ICAL 2015:
STUDYING EVIDENCE IN THE LAW
Formal, Computational and Philosophical Methods

The Nature of Juridical Proof:
Probability as a Tool of Plausible Reasoning

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Interrelated Set Papers

• Stanford Conference: What are we doing:
• Here—plausibility as a partial explanation of juridical proof
• International Association of Philosophy of Law and Social Philosophy, July 30 and 31—Why There is no Theory of Evidence and Couldn’t Be
What Are We Doing? Reconsidering Juridical Proof Rules

1. Different disciplines are doing lots of different things, whatever the ostensible appearance, all of which may make sense within the various disciplines.

2. It is a mistake at various levels to conceptualize the legal system and its various parts as a subset of particle physics subject to discovery of general organizing principles (e.g. that there is a probability algorithm applicable to juridical inference) although there are explanations of the data.

3. The best explanation of juridical proof—which refers to the general process of convincing the fact finder what happened—involves a form of inference to the best explanation—today’s talk.

4. The best explanation of the “legal system” is as a complex adaptive system.

5. But legal systems implement a theory of government
THE EPISTEMOLOGICAL PROBLEM:
THE SIGNIFICANCE OF FACTS

THE ORGANIZATIONAL PROBLEM:
ALLOCATION OF POWER AND DISCRETION ORDERS ACTOR AND BRANCH OF GOVERNMENT RELATIONSHIPS

THE GOVERNANCE PROBLEM:
INTERACTION OF LITIGATION AND PRIMARY BEHAVIOR—ROLE OF INCENTIVES

THE SOCIAL PROBLEM:
TRIALS AS PERFORMATIVE EVENTS; OBSTRUCTIONS TO GOVERNMENT

THE ENFORCEMENT PROBLEM:
LAW ON THE BOOKS V. LAW IN ACTION
WHAT ARE WE DOING?

1. Kaplan was simply offering an explanation
2. Tribe, Marcello di Bello, Alex Stein (in his book) focusing on the moral imperatives of criminal trials
3. Larry Laudan, Truth — epistemological implications of criminal procedure
4. Finkelstein and Farley—analysis of trace elements
5. Pennington and Hastie—how people reason about trial evidence
6. DeKaye, Kay, Friedman—normative attractiveness of Bayesianism
9. Efforts to tame the conjunction paradox:
   a. J. Cohen—Substitute a different form of probability
   b. Chang—modify probabilism
   c. Clermont—replace probability theory with fuzzy set theory
11. Analysis of discrete mistakes. Bart Verheij project/Lucia de Berk
12. Various economic arguments: Sanchirico and incentive effects of evidence rules, Kaplow’s strange economic argument that ignores infinite transaction costs.
Juridical proof, plausibility, and probability

Meaning of “probability”:

Relative frequency:
  rare, but some cases, statistical proof of discrimination, DNA to some extent

Classical: never

Propensity: never
Bayesianism

No objective data typically—forensics is an exception

Can the exception become the rule?

I doubt it.
Biedermann, Taroni & Thompson: Using Graphical Probability Analysis (Bayes Nets) to Evaluate a Conditional Probability
SIMPLE BAYES NET
Mixed Samples

• Biedermann et al. use as an example a mixed DNA sample from a hat, and develop an extraordinary model of how to analyze it.
• But, as they say, “In order to apply the model . . . It is necessary to have a probability distribution of values for N” (N = how many contributors to the sample).
• True not only for math but law—this is conditional relevance (FRE 104(b)) and the entire line of testimony is inadmissible without it.
• Have forensic DNA analysts opine: “one might argue [they] will be more knowledgeable than anyone else . . .” about number of likely contributors, and “their judgement might nevertheless be better than that of anyone else.”
• One might argue it, and it might be true, but the evidentiary process requires personal knowledge or justified expert knowledge, neither of which exists here. At least I couldn’t find any . . .
• Why not? The history of hats . . . A paradigm of why few legal problems look like problems in particle physics.
SOME EXAMPLES
MORE EXAMPLES
HAVEN’T EXHAUSTED THE SET
Napoleon’s hat: $2.4 million
The History of Hats

1. Size of framily . . .
2. Sharing tendencies within framilies . . .
3. Hair and grease characteristics and their implications for hair stickiness
4. Cleanliness and Godliness—the cleaning history of hats and its effectiveness
5. The chronology of hathood—how many owners, framilies, cleanings, and misadventures
SPECTER OF DEPENDENCIES

DNA IDENTIFIES DEFENDANT, BUT WHAT OTHER EVIDENCE DOES AND HOW DOES IT RELATE TO DNA?
Don’t neglect computational problems. DNA on hat interacts with all the other evidence in the case: Assuming that there are only 300 assertions or propositions that would be pertinent:

Even such a small set would require more than $10^{100}$ checks to determine that a new assertion was consistent with the entire set that comprised the existing knowledge base. Assuming the universe is between $10^{10}$ and $10^{11}$ years old, a computer that could make a check every picosecond ($10^{-12}$ second) and that had been checking continuously since the instant of the big bang would by now have made roughly $10^{30}$ checks, which is such a small fraction of $10^{100}$ that if it were subtracted from $10^{100}$, there would be approximately $10^{100}$ left. In other words the progress made by our imaginary supercomputer towards its goal would be so small relative to the magnitude of the task that one would be justified in saying it had hardly begun. A truth table to test the logical consistency of the conjunction of 300 elements would require 2300 lines, which in turn would require approximately $10^{100}$ checks for consistency.
Size is a problem, too, in two different ways

If a sphere 100 billion light years in diameter (considerably larger than the known universe) were tightly packed with proton-sized (10^{-15} meter) computers, each capable of checking for a contradiction in 10^{-23} second (roughly the time require for light to travel a distance equal to a proton’s diameter), and the resulting machines were to run non-stop at full tilt for a 100 billion years or so, it could make on the order of 10^{168} checks, which would be enough to ensure the logical consistency of about 558 beliefs.
Size is a problem (cont.):

• Making it worse is that each time a new proposition is added, the process has to begin all over again. Any particular proposition may be consistent with one or more other propositions when judged alone, but inconsistent with them when judged together. Consider for example the proposition “all A are B.” This is consistent with “all C are A.” It is also consistent with “no C are B.” However, “all A are B” is not consistent with the latter two propositions, as they imply that “some A are not B.”
To make this concrete:

- (All A are B): “All law professors are Dworkian God-like creatures.”
- This is consistent with (All C are A): “All economics professors with appointments in law schools are law professors.”
- It is also consistent with (no C are B): “No economics professors with appointments in law schools are Dworkian God-like creatures.”
- The consistency of the first proposition with each of the second two is obvious (the third proposition could mean that economics professors with appointments in law schools are not law professors). The second two standing alone are also consistent; they imply that some law professors are not Dworkian God-like creatures.
WHAT DATA DEMONSTRATES THAT USING A “BAYESIAN” APPROACH AT TRIAL IMPROVES DECISION MAKING?

NONE
DEEPER PROBLEM—FOUNDATIONS OF MATHEMATICS

Savage’s axioms require:

1. The formation of a probability space of mutually exclusive hypotheses;

2. Initial assignments of probabilities to each of the hypotheses within the probability space so that the sum of their probability = 1.0.

3. A “recognition of all logical truths in the [probability] domain.”

4. Conditioning on the evidence at some point.
NO LEGAL SYSTEM ADHERES TO SAVAGE’S AXIOMS

1. Knowledge emerges slowly
2. Legal hypothesis are NOT guilt or innocence—those are verdicts
3. New emerge until the end
4. All evidence is “old” evidence by the time the probability space is configured
PHYSICS ENVY—YET AGAIN A MISTAKE

- Rules as simple deductive structures stating necessary or sufficient conditions
- Works great in science—Higgs Boson
- But not all science: imagine the particle physicist predicting the path of a water molecule down the mountain.

Where is that sucker?
POINT IS NOT TO BE DISMISSIVE OF FORMAL APPROACHES

• Many disciplines working on various aspects of legal system can afford physics envy: can pick the problem to analyze, can defer decision until new or better data is available, can often run replicable experiments with falsifiable propositions.

• The legal system has none of those luxuries: cannot pick its “problems” and no decision on the merits is a decision on the merits.

• The point is to be clear what the problem actually is from the point of view of legal analysts.
NATURE OF JURIDICAL PROOF

Plausible reasoning:

-- civil cases: whose story is more plausible

-- criminal cases: plausible story of guilt? of innocence?
WHAT IS A PLAUSIBLE EXPLANATION?

coherence
consistency
completeness
uniqueness
economy
and (yes) probability
AT THE END OF THE DAY, THE MOST “PROBABLE EXPLANATION”

But—probability is arrived at through plausible reasoning, not the other way around.

Plainly is the best explanation of Anglo-American legal systems. . .

Read transcripts—it is obvious; no mention of formal approaches to evidence

Opening statement/closing argument

Cross-examination tests narrative capacities: ambiguity, sincerity, perception, memory

Admit all relevant evidence with few exceptions

Rules of exclusion are actually rules of admission: hearsay and character

Rules of completeness: Res gestae, Old Chief case, rule about documents (e.g. FRE 612)
THE FUTURE

FORENSICS—I WOULDN’T PRESUME TO ADVISE, but if I did, keep doing what you’re doing


EVIDENCE SCHOLARS—THE NATURE OF RATIONAL THOUGHT CONSTRAINED BY PECULIAR NEEDS OF LEGAL SYSTEM

WILL BE DOMINATED BY THE IMPLICATIONS OF PLAUSIBLE REASONING (in my humble opinion).
As always, thank you for listening