Current Issues in Forensic Evidence - 2023

Berkeley Judicial Institute

Andrea Roth, aroth@law.berkeley.edu
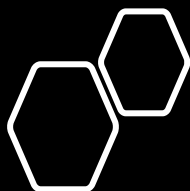
April 13, 2023

Topics Covered

- Where we were – from DNA exonerations to the PCAST Report
- Where we are now – Current hot topics, OSAC
- Where we are going – ChatGPT and Beyond

Forensic Evidence in DNA Exoneration Cases

Test May End 10-Year Rape Dispute

By ISABEL WILKERSON
Special to The New York Times

CHICAGO, Feb. 5 — Illinois officials and the lawyers for Gary Dotson, a convicted rapist who was freed after Cathleen Crowell Webb recanted her accusation, are turning to a new genetic testing procedure in an effort to determine Mr. Dotson's guilt or innocence.

In the next few days physical evidence from the case will be taken to a laboratory in Leicester, England, to be identified genetically by the comparison of deoxyribonucleic acid, or DNA, the substance of the genes of all living things. Officials say that if the molecules of the DNA are intact, the test should prove conclusively whether Mr. Dotson raped Cathleen Crowell 10 years ago.

The physical evidence from the case includes Mrs. Webb's underwear bear-

Officials turn to genes in a case of recanted testimony.

The fragments separate by size into bands and create a pattern, but are invisible. Radioactive probes of common DNA material are then attached to the fragments to make them visible, and the sample is exposed to X-ray film.

The end result is a pattern of bands looking like the bar codes used in supermarkets. The pattern of bands can then be compared with that of another sample. The patterns will be the same only if they came from the same per-

Since his sentence was commuted, Mr. Dotson, now 30 years old, has been arrested for numerous alcohol-related traffic violations and was jailed last August after his wife, Camille, said he struck her.
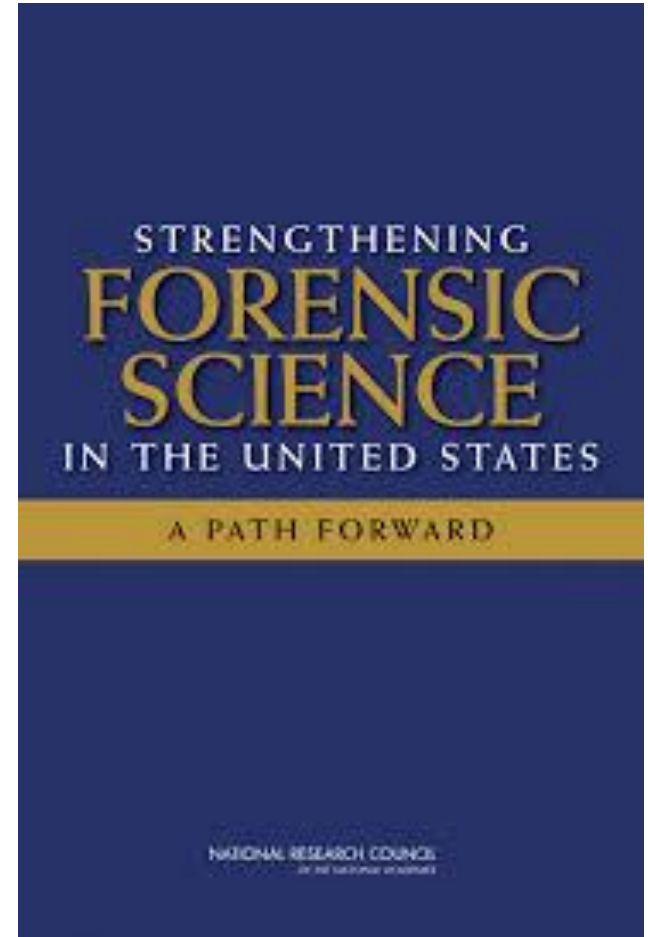
'Last-Chance Release'

Last December, Governor Thompson granted Mr. Dotson a "last-chance" release from prison and said he would have to finish his rape sentence if he violated parole again.

Two days later Mr. Dotson was arrested and charged with stabbing a cook after a quarrel at a bar. Those charges were dropped last week. But Mr. Dotson remains in jail for a violation of parole; he did not report to his parole officer at the time of his brief release in December. The Illinois Prisoner Review Board is scheduled to hear his case this month.

Mr. Dotson's lawyers say that the

INNOCENCE PROJECT

Forensic science, or more specifically, problems in forensic science, contributes to many wrongful convictions, as seen in in nearly half (45%) of DNA exoneration cases and one-quarter (24%) of all exonerations in the United States.

2009 Report of the National Academy of Sciences

STRENGTHENING

FORENSIC SCIENCE

IN THE UNITED STATES

A PATH FORWARD

NATIONAL RESEARCH COUNCIL

Key finding from NAS Report

"Among existing forensic methods, only nuclear DNA analysis has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between an evidentiary sample and a specific individual or source." (Report at 100)

NAS:
2 things missing in non-DNA methods

"Variability" data showing rarity of characteristics in population

Error rates of "subjective" methods

Variability

loop   whorl   arch

A Review of the FBI's Handling of the Brandon Mayfield Case

U. S. Department of Justice
Office of the Inspector General

In addition, the Mayfield case illustrates a particular hazard of the IAFIS computer program. IAFIS is designed to find candidate fingerprints having the most minutiae arrangements similar to the encoded minutiae from the latent print. These candidates should include the correct match of the print (if it is in

Dr. Michael West

Bitemark Analysis:
A NIST Scientific Foundation Review

Kelly Sauerwein
John M. Butler
Christina Reed
Division 602 - Special Programs Office
Laboratory Programs
National Institute of Standards and Technology

Karen K. Reczek
Division 601 – Standards Coordination Office
Laboratory Programs
National Institute of Standards and Technology
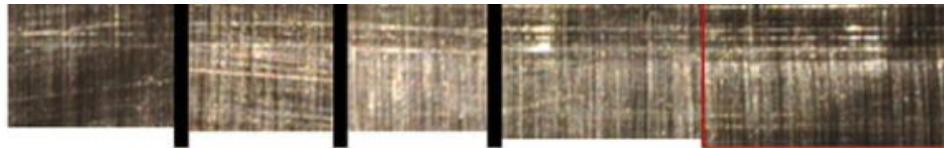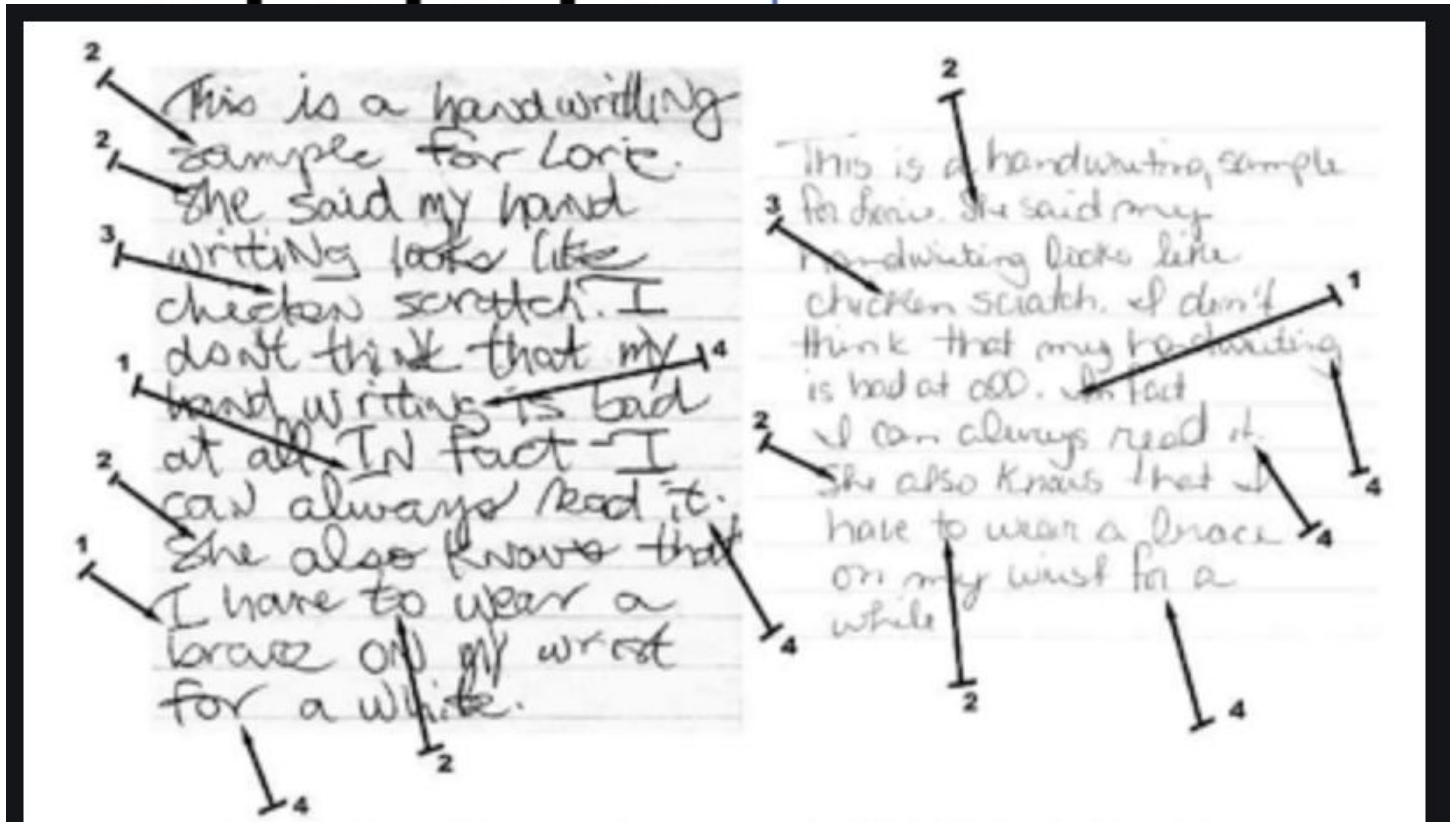
PCAST Report (2016)

REPORT TO THE PRESIDENT
Forensic Science in Criminal Courts:
Ensuring Scientific Validity
of Feature-Comparison Methods

Executive Office of the President
President's Council of Advisors on
Science and Technology

September 2016

Key findings of PCAST

- Finds that very few pattern identification disciplines are "foundationally valid" under *Daubert*.
- Says that to be foundationally valid, a pattern technique has to have a low FALSE POSITIVE RATE based on "black box studies"
- Explains what a good "black box study" entails (independent, realistic casework-like samples)
- Lists all the black box studies and error rates for each discipline (e.g. 1 in 18 for fingerprints)
- Argues for proficiency testing to determine whether analysts are reliably *applying* the method ("reliably applied" under *Daubert*)

Critiques of PCAST

- Elite academics, scientists, and government policymakers but no stakeholders from the forensic community itself
- NDAA argued that not all of these methods are "scientific" and thus need not be subject to black-box validation testing with error rates to pass *Daubert*
- PCAST's criteria for what makes a good study was "subjectively derived" and not the only valid way to think about science

National Commission on Forensic Science

Reflecting Back—
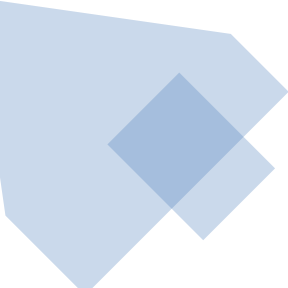## Looking Toward the Future

April 11, 2017

WORK PRODUCTS ADOPTED BY THE COMMISSION

https://www.justice.gov/archives/ncfs/work-products-adopted-commission

Views on Use of the Term "Reasonable Scientific Certainty" *(Adopted at NCFS Meeting #9 – March 22, 2016)*

Recommendation on Proficiency Testing *(Adopted at NCFS Meeting #11 - September 12, 2016)*

Views on Ensuring that Forensic Analysis is Based Upon Task-Relevant Information *(Adopted at NCFS Meeting #8 – December 8, 2015)*

Cognitive issues in fingerprint analysis: inter- and intra-expert consistency and the effect of a 'target' comparison

Itiel E Dror [1], Christophe Champod, Glenn Langenburg, David Charlton, Heloise Hunt, Robert Rosenthal

Subjectivity and bias in forensic DNA mixture interpretation[☆]

Itiel E. Dror [a,b,*], Greg Hampikian [c]

THE PROFICIENCY OF EXPERTS

Brandon L. Garrett[†] & Gregory Mitchell[††]

"To demonstrate the importance of proficiency data, we collect and analyze two decades of proficiency testing of latent fingerprint examiners. In this important domain, we found surprisingly high rates of false positive identifications for the period 1995 to 2016. These data would qualify the claims of many fingerprint examiners regarding their near infallibility, but unfortunately, judges do not seek out such information."

One more slide on error rates…

- _Whose_ error rate?: "But we're the FBI – it's not fair to judge us based on the overall error rate from some state lab!"
- What's an "error"? If 2 prints don't match but an examiner says "inconclusive-not enough data," is that an _error_ that should be considered part of the examiner's false positive rate? (bottom line: there's disagreement on this in the literature)

Organizational chart for the National Institute of Standards and Technology (NIST)'s "Organization of Scientific Area Committees (OSAC)

What does OSAC do?

- Creates, and approves, forensic standards and puts them on an approved "registry"
  - Beware: these standards aren't necessarily approved by all groups
- Creates lists of "research needs" for each discipline
- Allows the legal community a chance to work with forensic practitioners ("changing hearts and minds") – email me if interested! ☺

4 big take-aways from these institutional efforts:

- Many forensic identification techniques aren't backed up by *variability data* to show the likelihood that *the defendant may be the source*

- Forensic identification techniques haven't been widely tested through "**black box studies**" to determine their error rate

- Forensic examiners often don't wall themselves off from **task irrelevant information** to combat contextual bias and often don't know what the scientific method is

- Proficiency testing is *non-blind, too infrequent, too easy,* and not taken seriously by judges.
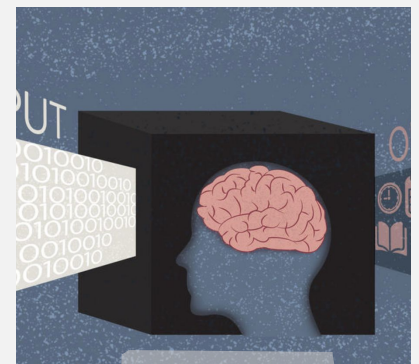
Suggestions for judges:

- Ask yourself: is this technique sufficiently *foundationally* reliable and reliable *as applied by this examiner* to be admissible, given what we know now (regardless of older case law)
- If expert testimony *is* allowed, what limits should I place on it? (e.g. don't use the term "identification," "to the exclusion of all other guns," "ballistic certainty," etc.)
- What discovery should be allowed, both before the *Daubert/Frye* hearing and before trial? (e.g. source code for software?)
- Should the opposing party be allowed to mention evidence about the discipline's error rate, based on existing studies? Should I ask the parties to craft a jury instruction that explains error rates?
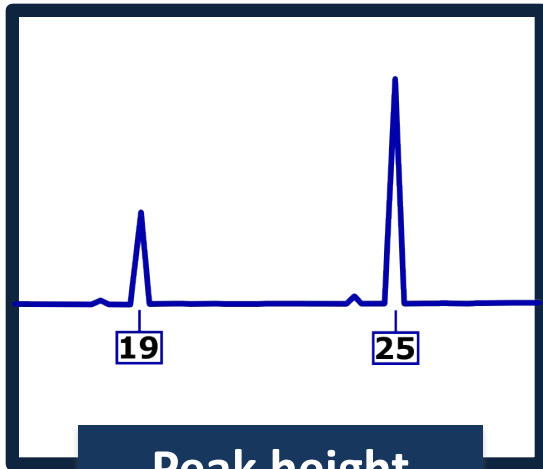

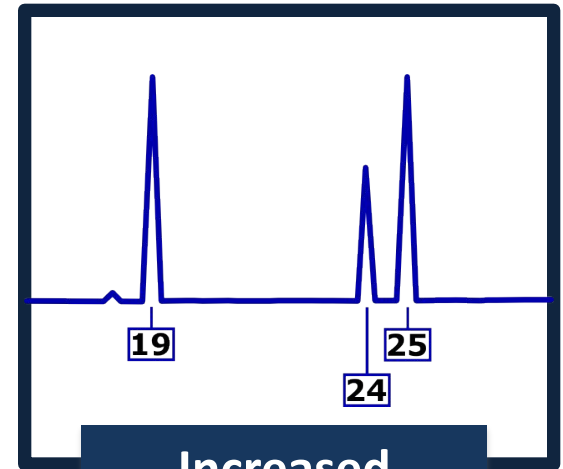op   whorl   a
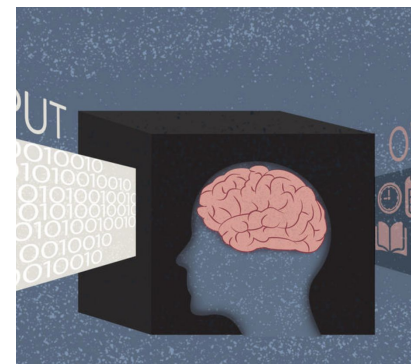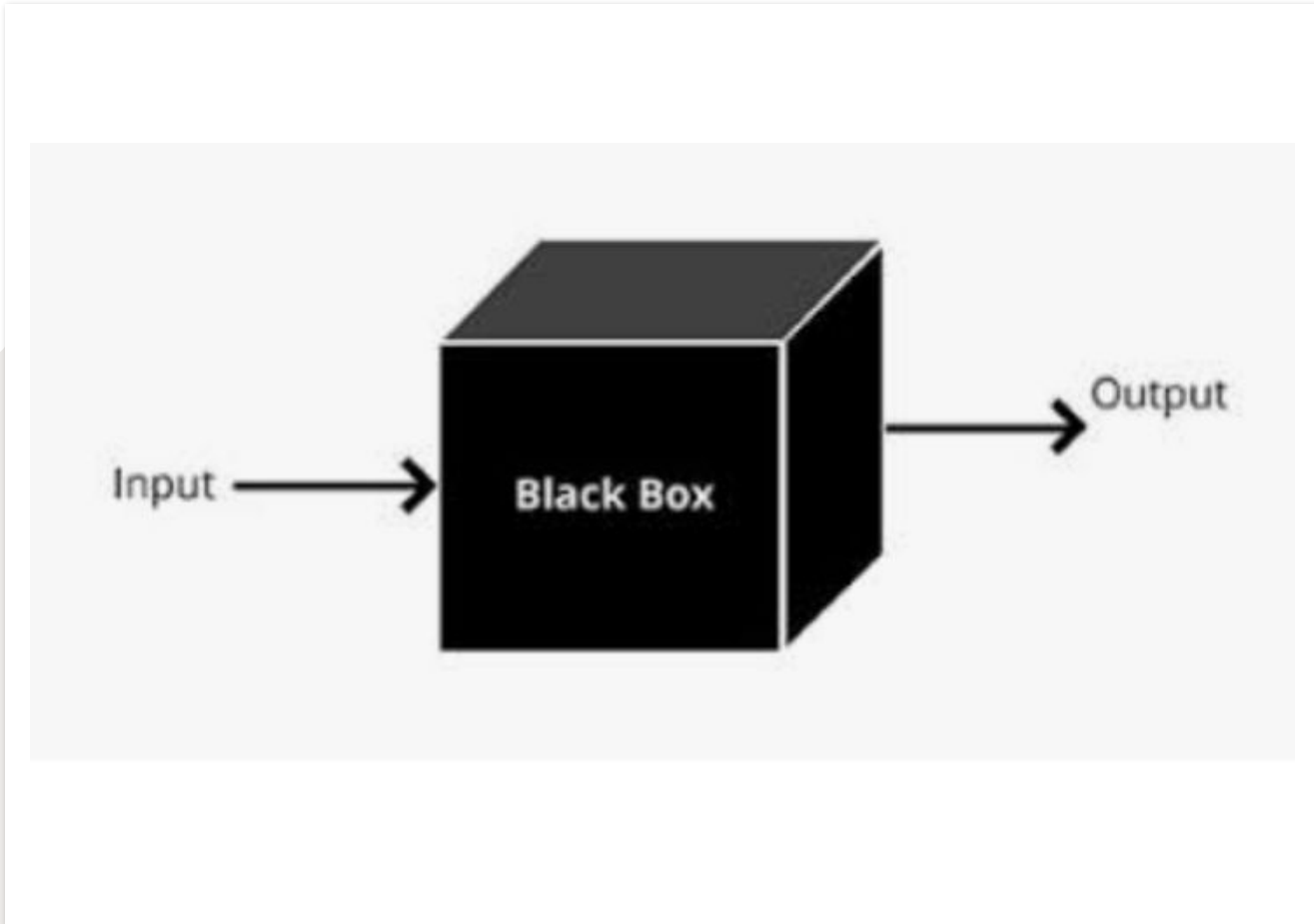
Forensic Evidence Is Increasingly Automated…

Example:
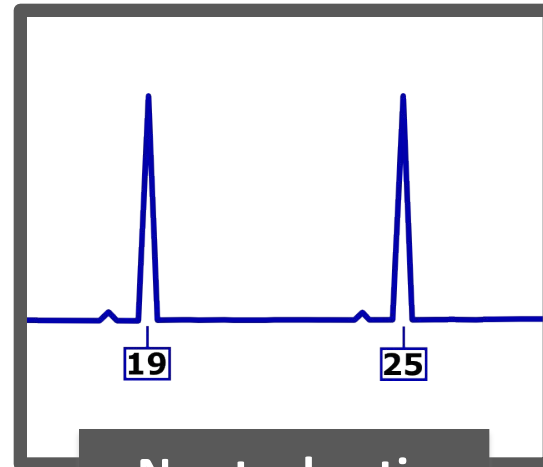DNA Software for Interpreting Mixtures

Mixtures are hard because of…

Peak height imbalance

19   25

Drop-out

25

No stochastic effects

19   25

Increased "stutter"

19   24 25

Drop-in

19   21   25
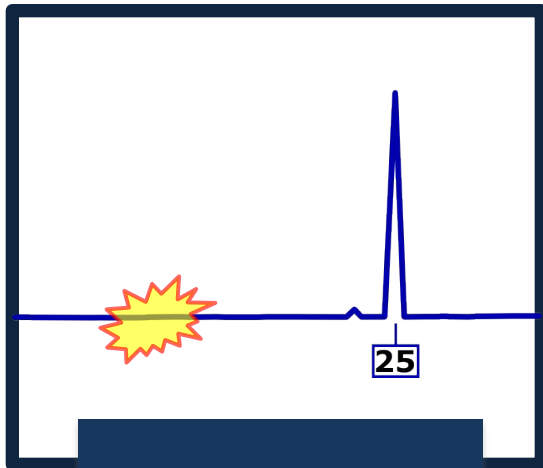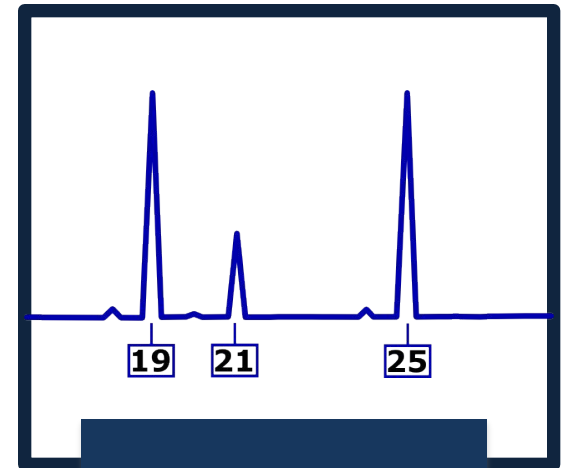
Probabilistic Genotyping Software

A match between the **beer bottle** and **Ronald Meadow** is:

471 million times more probable than a coincidental match to an unrelated Black person

28 million times more probable than a coincidental match to an unrelated Caucasian person

22.6 million times more probable than a coincidental match to an unrelated Hispanic person

Issues with "Likelihood Ratios"

- They are typically generated by computers, based on many complex secret assumptions about the chance of stutter, allelic drop-in, etc.

- The accuracy of a computer program's likelihood ratio can't be easily tested through validation studies…

"Laboratory procedures to measure a physical quantity such as a concentration can be validated by showing that the measured concentration consistently lies within an acceptable range of error relative to the true concentration. *Such validation is infeasible for software aimed at computing an LR [likelihood ratio] because it has no underlying true value* (no equivalent to a true concentration exists). …"

– Steele & Balding. "Statistical evaluation of forensic DNA profile evidence." Annual Review of Statistics and Its Application 1 (2014): 361-384.
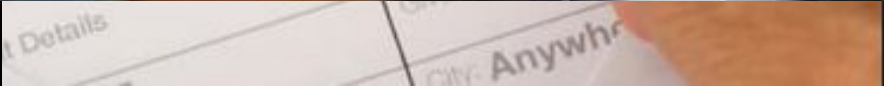
Issues with "Likelihood Ratios"

- They are typically generated by computers, based on many complex secret assumptions about the chance of stutter, allelic drop-in, etc.

- The accuracy of a computer program's likelihood ratio can't be easily tested through validation studies…

- Sometimes there are differences between LRs of different computer programs based on the same information!

Is TrueAllele reliable to interpret a low-quantity DNA mixture with at least 3 contributors?

TrueAllele is a software program that uses probabilistic genotyping to interpret DNA mixtures, including low-quantity samples and those with multiple contributors. The program is designed to handle complex mixtures that may be difficult or impossible for human analysts to interpret accurately.

Studies have shown that TrueAllele can accurately analyze low-quantity DNA mixtures with multiple contributors, even when the mixture is extremely complex. For example, a study published in the Journal of Forensic Sciences evaluated TrueAllele's performance on a simulated mixture with five contributors, and found that the software produced accurate and reliable results.

However, like any forensic tool, TrueAllele is not infallible and its results must be interpreted carefully. It is important to note that the accuracy of TrueAllele (or any other forensic tool) depends on a variety of factors, including the quality and quantity of DNA in the sample, the complexity of the mixture, and the proficiency of the analyst using the software.

Therefore, while TrueAllele can be a valuable tool for analyzing complex DNA mixtures, it should be used in conjunction with other forensic techniques and the results should be interpreted carefully by experienced analysts.

NISTIR 8351-DRAFT

DNA Mixture Interpretation:
A NIST Scientific Foundation Review

John M. Butler
Hari Iyer
Rich Press
Melissa K. Taylor
Peter M. Vallone
Sheila Willis*

*International Associate under contract; retired director of Forensic Science Ireland

2021 NIST Mixture Study Takeaways

1. Studies need to cover the sample in the case at hand in terms of all 4 big challenges or "factor space" (# of contributors, quantity, ratio, & allele sharing)

2. To figure that out, we need access to the underlying data of studies and models (the "black box"), not just "summaries," and we don't have it

3. It's possible to test LRs but we'd need more data and better tracking to see what factors are present when they lend support to a false proposition

4. LRs can change dramatically based on assumptions/models and we don't have enough comparison studies on how or why. **For now, corroboration from 2+ systems may be important.**

Are machine assertions admissible? Impeachable?

- Why not? They're relevant; they're not hearsay…
- You can require proof of accuracy in order to "authenticate" the result:
  - FRE 901(9): ***Evidence About a Process or System.*** Evidence describing a process or system and showing that it produces an accurate
- If an expert relies on it, then *Daubert/Frye*
- What if you refused to admit software that wasn't independently tested or open to independent audits? Or wasn't corroborated by a 2nd machine?
- Once machine assertions are admitted, then what? Are they "witnesses" under the Confrontation Clause? If so, how does a defendant "confront[]" them?

How could a machine be a "witness"? And what would machine "confrontation" look like?

- "Witness" for 6th Amendment compulsory process purposes includes documents, physical objects

- "Confrontation" of human witnesses used to include access to prior written statements of witness

- "Confrontation" could include pretrial access to machine; interrogatories; prior runs of machine; access to source code or license access to independent researchers?

Where We're Going:
AI and Beyond

you ni███ all fufu shoot you like I did #CQ

Authorship Attribution of Micro Messages

Roy Schwartz,   Oren Tsur,   Ari Rappoport
Institute of Computer Science
Hebrew University of Jerusalem
{roys02|oren|arir}@cs.huji.ac.il

Moshe Koppel
Department of Computer Science
Bar Ilan University
koppel@macs.biu.ac.il

Aaron Mok Apr 6, 2023, 9:45 AM

ChatGPT falsely accused legal scholar Jonathan Turley of sexually harassing a student during a class trip to Alaska, The Washington Post reported. Carolyn Kaster/AP

Questions?
aroth@law.berkeley.edu