Impression and Pattern Evidence Seminar:
The Black Swan Club

Clearwater Beach
Aug. 3, 2010
David H. Kaye
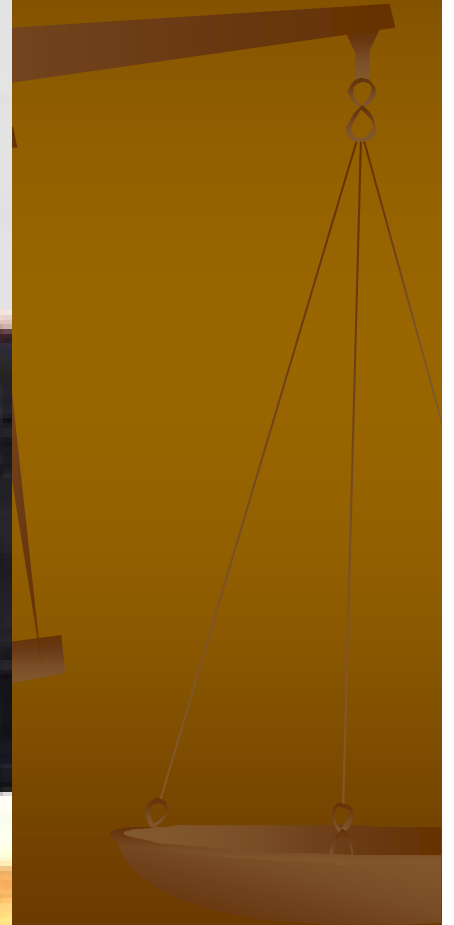
Academic musings

Advice of counsel

Some Recent Cases

United States v. Diaz
(C.D. Cal. 2007)

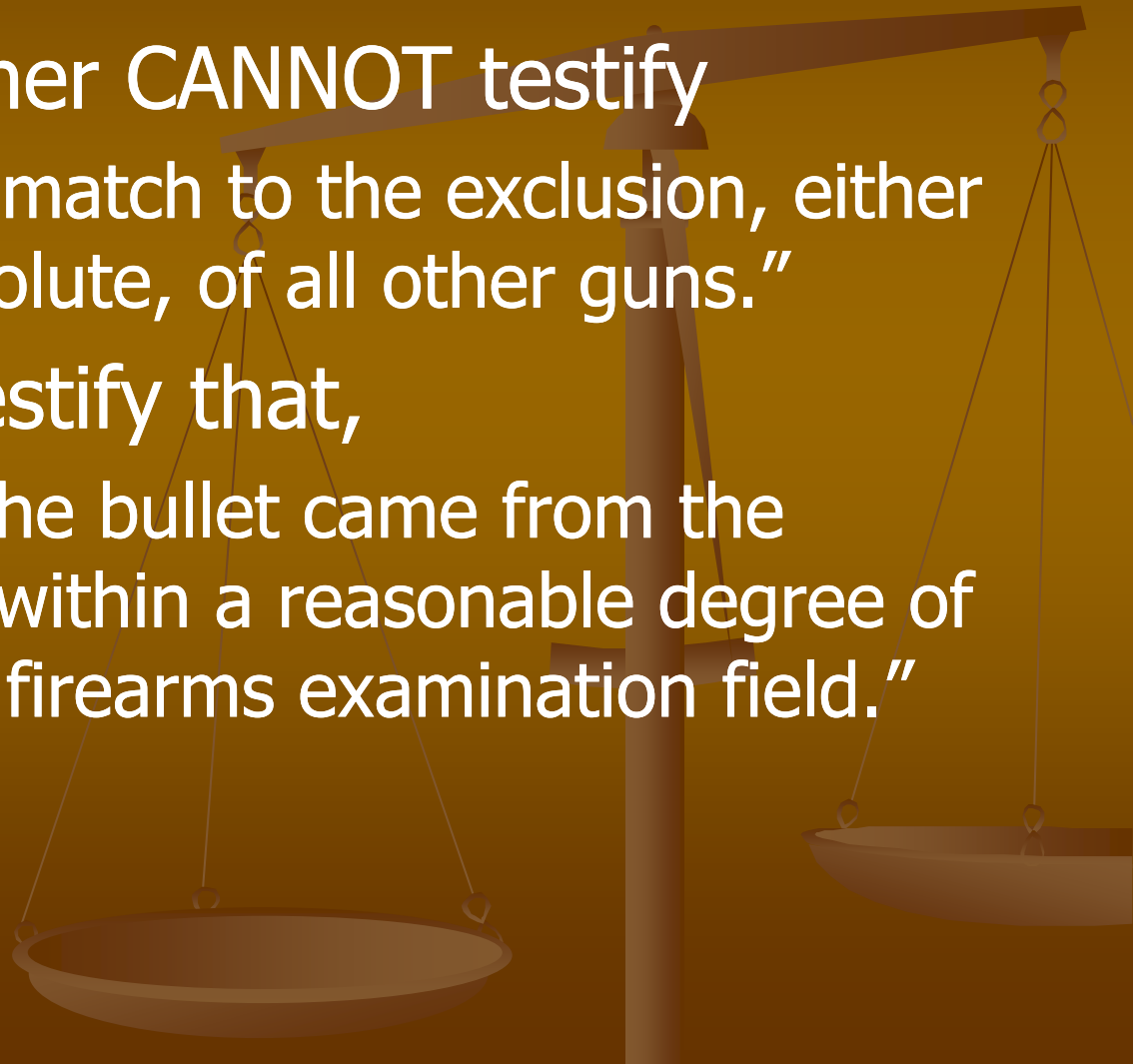- Firearms identification by toolmarks admissible under *Daubert*

BUT

- "The experts may not . . . testify to their conclusions 'to the exclusion of all other firearms in the world.' They may only testify that a particular bullet or cartridge case was fired from a particular firearm to a 'reasonable degree of certainty in the ballistics field.'"
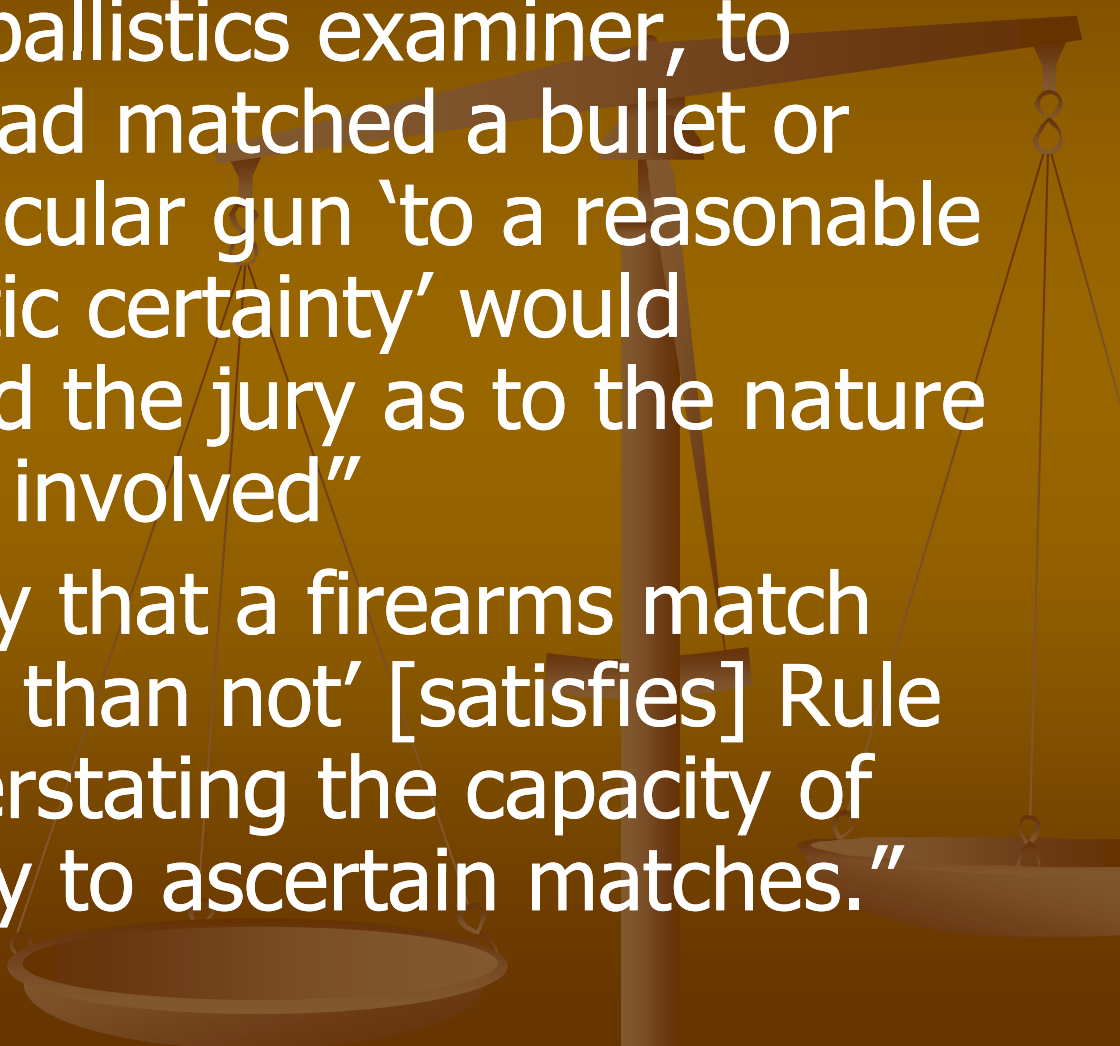
United States v. Taylor
D.N.M. 2009

- Firearms examiner CANNOT testify
  - "that there is a match to the exclusion, either practical or absolute, of all other guns."
- "He may only testify that,
  - in his opinion, the bullet came from the suspect rifle to within a reasonable degree of certainty in the firearms examination field."

United States v. Glynn
S.D.N.Y. 2008

- "[T]o allow [a] ballistics examiner, to testify that he had matched a bullet or casing to a particular gun 'to a reasonable degree of ballistic certainty' would seriously mislead the jury as to the nature of the expertise involved"

- "[T]o testify only that a firearms match was 'more likely than not' [satisfies] Rule 401 without overstating the capacity of the methodology to ascertain matches."
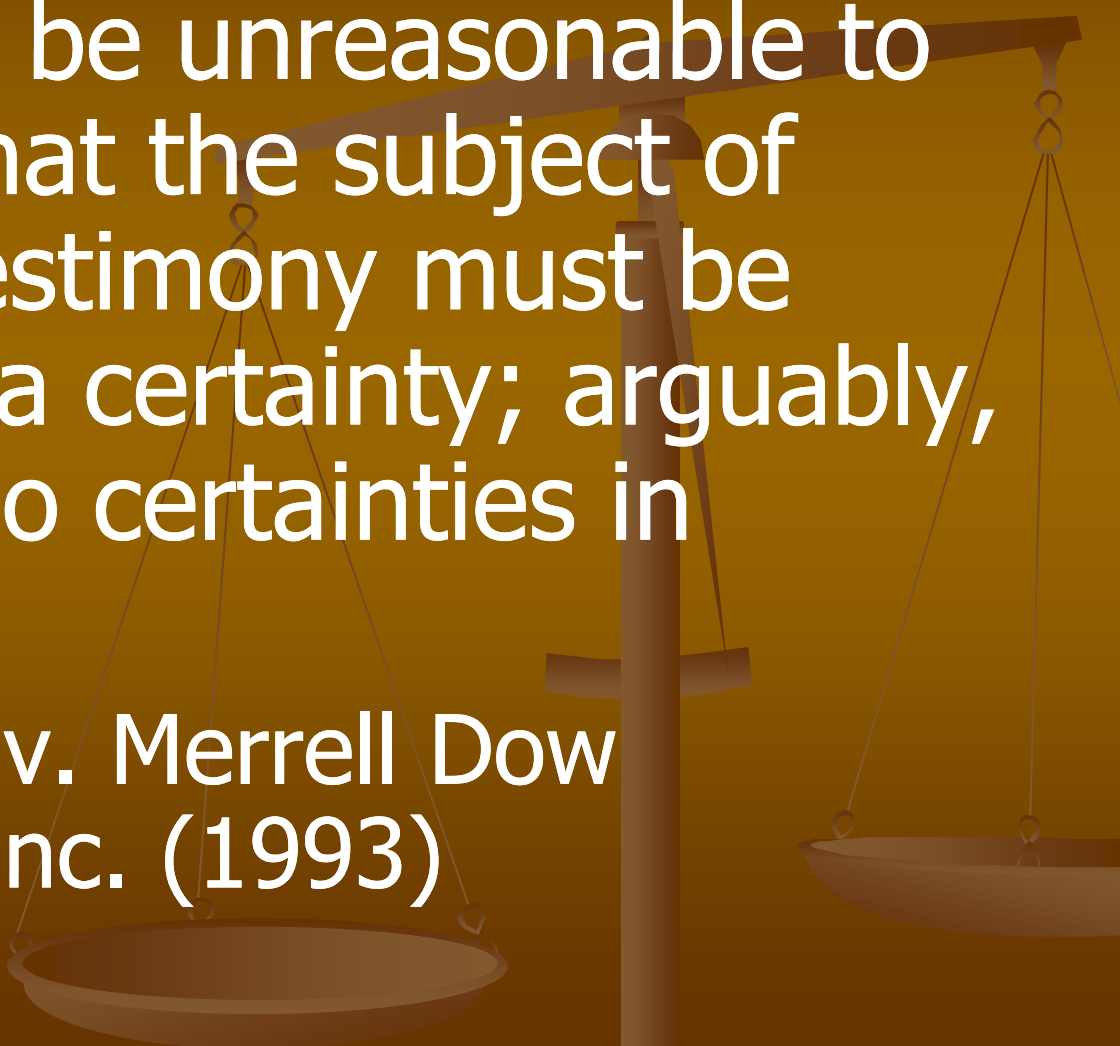
United States v. Willock
D. Md. 2010

- A firearms expert was "not … allowed to opine that it is a 'practical impossibility' for any other firearm to have fired the cartridges … ."

- "permitted only to state his opinions and bases without any characterization as to degree of certainty (whether "more likely than not" or "to a reasonable degree of ballistic certainty").

The More You Claim ...

- Ramirez v. State (Fla. 2001)
  - the extraordinarily precise claims of identification that Hart makes under his testing procedure—i.e., he claims that a "match" made pursuant to his method is made with absolute certainty. Such certainty, which exceeds even that of DNA testing, warrants careful scrutiny in a criminal—indeed, a capital—proceeding.
- Yet in case after case ...
  - "He testified that he was 100% certain that the casings came from the same weapon."
  - "the government's fingerprint expert, then testified that he was '100%, without a doubt' certain that 'the latent print is that of Nolan Hugh.'"
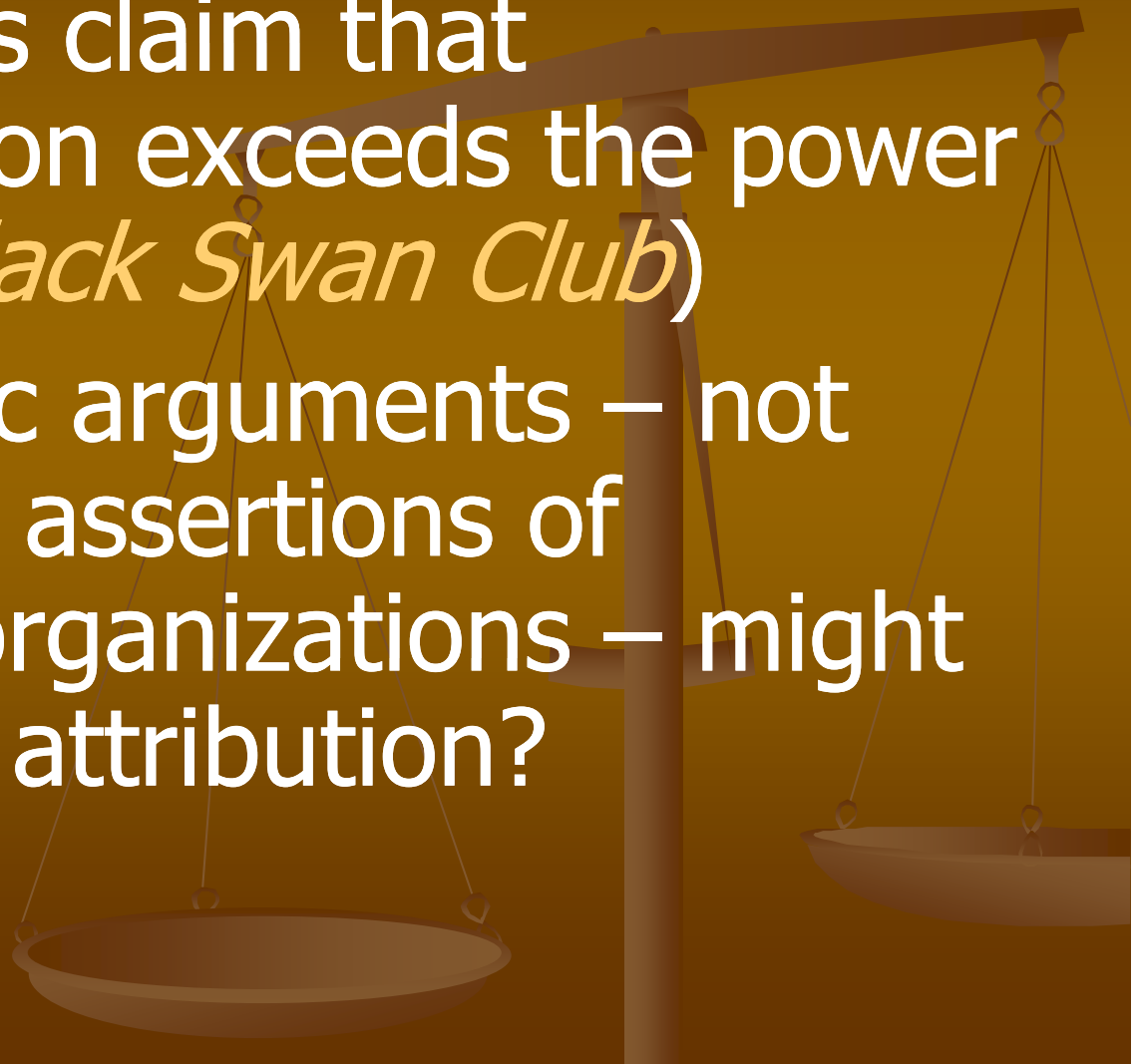
- "[I]t would be unreasonable to conclude that the subject of scientific testimony must be 'known' to a certainty; arguably, there are no certainties in science."
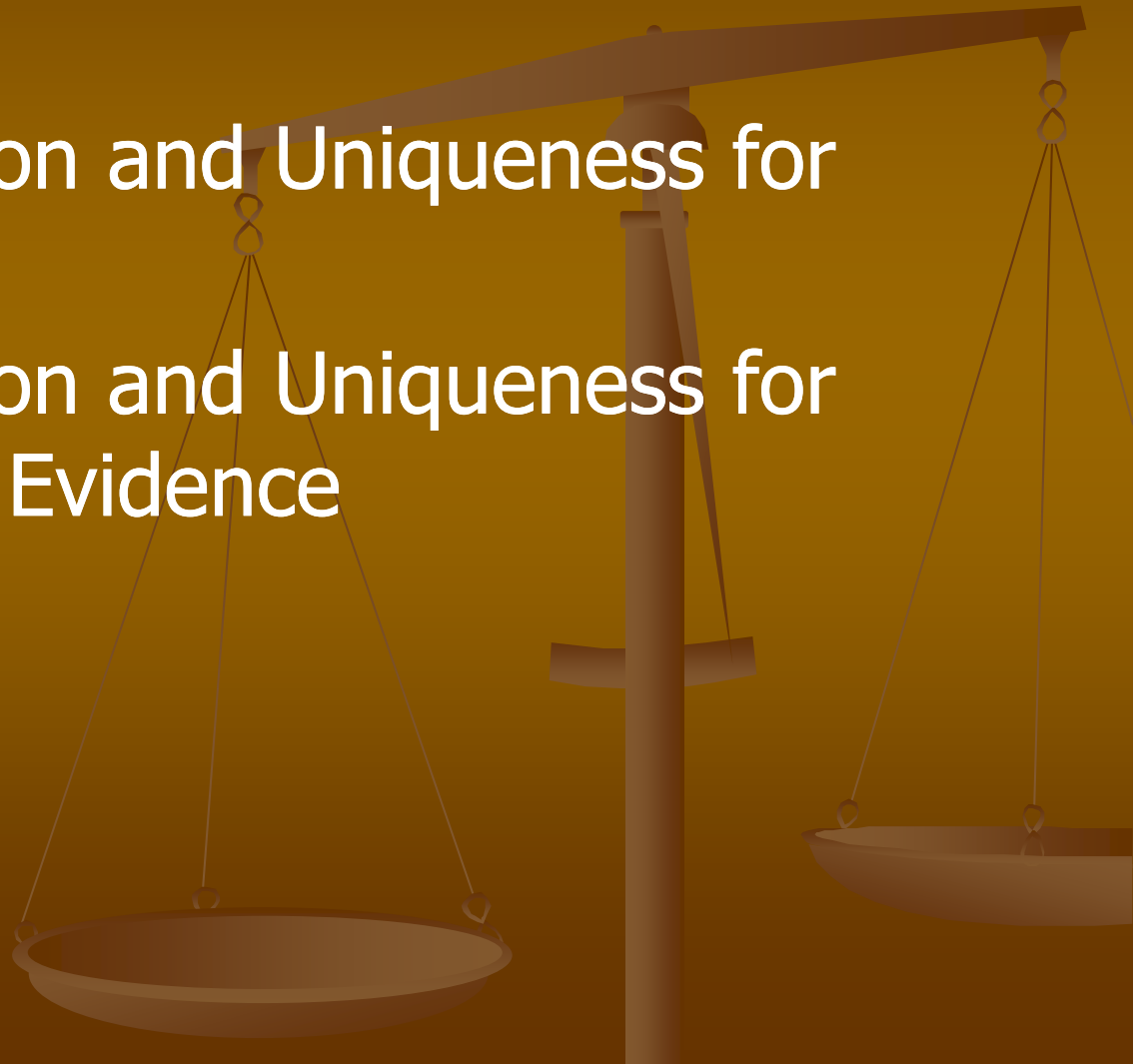 - –Daubert v. Merrell Dow Pharms., Inc. (1993)

What Can You Claim?

- Some scholars claim that individualization exceeds the power of science (*Black Swan Club*)
- What scientific arguments — not resolutions or assertions of professional organizations — might justify source attribution?
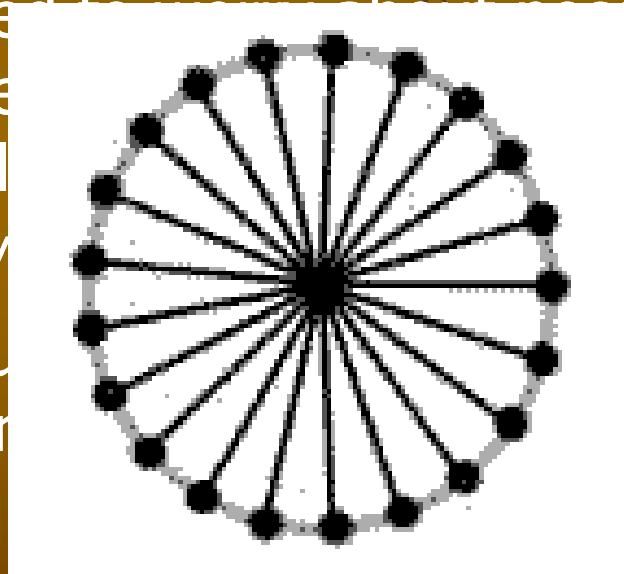
Source Attributions:
Two Different Bases

- Source Attribution and Uniqueness for DNA Profiles
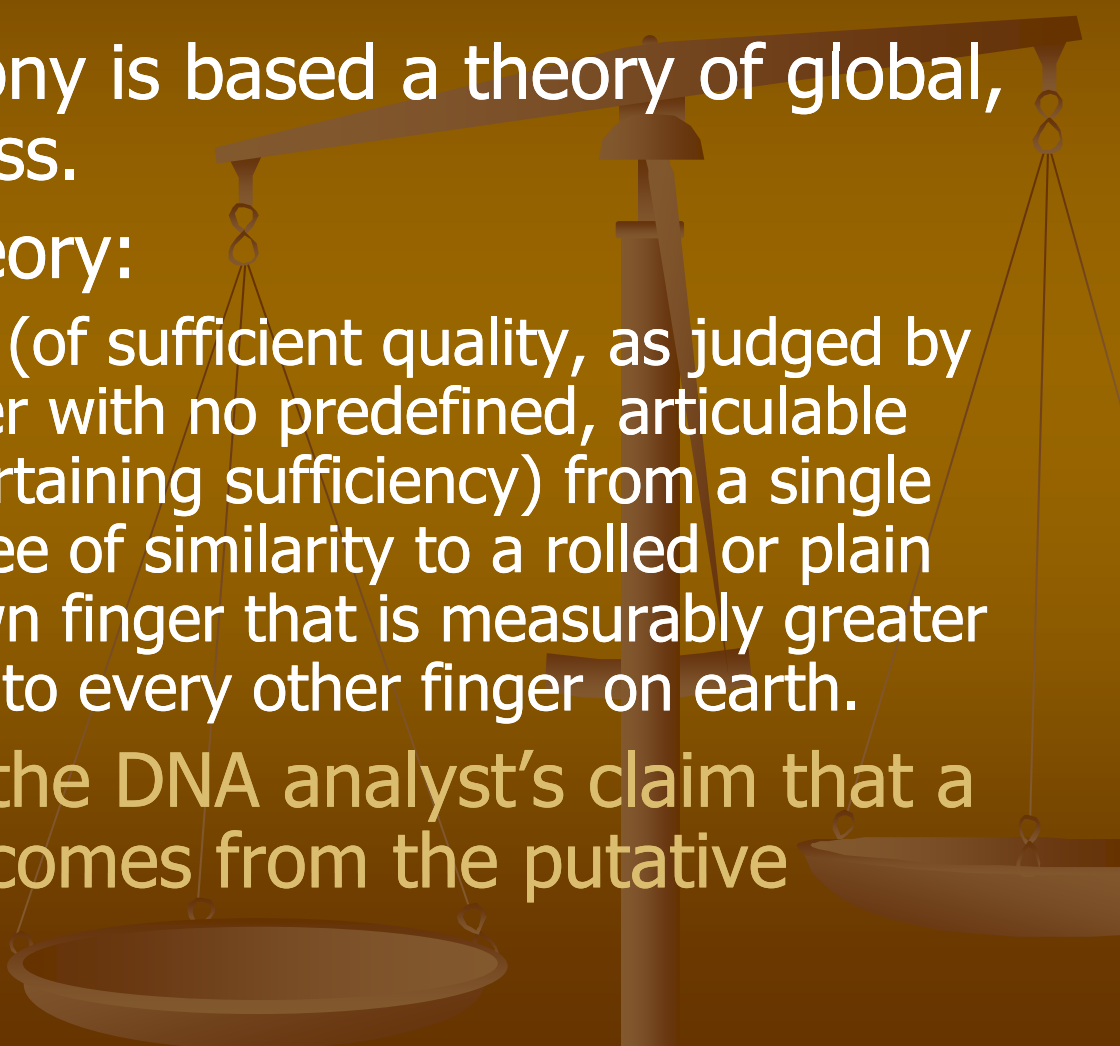- Source Attribution and Uniqueness for Other Matching Evidence

Source Attribution for DNA Profiles

- Based on local special uniqueness
  - No claim that every possible profile is unique
  - We only need to worry about possible matches between the ... eryone else's profile: 7 bil... ... e world.
  - Suppose RM...
  - Expected nu... ...inent to this claim of special un... ... $10^{-12} = 0.007$.
  - There could ... but it is not a high probability event.

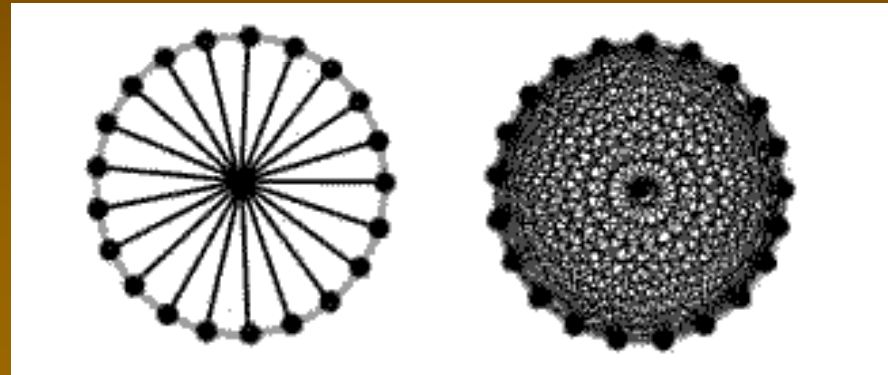# Source Attribution for Other Matching Evidence

- The usual testimony is based a theory of global, general uniqueness.

- Fingerprinting theory:
  - Every latent print (of sufficient quality, as judged by a human examiner with no predefined, articulable standard for ascertaining sufficiency) from a single finger has a degree of similarity to a rolled or plain print from a known finger that is measurably greater than its similarity to every other finger on earth.

- Goes far beyond the DNA analyst's claim that a particular profile comes from the putative source.

An RMP of 1/trillion is not good enough for global general uniqueness

- Suppose that the random processes that generate fingerprint features have a probability of a mere 1/trillion of producing (1) a finger that would give rise to a latent print and (2) another finger that would generate an exemplar that are at least as similar to the first in terms of the characteristics used in the comparison as are the two images that were compared.

- Since the earth's population is under 7 billion, it seems that no pair of fingers from different individuals now living would match.
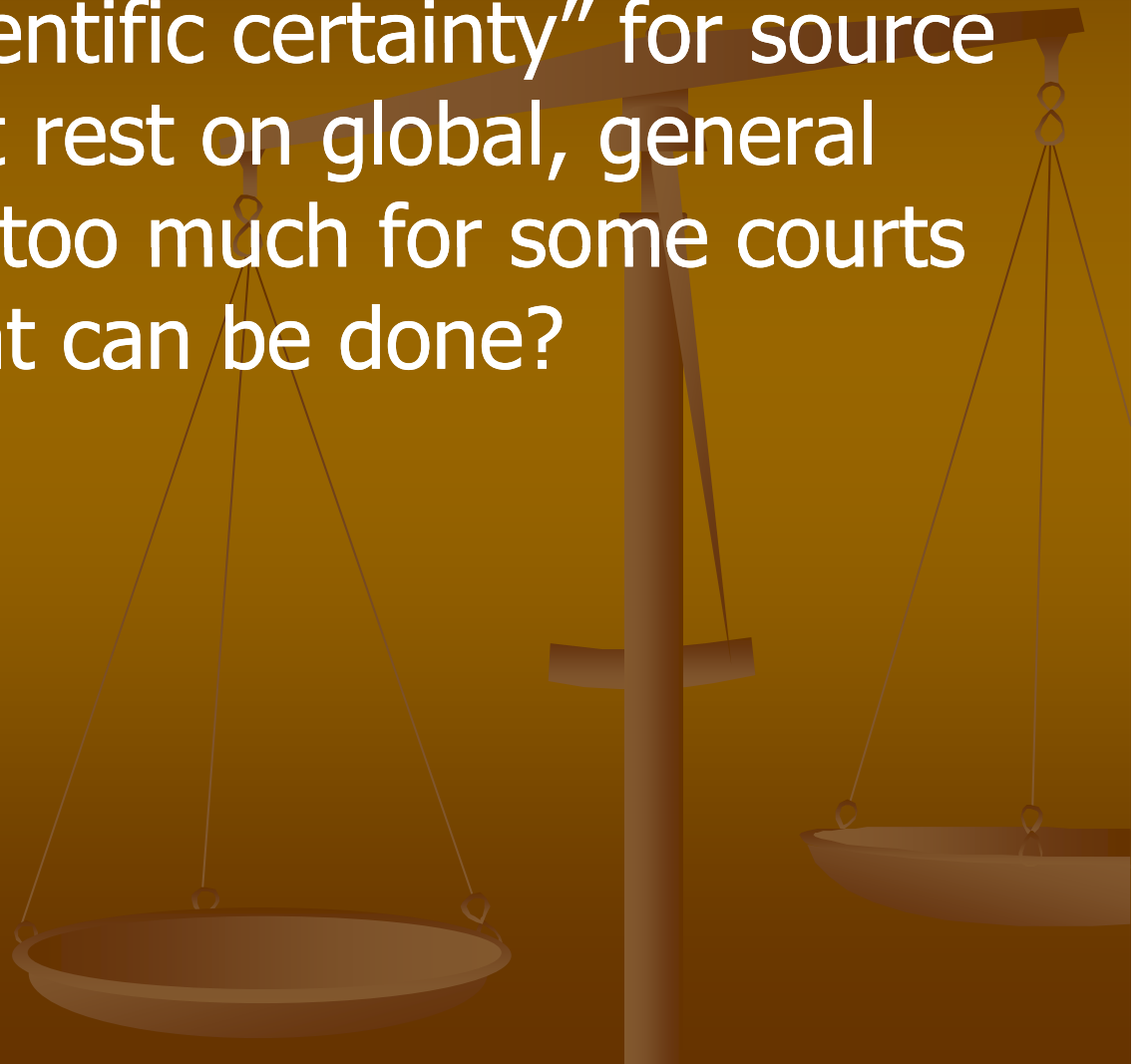
The Problem of Pairs

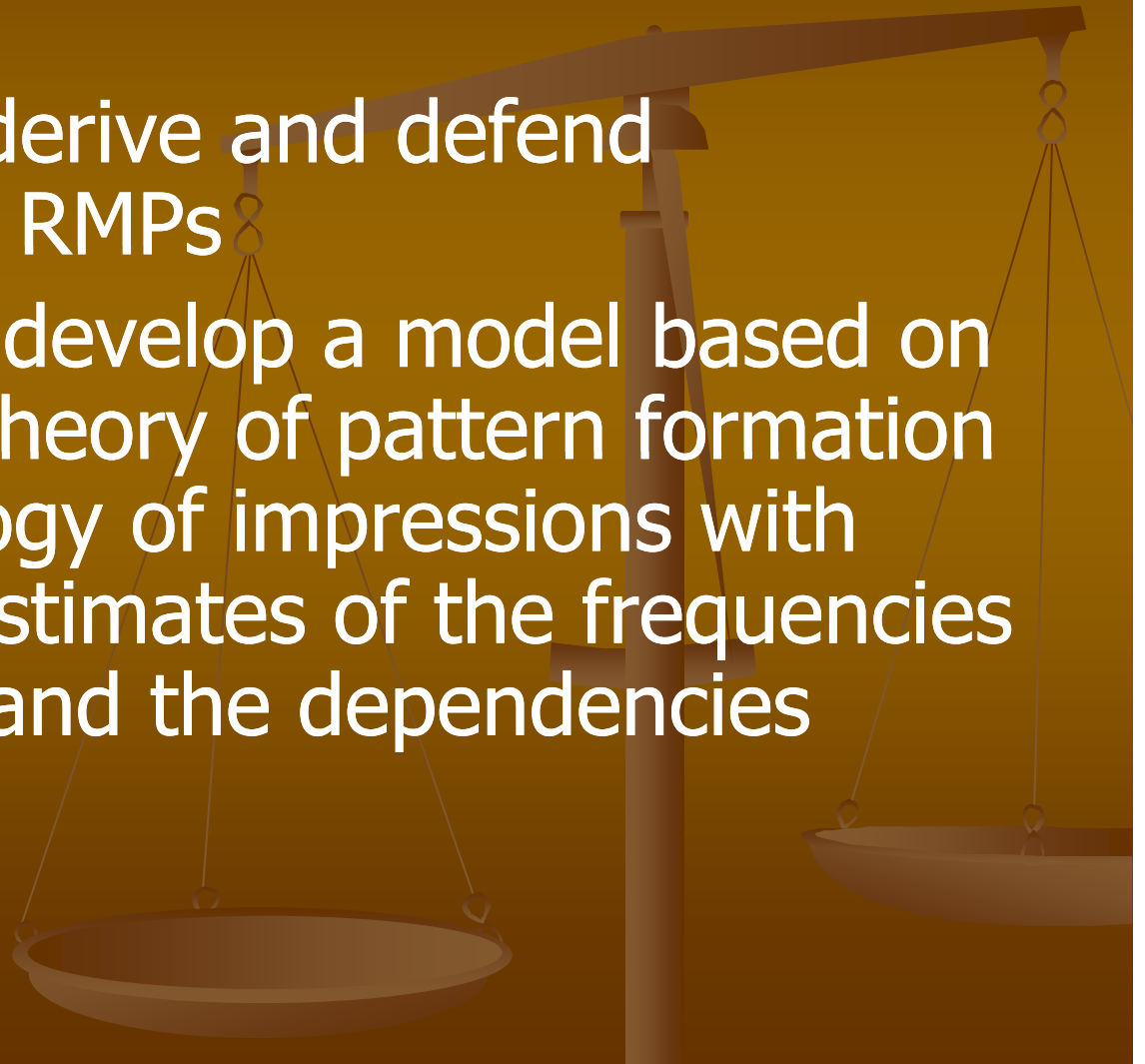|	1	2	3	...	N
1		x	x	...	x
2			x	...	x
3				...	x
⋮				...	...
N					x

- 7 billion individuals give rise to nearly 25×10^{18} pairs of individuals.

- Expected number of matching pairs = $25 \times 10^{18} \times 10^{-12} = 25$ million.

If claims of "scientific certainty" for source attributions that rest on global, general uniqueness are too much for some courts to swallow, what can be done?
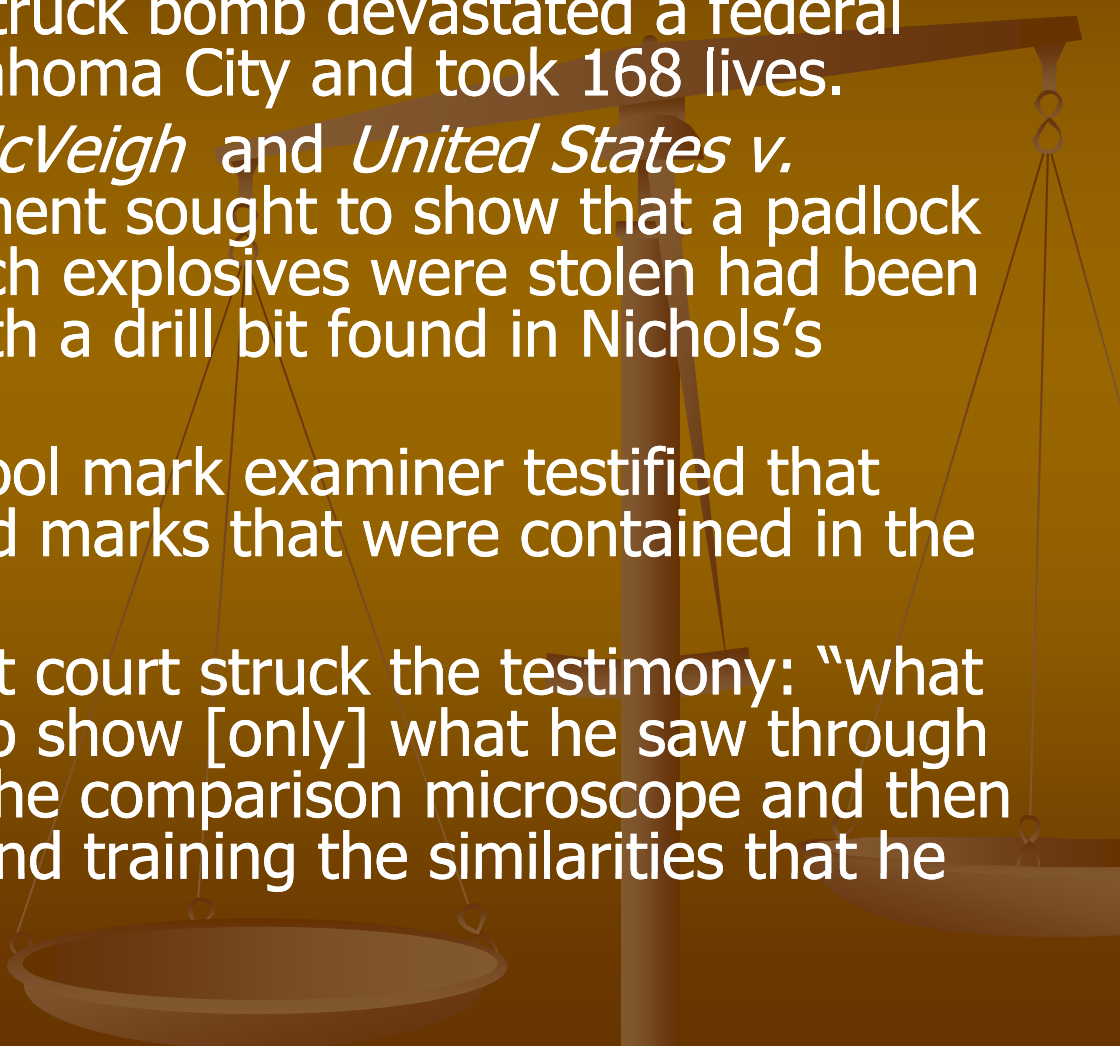
Source attribution based on local, special uniqueness

- Need a way to derive and defend extremely small RMPs
- Much harder to develop a model based on an established theory of pattern formation or even a typology of impressions with sample-based estimates of the frequencies of the features and the dependencies among them.

"Features-only" testimony

- On April 19, 1995, a truck bomb devastated a federal office building in Oklahoma City and took 168 lives.

- In *United States v. McVeigh* and *United States v. Nichols*, the government sought to show that a padlock at a quarry from which explosives were stolen had been opened by drilling with a drill bit found in Nichols's home.

- In *McVeigh*, an FBI tool mark examiner testified that "this drill bit produced marks that were contained in the padlock."

- In *Nichols*, the district court struck the testimony: "what is permitted here is to show [only] what he saw through the microscope and the comparison microscope and then with his experience and training the similarities that he pointed out."
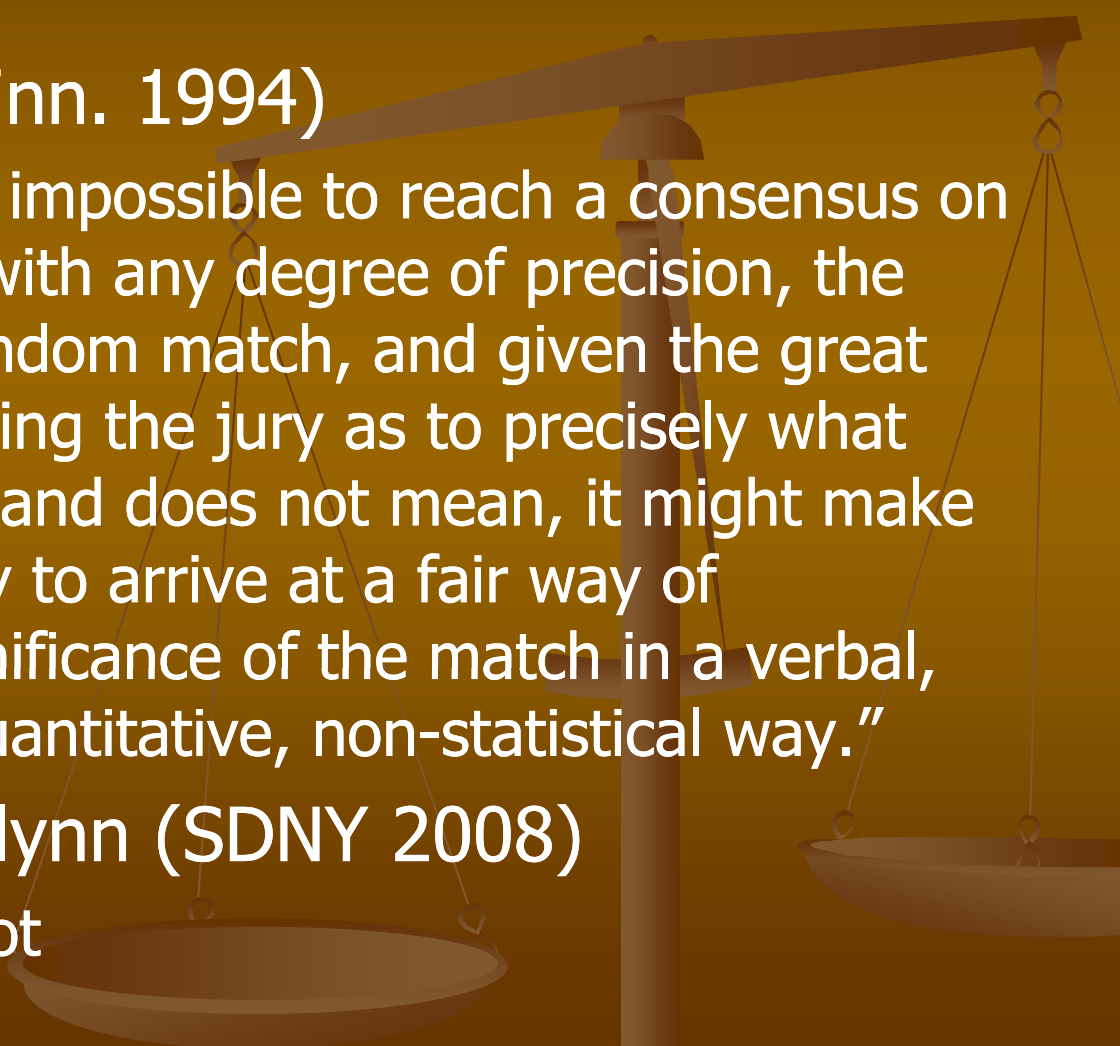
"Not excluded" or "match" testimony

- Brown v. State (Miss. 2008)
  - Hair examiner "testified that some of those hairs were consistent, meaning had the same characteristics, with known hair samples provided by [the defendant] and some of those hairs were consistent with hair samples from the victim . . . ."

- State v. Gomes (RI 2005):
  - Director the Rhode Island State Crime Laboratory "testified that . . . a piece of cord taken from the scene of the crime [and] a piece of cord taken from the hood of a jacket 'matched each other in component structure, . . . were similar and could have . . . originated from the same jacket."
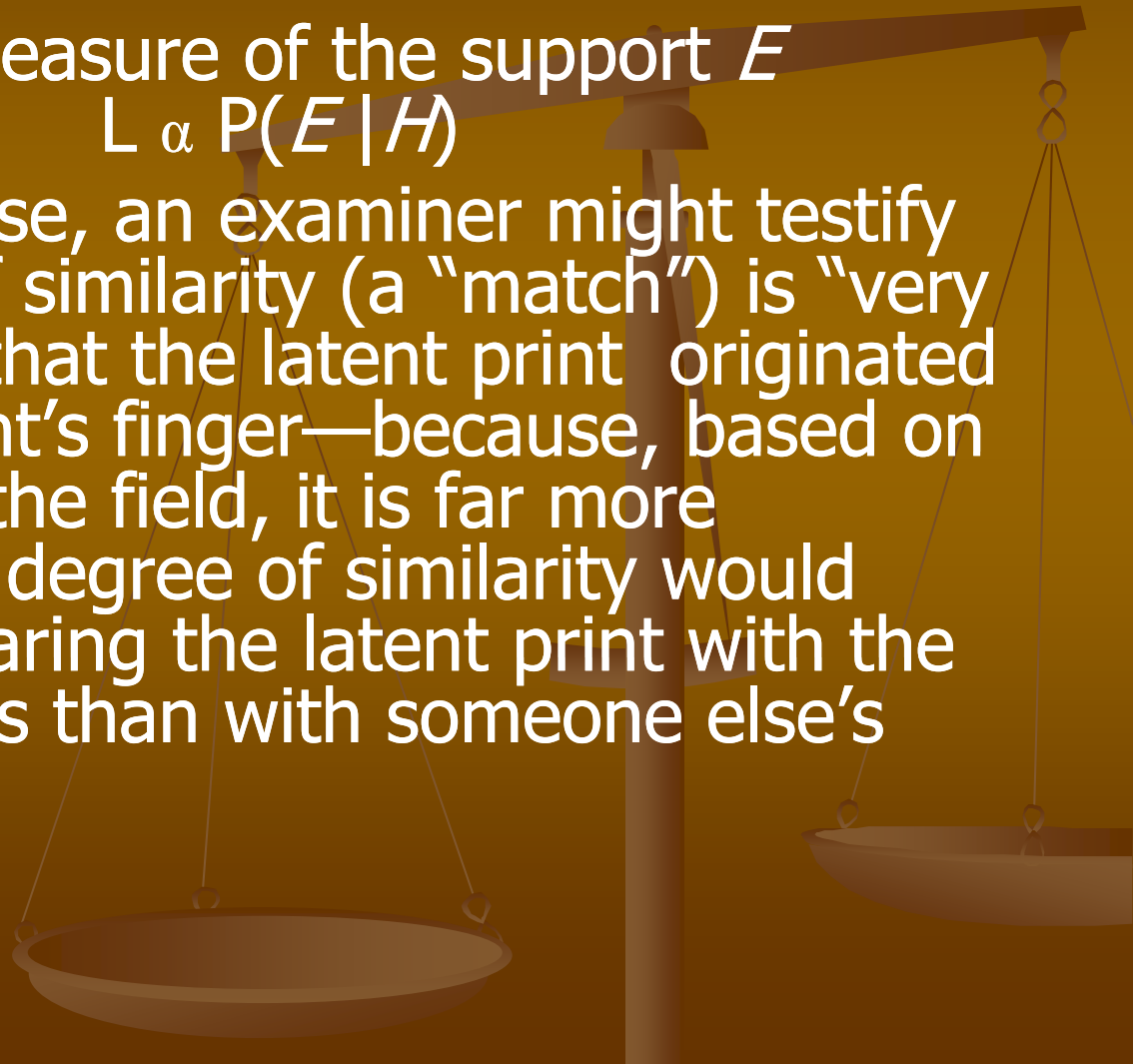
Proof of Discriminating Power

- ## State v. Ware (Tenn. Ct. Crim. App. 1999)
  - testimony that the mitotype of a hair removed from the throat of a murder-rape victim had not been seen in a database of 742 samples was admitted without any further effort at quantification.
- ## State v. Bogan (Ariz. Ct. App. 1995)
  - Blind testing "distinguished the DNA from the seed pods in the truck bed from the DNA of all twenty-eight trees except [the one that matched]." Although the issue there was the admissibility of the botanist's statement that "these two samples [of seed pods found in the truck bed] . . . most likely did come from that tree," it is clear that any testimony about the blind testing also was admissible.
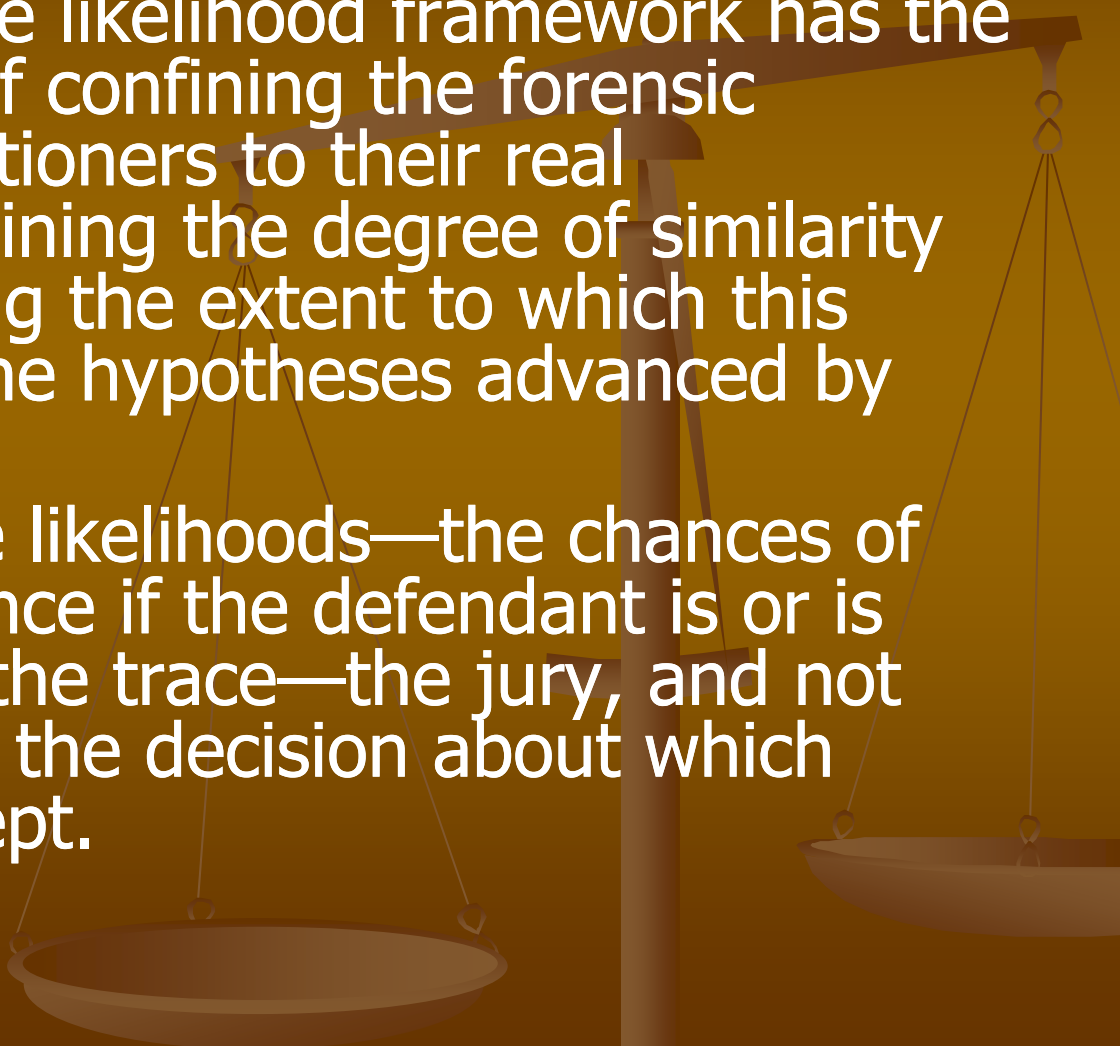
Qualitative testimony on random-match and source probabilities

- State v. Bloom (Minn. 1994)
  - "[S]ince it may be impossible to reach a consensus on how to estimate, with any degree of precision, the probability of a random match, and given the great difficulty in educating the jury as to precisely what that figure means and does not mean, it might make sense to simply try to arrive at a fair way of explaining the significance of the match in a verbal, qualitative, non-quantitative, non-statistical way."
- United States v. Glynn (SDNY 2008)
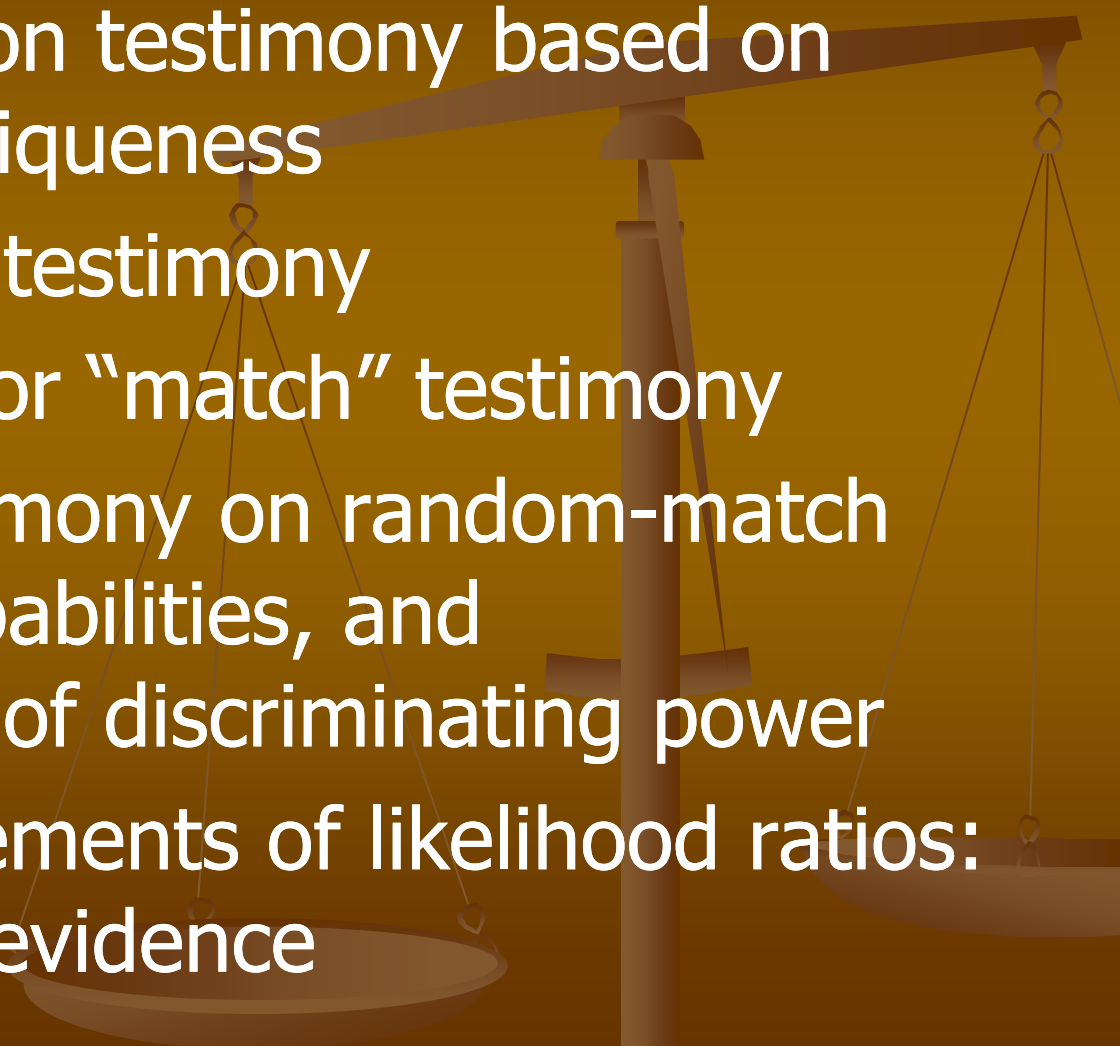 - More likely than not

Qualitative evidence for likelihood ratios: Strength of the evidence

- A likelihood is a measure of the support E provides for H.   L α P($E|H$)
- In a fingerprint case, an examiner might testify that the degree of similarity (a "match") is "very strong" evidence that the latent print originated from the defendant's finger—because, based on what is known in the field, it is far more probable that this degree of similarity would occur when comparing the latent print with the defendant's fingers than with someone else's fingers.
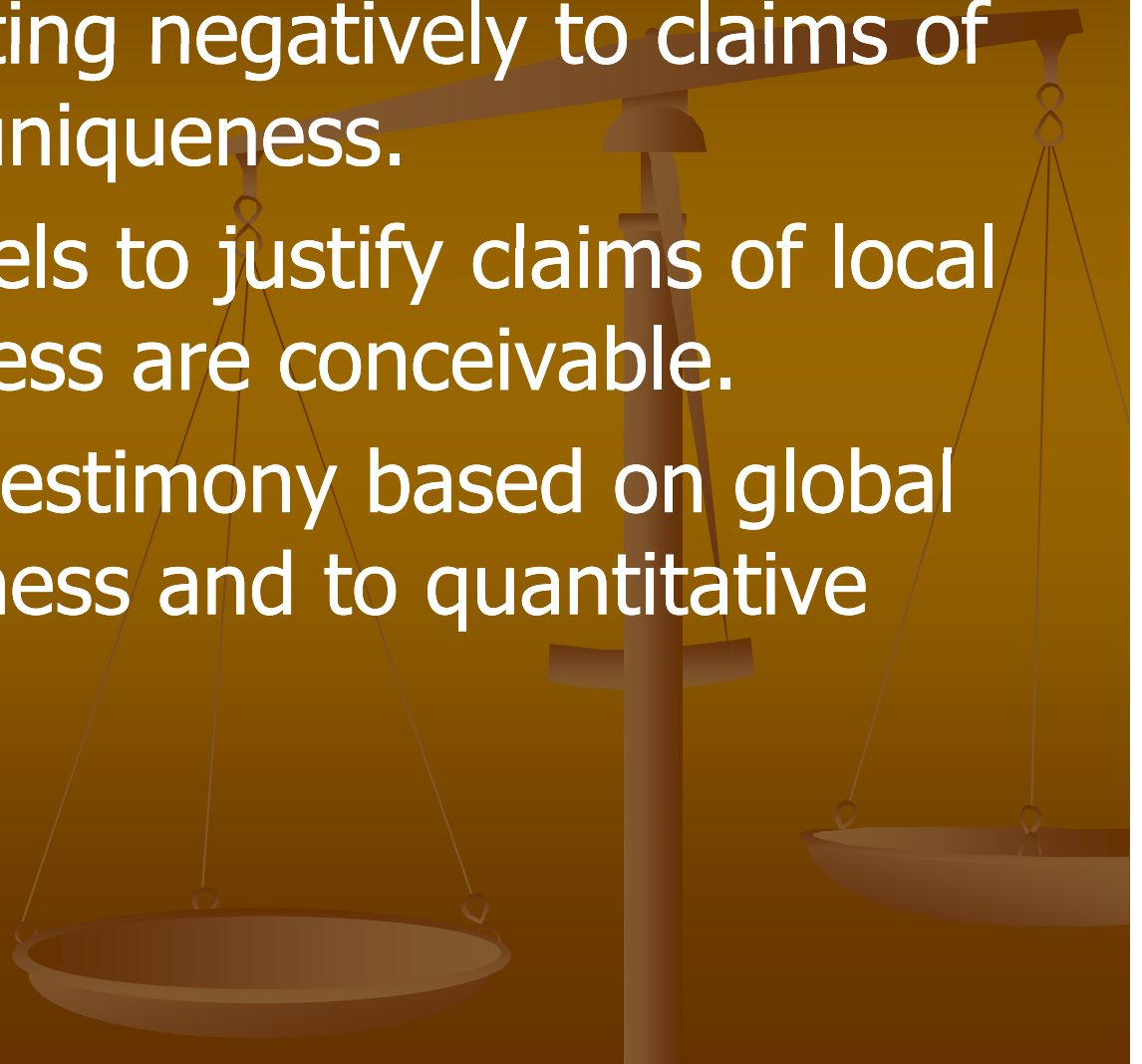
- More generally, the likelihood framework has the great advantage of confining the forensic scientists or practitioners to their real expertise—ascertaining the degree of similarity and then explaining the extent to which this finding supports the hypotheses advanced by the parties.

- By considering the likelihoods—the chances of the forensic evidence if the defendant is or is not the source of the trace—the jury, and not the expert, makes the decision about which hypothesis to accept.

Ways to Explain Significance Qualitatively

- Source attribution testimony based on local, special uniqueness
- "Features-only" testimony
- "Not excluded" or "match" testimony
- Qualitative testimony on random-match and source probabilities, and demonstrations of discriminating power
- Qualitative statements of likelihood ratios: strength of the evidence

Summary

- Courts are reacting negatively to claims of global general uniqueness.

- Probability models to justify claims of local special uniqueness are conceivable.

- Alternatives to testimony based on global general uniqueness and to quantitative testimony exist.

- Identification, Individualization, Uniqueness: What's the Difference?, Law, Probability and Risk, Vol. 8, 2009, pp. 89—94 (festshrift)
- Interpretation: A Legal Perspective, in Wiley Encyclopedia of Forensic Science, A. Jamieson & A. Moenssens eds., John Wiley & Sons, 2009, vol. 3, pp. 1561-1566
- Probability, Individualization, and Uniqueness in Forensic Science Evidence: Listening to the Academies, Brooklyn Law Review, Vol. 75, No. 4, Spring 2010 (invited festshrift article, in press)
- The New Wigmore on Evidence: Expert Evidence (Aspen Publ., 2d ed. 2010) (in press)