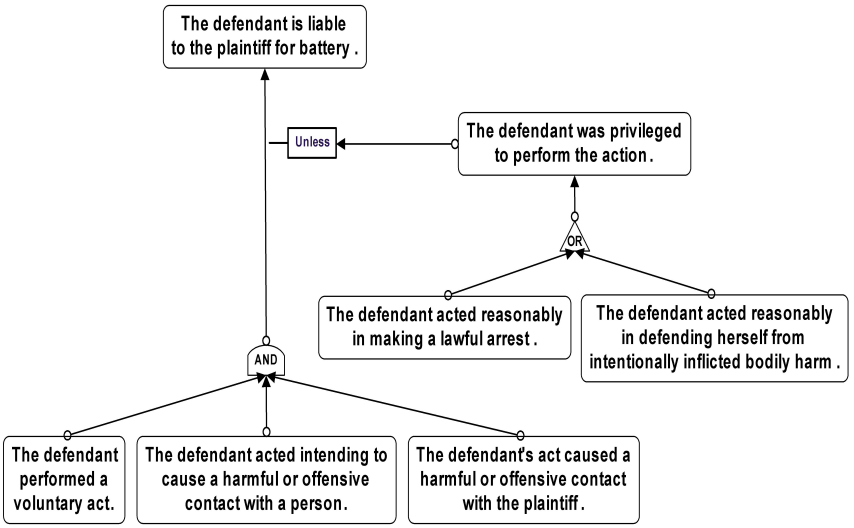
We can visualize systems of substantive rules of law (such as the law of battery) as inverted "implication trees"—trees that map the conditions of rules, or the implications of proving issues of fact.[20] Figure 1 shows a partial implication tree for the law of battery. The nodes of an implication tree are propositions to be proved or disproved, and the top node of a tree is the ultimate issue to be proved before some governmental action is justified (for example, entering a court judgment for the plaintiff). Each level of each branch extending downward from the top node states the logical conditions for proving the immediately higher proposition. Figure 1 illustrates both a conjunctive level (stating a conjunction of conditions connected by "AND") and a disjunctive level (stating a disjunction of conditions connected by "OR"). A conjunction is true if, but only if, all of the conjuncts are true, while a disjunction is true if, but only if, at least one disjunct is true. A branch can also state a defeating condition (connected by "UNLESS"), the truth of which determines the conclusion to be false, even if the prima facie branch is true. Because rules tend to have multiple conditions for making an inference to a single conclusion, successively lower levels of a rule tree tend to expand horizontally as they expand downward. The shape of the inverted implication tree therefore tends to be triangular, with the single ultimate issue as the apex at the top, dependent for its truth or falsehood upon combinations of factual issues that terminate the branches along the triangle's base at the bottom.

---

19. For logical discussions of the defeater connective, see BREWKA ET AL., *supra* note 16, at 2-3, 16; JOHN L. POLLOCK, NOMIC PROBABILITY AND THE FOUNDATIONS OF INDUCTION 79 (1990). For discussions in the field of AI and law, see Prakken et al., *supra* note 7, at 32, 37-38; Prakken & Sartor, *supra* note 7, at 120-24; Henry Prakken & Giovanni Sartor, *Reasoning with Precedents in a Dialogue Game*, 6 INT'L CONF. ARTIFICIAL INTELLIGENCE & L. PROC. 1, 3 (1997); Vern R. Walker, *A Default-Logic Paradigm for Legal Fact-Finding*, 47 JURIMETRICS 193, 199-204, 213-15 (2007).

20. For the use of tree structures in logic, artificial intelligence, and models of legal reasoning, see Walker, *supra* note 19, at 201 & n.35.

Figure 1. Partial Implication Tree for the Law of Battery



Traditional logicians are used to the deductive logic of mathematics, in which proof begins with axioms (at the top) and deduces conclusions (downward). They may therefore overlook this fundamentally different orientation of legal reasoning. The rule-based deductions of legal reasoning do not rest upon self-evident axioms, but rather upon the truth or falsehood of the relevant issues of fact, which are defined by rules adopted by legal authorities. The soundness of the reasoning depends upon the appropriateness of the rules governing the reasoning, and (at bottom) upon the plausibility of the relevant evidence. Moreover, conclusions that rest upon uncertain and incomplete evidence are at best plausible and conditionally true. The rule-based reasoning of law can be only as sound as the factfinder's evaluation of the evidence (which is the topic of the next section of this Idea).

Another feature of rule-based legal reasoning that challenges traditional deductive logic is the possibility of changing the rules themselves as a result of the reasoning. For example, within common law systems, courts have inherent authority to elaborate new legal rules that apply to the very case being decided, as well as to future cases. Even when the authority is legislative and the legal rules are derived from statutes or regulations, a court or administrative agency has considerable discretion to elaborate new rules of application in pending cases. Whenever a court or agency explicates a new definition for a legal term,

or interprets a legal phrase, or carves out an exception to an existing rule, it creates a new rule. Such new rules may create new conditions that extend the branches of the rules tree, or create exceptions that add defeaters to the tree. Courts sometimes also overrule prior cases, hold statutes unconstitutional, or vacate administrative regulations, thus removing branches from the tree. Under the rule of law, however, the action of changing a substantive rule is itself governed by legal rules and must be justified in each particular case. This second-order aspect of legal reasoning (reasoning about the rules themselves) will be discussed in a later section of this Idea.

IV. EVIDENCE EVALUATION

The legal rules therefore identify those issues of fact that are relevant to proving the ultimate issue of fact. As the branches of the implication tree extend downward, the terminal conditions at the end of each sub-branch (the last propositions in each chain) constitute the issues of fact that are relevant. In any particular case, various participants (such as private parties, prosecutors, or administrative staffs) produce evidence for the legal record, and use that evidence to try to prove or disprove those issues of fact. The factfinder's role is evidence evaluation: deciding which evidence is relevant to which issues of fact, evaluating the probative value of the relevant evidence, and making findings of fact based on that evidence. The logic of evidence evaluation, therefore, studies the methods and principles for the inferential aspects of the factfinder's task. It explains the reasoning that a reasonable factfinder would use to determine the probative value of the evidence.

As in the case of rules, a basic building block of evidence evaluation is the proposition. The propositions that constitute the evidence can be called "evidentiary assertions," or simply "assertions," to distinguish them from the propositions that constitute rules. Examples of evidentiary assertions are statements made by testifying witnesses or statements contained in documents that are admitted into evidence. Although witnesses and documents provide many of the evidentiary assertions in a particular case, the factfinder formulates additional assertions that play a role in the reasoning—for example, a description of an evidentiary exhibit or of a witness's demeanor. While legal authorities create the rules for categories of cases, the witnesses, the documents, and the factfinder create the evidentiary assertions in each particular case.

Although evidentiary assertions are propositions, and therefore capable of being either true or false, factfinders are permitted to assign

them degrees of plausibility ("plausibility-values") instead of truth-values.[21] In evaluating any particular evidentiary assertion, the legal rules also allow the factfinder to select the scale of plausibility to use. For example, the factfinder might use an ordinal, five-valued plausibility scale for some evidentiary assertions (with values such as "highly plausible" / "somewhat plausible" / "undecided" / "somewhat implausible" / "highly implausible") and an ordinal, seven-valued scale for other assertions (with values such as "highly plausible" / "very plausible" / "slightly plausible" / "undecided" / "slightly implausible" / "very implausible" / "highly implausible"). On rare occasions, circumstances might even warrant using mathematical probabilities, with real numbers between zero and one as possible values.

A reasonable factfinder would select a scale of plausibility that is appropriately precise, given both the reliability of the available evidence and the accuracy and reliability needed to make the relevant findings of fact. For example, a factfinder might have little confidence in assessing the credibility of a particular fact witness, and so evaluate that witness's assertions on an ordinal scale having very few degrees of plausibility. Occasionally, however, an expert might persuade the factfinder that a causal system is so well understood (for example, DNA profiling) that the factfinder can evaluate assertions about it using mathematical probabilities. On the other hand, such precision may not be necessary to perform the factfinding task. In a legal proceeding whose findings are made by the preponderance standard of proof, the evaluative precision needed may be rather low, and an ordinal scale with a small number of values may be entirely adequate. The beyond-a-reasonable-doubt standard, however, probably requires greater evaluative precision in order to support a verdict.

Evidence evaluation poses some challenges for formulating a useful, normative logic. One challenge is explaining how we reason about "relevance" itself—how we decide to link particular evidentiary assertions to particular issues of fact. Another challenge is studying the logical properties of different plausibility scales, although we can learn lessons from the theories of scientific classification and measurement.[22]

---

21. *See id.* at 209-12.

22. For general texts on measurement theory, see, for example, EDWARD G. CARMINES & RICHARD A. ZELLER, RELIABILITY AND VALIDITY ASSESSMENT (1979); EDWIN E. GHISELLI, JOHN P. CAMPBELL & SHELDON ZEDECK, MEASUREMENT THEORY FOR THE BEHAVIORAL SCIENCES (1981); MEASUREMENT ERRORS IN SURVEYS (Paul P. Biemer et al. eds., 1991). For general statistics texts with good treatments of measurement error, see, for example, DAVID FREEDMAN, ROBERT PISANI, ROGER PURVES & ANI ADHIKARI, STATISTICS (2d ed. 1991); HERMAN J. LOETHER & DONALD G. MCTAVISH, DESCRIPTIVE AND INFERENTIAL STATISTICS: AN INTRODUCTION (4th ed. 1993). For discussion within a legal context, see David H. Kaye & David A. Freedman, *Reference*

A further challenge is combining the plausibility-values of numerous evidentiary assertions into a single plausibility-value for a particular conclusion. This is a complicated problem in law because factfinders must be able to integrate both non-expert and expert evidence into a single pattern of reasoning. The warrant for the non-expert evidence might be commonsense reasoning about an eyewitness's perceptual abilities and credibility, while the warrant for the scientific evidence might be controlled laboratory experiments and epidemiological studies. In the end, the factfinder must reason from all of the relevant evidence to a particular finding of fact.

Ideally, we want to identify the patterns of default reasoning that are actually used in law. If such patterns could be formalized into "plausibility schemas,"[23] they might furnish useful, normative models for factfinders. In logic, a "schema" is a formal linguistic pattern containing variables, so that appropriate substitutions for the variables create instances of the pattern.[24] A "plausibility" schema is a pattern of default reasoning that, when instantiated, warrants the conclusion to be plausible. For example, the schemas of deductive logic (such as "modus ponens"[25]), which necessarily preserve truth from premises to conclusion, also preserve plausibility from premises to conclusion. More useful in typical legal cases, however, would be schemas based on inductive or abductive logic, or derived from scientific methodologies or heuristics.[26] The typical plausibility schema has an inverted tree structure similar to that of an implication tree, except that the logical operators connecting the lower-level assertions to the upper-level

---

Guide on Statistics, *in* REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 83, 102-04 (Federal Judicial Center, 2d ed. 2000); Vern R. Walker, *The Siren Songs of Science: Toward a Taxonomy of Scientific Uncertainty for Decisionmakers*, 23 CONN. L. REV. 567, 580-88 (1991).

23. For a discussion of plausibility schemas, see Walker, *supra* note 19, at 212-18.

24. For the use of schemas in logic to specify sets of permissible axioms or inferences, see, for example, JOHN M. ANDERSON & HENRY W. JOHNSTONE, JR., NATURAL DEDUCTION: THE LOGICAL BASIS OF AXIOM SYSTEMS 20-21 (1962); GERALD J. MASSEY, UNDERSTANDING SYMBOLIC LOGIC 139-40, 147-49 (1970). For the use of schemas in semantics to specify conditions for assigning a truth-value to a sentence, see, for example, JOHN I. SAEED, SEMANTICS 89, 305-09 (2d ed. 2003).

25. This schema has the form "If *p* then *q*; *p*; therefore, *q*." COPI & COHEN, *supra* note 1, at 324, 373-74.

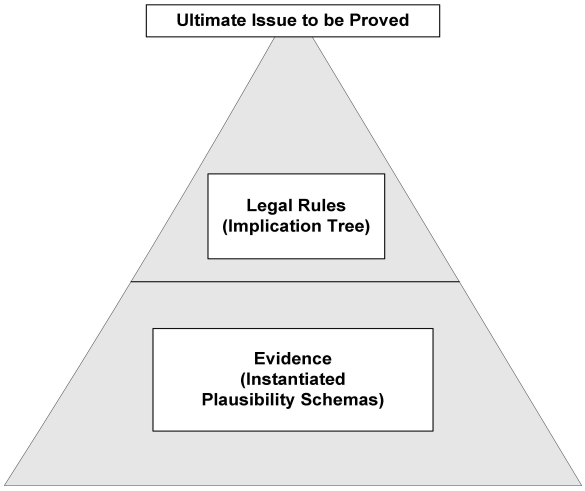
26. An example of a plausibility schema important in legal factfinding is what logicians call a "statistical syllogism." A statistical syllogism draws a conclusion about a specific individual based on a "statistical generalization" (such as "X percent of As are B"). *See* JOHN L. POLLOCK & JOSEPH CRUZ, CONTEMPORARY THEORIES OF KNOWLEDGE 229-30 (2d ed. 1999); WESLEY C. SALMON, LOGIC 87-91 (2d ed. 1973); Josephson & Tanner, *supra* note 15, at 23. Toulmin has referred to such inferences as "quasi-syllogisms." *See* STEPHEN TOULMIN, THE USES OF ARGUMENT 108-11, 131-34, 139-40 (1958). For early recognition of the difficulty such inferences pose for legal theory, see generally George F. James, *Relevancy, Probability, and the Law*, 29 CAL. L. REV. 689 (1941).

conclusion function on the plausibility-values of the evidence, instead of on the truth-conditions of rules. Such schemas formulate patterns of plausible reasoning that warrant drawing provisional conclusions, which then remain subject to re-evaluation. Identifying those plausibility schemas that are actually used in legal factfinding will require empirical research into the reasoning patterns of judges, administrative officers, and expert agencies.[27]

When a legal proceeding begins, the applicable legal rules identify all of the issues of fact that may be relevant. The factfinder then links the legally available evidentiary assertions to those issues of fact, using as heuristics those patterns of default reasoning familiar to the factfinder. (A logic of evidence evaluation would try to capture the acceptable patterns of reasoning as plausibility schemas.) The choice of pattern depends upon the nature of the issue of fact to be proved and the nature of the available evidence. When patterns of evidence are linked or attached to the terminal propositions of the inverted rule tree, they extend the branches of that tree further downward. As the schematic in Figure 2 suggests, the complete logical model for the legal reasoning in a particular case (the "inference tree" for the case) has the shape of an inverted triangle, with the implication tree generating the upper branches of the triangle and the attached patterns of evidence evaluation extending those branches downward to the evidentiary assertions.

Figure 2. General Structure of Reasoning in a Legal Case

27. For two examples of analyzing the reasoning of special masters in factfinding under the National Childhood Vaccine Injury Act of 1986, see Walker, *supra* note 19, at 226-32; Vern R. Walker, *Visualizing the Dynamics around the Rule-Evidence Interface in Legal Reasoning*, LAW, PROBABILITY & RISK (forthcoming 2007), *available at* http://lpr.oxfordjournals.org/cgi/reprint/mgm015?ijkey=GIBiZmvwOPjF0l6&keytype=ref.



After the factfinder organizes the evidence by relevance, evaluation can proceed upward from the bottom of the extended tree. After the factfinder assigns plausibility-values to the evidentiary assertions, the instantiated plausibility schemas warrant the plausibility-values of higher-level assertions. At the point in each branch where the evidentiary assertions end and the condition of a rule occurs, the applicable standard of proof directs the factfinder about how to make a finding of fact based on the plausibility of the evidence. A preponderance-of-evidence standard is the rule that a factfinder must find the issue of fact to be "true" if the totality of relevant evidence is to any degree plausible, and must find the issue of fact to be "false" if that evidence is to any degree implausible. In addition, the legal rules on burden of persuasion determine which party must lose (which finding to make) if the evidence is "undecided" or in equipoise. Discovering the logic of legal reasoning means making this process of evidence evaluation transparent.

Devising a useful, normative logic of factfinding is even more difficult because of the pragmatic and dynamic nature of the factfinding process. Factfinders must make findings in real time, using limited resources, and on the basis of the incomplete evidence. Moreover, the factfinding process is often highly structured around the factfinder, with participants other than the factfinder deciding what the legal rules are and producing evidence on the record. As a result, all conclusions are usually only tentative and subject to revision. New evidence, or a re-analysis of old evidence, can defeat an earlier conclusion or undermine its evidentiary support. A change in rules may modify what lines of

reasoning are acceptable. Yet at each stage of the legal proceeding, it must be reasonable to rely upon each provisional conclusion. These four characteristics of evidence evaluation—that it is practical, dynamic, defeasible, and presumptively sound—make it an exemplary instance of what logicians call "default reasoning." Default reasoning uses the available evidence, together with default inference rules, to warrant presumptive conclusions, which are then subject to future revision.[28] The highly structured framework in which law accomplishes evidence evaluation poses significant challenges to traditional logic.

V. SECOND-ORDER PROCESS REASONING

Legal decision-making is itself a process governed by the rule of law, and a third area of legal reasoning warrants conclusions about the structure of that process. Process rules allow the decision-making process to be dynamic, participatory, and interactive, while ensuring that the process serves the rule of law and the appropriate balance of epistemic and non-epistemic objectives. Different participants can play different roles, with divisions of labor and responsibility, ideally within a single, fair, and efficient process. Some participants have authority to constrain the decision-making power or discretion of other participants. For example, parties, trial judges, juries, and appellate judges have distinct roles in judicial trials, and public commenters, regulators, and reviewing courts have other roles in administrative rulemakings. Proceedings consist of many points where different participants must make decisions, and many of those decisions (such as rulings on motions) are themselves actions governed by legal rules and must be warranted by the available evidence.

From the standpoint of logic, such process decisions involve the same kind of rule-based reasoning and evidence evaluation discussed above. The ultimate issue to be decided may be whether the court has jurisdiction to adjudicate a particular case, or whether a particular document is admissible as evidence. For such decisions, legal rules define terms and structure the acceptable lines of reasoning, and the issues of fact often require evidence evaluation. For example, the citizenship of a party might be a factor in deciding jurisdiction, or the method of obtaining a document might affect its admissibility as evidence. The logic of rule-based reasoning and evidence evaluation, therefore, also applies to the reasoning about process decisions.

It is traditional to divide process decisions, as well as the rules

28. *See* Walker, *supra* note 19, at 194-95.

governing those decisions, into two types: procedural and evidentiary.[29] Procedural rules address issues as general as jurisdiction, or as specific as the appropriateness of particular filings. Procedural decisions based on those rules orchestrate the dynamics and timing of the decision-making process. Evidentiary rules address issues about the evaluation of evidence, such as the admissibility of evidence, the legal sufficiency of evidence, and burdens and standards of proof. Evidentiary decisions based on those rules manage the various tasks involved in evidence evaluation, and allocate them to various participants in the process. For example, the judge decides whether proffered evidence is admissible, while the factfinder decides the probative value of that evidence once it has been admitted. Usually, the same procedural and evidentiary rules apply across many types of cases—for example, rules of criminal procedure and evidence apply to criminal cases generally, while administrative procedure statutes apply to administrative proceedings generally.

Reasoned decision-making about the very process of decision-making has several distinctive features that create challenges for a useful, normative logic. One is that process decisions often involve "second-order" reasoning. That is, the propositions of process reasoning are *about* other propositions—about the propositions stating substantive legal rules or about the evidentiary assertions in a particular case. For example, a motion to dismiss a complaint for failure to state a cause of action questions whether there is any legal rule that allows a judgment favorable to the plaintiff. The motion claims that there is, in that jurisdiction, no legal rule that would let the plaintiff succeed, even if the plaintiff actually proves all of the plaintiff's allegations. A motion to exclude a particular expert's opinion from the evidence in a case requires the court to reason about the expert's proffered evidentiary assertion. The fact that the rule of law applies also to decisions about the legal process means that we need to have sound reasoning about *acceptable* rule-based reasoning and about *adequate* evidence evaluation. We need sound reasoning *about* legal reasoning.

An important type of process reasoning is policy-based reasoning about whether to adopt, modify, or rescind legal rules. Motions may raise questions about the interpretation of a statute's language, or about creating an exception to a previously adopted substantive rule of law, or about overruling a precedent. In the terminology introduced earlier in this Idea, such reasoning addresses the shape of the implication tree

---

29. For extended examples of process decisions in the context of default reasoning, see *id.* at 232-41.

itself. The rule of law requires that those decisions be justified in turn, and we expect courts and administrative agencies to provide reasons for adopting or modifying rules of law. Such justification involves balancing the epistemic objective against the relevant non-epistemic governmental objectives, with due regard for overriding legal principles such as non-discrimination and due process. A logic of policy-based reasoning would incorporate the content of policies and principles, and would formulate methods for weighing many divergent lines of reasoning in warranting decisions about particular rules.

Another area is analogical reasoning about case precedents.[30] Changing legal rules incrementally is a practice that addresses concerns for deciding similar cases similarly over time, for maintaining predictability of outcome, and for providing due notice to potentially affected parties. Decisions about adopting or modifying legal rules, therefore, generally consider cases that were decided earlier. The logic of legal reasoning should capture the kinds of reasons that courts routinely give for considering two cases to be similar, and for distinguishing one case from another. Making such reasoning transparent will be a very difficult task. At a minimum, it will involve identifying the attributes that are relevant for comparing legal cases, devising a valid and reliable method of classifying actual cases on those attributes, and determining how judges and regulators should decide whether two cases are sufficiently similar or dissimilar.[31] Any adequate theory would take into account the pragmatic contexts of different cases, including the balance of epistemic and non-epistemic policies that might explain dissimilarities among cases.

There are undoubtedly other features of second-order process reasoning that pose challenges to discovering its peculiar logic. Accomplishing the task requires solid empirical research into how the legal profession actually performs such reasoning, in both normal and borderline cases. The final section of this Idea discusses why empirical

---

30. For general legal discussions of the problem of analogical reasoning about precedents, see, for example, EDWARD H. LEVI, AN INTRODUCTION TO LEGAL REASONING (1949); Brewer, *supra* note 18; Cass R. Sunstein, Commentary, *On Analogical Reasoning*, 106 HARV. L. REV. 741 (1993).

31. For research in Artificial Intelligence and law dealing with case-based reasoning, see, for example, L. KARL BRANTING, REASONING WITH RULES AND PRECEDENTS: A COMPUTATIONAL MODEL OF LEGAL ANALYSIS 6 (2000) (discussing the research goal of using rule-based reasoning and case-based reasoning "as complementary processes for classification and explanation in legal analysis"); Ashley & Rissland, *Law, Learning*, *supra* note 8, at 33–54 (surveying "the HYPO family of case-based reasoning (CBR) models," including HYPO, CABARET, and CATO); Rissland, *Artificial Intelligence*, *supra* note 8, at 1968–78 (surveying early developments in AI and law that used case-based reasoning).

research into our actual reasoning is a necessary step in discovering a useful logic for legal reasoning.

VI. LANGUAGE, EVOLUTION, AND LOGIC

Legal reasoning is the method by which lawyers invent arguments, judges and regulators make considered legal decisions, and students and professionals learn the law. The professional community has developed the language, concepts and patterns of reasoning that help us perform these tasks well. The philosopher Ludwig Wittgenstein called such linguistic practices "forms of life" or "language games."[32] Legal rules show a proposition's use by stating the conditions under which we accept it as true, and implicitly show the meaning of legal concepts. "Thinking like a lawyer" means knowing how to use legal concepts to formulate those lines of reasoning that are acceptable to lawyers. Practicing law well means using such reasoning effectively to influence legal decision-makers. The logic of legal reasoning studies the patterns of legal language that legal professionals generally regard as appropriate. The study of legal logic is the study of the appropriate use of legal language.

Legal language and reasoning, moreover, are evolving, as we adapt them to solve new legal problems. The existence of a hierarchy of legal decision-makers ensures that all legal professionals (those who seek to influence the decisions of those decision-makers) use legal language in ways that judges, regulators, and other attorneys all understand. Lawyers want to speak coherently and effectively to judges, trial judges want to give jury instructions that correctly state the law, and trial judges and regulators want to give reasons that satisfy appellate and reviewing judges. Legal language is not a haphazard affair, but is highly disciplined and difficult to learn (as first-year law students can attest). Moreover, many decision-makers document their legal reasoning in written opinions and rulings. This documentation helps ensure continuity of language and reasoning patterns over time. This broad communal effort at solving recurring types of legal problems causes legal language and reasoning to evolve into those patterns that the community finds

32. Understanding the meaning of a linguistic expression involves knowing how to use it appropriately within the rich contexts of human activity that Wittgenstein called "forms of life." *See, e.g.*, LUDWIG WITTGENSTEIN, PHILOSOPHICAL INVESTIGATIONS 4, 7, 10, 23, 27-29, 34-35, 68-71, 116-17, 127-28, 192 (G.E.M. Anscombe trans., 3d ed. 2001). In particular, knowing how to use a descriptive expression correctly requires knowing the conditions under which we consider it to be true or false, at least in paradigmatic circumstances. *Id.* at 21-22, 24, 29-30, 48, 75, 99, 142; LUDWIG WITTGENSTEIN, ON CERTAINTY 2, 8-9, 10-12, 28, 30 (G.E.M. Anscombe & G.H. von Wright eds., Denis Paul & G.E.M. Anscombe trans., 1969).

effective at solving such problems. The forces of evolution behind those patterns make it likely that whatever we find will be both useful and normative.

Discovering the evolving language and reasoning of law therefore requires empirical research into the actual balances that have been struck between epistemic and non-epistemic objectives in different pragmatic contexts. The rule of law promotes evolution through an insistence that similar cases be decided similarly, that decisions be based on transparent evidence and reasoning, and that decision-making proceedings be governed by process rules. Each particular area of law evolves some concepts and modes of reasoning that are precisely tailored to achieving its own balance of objectives. Only empirical research into the actual reasoning behind actual decisions can discover the tailored patterns that have evolved. But in addition, legal reasoning also employs certain distinctive methods wherever it is found—those methods that have proved successful in achieving the epistemic objective within many legal contexts. Such general methods include rule-based reasoning, evidence evaluation, and second-order process reasoning. Even these general methods require empirical research, if we hope to discover a useful logic of legal reasoning.

For example, we need empirical research on how legal rules evolve over time. One hypothesis is about how factfinding can result in new legal rules. When a factfinder evaluates evidence and makes findings of fact, and the proceeding is one in which the factfinder's reasoning is explicitly documented and carefully reviewed, then "soft rules" can emerge.[33] Soft rules in this context are patterns of reasoning that have been publicly scrutinized and upheld on review as being reasonable. Soft rules are "safe havens" that show later factfinders how evidence can be reasonably evaluated, with likely immunity from second-guessing by reviewing judges. After a consensus forms around soft rules as accepted patterns of reasoning, however, courts may eventually "harden" such patterns into conventional rules of law. This hypothesis is an example of how empirical research may uncover mechanisms by which new rules can evolve from past legal proceedings.

Empirical research on the evolution of evidence evaluation promises even more progress, in part because so little empirical research has been done. We should begin by discovering more about the patterns of reasoning that factfinders in different areas actually find plausible, and how those factfinders integrate non-expert and expert evidence into a single conclusion or finding. We should also clarify how rule-based

33. For a discussion of this hypothesis, see Walker, *supra* note 27.

reasoning and evidence evaluation actually interact in particular legal areas—for example, the interaction between decisions about admissibility of evidence, or about the legal sufficiency of evidence, and the evaluation of probative value. We might then discover how second-order reasoning about evidence evaluation can evolve new patterns of plausible reasoning. For example, rulings about the admissibility or sufficiency of evidence may evolve new plausibility schemas for evidence evaluation.

Finally, the evolutionary effect of second-order reasoning should become an important area of empirical research. It is probably in this area that the logic of legal reasoning is most distinctive. The legal community has evolved rule-based reasoning and evidence evaluation as a paradigm for substantive decision-making, but employs that same paradigm in making decisions about the decision-making process itself. This creates the possibility of a reasoned evolution of legal reasoning. Empirically studying the mechanisms by which legal language evolves holds the promise of also discovering its normative and useful logic.

VII. CONCLUSION

The goal of this Idea is to be suggestive but open-ended about discovering the logic of legal reasoning. These brief thoughts about the rule of law and the pragmatic nature of legal reasoning, as well as about rule-based reasoning, evidence evaluation, and second-order process reasoning, can only suggest that there is something distinctive about legal reasoning. The added thoughts about how legal language and reasoning patterns evolve are intended to spur a desire for empirical research into actual reasoning patterns, even if this Idea cannot propose particular designs for carrying out such research. But we in the legal profession have little incentive to engage in such research if we do not sense a need for it. And if we do not sense that the reasoning we apply to legal problems has any distinctive and coherent structure, we are unlikely to try to study that structure. What we need is a professional awakening—to the possibility of discovering a useful logic of legal reasoning.