

Comment on the Cardozo Conference on Graphic and Visual  
Representations of Evidence and Inference in Legal Settings

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The paper I presented at the conference gave graphical form to certain kinds of legal arguments: arguments from precedent cases.[1] I did not intend to impose a kind of discipline on those who make such arguments. Our research aims at elucidating the various forms of reasoning, proposing rules that capture their patterns and regularities, even if those rules and patterns might seem naive to experts at arguing from precedent. To a formalist, a few good rules are better than no rules, especially since artificial intelligence depends on having rules for computers to follow. A graphical way of diagramming such arguments is simply an alternative way to present the disciplined arguments, to make them comprehensible to humans, especially when the symbols are being manipulated by automata. For some, however, the implicit value of such a graphical mechanism is normative: one presumes to improve the quality of legal arguments by imposing a canonical form. This is the presumption that ran badly afoul at this conference. Why should someone who is already very good at making arguments be interested in following our rules for diagramming their arguments?

Our idea was simply to improve on the ubiquitous "Toulmin form" for diagramming defeasible arguments.[2] Our analogies are a specific kind of argument requiring a specific kind of Toulmin structure. Our theory is itself a putative improvement on existing theories of analogy from precedent. Hence, by claiming to have an improved theory of analogical argument, and claiming to refine Toulmin diagrams with that theory, it is easy to imagine that people could be led to better arguments, better rationality, and better decisionmaking, by using our new diagramming conventions. This is what many formalists, many research computer scientists engaged in logic and visualization would have claimed. But why should it be true? Why are more diagramming rules better than fewer?

I did not explicitly claim that people who use our diagrams make better arguments. I would not even have claimed that people who use Toulmin diagrams make better arguments with those diagrams. My paper was actually a "Modest Proposal for Annotating the Dialectical State," and literary tradition required that such a paper be ironic or satirical, even humorous in the face of serious circumstances.[3] So I suggested, whimsically, that the boxes and arrows and recursive structure of argument-graphs could be replaced by a single historical image: the face of a political candidate, or a civil war general, perhaps even an football quarterback. Throw out all the rigid logical form, I wrote tongue-in-cheek,

and use Barack Obama's face for a new and untested argument of great popular force, or George W. Bush's face for an old argument that has gotten progressively more difficult to make, and which began on dubious grounds anyway. It wasn't such a bad idea: replace the Microsoft-Windows-style summaries that use plus and minus signs (or red and green lights) with a richer set of "emoticons." Some arguments get a plus sign, or a green light, when many counterarguments exist and all are defeated; some get a plus sign, or a green light, when there are no counterarguments whatsoever; and the differentiation can be made visual by having different kinds of plus signs and different kinds of green lights, i.e., by using different people's faces, a richer set of representational metaphors, instead of traffic lights and arithmetic signs.

The conference went further. The non-formalists, the non-logicians who were mostly lawyers and literary scholars, suggested that diagramming might not even be a rational activity. In fact, it might be irrational, or in any case, not a rationality-producing activity. They suggested that Wigmore's first big diagram was like modern art, possibly the product of an unwell mind. They suggested that simply enumerating premises feigned deductive inference, regardless of the deductive validity of the inference. They suggested that rationality was not even the goal of persuasive argument, when specific colors and fonts and video clips might have greater effect on judge and jury. Chaim Perelman and others in rhetoric have defended the importance of persuasion[4], but never has a logician wandered so far as to suggest that a paradigm example of rhetoric invokes a "Hollywood Squares" layout of nine simultaneous video screens showing nine separate video clips of a witness refusing to answer a question.

My satire would represent actually a middle ground between two distant extremes. On one side, the logicians simply assumed that people would want to enumerate and individuate their premises, then connect them and collect them into a whole, in the same way that a boxer connects torso twist and shoulder thrust to produce a single wallop, P and Q, hence R. Kapow. On the other side, people who have always found symbolic logic too rigid wondered how additional computer tools with additional formatting rules were going to make courtroom outcomes in their own lives more favorable. These people already know how to throw a punch, and they do not appreciate people telling them the "right" way to divide punch-throwing into basic steps.

The difference was recognized by the participants, but there was no attempt made to resolve this difference. It is an old and deep question for the symbolic logician, "Why should I follow your prescribed form?" It is not asked often enough, and the formal logician is loath to answer, since most do not have very good answers. It is really a philosophical logician's

question to answer. Usually the answer is "Follow my form because it is better than following this other form." And even this answer, that one logic is an improvement on another, cannot actually be defended. On the other side of this question is also a nagging concern for the informalist. "Isn't a disciplined pattern of reasoning better, all things being equal?" "Aren't some patterns of reasoning simply indefensible?" "Could all patterns of reasoning really be equally acceptable?"

I want to address these questions here. They are such important questions that the conference could not have avoided them, especially after Peter Tillers endeavored to throw together formalists and informalists, theoretical and practical people, to decide the fate of the evidence visualization tools that are proliferating at software houses and human-computer interface (HCI) labs.

There are several distinct uses of a symbolic logic. For the dialectician, logic permits adversary analysis of argument. By breaking an argument into components, an attack can be focused on a specific subclaim. Dialectic identifies places of disagreement and ideally, after a few rounds of attack and counterattack, it produces refined statements of the opposing claims that are not as easily attacked as the initial opposing statements. For the person who is prone to fallacy, especially in probabilistic or set-theoretic reasoning, a symbolic logic provides a way of checking trains of thought, keeping heuristic patterns of thought from reaching too far in specific situations where heuristics are known to fail. For the mathematician and mathematical modeler (especially the economist), a symbolic logic provides a means of deriving claims from assumptions, so that an axiom system can inform, even when there are no new observations. Here, there are deep connections to linguistics, the "meaning postulates" of a language, and the entrenched paradigms of scientific theory which function as logico-observational constraints.

In theory, in some evidentiary legal situations, a logic can be used to persuade. At least in the ideal, it is persuasive by appealing to one's self-discipline, or to the authority of a derivation, given agreement on the premises. We often fall short of that ideal. The rhetorical use of  $P$ , if  $P$  then  $Q$ , hence  $Q$ , is often an abuse of logical derivation when two people are already in disagreement. In the context of persuasive dialogue, an appeal to such logical rigidity and simplicity can seem puerile. It is almost as fatuous as rhyming, "if it doesn't fit, you must acquit." For a more respectable image of how logical calculi can actually help to resolve doxastic conflict, consider the use of Venn diagrams to explain Simpson's Paradox of probabilistic reasoning in a courtroom. [5] If successful, it can be persuasive because it is clarifying, illuminating, and mathematically careful. Again, it is a deep question why counting is convincing, but *modus ponens* is not.

Ironically, my interest in logic, and probably the motivation of many of my colleagues, lies elsewhere. As an AI researcher, inventing logics is one of the ways that we can engineer artificial decisionmaking devices. The question of the usefulness of a logic, such as fuzzy logic, is similar to the question of the usefulness of a programming language. We often have no one to persuade but the computing machine. The logic is used to construct belief states, not to change opposing minds.

As an AI researcher who is interested in legal reasoning, logic is useful as a restriction on a decisionmaker who could otherwise be grossly unfair. A juridical decisionmaker might be free to decide any way in a case, so long as there is a well-formed argument for the decision. Not just anything is a well-formed argument. In fact, the ontology of the premises is more important than the calculus of the derivation. What issue distinguishes two persons who have unequal outcomes under the law? It has to be stated, even if it is an outright ad hoc invention, and the language used to justify a distinction becomes grounds for future argumentation, subject of course to future interpretation. It is a linguistic constraint that biases future proceedings toward a specific kind of fairness (like treatment for like situations). Logic here refers to rules governing valid analogy. Logic of this kind is used as a constraint on how language can be interpreted. It should be pointed out that many of the AI researchers interested in formal models of argument are also AI researchers interested in legal reasoning.

It seems that such users of logic, the AI researcher and the analogy-maker in legal settings, should be responsive to a request that an argument be diagrammed. In the first case, the symbols are not just a proposed model of the reasoning; the symbols are actually there to be found inside the machine. In the second case, the logic provides pieces in a formal game, and if the "players" adhere to the rules of the game, they ought to be willing to accept greater formality. Of course, there are many who would not agree that analogy-making and analogy-breaking comprise a task that is as well formed as a game, and there are others who might agree that it is a well-regulated game, but not according to the particular rules we provide. As the game-maker, the purveyor of proper analogical form, I leave it to such people to make their opposing case. The important point here is that there are situations where users of logic are not burdened by the request to diagram their arguments.

In other cases, it is clear that diagramming is a burden. One who alleges to diagram the logical form of another person's argument might do so in an objectionable way. And even if one were entreated to diagram one's own argument, it's not clear that doing so would strengthen or legitimize the argument. In such cases, the problem is that there is no single authoritative diagram of the argument. Even if people agree on a logical

form, the interpretation of claims as formal objects, as P's and Q's, is subjective. There is no single correct way of writing claims formally. While one might write P, and if P then Q, therefore Q, another might simply write P and Q. In some cases, the law or rule "if P then Q" is already available as a formal or semi-formal assertion, so people try to connect their claims to such an assertion. But there is still plenty of room for quibbling, individual variation, difference of interpretation, incommensurability, machination, and downright mendacity. (It all depends on what "is" is.)

The simple ugly truth about logic is that you can't actually force a person to use it, that is, to use a specific formal system of axioms and inference rules, for objective appraisal of argument. To say "you are not using the logic properly" is a pointless criticism once one moves beyond introductory logic courses. When you are not the logic instructor, you no longer have absolute authority on how linguistic claims or states of belief should be converted into formal symbols. You don't even have the authority over what logic two people ought to be using to regulate their discourse ("Are the conditionals you use counterfactual conditionals with a closest world semantics?" "Of course, but mine are Lewis-type and yours are Stalnaker-type." [6] "How can I force you to use my semantics?" "You can't.").

I encountered this problem early as a logician, in a comment I wrote for the second TARK Conference called "The Curse of Frege," then again in a Journal of Philosophy article, "How a Formal Theory Can be Normative," and again in an AI and Philosophy chapter, "Dialectic, Computation, and Ampliative Inference." [7,8,9] It is a problem that surfaces whenever there is a question of whose logic to use, whether there is progress in the invention of new logics, or whether a person is using a logic properly. The basic enemy of logic is something called the Principle of Charity. [10] This principle governs the interpretation of another mind; it says that one should suppose the maximum possible rationality of the other mind when interpreting states of belief. If, under the best attempt to understand the other person as a follower of logical rules, it is still difficult or impossible to reach an understanding, then that person is simply irrational. The reason for the Principle of Charity is that in its absence, there is an "indeterminacy of translation." I might say "If Bizet and Verdi are compatriots, then both are German." You might suggest the formalization, "if P and Q then counterfactually, R." I might then say, "If Bizet and Verdi are compatriots, then both are not German." You now have a choice. You can either write, "If P and Q then counterfactually, not-R," which is inconsistent with the first counterfactual assertion. Or you can revise your formulation of my locutions so that they are material assertions, "If P and Q then materially R", i.e., "not-R or not-P or not-Q". The Principle of Charity suggests that you do the latter.

The Principle of Charity does not actually remove all indeterminacy of translation if there are multiple ways that a person could be held to be rational, under generous interpretation. A simplicity ordering would be needed, in addition to Charity, to pin down a unique formalization. But it does illustrate how controversial is the process of taking locutions and turning them into formal assertions. Informalists who resist rigid logical systems know this intuitively but do not have the experience with enough different logics to illustrate the controversy. A much larger problem is that one can be so creative and so heroically generous, that no one can be held to be irrational. In an extreme example, where preference is supposed to be transitive, one might nod yes to each of the following questions, "Do you prefer Mozart to Mendelssohn?" "Do you prefer Mendelssohn to Bartok?" "Do you prefer Bartok to Mozart?" The very generous transcriber of this behavior, who takes seriously the Principle of Charity, might write  $A > B$ , for Mozart preferred to Mendelssohn,  $B > C$ , for Mendelssohn preferred to Bartok, and  $A > C$ , for Mozart preferred to Bartok, even though the nod appeared to be very good evidence for writing  $C > A$  (Bartok preferred to Mozart) instead of  $A > C$  (Mozart preferred to Bartok). In the absence of a strict method of converting observations of the world into formal symbols, the generous transcriber is basically free to write with impunity. In the philosophy of science, we would say that if there is no measurement theory, you can write whatever laws of nature you want. There are of course other creative ways of interpreting the world as a set of formal P's and Q's that are not so blatantly inventive. One might introduce the element of time, for example, and write that  $A@1 > B@1$ , then  $B@2 > C@2$ , and finally, at time three,  $C@3 > A@3$ . There is no violation of transitivity because the music appreciator simply changed preferences over time. This kind of thing happens all the time in putative uses of logic when one hopes to gain critical control over another's reasoning. Far from being the constraint on discourse that cleanses the opponent's mouth of alleged irrationality, it is exposed as a formalist's farce based on the lessons of radical translation. Instead of invalidating the opposing lines of argument, and with them, the opposing point of view, it merely begs the question, "Why these symbols?"

I do not have a solution at this point. Logic works where our research community uses it because there is no issue of variable interpretation. Whoever creates the initial database of beliefs in an artificially intelligent agent is responsible for the transcription of the world into formal symbols, and for any bias or point of view this might entail. If the machine has its own sensory devices, like a robot's camera, then it converts those sensory inputs into formal symbols according to its programming. If I don't like the programming, I can get my own robot and redesign the epistemology, ontology, and semantics, to my own liking. Meanwhile, logic works in our

theory of legal precedent because we are attempting to be descriptive rather than normative. Our theory of prima facie similarity and argument-based distinction is a formal game. It is proposed as a model of how the thinking and disputing actually take place (when it is done well); as a model, it is a simplification and an ideal, intended as legal philosophy or jurisprudence. It would be folly to require that actual legal proceedings adopt the simple and restrictive rules of our game. It would be worse, we claim, for actual courts to use Kevin Ashley's game, HYPO, which we aimed to improve, or for that matter, a game based on Joseph Raz's simple and early ruminations, which Kevin Ashley improves. It may even be better for a court to play by the rules of Henry Prakken and Giovanni Sartor, who think their theory of precedent is better than ours (we think it is different, not better). [11,12,13] But even if it would be better, it would still not be a particularly good idea to play by any of these formal rules in a courtroom (although our colleague, Layman Allen, once famously persuaded a state legislature to restrict its use of the conjunction "and" in its legislative bills to the familiar logical use; this success for logic was short-lived, as the resolution to restrict was quickly repealed [14]). The formal system is just too rigid, and the range of modeled phenomena is too narrow. More importantly, the modeling presupposes general agreement on how to write claims as formal objects, as tokens in the game. In actual adversarial settings, there is no reason to suppose such agreement.

Here, then, is where there is hope for using logic in the critical appraisal of another person's argument. To the extent that there is a shared habit of translating linguistic objects into logical syntax, parties to a dispute can limit the potential profligacy of the Principle of Charity. We could agree to use the logical "and" whenever "and" occurs in speech, excluding for example, temporal uses of "and then". That's not a bad idea. We could also agree to use the "inclusive disjunction" whenever "or" occurs in speech, which is not a bad convention either, though it appears to exclude parental threats ("Wash the dishes or you will be grounded!"). "Each," "Every," "All," and "In general," could be taken to be universal quantifiers, though this certainly imposes a toll on the nuance and expressive range of language. And we could agree that "If ... then ..." should be translated, as mathematicians like to do, as the material conditional, Peirce's arrow, a backwards way of saying "Not ... or ...". This is almost certainly a fatal mistake, one of the worst conventions of translation ever to appear in logico-linguistics. But it would permit greater logical control of discourse because there would be greater agreement on the formal symbols.

This is why a single mind can use logic for self-discipline. Write the symbols according to whatever habit or self-charity, according to whatever "measurement theory" one chooses. Then, relative to that practice of attaching the world to the symbols, the logic provides suggestions for

additional symbols (inferences), or makes discoverable the inadmissible states (inconsistencies). Perhaps twins who are very much "in tune" with each other could act as a single mind. Perhaps two people who attended the same school and subscribe to the same schools of thought, who adopt very similar world views, could apply logic to their disagreements. By hypothesis, in each case, the habits of translation and limits on charity would be well understood and largely shared. Two people who were quite different, but who actually wanted to find agreement, could use logic to appraise their reasoning, because they would presumably seek ways to resolve disagreements over formal-to-informal translations. The HCI labs that are purveyors of argument diagramming software are interested in CSCW, computer-supported "collaborative work."

What is the best that could be done for people who truly want to convince each other of their opposing view, and who want to use logic in part to do the convincing in an adversary setting? Here, I have suggested that contracts could be written to act as further constraints on logico-linguistic interactions. These contracts bridge the formal-informal gap because they are natural language documents in which formal requirements are set forth, and it may well be that the process of deciding whether there is adherence to the obligations of a contract is clearer than the process of deciding whose argument is better when there is a purely logical dispute. Or perhaps there is just a circularity here, as the dispute over contract might require a dispute over logical form. Nevertheless, it is perhaps a superior alternative to the obligation games that were played in the Middle Ages, where one has to commit to a formalization of claims before one can know what the adversary will do with those formal commitments.[15]

So who should use box and arrow argument diagrams in the presentation of evidential arguments? The question is basically the same as who should use logical symbol systems, though the graphical aspect clearly raises the theatrical ante.

My answer is: those people who think they can obtain agreement on the translation of each claim into its corresponding box, who can agree on the decomposition of the argument into its alleged components, and who are likely to find agreement on the authority of the logical method underlying the diagram. They can use their time to diagram arguments during disputes. Otherwise, it is a waste of time. Absent agreement, denial of the formalization is easy: "Here is your argument as I see it, according to my discipline of diagramming, and here is the flaw I see in your argument." "Oh no, that's not my argument (and by the way, I don't think much of your logical regimen)."

The Medievals would have played a different game: "This is a diagram of your argument, correct? If there are any errors in my diagram, please

correct them now. I see that you have alleged P and Q in this box. You therefore claim Q, so there must be a box here. ..." Having committed to the symbolization "P and Q", the rules of the game permit the linguistic "and" to be interpreted as logical conjunction, and so forth. Since the linguistic claims were submitted to the adversary for acceptance, there is a certain embarrassment when the dialectician is able to derive an inconsistency from the assertions. But we would recognize this as merely a game, a clever sophistry, not necessarily compelling one decision or another. It is too easy, and acceptable, for the opponent to say "Well, that isn't really a fair and accurate characterization of my claim. P and Q was really a shorthand for: if not-R, then P and Q. I thought the assumption of not-R was implicitly understood." It sounds weak to revise something that has already been claimed to be acceptable. But the dialectical method of achieving inconsistency from tentative symbolic forms is so artificial that being clear through restatement of claims actually looks more mature and honest, and hence is probably more persuasive. "I got you to agree to these symbols, and I derived an inconsistency from them. Those symbols are untenable; hence, you are irrational; hence my view is superior." "Yes, I see your derivation. But I was wrong to agree to those symbols. This is a more honest way of writing my claim in your symbols, if you insist that I do so." Which side do you like better?

My idea of contracts is to have translation agreements in place in advance. "We agree not to index preferences by time." "We agree that the linguistic use of 'prefers' will be symbolized as strict preference rather than weak preference." "We agree to treat the entire body of work, the oeuvre of Bartok, as a single object of preference, 'Bartok', even though a person could have a distinct preference for some works and distaste for others." Two people who are participants to a dispute dialogue could still find themselves unable to agree on the boxes and arrows that represent the arguments of each side. But at least they would realize that the logic diagramming will only be persuasive if they can agree that the diagrams are fair representations of their positions.

All of this has nothing to do with other graphical presentation of evidence, such as the visualization of numerical quantities to appreciate large differences in scale. No one mentioned the book, "How to Lie with Statistics" at the conference [16], but it was obvious that issues arising from the presentation of data, or the calculation of probabilities, are more important in practice than the graphical presentation of an argument's logical form. What was mentioned instead was the importance of extra-logical form in front of juries: the size of text, the emotional content of words and phrases chosen, the colors and layout, etc. It was easy to wonder whether a basic manual could be written about these choices, like the little classic on statistics, or like classical instruction in body language and intonation for rhetorical orators.[17] Or perhaps it is always

subjective, attached to the era and the culture, and too much like storytelling, far from the world of the objective.

What we have seen at this conference is that logic diagrams are also very much like storytelling. They bring with them a subjectivity of translation even though they purport to appeal to objective standards. I was surprised to see how many of the informal legal scholars and practitioners understood this about logic, this deep dark secret about which no logician speaks. They remain skeptical that computer programs providing user interfaces for diagramming logical arguments will be helpful. Though my erudite fellow inventors of logics will probably be aghast, I am completely in agreement with the skeptics.

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