

*Comments*

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# Main Points

- Let's help develop a scientific forensic individualization science (FIS)
- FIS has been built on little or no science
  - Science = systematic empirical testing and/or application of validated basic research
- A culture of faith and exaggeration
- “The world of forensic science is divided into those who see there is a problem and those who deny there is a problem”
  - + Various signs of progress toward becoming more sound and more tempered
    - Rear guard action and new instances of old methodology
- Support a program of research aimed at testing various claims, mapping skills, etc.
- Until that knowledge is developed
  - Temper common exaggerated claims
  - Apply NAS recommendations on bullet lead comparison
  - Institute blind testing and evidence lineups

# First Visit

- Firearms examiner
  - “This is an exact science”
  - “When I first look...”
  - “By the time I reach my conclusion...”

# A Quarter of a Century Later

- US v Green (2005)
  - “The examiner has to exercise his judgment as to which marks are unique to the weapon in question, and which are not.”
  - The examiner “conceded, over and over again, that he relied mainly on his subjective judgment. There were no reference materials of any specificity, no national or even local database on which he relied. And although he relied on his past experience with these weapons, he had no notes or pictures memorializing his past observations.”

- US v Montiero (2006)
  - "the interpretation of individualization/identification is subjective in nature"
  - "during the testimony at the hearing, the examiners testified to the effect that they could be 100 percent sure of a match." Yet "an examiner's bottom line opinion as to an identification is largely a subjective one, there is no reliable statistical or scientific methodology..."

# Thornton on forensic scientists' experience-based opinions

- W is asked: What is the basis of your opinion?
- W answers: My 26 years of experience in the field.
- W means: It's really a surmise on my part. I believe it to be true, but I can't really tell you why I think that. It's really more of an impression... but I can't say that it's a surmise or a vague impression, can I?

“It’s all subjective, and therefore it presents terrible problems of human error and potential for mischief.”

James Baker

USA Today

Nov. 13, 2000, p. 6A

# Individualization



# Forensic Individualization Science

- "Criminalistics is the science of individualization."
- Individualization refers to "absolute specificity and absolute identification."
- Individualization is defined as "the process of placing an object in a category which consists of a single, solitary unit. Individualization implies uniqueness...."
- "Individualization is unique to forensic science."
- "The concept of individualization is clearly central to the consideration of physical evidence.... Our belief that uniqueness is both attainable and existent is central to our work as forensic scientists."
- "The major members of the pattern group are fingerprints, questioned documents, tool mark, and firearms evidence, and other patterns such as footwear and tire impressions."

# Whence Come These Notions?

- Quetelet: "Nature never repeats."
- Early criminalists enlisted the product rule in probability theory to argue for individualization in their areas of interest
  - Bertillon – anthropometry
  - May – toolmarks
  - Osborn – handwriting
  - Goddard – firearms
  - Etc.

# Yet it has long been appreciated that you can't get to individualization by that route

- "This approach carries the implication that a complete correspondence of two patterns might occur.... it is impossible to offer decisive proof that no two fingerprints bear identical patterns."
- "What Made us Ever Think we Could Individualize Using Statistics"
- "[T]hough individualization is clearly the goal toward which forensic science strives, it can be achieved only in a probabilistic sense, of reducing uncertainty to the smallest possible amount.... Behind every opinion rendered by a forensic scientist there is a statistical basis. We may not know what that basis is, and we may have no feasible means of developing an understanding of that basis, but it is futile to deny that one exists."
- Without the science to support their conclusions, examiners in various areas of criminalistics are merely "making the leap" to individualization.

# So maybe small probs = unique individuality?

- "This probability is so small as to exclude the possibility of any two individuals having the same fingerprints."
- "When a characteristic (or characteristics) of an item can be described in such a fashion, it is believed to be unique, with no duplicate on earth. It has then been individualized."
- "... I should think there are not more than 27 million males in the United Kingdom, which means that it is unique"

# The Individualization Fallacy

- Lottery ticket example
  - Machine randomly prints lottery tickets with numbers 00-99
  - 10 purchased
  - no law of nature prevents two from having the same number
- In fact, there is a 37.2% chance of two of these random tickets bearing the same number
  - Human probabilistic intuition diverges from the actual

# Where things stand

- "The criteria for absolute identification in fingerprint work are subjective and ill-defined. They are the product of probabilistic intuitions widely shared among fingerprint examiners, not of scientific research. Outside of the fingerprint profession this is generally unappreciated."
- Individualization is invariably a claim that (to date) cannot be supported.

**Little or No Science**

# Where's the Science?

- Fire and arson example – Lentini
- Similarly, no empirical testing of assumptions, boundary conditions, procedures, etc. in FIS
- If “forensic science is the application of science to problems of law,” where is the basic science?

Handwriting

Hair comparison

Toolmarks

Tire tread

Fingerprints

Bitemarks



Pretty & Sweet,  
The Scientific Basis for Human Bitemark  
Analyses – A Critical Review

41 Science & Justice 85 (2001)

This article presents a discussion of the scientific basis for human bitemark analyses.

...

The review revealed a lack of valid evidence to support many of the assumptions made by forensic dentists during bitemark comparisons.

# Handwriting Identification: Very Little Empirical Research

- Galbraith et al.: There is an “admittedly sparse history of carefully controlled empirical studies.” “... there certainly has been a shortage of studies...”
- Kam et al.: There is “an acute lack of empirical evidence on the proficiency of document examiners” and therefore “it is widely agreed that testing of professional document examiners and acquiring data on their abilities... are necessary.”
- Moenssens: “Document examiners have not done the kind of empirical research that could have and should have been done.... On that the critics are absolutely correct.” There is “indeed a dearth of published empirical information relating to the proficiency of document examiners....”

# Counting Discordance

# Many ways to calculate discordance

		Visual Comparison		
		Incl	Excl	Incon
mt D N A	Incl	69	0	15
	Excl	9	17	20
	Incon	1	1	1

Initial sample = 170

Unsuitable for testing = 37, dropped

Leaving 133, if you keep inconclusives

# Many ways to calculate discordance

		Visual Comparison		
		Incl	Excl	Incon
mt D N A	Incl	69	0	15
	Excl	9	17	20
	Incon	1	1	1

Inclusion by visual and exclusion by DNA versus everything else =  $9/133 = 6.8\%$  (Houck's preferred method)

# Many ways to calculate discordance

		Visual Comparison	
		Incl	Excl
mt D N A	Incl	69	0
	Excl	9	17

26

Of all instances when DNA excluded, how often did visual include =  $9/26 = 34.6\%$  (complement of specificity)

Or  $17/26 = 65.4\%$  (specificity)

Some Law and  
Some Views from Bench and Bar

# Old Cases... Offer no Help

- Fingerprints – Approved by Dr. Twain and God
- Toolmarks – Reversals without reasons
- Handwriting – Can't be any worse than the method already in use
- Bitemarks – Courts persuaded the experts



	Daubert/Kumho: Valid Foundation	
Frye: General Acceptance	Strong	Weak
High	<b>Both admit</b>	<b>Frye admits Daubert excludes</b>
Low	<b>Frye excludes Daubert admits</b>	<b>Both exclude</b>

Judge McKenna in *U.S. v. Starzecpyzel*:

“Were the court to apply *Daubert* to FDE it would have to be excluded. This conclusion derives from a straightforward analysis of the suggested *Daubert* factors....”

Judge Gertner in *U.S. v. Hines*:

“There are no meaningful, and accepted validity studies in the field.”

## Judge Pollack in Llera-Plaza

Found no research that could support proponent of fingerprint expert testimony in the first or in the second incarnation of this case.

# A Post-*Daubert* AUSA view of FDE

- “[T]he QDE community [has failed] to develop a rigorous empirical defense of its theories and methods....”
- “*Daubert* challenges prosecutors and the QDE community to work with scholars to develop ways to demonstrate to courts... that the basic principles of QDE analysis are scientifically valid ....”
- The reason for this shortcoming is that “forensic document examiners traditionally had not had any particular reason to conduct validity studies because their testimony was being admitted without them.”

# The Problem of Context Cues

# Itiel Dror et al.

<b>Time 1: In Court</b>	<b>Time 2: In Study</b>
Positive Ident	Not a Match
Positive Ident	Not a Match
Positive Ident	Not a Match
Positive Ident	Undecided
Positive Ident	Positive Ident

# FBI Investigation of Madrid Error

“This influence was recognized as confirmation bias (or context effect) and describes the mind-set in which the expectations with which people approach a task of observation will affect their perceptions and interpretations of what they observe.”



# Post-mortems of DNA Exonerations



What to Do

# Serious Empirical Research

“In scientific inquiry it becomes a matter of duty to expose a supposed law to every possible kind of verification, and to take care, moreover, that this is done intentionally, and not left to a mere accident.” -- T.H. Huxley

# Three Research Strategies

- DNA Model
  - Develop defensible probability models
- Basic Research Model
  - Various tests of various hypotheses
- Black Box Model
  - Develop a map of skills vis a vis the variety of casework tasks

# While waiting for the research to develop...

- Blind testing
- Evidence lineups
- Temper exaggerated and opinions supported only by subjective estimation
- Avoid misleading terminology

# ABFO Terminology

<b>Testimony</b>	<b>Official Definition</b>	<b>Rating</b>
Reasonable scientific certainty	Highest order of certainty; no reasonable probability of error.	70.7
Probable	More likely than not; most people could not leave such a mark.	57.4
Consistent (with)	Similarity, but no degree of specificity, like match; may or may not be.	75.6
Match	Some concordance, some similarity, but no expression of specificity intended; generally similar but true for large percentage of population.	86.0

The NAS Recommendations on tempering conclusions about bullet lead comparison are equally applicable to the even more extreme claims of the “individualization” fields.