

Working Group Version_Handwriting_12_06_17

From: "Waltke, Heather (OJP)" (b) (6)
To: "Hunt, Ted (ODAG)" <(b) (6)>
Cc: "Antell, Kira M. (OLP)" <(b) (6)> "Laporte, Gerald (OJP)"
(b) (6)
Date: Mon, 18 Dec 2017 15:39:57 -0500
Attachment Working Group Ver ion Handwriting 12 06 17 doc (10 91 MB)

Hi Ted!

This is just an FYI regarding a human factors working group document that NIST will be looking to release this spring sometime. The group has been working on this for 3+ years. Page 2 has the disclaimer as it is NIJ and NIST sponsored.

Thanks so much,

H

RE: NIST Human Factors in Handwriting - HUDDLE

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Isenberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>, "Czarnopys, Greg P. (ATF)" <(b) (6)>, "Wroblewski, Jonathan (CRM)" <(b)(6), (b)(7)(C), (b)(7)(F) per DEA>, "Santos, Nelson A. (DEA)" <(b)(6), (b)(7)(C), (b)(7)(F) per DEA>, "(OGC) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Cc: "Hunt, Ted (ODAG)" <(b) (6)>, "Ratthey, Justin (OLP)" <(b) (6)>, "Magstadt, Michael (OLP)" <(b) (6)>, "Laporte, Gerald (OJP)" <(b) (6)>
Date: Tue, 12 Jun 2018 14:06:47 -0400

Good afternoon,

A reminder that if you have edits or bullets that you would like us to share with NIST, please send them to me and Ted by tomorrow morning. We expect to send a redline and a short bullet point memo with high-level issues later tomorrow.

Thank ,
Kira

From: Antell, Kira M. (OLP)
Sent: Thursday, June 7, 2018 4:59 PM
Isenberg, Alice R. (LD) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>, Czarnopys, Greg P. (ATF) <(b) (6)>, Wroblewski, Jonathan (CRM) <(b)(6), (b)(7)(C), (b)(7)(F) per DEA>, Santos, Nelson A. (DEA) <(b)(6), (b)(7)(C), (b)(7)(F) per DEA>, Laporte, Gerald (OJP) <(b) (6)>, Ratthey, Justin (OLP) <(b) (6)>, Magstadt, Michael (OLP) <(b) (6)>
Subject: RE: NIST Human Factors in Handwriting - HUDDLE

Duplicative Material

FW: NIST Human Factors in Handwriting - HUDDLE

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Hunt, Ted (ODAG)" <(b) (6)>
Date: Tue, 12 Jun 2018 14:48:39 -0400
Attachment: DRAFT Working Group Ver ion Handwriting with bibliography (Shiver comment) doc (11 12 MB); Human Factors Report CM 2018.docx (11.17 MB)

Call me

From: (b)(6) Greg P. Czarnopys
Sent: Tuesday, June 12, 2018 2:23 PM
To: Antell, Kira M (OLP) (b) (6)
Subject: FW: NIST Human Factors in Handwriting - HUDDLE

Greg
Greg P. Czarnopys
Deputy Assistant Director, OST
Forensic Services
Cell (b) (6)



From: (b)(6) per ATF
Sent: Tuesday, June 12, 2018 2:09 PM
To: Czarnopys, Greg P. <(b) (6)>
Subject: RE: NIST Human Factors in Handwriting - HUDDLE

Greg,
Our responses are attached

From: Czarnopys, Greg P
Sent: Monday, June 11, 2018 12:59 PM
To: (b)(6) per ATF
Subject: FW: NIST Human Factors in Handwriting - HUDDLE

Greg
Greg P. Czarnopys
Deputy Assistant Director, OST
Forensic Services
Cell (b) (6)



From: Antell, Kira M. (OLP) (JMD)
Sent: Thursday, June 07, 2018 5:00 PM
To: Isenberg, Alice R. (LD) (FBI); Czarnopys, Greg P. (b)(6), (b)(7)(C), (b)(7)(F) per DEA (DEA); Wroblewski, Jonathan (CRM) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; Laporte, Gerald (OJP) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>; (OGC) (FBI); Santos, Nelson A. (DEA)

(b) (6), (b) (7) (C), (b) (7) (F), (b) (7) (G)

Cc: Hunt, Ted (ODAG) (JMD) [REDACTED]

(b) (6), (b) (7) (C) Rattey, Justin (OLP) (JMD) [REDACTED]

(b) (6) ; Magstadt,

Michael (OLP) (JMD) <[REDACTED]>

Subject RE: NIST Human Factors in Handwriting HUDDLE

Duplicative Material

RE: NIST Human Factors in Handwriting - HUDDLE

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Hunt, Ted (ODAG)" <(b) (6)>
Date: Tue, 12 Jun 2018 15:17:47 -0400

I edited ATF's comments and combined them. My plan is this.

1. Include them (a I edit them) in the working draft
2. Include FBI edits as I edit them (coming tomorrow)
3. Include footnotes edits.
4. I will not review your edits.
5. Anonymize all edit
6. Send the working draft with all edits incorporated back to you midday tomorrow.
7. You can review and revise or just send.

From: Antell, Kira M (OLP)
Sent: Tuesday, June 12, 2018 2:47 PM
To: Hunt, Ted (ODAG) (b) (6)
Subject: FW: NIST Human Factors in Handwriting - HUDDLE

Call me

From: (b) (6) Greg P. Czarnopys
Sent: Tuesday, June 12, 2018 2:23 P
To: Antell, Kira M. (OLP) <(b) (6)>
Subject: FW: NIST Human Factors in Handwri HUDDLE

Greg
Greg P. Czarnopys
Deputy Assistant Director, OST
Forensic Service
Cell (b) (6)



From: (b) (6) per ATF
Sent: Tuesday, June 12, 2018 2:09 PM
To: Czarnopys, Greg P. (b) (6)
Subject: RE: NIST Human Factors in Handwriting HUDDLE

Greg,
responses are attached.

(b) (6) per ATF

From: Czarnopys, Greg P.
Sent: Monday, June 11, 2018 12:59 PM
To: (b) (6) per ATF
Subject: FW: NIST Human Factors in Handwriting HUDDLE

Greg
Greg P. Czarnopys
Deputy Assistant Director, OST
Forensic Services
Cell (b) (6)



From: Antell, Kira M. (OLP) (JMD)
Sent: Thursday, June 07, 2018 5:00 PM
To: Iseberg, Alice R. (LD) (FBI); Czarнопys, Greg P. (b)(6), (b)(7)(C), (b)(7)(F) per DEA
(DEA) (b)(6), (b)(7)(C), (b)(7)(F) per DEA; Wroblewski, Jonathan (CRM) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
(JP) (b)(6), (b)(7)(C), (b)(7)(F) per DEA; Sa Nelson A. (DEA)
Cc: Hunt, Ted (ODAG) (JMD) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; Rattey, Justin (OLP) (JMD) (b)(6); Magstadt, Michael (OLP) (JMD) (b)(6)
Subject: RE: NIST Human Factors in Handwriting - HUDDLE

Thank you to everyone and apologize for the late minute nature of this request

Attached is a Word version of the NIST Human Factors Handwriting report and their reviewer instructions (provided only FYSA). We are preparing a Department response to this document.

Per our phone call, to the extent you are interested in participating in this response, I ask that you review the attached document and provide themes and comments in redline and comment bubble by 8:00 am Wednesday, June 13.

I know that you may not be able to get through the document that's fine. Please just send me what you have by Wednesday morning. I'll combine everything into a single document.

Practitioner Review	Legal Review
<ol style="list-style-type: none"> Share this with QD personnel for their review for any issues from a practitioner perspective. Pay special attention to creation of new terms, misuse of current standard, and dilution of current practices. Provide <u>5-7 high level themes</u> in bullet point that you find problematic – feel free to make high level suggestion Provide comments in comment bubbles in the document (redline where appropriate) <p>FBI to the extent you participate, please start at the front. ATF/DEA - to the extent you participate, please start at the back.</p>	<ol style="list-style-type: none"> Review as to legal issues – you may wish to focus on Chapter 3. I would pay special attention to creation of new duties for lab personnel, legal analysis, code of professional responsibility. Provide <u>5-7 high level themes</u> in bullet point that you find problematic – feel free to make high level suggestion Provide comments in comment bubbles in the document (redline where appropriate) <p>FBI to the extent you participate, please start at the front. ATF/DEA - to the extent you participate, please start at the back.</p>

OLP interns are going through selected footnotes (legal, case law, PCAST, NAS, NCFS, DOJ) to assess whether the original source supports the assertion. Ted and I are also going through the whole document for legal and practitioner issues.

If you have any questions, do not hesitate to call or email!

Thanks,
Kira

From: Antell, Kira M (OLP)
Sent: Thursday, June 7, 2018 2:46 PM
To: Iseberg, Alice R. (LD) (FBI); Czarнопys, Greg P. (ATF) (b)(6) Greg P., (b)(6), (b)(7)(C); Wroblewski, Jonathan (CRM) (b)(6), (b)(7)(C), (b)(7)(F) per DEA; Gerald Laporte (OGC) (FBI) (b)(6); Santos, Nelson A. (DEA)
Cc: Hunt, Ted (ODAG) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Subject: NIST Human Factors in Handwriting - HUDDLE
Importance: High

Good afternoon,

NIST's Human Factors in Handwriting Examination Report is nearing completion. I knew the report was coming but I was not closely following it and was alerted to its content last week.

While there is much in the report of value, there are many portions that are problematic from forensic practitioner and legal standpoints. The Department has been given an opportunity to provide line edits.

I'd like to arrange a very quick huddle on this by phone this afternoon at 3:15 to discuss how we would like to proceed. Call in information to follow. If you can't make the call, I totally understand. I will follow up by email.

Thanks,
Kira

Kira Antell
Senior Counsel
Office of Legal Policy
U.S. Department of Justice
950 Pennsylvania Avenue, NW
Washington, DC 20530

(b) (6)

(b) (6)

RE: NIST Human Factors in Handwriting - HUDDLE

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
To: "Hunt, Ted (ODAG) (JMD)" <(b) (6)>
Date: Tue, 12 Jun 2018 17:58:44 -0400

Mostly arinches. (b)(5) per FBI

(b)(6), (b)(7)(C), (b)(7)(E) per FBI
Science Law Unit
Office of the General Counsel
Federal Bureau of Investigation
Desk: (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cell: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Confidentiality Statement: This message is transmitted to you by the Office of the General Counsel of the Federal Bureau of Investigation. The message, along with any attachments, may be confidential and legally privileged. If you are not the intended recipient of this message, please destroy it promptly without further retention or dissemination (unless otherwise required by law). Please notify the sender of the error by a separate e-mail or by calling (b)(6), (b)(7)(C), (b)(7)(E) per FBI.

From: Hunt, Ted (ODAG) [mailto:(b) (6)]
Sent: Tuesday, June 12, 2018 5:12 PM
To: Antell, Kira M (OLP) (JMD) (b) (6) (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Subject: RE: NIST Human Factors in Handwriting - HUDDLE

Thanks (b)(6)!

From: Antell, Kira M. (OLP)
Sent: Tuesday, June 12, 2018 4:42 PM
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI AG <(b) (6)>
Subject: RE: NIST Human Factors in Handwriting - HUDDLE

Thank !

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Sent: Tuesday, June 12, 2018 2:31 PM
To: Antell, Kira M (OLP) (b) (6) Hunt, Ted (ODAG) (b) (6)
Subject: FW: NIST Human Factors in Handwriting - HUDDLE

Kira and Ted: Legal Review Chapter 3 and a comment regarding a section in Chapter 4. I'm sending bullets as I was getting too angry redlining the material.

(b)(5) per FBI

(b)(5) per FBI

I'm sure you have addressed the big picture issues with this chapter from a legal perspective. Let me know if you need more on other chapters.

(b)(6), (b)(7)(C), (b)(7)(E) per FBI

Chief, Forensic Science Law Unit
Office of the General Counsel
Federal Bureau of Investigation

Desk: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Cell: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Confidentiality Statement: This message is transmitted to you by the Office of the General Counsel of the Federal Bureau of Investigation. The message, along with any attachments, may be confidential

RE: NIST Human Factors in Handwriting - HUDDLE

From: "Isenberg, Alice R. (LD) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI
To: "Antell, Kira M. (OLP) (JMD)" <(b) (6)> (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI)"
Cc: "Hunt, Ted (ODAG) (JMD)" <(b) (6)> "Rathey, Justin (OLP) (JMD)"
(b) (6), "Magstadt, Michael (OLP) (JMD)" (b) (6)
Date: Wed, 13 Jun 2018 08:00:30 -0400
Attachments: Human Factors General Comments_QDU ari.docx (16.63 kB); DRAFT Working Group Version Handwriting__with bibliography_QDU Edits ari.docx (11.15 MB)

Kira,
Consolidated FBI handwriting SME comments are in the two attached documents. Please let me know if there are any aspects of the e document that we need to discuss further
Thanks,
Alice

From: Antell, Kira M. (OLP) [mailto:(b) (6)]
Sent: Thursday, June 07, 2018 5:00 PM
Isenberg, Alice R. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; Czarnopys, Greg P. (ATF) (b) (6); (b)(6), (b)(7)(C), (b)(7)(F) per DEA; <w> nathan (CRM) (b)(6), (b)(7)(C) per CRM; <w> (OGC) (FBI) (b)(6), (b)(7)(C) per CRM; A.
(DEA) (b)(6), (b)(7)(C), (b)(7)(F) per DEA
Cc: Hu (b) (6); (b) (6); (b) (6) Magstadt, Michael (OLP) (JMD) (b) (6)
Subject: RE: NIST Human Factors in Handwriting - HUDDLE

Duplicative Material

(b) (5) per FBI

(b)(5) per FBI

RE: NIST Human Factors in Handwriting - HUDDLE

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Isenberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>, <(b)(6), (b)(7)(C), (b)(7)(E) per FBI> (OGC) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Cc: "Hunt, Ted (ODAG)" <(b) (6)>, "Ratthey, Justin (OLP)" <(b) (6)>, "Magstadt, Michael (OLP)" <(b) (6)>
Date: Wed, 13 Jun 2018 08:09:38 -0400

Thanks.

From: Isenberg, Alice R (LD) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Sent: Wednesday, June 13, 2018 8:01 AM
To: Antell, Kira M (OLP) <(b) (6)>, <(b)(6), (b)(7)(C), (b)(7)(E) per FBI> (OGC) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Hunt, Ted (ODAG) <(b) (6)>, Ratthey, Justin (OLP) <(b) (6)>; Magstadt, Michael (OLP) <(b) (6)>
Subject: RE: NIST Human Factors in Handwriting - HUDDLE

Kira,
Consolidated FBI handwriting SME comments are in the two attached documents. Please let me know if there are any aspects of these documents that we need to discuss further.
Thank ,
Alice

From: Antell, Kira M. (OLP) [mailto:(b) (6)]
Sent: Thursday, June 07, 2018 5:00 PM
(b)(6), (b)(7)(C), (b)(7)(F) per DEA <(b)(6), (b)(7)(C), (b)(7)(E) per FBI> (LD) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>; Czarnopys, Greg P. (ATF) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
(b)(6), (b)(7)(C), (b)(7)(F) per DEA <(b)(6), (b)(7)(C), (b)(7)(E) per FBI> roblewski, Jonathan (CRM) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI> (OGC) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>; Santos, Nelson A.
Cc: Hunt, Ted (ODAG) (JMD) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI> (b)(6), (b)(7)(C), (b)(7)(E) per FBI; Ratthey, Justin (OLP) (JMD) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI> Magstadt, Michael (OLP) (JMD) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Subject: RE: NIST Human Factors in Handwriting - HUDDLE

Duplicative Material

DOJ Comments-DRAFT Working Group Version Handwriting__with bibliography_06132018

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Hunt, Ted (ODAG)" <(b) (6)>
Date: Wed, 13 Jun 2018 09:26:10 -0400
Attachments: DOJ Comments-DRAFT Working Group Version Handwriting__with bibliography_06132018.docx (12.38 MB)

Hi Ted,

Attached is the draft with

1. Your comments (largely unedited)
2. Footnote review from OLP interns (edited by Kira)
3. ATF comments (edited by Kira)
4. FBI comments (edited by Kira)

I have combined comments where I feel appropriate so it is not clear how many reviewers participated in this effort. I sometimes edited the flow of your comments slightly for this purpose to insert or remove another reviewer's comment where appropriate. I do not think I edited them substantively. I also went through and added a few general classifications—"overbroad" "simplistic" "outdated" "misstatement". I did not do that for the whole document.

I am currently working on revising your high level themes.

-K

FW: DOJ Comments-Handwriting Human Factors Draft Report

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Isenberg, Alice R. (LD) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI, "Laporte, Gerald (OJP)" <(b) (6)>
Cc: "Hunt, Ted (ODAG)" <(b) (6)> (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Date: Fri, 15 Jun 2018 13:05:52 -0400
Attachment: DOJ Comment DRAFT Working Group Ver ion Handwriting with bibliography 06142018 pdf (2 93 MB)

Good afternoon,

Attached is the correspondence Ted sent to NIST last night. He attempted to send it to you previously but it bounced back – probably due to size so I am only attached the PDF. He wanted you to have it given that your staff participated directly in the report drafting process. This has not been shared more broadly within the Department. Let me know if you have any que tion

Thanks,
Kira

From: Hunt, Ted (ODAG)
Sent: Thursday, June 14, 2018 7:11 PM
To: Taylor, Melissa (Fed) (b) (6)
Cc: Antell, Kira M. (OLP) (b) (6) >
Subject: DOJ Comments-Handwriting Human Factors Draft Report

Hi Melissa,

Attached is a DOJ redline (Word and PDF versions) of the current draft version of *Forensic Handwriting Examination and Human Factors: Improving the Practice Through a Systems Approach*.

Thank you so much for your willingness to consider our collective thoughts for improving the draft report. As you will see, our comments and suggestions are many. Some of the problems we've highlighted will be easier to fix than others. Some are based on perspective, and others on facts, data, and substance. However, after conducting an in-depth review over the last week, I think it's important that we both identify and explain our significant concerns about this draft.

(b) (5)

[Redacted]

[Redacted]

[Redacted]

[Redacted]

(b) (5)

Having worked with you in the past, I know that you are very committed to producing high quality materials and will take our concerns very seriously. We are equally committed to helping improve this draft document in any way that we can.

Again, thanks very much for allowing us to provide substantive comments and suggestions at this late stage in the drafting process. We're available for any discussions that may help clarify or expand upon our redline suggestions, comments, and concerns.

Ted

Ted R. Hunt
Senior Advisor to the Attorney General on Forensic Science
Office of the Deputy Attorney General
United States Department of Justice
950 Pennsylvania Ave. NW
Washington, DC 20530

(b) (6)
(b) (7)

RE: NIST/NIJ Report on HF in handwriting

From: "Laporte, Gerald (OJP)" <(b) (6)>
To: "Antell, Kira M. (OLP)" <(b) (6)>
Cc: "Hunt, Ted (ODAG)" <(b) (6)> "McGrath, Jonathan (OJP)" <(b) (6)>
Date: Fri, 01 Jun 2018 14:39:59 -0400
Attachment Working Group Ver ion Handwriting WERBwith bibliography pdf (10.49 MB)

Here' the late t and greate t report

Best Regards,

Gerry LaPorte
Director
Office of Investigative and Forensic Science
National Institute of Justice
810 7th Street NW
Washington, DC 20531
Office: (b) (6)
Mobile: (b) (6)

Original Message
From: Antell, Kira M. (OLP)
Sent: Friday, June 01, 2018 10:54 AM
To: Laporte, Gerald (OJP) <(b) (6)>
Cc: Hunt, Ted (ODAG) <(b) (6)> McGrath, Jonathan (OJP) <(b) (6)>
Subject: RE: NIST/NIJ Report on HF in handwriting

It seem the IP wa al o on the group and I believe the language came from them

-----Original Message-----
From: Laporte, Gerald (OJP)
Sent: Friday, June 1, 2018 10:51 AM
To: Antell, Kira M. (OLP) <(b) (6)>
Cc: Hunt, Ted (ODAG) <(b) (6)> McGrath, Jonathan (OJP) <(b) (6)>
Subject: RE: NIST/NIJ R ting

As soon as we get the latest draft, I'll send to you. Ken Melson was on the group, so any legal language would've likely come from Ken.

Best Regards,

Gerry LaPorte
Director
Office of Investigative and Forensic Sciences National Institute of Justice
810 7th Street NW
Washington, DC 20531
Office: (b) (6)
Mobile: (b) (6)

-----Original Message-----
From: Antell, Kira M. (OLP)
Sent: Friday, June 01, 2018 10:49 AM
To: Laporte, Gerald (OJP) <(b) (6)>
Cc: Hunt, Ted (ODAG) <(b) (6)> McGrath, Jonathan (OJP) <(b) (6)>
Subject: RE: NIST/NIJ Report on HF in handwriting

Thanks Gerry. The recommendation is vaguely worded (3.2) but the actual text makes clear they are talking about the differences between the rules of civil and criminal discovery. I missed it because I looked it at the recs and not the supporting language.

I'd like to know if it is more specific in the last draft.

-----Original Message-----

From: Laporte, Gerald (OJP)

Sent: Friday, June 1, 2018 10:35 AM

To: Antell, Kira M. (OLP) <(b) (6)>

Cc: Hunt, Ted (ODAG) <(b) (6)> [redacted] McGrath, Jonathan (OJP) <(b) (6)>

Subject: RE: NIST/NIJ Report on HF in handwriting

Here is a version we sent to you and Ted on 12/18/2017. Also, are there specific 'legal recommendations' you are concerned with? (b) (5)

[redacted]

Best Regards,

Gerry LaPorte
Director
Office of Investigative and Forensic Sciences National Institute of Justice
810 7th Street NW
Washington, DC 20531
Office: (b) (6)
Mobile: (b) (6)

-----Original Message-----

From: Antell, Kira M. (OLP)

Sent: Friday, June 01, 2018 10:28 AM

To: Laporte, Gerald (OJP) <(b) (6)>

Cc: Hunt, Ted (ODAG) <(b) (6)> [redacted] McGrath, Jonathan (OJP) <(b) (6)>

Subject: RE: NIST/NIJ Report on HF in handwriting

In the interim, do you have a list of the members who participated?

-----Original Message-----

From: Laporte, Gerald (OJP)

Sent: Friday, June 1, 2018 10:19 AM

To: Antell, Kira M. (OLP) <(b) (6)>

Cc: Hunt, Ted (ODAG) <(b) (6)> [redacted] McGrath, Jonathan (OJP) <(b) (6)>

Subject: RE: NIST/NIJ Report on HF in handwriting

We are reaching out to NIST for the latest draft ... stand by.

Best Regards,

Gerry LaPorte
Director
Office of Investigative and Forensic Sciences National Institute of Justice
810 7th Street NW
Washington, DC 20531
Office: (b) (6)
Mobile: (b) (6)

-----Original Message-----

From: Antell, Kira M. (OLP)

Sent: Friday, June 01, 2018 10:07 AM

To: Laporte, Gerald (OJP) <(b) (6)>

Cc: Hunt, Ted (ODAG) <(b) (6)> McGrath, Jonathan (OJP) <(b) (6)>

Subject: NIST/NIJ Report

Can you send me the latest draft? I was not aware it would make legal recommendations.

I am surprised by this.

Thanks,
Kira

Sent from my iPhone

Working Group Version_Handwriting_WERBwith bibliography.pdf

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Wroblewski, Jonathan (CRM)" <(b)(6), (b)(7)(C) per CRM >
Cc: "Hunt, Ted (ODAG)" <(b) (6)>
Date: Fri, 01 Jun 2018 15:13:11 -0400
Attachments: Working Group Version_Handwriting_WERBwith bibliography.pdf (10.49 MB); ATT00001.txt (23 bytes)

Close Hold - forthcoming.

Sent from my iPhone

Draft Fordham Forensics Articles - comments by January 18

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Hafer, Zachary (USAMA)" <(b) (6)> "Young, Cynthia (USAMA)" <(b) (6)> "Goodhand, David (CRM)" <(b) (6)> "Ibrahim, Anitha (CRM)" <(b) (6)> "(b)(6), (b)(7)(C), (b)(7)(E) per FBI" "(OGC) (FBI)" "(b)(6), (b)(7)(C), (b)(7)(E) per FBI", "Hulser, Raymond (CRM)" <(b) (6)> "Wroblewski, Jonathan (CRM)" <(b) (6)> >, "Smith, David L. (USAEO)" <(b) (6)>
Cc: "Hunt, Ted (ODAG)" <(b) (6)> "Isenberg, Alice R. (LD) (FBI)" "(b)(6), (b)(7)(C), (b)(7)(E) per FBI", "Goldsmith, Andrew (ODAG)" <(b) (6)> "Shapiro, Elizabeth (CIV)" <(b) (6)>
Date: Tue, 09 Jan 2018 14:30:06 -0500
Attachments: Hunt Article 01092018_DISTRIBUTED.docx (53.03 kB); ADG Article 01092018_DISTRIBUTED.docx (56.57 kB)

Good afternoon,

As you know, in October the Department presented at a forensics evidence symposium at Boston College. You all participated in preparing Department presenters and we appreciate your assistance. The transcript of the event will be published in an upcoming issue of the Fordham Law Review. Department speakers were invited to provide supplementary articles to the Fordham Law Review Online. Andrew Goldsmith, Ted Hunt, and Alice Isenberg have elected to submit articles.

I am circulating the draft articles by Andrew and Ted here for your review and suggestions before they are sent to Fordham. Dr. Isenberg's article about modern lab practice is being reviewed by FBI and FBI-OGC before ODAG approval.

Ted's article is drawn from previous public remarks but it is more granular than previously provided statements and is a direct written response to PCAST. Andrew's article is quite similar to his approved statements from the symposium but provides more in depth legal arguments. Both of them contain Department legal and policy positions. No need to focus on the footnotes or formatting as Fordham will provide editorial assistance on that front.

Please review and provide your edits and suggestions in redline to me by 6:00 pm, Thursday, January 18. If it would be helpful, we could meet in person on this next week on Tuesday or Wednesday.

Thanks,
Kira

Kira Antell
Senior Counsel
Office of Legal Policy
U.S. Department of Justice
950 Pennsylvania Avenue, NW
Washington, DC 20530

(b) (6)
(b) (6)

RE: Draft Fordham Forensics Articles - comments by January 18

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
To: "Antell, Kira M. (OLP) (JMD)" <(b)(6)> "Hafer, Zachary (USAMA)" <(b)(6)>
<(b)(6)> "Young, Cynthia (USAMA)" <(b)(6)> "Goodhand, David (CRM)" <(b)(6)>
v. "Ibrahim, Anitha (CRM)" <(b)(6)> "Hul er, Raymond (CRM)" <(b)(6)>
>, "Wroblewski, Jonathan (CRM)" <(b)(6)>
>, "Smith, David L. (USAEO)" <(b)(6)>
Cc: "Hunt, Ted (ODAG) (JMD)" <(b)(6)> "Isenberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
"Goldsmith, Andrew (ODAG) (JMD)" <(b)(6)> "Shapiro, Elizabeth (CIV)" <(b)(6)>
Date: Wed, 10 Jan 2018 16:42:10 -0500

Kira, Ted, Andrew I think these are both very well written and my only small comment relates to Ted's article which I've left him in a vm

(b)(6), (b)(7)(C), (b)(7)(E) per FBI
Chief, Forensic Science Law Unit
Office of the General Counsel
Federal Bureau of Investigation
Desk: (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cell: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Confidentiality Statement: This message is transmitted to you by the Office of the General Counsel of the Federal Bureau of Investigation. The message, along with any attachments, may be confidential and legally privileged. If you are not the intended recipient of this message, please destroy it promptly without further retention or dissemination (unless otherwise required by law). Please notify the sender of the error by a separate e-mail or by calling (b)(6), (b)(7)(C), (b)(7)(E) per FBI.

From: Antell, Kira M. (OLP) [mailto:(b)(6)]
Sent: Tuesday, January 09, 2018
To: Hafer, Zachary (USAMA) <(b)(6)>; Young, Cynthia (USAMA) <(b)(6)>
<(b)(6)> "Goodhand, David (CRM)" <(b)(6)>; Ibrahim, Anitha (CRM) <(b)(6)>; (b)(6), (b)(7)(C), (b)(7)(E) per FBI
> "Wroblewski, Jonathan (CRM)" <(b)(6)> "Smith, David L. (USAEO)" <(b)(6)> "Isenberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
> "Goldsmith, Andrew (ODAG) (JMD)" <(b)(6)> "Shapiro, Elizabeth (CIV)" <(b)(6)>
Subject: Draft Fordham Forensics Articles - comments by January 18

Duplicative Material

Fwd: Draft Fordham Forensics Articles - comments by January 18

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Hunt, Ted (ODAG)" <(b) (6)>
Date: Wed, 17 Jan 2018 07:04:39 -0500
Attachment: Hunt Article 01092018_DISTRIBUTED.docx (53.03 kB); ATT00001.htm (216 bytes); ADG Article 01092018_DISTRIBUTED.docx (56.57 kB); ATT00002.htm (168 bytes)

I think the fn are okay in this version.

Sent from my iPhone

Begin forwarded message:

From: "Antell, Kira M. (OLP)" <(b) (6)>
Date: January 9, 2018 at 2:30:06 PM EST
To: "Hafer, Zachary (USAMA)" <(b) (6)>; "Young, Cynthia (USAMA)" <(b) (6)>; "Goodman, David (CRIV)" <(b) (6)>; "Ibrahim, Anitha" <(b) (6)>; "(CRM)" <(b) (6)>; "(CRM)" <(b) (6)>; "(OGC) (FBI)" <(b) (6), (b)(7)(C), (b)(7)(E) per FBI>; "Hulser, Raymond" <(b) (6)>; "Wroblewski, Jonathan (CRIV)" <(b) (6)>; "Smith, David L. (USAE0)" <(b) (6)>
Cc: "Hunt, Ted (ODAG)" <(b) (6)>; "Lienberg, Alice R. (LD) (FBI)" <(b) (6), (b)(7)(C), (b)(7)(E) per FBI>; "Goldsmith, Andrew (ODAG)" <(b) (6)>; "Shapiro, Elizabeth (CIV)" <(b) (6)>
Subject: Draft Fordham Forensics Articles - comments by January 18

Duplicative Material

FW: Draft Fordham Forensics Articles - comments by January 18

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Hunt, Ted (ODAG)" <(b) (6)>
Date: Wed, 17 Jan 2018 16:17:31 -0500

From: Smith, David L (USAEO) [(b) (6)]
Sent: Wednesday, January 17, 2018 4:14 PM
To: Antell, Kira M (OLP) (b) (6)
Subject: RE: Draft Fordham Forensics Articles - comments by January 18

Kira,

(b) (5)

et him know that (b)(5) per EOUSA

From: Antell, Kira M. (OLP) <(b) (6)>
Sent: Wednesday, January 17, 2018 12:00 PM
To: Malis, Jonathan M. (USADC) <(b) (6)>; Kirsch, Matthew (USACO) <(b) (6)>; Porter, Gene (USAMOW) <(b) (6)>
Cc: Smith, David L. (USAEO) <(b) (6)>; Young, Cynthia (USAMA) <(b) (6)>
Subject: Draft Fordham Forensics Articles - comments by January 18

Good afternoon,

In October, the Department presented at a forensic evidence symposium at Boston College for the Advisory Committee on Evidence Rules. The purpose of the symposium was to begin to discuss whether it was appropriate to amend Rule 702 for cases involving forensic evidence. OLP and CIV briefed the CrCWG about this event over the summer.

The Department was represented at the symposium by Andrew Goldsmith and Ted Hunt (both of ODAG), Zach Hafer (USAO-MA), and Alice Isenberg (FBI-Lab). OLP, CIV, CRM, CRM-Appellate, EOUSA, and Cynthia Young (USAO-MA) (CC'd here) assisted in preparing the presenters in advance. Many of us attended the symposium as well.

The transcript of the symposium will be published in an upcoming issue of the Fordham Law Review. Department speakers were also invited to provide articles to the Fordham Law Review Online.

Draft articles by Andrew and Ted were circulated last week to a small group of reviewers including Cynthia. Ted's article is a direct written response to the PCAST report drawn from previous public remarks but it is more granular than previously provided. Andrew's article is quite similar to his approved statement from the symposium but provides more in-depth legal arguments. Both of them contain Department legal and policy positions.

Cynthia suggested that it would be helpful to have additional criminal chiefs review these articles before they are sent to Fordham for publication. I would be grateful if you could review the effort article and let me know if you have concern by COB on Friday. Happy to speak with you by phone at any point.

Thanks,
Kira

Kira Antell
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(b) (6)
(b) (6)

RE: Fordham Law Review Articles (2 of 3 articles attached)

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Hur, Robert (ODAG)" <(b) (6)>
Cc: "Hunt, Ted (ODAG)" <(b) (6)> "Goldsmith, Andrew (ODAG)" <(b) (6)>
"Shapiro, Elizabeth (CIV)" <(b) (6)>
Date: Mon, 22 Jan 2018 11:32:03 -0500
Attachment Hunt Fordham Law Review Article DISTRIBUTED doc (58 85 kB)

Hi Rob,

Attached is Ted's article. Hopefully the furlough will be short but in I have contacted Fordham to let them know our articles could be slightly delayed.

Thanks,
Kira

From: Antell, Kira M. (OLP)
Sent: Friday, January 19, 2018
To: Hur, Robert (ODAG) <(b) (6)>
Cc: Hunt, Ted (ODAG) <(b) (6)> Goldsmith, Andrew (ODAG) <(b) (6)> Shapiro, Elizabeth (CIV) <(b) (6)>
Subject: Fordham Law Review Articles (2 of 3 articles attached)

Hi Rob,

As you know, Department speakers at the Boston College forensics evidence symposium were invited to provide articles to the Fordham Law Review Online. **IN order to ensure inclusion in the March edition, we need to transmit Department approved articles to Fordham NLT Monday, January 29.** I am attaching articles by Andrew and Alice I enberg (FBI Lab) for your review Ted i reviving hi article and I will end it by eparate cover on Monday (January 22).

Andrew' article i quite imilar to hi approved tatement from the ympo ium but provide more in depth legal arguments. Ted's article is a direct written response to the PCAST report drawn from previous public remarks but it is more granular than previously provided statements. The draft articles by Andrew and Ted were circulated last week to a small group of reviewers from CRM, CRM-Appellate, EOUSA, individuals at CrCWG, Cynthia Young and Zach Hafer at USAO MA, and Bet y Shapiro. None of the reviewer had any concern with the po ition taken by Andrew or Ted but several provided thoughtful comments which were largely incorporated. The draft article by Alice has been reviewed by FBI Lab, FBI OGC, and Ted. Andrew and I have also reached out to Cindy Shaw for ethics review prior to submission to Fordham.

The authors are available to discuss these articles and I am available to discuss the review process if it would be helpful. I look forward to hearing your thoughts. If at all possible, I'd like to receive your edits by next Friday (January 26). Don't hesitate to call or email.

Thanks,
Kira

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A new methodological framework to interpret complex DNA profiles using likelihood ratios

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ABSTRACT

Although likelihood ratio (LR) based methods to analyse complex mixtures of two or more individuals, that exhibit the twin phenomena of *drop out* and *drop in* has been in the public domain for more than a decade, progress towards widespread implementation in to casework has been slow. The aim of this paper is to establish a LR based framework using principles of the *basic model* recommended by the ISFG DNA commission. We use the tools in the form of open source software (LRmix) in the Forensim package for the R software. A generalised set of guidelines has been prepared that can be used to evaluate any complex mixture. In addition, a validation framework has been proposed in order to evaluate LRs that are generated on a case specific basis. This process is facilitated by replacing the reference profile of interest (typically the suspect's profile) with simulated random man using Monte Carlo simulations and comparing the resulting distributions with the estimated LR. Validation is best carried out by comparison with a standard. Because LRMix is open source we proposed that it is ideally positioned to be adopted as a standard basic model for complex DNA profile tests. This should not be confused with 'the best model' since it is clear that improvements could be made over time. Nevertheless, it is highly desirable to have a methodology in place that can show whether an improvement has been achieved should additional parameters, such as allele peak heights, are incorporated into the model. To facilitate comparative studies, we provide all of the necessary data for three test examples, presented as standard tests that can be utilised to carry out comparative studies. We envisage that the resource of standard test examples will be expanded over coming years so that a range of different case types that are included will be used in order to improve the efficacy of models; to understand their advantages; conversely, to understand any limitations and to provide training material.

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1. Introduction

In this paper we illustrate the application of exploratory data analysis using likelihood ratios (theory outlined by Haned et al. [1]), applied to the interpretation of complex DNA profiles. An important principle of the methodology is that the incorporation of the twin effects of *drop out* and *drop in* [2] into the interpretation strategy [3] enables a meaningful comparison to be made between any crime stain and any reference sample. This is possible because there is no longer any requirement to think in terms of 'match' or 'non match' [4]. A traditional analysis is a two step consecutive process: a) Is there a match? b) What is the strength of evidence if there is a match? A numeric strength of evidence is usually formulated to support a prosecution hypothesis ($LR > 1$) and this is

a weakness of the traditional approach. However, by using a suitable model that by passes the requirement to decide a definitive 'match' based on subjective criteria, there is no reason why the strength of evidence cannot also be calculated in favour of the defence hypothesis ($LR < 1$). Subjective assessments of cases are therefore avoided because the statistical model employed [5,6] is able to simultaneously measure strength of evidence that could favour the defence hypothesis, as well as the prosecution hypothesis.

In the past, mixture interpretation has been difficult to standardise. Different laboratories follow different mixture interpretation guidelines [7,8] and the diversity of casework and associated propositions encountered renders the generalisations of such guidelines difficult. It is therefore desirable to develop an interpretation framework that not only facilitates associating a weight to any type of DNA evidence, but also provides a way of testing the reliability of the obtained results. Haned et al. [1] have developed an exploratory approach, anchored in a likelihood ratio framework, which addresses these two requirements. Relying on

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their approach, the key features of the proposed framework are summarised as follows:

- a) There is no requirement to make an assessment about *whether* an analysis should be carried out based on subjective criteria to decide a 'match' or 'non match' with a reference sample. There is no inherent restriction on comparing any crime stain(s) with any reference sample.
- b) Because the analysis of crime and reference samples is concurrent, the Clayton recommendation [9] that consecutive examination of reference samples at the end of the interpretation process, is no longer a requirement.
- c) There is no need to filter any of the allelic peaks within our framework apart from selecting all alleles that are above the limit of detection threshold (LDT). If ambiguous allelic peaks are present (stutters) then they are incorporated directly into the analysis.
- d) The shift of focus is firmly towards the formulation of propositions (hypotheses provided by the defence and prosecution). Because propositions can only be described in pairs, it may not be obvious which to consider, especially with low template DNA analysis with no identifiable body fluid. To facilitate, we provide guidance to estimate the minimum number of contributors.
- e) The interpretation process is regarded as exploratory since the results can be conditioned on different circumstances that are considered to be relevant to the case.
- f) Performance testing is built into the interpretation process and is used to *evaluate* reported likelihood ratios; acting as a component of *validation* (we discuss this concept in detail in Section 9.1). It is proposed that the LRmix module fulfils the requirements to act as a *standard*. Consequently, it can be used to determine whether alternatives (or changes to existing models) result in improved performance.

To illustrate the principles, we evaluate three different cases in order to explore the effect of conditioning, and to demonstrate the importance of simplifying the hypotheses used to describe the circumstances of a case. These cases are also submitted as a set of standard test examples (see [electronic supplement](#)) that can be utilised as a resource for others to carry out comparative tests with other models, or model improvements, thereby fulfilling an important requirement for validation exercises.

2. Characterisation of low template DNA profiles

There has been recent debate about the characterisation of a low template DNA, but the position is now summarised by a recent ISFG DNA commission [10].

LT DNA profiles usually exhibit some degree of allele *drop out*. DNA profiles can be characterised and classified as LT DNA vs. standard DNA profiles by comparison of peak heights to a stochastic threshold (T), determined by logistic regression [11,12]. The threshold measures the *risk* of allelic dropout if allele peak heights are between the lower limit of detection threshold (LDT) and the stochastic threshold (T). In addition, allele *drop in* may be observed its frequency tends to increase with higher sensitivity of detection (e.g. elevated cycle number; increased injection time). Degradation can also affect a DNA profile so that it appears standard at low molecular weight loci, and low template at high molecular weight loci [13]. Alternatively, *differential degradation* may occur where the relative amounts of degradation vary per contributor and this in turn affects the mixture proportion (M_x) [14,15] across the DNA profile.

If all contributors are within the low template range then the relationship between the DNA quantity allelic peak heights tends

towards a uniform distribution, so that heterozygotes become increasingly unbalanced. These stochastic effects are predictable however, and computer simulations [16,17] have demonstrated a sound theoretical basis to explain heterozygote balance and allele drop out relative to DNA quantity.

2.1. Analysis of LT DNA profiles

Historically, LT DNA profiles were first interpreted using the consensus profile method [2] where only alleles observed in two or more replicate profiles were reported; a variation of the method was described by Benschop et al. [18–20]. In addition, composite profiles are sometimes reported: here profiles are combined in their entirety to form a single combined genotype the robustness of this strategy was investigated by Bright et al. [17]. Consequently, several methods are in current use to interpret LT DNA profiles. None is ideal because not all of the information in the DNA profile is utilised. It is not possible to incorporate the allele *drop out* and *drop in* phenomena in probabilistic terms. This may lead to anti conservativeness [21] and readers are referred to the ISFG DNA commission paper [10] for further clarification of the arguments. Therefore, there are strong reasons in favour of the introduction of 'new' probabilistic approaches, since all of the information in replicate profiles is analysed without the need to construct a consensus or composite profile [1,4]. The incorporation of *drop in* and *drop out* into the model fulfils the criteria suggested by the ISFG DNA commission [10], greatly reducing anti conservative risks since $LRs < 1$ can be assigned to loci. Whereas the complexity of applying consensus and composite methods restricted their use to profiles categorised as non mixtures and simple mixtures, probabilistic methods are not restricted by the number of replicates, or the number of contributors. This leads to the necessity to move the focus of the discussion to the formulation of propositions.

3. DNA profiling evidence, transfer and propositions

The interpretation of all DNA profiling evidence has to be considered in the context of the case circumstances. Increased sensitivity of detection quite often means that there is no body fluid or cell type that can be associated with the DNA profile if the profiling evidence has been recovered from a touched surface. When this occurs it seems to be common practice to attribute the profile to epithelial cells (but there is usually no direct evidence for this assumption). It is never implicit that the recovery of a DNA profile is associated with a crime event [22], and alternative methods of DNA transfer must always be a consideration when hypotheses are formulated, especially when LT DNA is analysed.

It can be generalised that contributors to a DNA profile will always comprise *known* individuals (victim(s), suspect(s) and witnesses) and zero or more *unknown* individual(s). When a profile consists of DNA from several contributors, it cannot be assumed that each was deposited concurrently on a surface (e.g. weapon). It is inevitable that depositions will be made before, during and/or after a crime event the reader is referred to [23] for an outline of these principles.

The number of contributors is itself often uncertain unknown individuals are more common in LT DNA profiles and the 'masking effect', where alleles are shared between different contributors [24], complicates the assessment. The more contributors there are, the more likely it is that the total will be underestimated. Maximum likelihood principles [19,25,26], can assist reporting officers in deriving the most plausible number of contributors that can explain the observed epgs. Additional tests, such as Y chromosome analysis, are often useful to determine the number of male contributors. Therefore the elucidation of the absolute

number of contributors is never precise. Nevertheless, it is usually valid to determine the *minimum number of contributors* and this is usually sufficient – see ISFG DNA commission [3]. To summarise, each case is considered on its own merits, and propositions based on the minimum number of contributors can be informed from a variety of sources.

4. An outline of models used to interpret ‘complex DNA profiles’

A ‘complex DNA profile’ is any profile that is, or may be, subject to allele *drop out* and/or allele *drop in*. Mixtures are usual and within our definition a model should be capable to analyse mixtures and replicate samples. A number of different LR based models have been described to interpret ‘complex DNA profiles’ [5,6,27–30]. They are traditionally classified into two categories based on the type of information they take into account: the so called continuous models [29,30] incorporate peak heights as continuous variables, and therefore account for both the qualitative and quantitative data provided by the epgs. Qualitative models only make use of the list of alleles observed in the epg. Continuous models are expected to extract more information from the available data than qualitative models, however, they rely on distributional assumptions of the signal intensities (peak heights), which makes their implementation in casework difficult. On the other hand, qualitative models are easier to implement as they rely on fewer assumptions. Because they are based on different assumptions, it is expected that different models will produce different LRs for a given case, for a given set of propositions. Comparative studies will be of interest in (near) future work to establish the relative performance of these different models. The qualitative model described here was first introduced by Curran et al. [5] and later extended by Haned et al. [1,31]. This model, freely available in the LRmix module of the Forensim package [31,32], facilitates the calculation of likelihood ratios for complex mixtures, i.e. LT DNA (partial) profiles with two or more known and unknown contributors. The model incorporates the probabilities of *drop out* and *drop in* into the LR calculation in order to account for the uncertainty about the composition of the crime sample. For a given set of propositions, the model yields a sensitivity analysis of the LR, where *drop out* and *drop in* probabilities are varied within their plausible ranges. The final output of LRmix, is a lower bound of the LR, corresponding to the most plausible values of *drop out* and *drop in* probabilities [1].

In the following section we describe performance tests that could in principle be used to facilitate comparative studies *between* different interpretation methods. Here they are used primarily to determine the *within* model performance on a case specific basis.

5. An outline of the interpretation process

1) Evidence is considered under two alternative propositions within the classical likelihood ratio (LR) framework.

$$LR = \frac{Pr(E|H_p)}{Pr(E|H_d)}$$

where E is the evidence; H_p is the prosecution hypothesis and H_d is the defence hypothesis.

2) There are two classes of conditional types:

- a) *Conditioning a known individual under H_d* : This is typically victim focussed – e.g. a swab may be taken from a victim and it is reasonable to condition H_d on the victim’s DNA profile. Sometimes H_d is suspect conditioned – e.g. a penile swab may be taken to search for victim’s DNA, so the purpose of the test under H_p would be to identify the victim’s DNA profile.

- b) *No known individuals conditioned under H_d* : e.g. a weapon has been used and removed either from the crime scene or remote from the crime scene – is the victim’s DNA profile recovered from the weapon? Is the suspect’s profile recovered?

- 3) *The minimum number of contributors*: is determined under H_p by counting all of the unique alleles in the crime stain profile and the set of ‘known’ individuals and dividing the total by two.
- 4) Typical hypotheses incorporate one or more suspects (S_n) under H_p (where $n = 1..y$ where y is the total number of suspects). However, the questioned profile e.g. S_1 is always replaced by an unknown individual (U) under the H_d propositions. We use a short hand to describe the propositions per H_p , H_d hypothesis. For example $H_p = V, S_1, U$ means that a victim, suspect 1 and unknown persons are incorporated into the LR analysis under H_p and $H_d = U, U, U$ means that three unknown individuals are incorporated into the LR analysis under H_d .
- 5) Within the framework described, for convenience, evidence may be considered *inclusionary* if the $LR > 1$ and *exclusionary* if $LR < 1$, without any formal requirement to decide a ‘match’ or ‘non match’.
- 6) It is convenient to consider $\log_{10}(LR)$ throughout.
- 7) A step wise approach is introduced in order to formalise the interpretation process.

6. Model validation and the use of performance tests

6.1. Model definition

We distinguish between the ‘probabilistic model’ and the ‘specific model’ where the former is the algorithm, comprising generalised assumptions and the theory that is *hard coded*. On the other hand, the ‘specific model’ refers to the parameters that are used to inform the ‘probabilistic model’. These are case specific. In the LRmix ‘specific model’ the parameters are as follows:

- a) The set of propositions to be evaluated under H_p and H_d defined as:
 - I) number of contributors;
 - II) number of known and unknown individuals.
- b) The genotype(s) of the known individuals.
- c) The genotype(s) of the crime stain.
- d) Probability of *drop in*.
- e) Probability of *drop out*.
- f) Some value of F_{st} or θ (optional).
- g) A size bias correction (optional).
- h) Frequencies from a population database.

We now describe a method to measure the performance of the ‘specific model’ by applying random man non contributor tests as follows.

6.2. Non contributor performance tests

Non contributor performance (N_p) tests are introduced here to assess the performance of a model relative to the specific conditional constraints that form the basis of the analysis [33]. The method is illustrated by cross reference to case example 2 (Section 7.2). Consider a pair of propositions: that consider $H_p =$ suspect (S) and victim (V) have contributed to the sample; and $H_d =$ an unknown person (U) and a victim (V) have contributed to the sample. The rationale behind the performance tests is to evaluate the output of the model: i.e. the LRs obtained by LRmix when the suspect profile is replaced by the profile of a random man. If the model works efficiently we expect that the LRs would

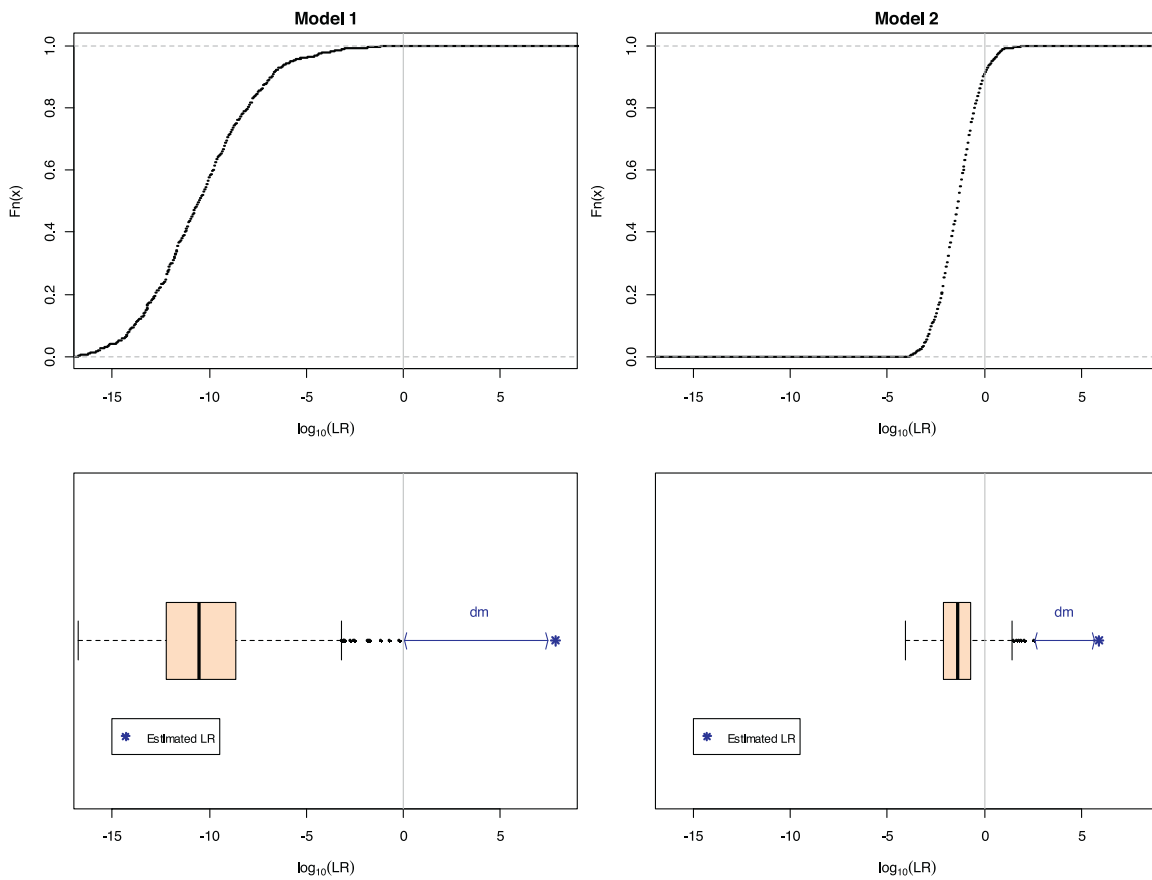


Fig. 1. Analysis of two LR hypotheses based on two person (Model 1) and three person (Model 2) propositions from case example 2 (Section 7.2). The empirical cumulative distribution functions are shown and the data are summarised in boxplots where the relative performance of the models can be defined by the discriminatory metric (dm). A proportion of LRs $> \log_{10}(0)$ are inclusionary in the three person model, and dm is also lower compared to the two person model (hence its power to discriminate is not as great).

be very small, $\ll 1$ if ' H_d is true'. The random man substitution simulates ' H_d is true', hence the frequency of inclusionary LRs > 1 can be used as an estimate of the false positive error rate determined from the cumulative density function (cdf) distribution of LRs > 1 (Fig. 1). This distribution can be used to define the performance of the specific model used.

Repeating the substitution procedure n times, yields a distribution of LRs of the aforementioned propositions, where the suspect profile has been replaced by a random profile, simulated by sampling the alleles at their respective frequencies in the population of interest. In this study, we take $n = 1000$ random profiles, and for each simulation, suspect S is substituted by the simulated profile, and a likelihood ratio calculated.

The LR result is evaluated by 1000 $\log_{10}(\text{LR})$ taking the 1 percentile, 50 percentile and 99 percentile and representing these as a series of parameters in parentheses: (Np_1, Np_{50}, Np_{99}). For example, $\log_{10}(\text{LR}) = 5.98(6, 3, +1)$ is short hand for $\log_{10}(\text{LR}) = 5.98$ followed by $\log_{10}(Np_1) = 6$; $\log_{10}(Np_{50}) = 3$; $\log_{10}(Np_{99}) = +1$. The plus sign is included for emphasis.

In Fig. 1, two sets of propositions are evaluated using the same probabilistic model. The propositions are either two persons or three persons respectively. The formally reported \log_{10} LRs are 5.98 (6, 3, +1) and 8.04 (17, 9, 5) respectively. We introduce a discriminatory metric (dm) parameter to compare the Np_{99} percentile with the estimated LR:

$$\log_{10}(dm) \leftarrow \log_{10}(\text{LR})_{\text{estimated}} - \log_{10}(Np_{99}).$$

Np distributions do not have tails that coincide with $\text{LR} = 1$ (the traditional inclusionary/exclusionary boundary). It certainly does

not follow that the best 'probabilistic' or 'specific model' is one that results in the highest LR. Neither does it follow that the greatest dm is the best supported model. The first step is for the court to decide the 'preferred model(s)'. The second step is to use dm to evaluate the likelihood ratio(s) to ensure that the reported LRs are meaningful – the purpose of the scientist is to guide and to facilitate the debate, without bias – in principle there is no limit to the number of pairs of propositions that may be evaluated and it is always better to be 'inclusive' rather than 'exclusive'.

The dm parameter is a useful evaluative indicator of the performance characteristics of any model – apart from choice of propositions, the court will wish to be assured that the model is capable to discriminate between random man and an alleged perpetrator – and this is its prime purpose.

To summarise: because performance tests are applied to the model on a *per case* basis, this also acts as an important component of 'specific model' evaluation, since a risk analysis that describes the limitations of the model is concurrently provided.

7. Casework examples to illustrate the process

We describe the analysis of three complex cases that are typical of those processed in laboratories. The aim is to outline a generic method to simplify the interpretation process by introducing an exploratory approach that is able to concurrently evaluate the diversity of propositions that is inherent with any casework. To keep things simple, we restrict examples to single tests without replicates, but this expansion is straight forward. Laboratories world wide have different practices to implement theta and size bias corrections – neither are discussed here, although the LRmix

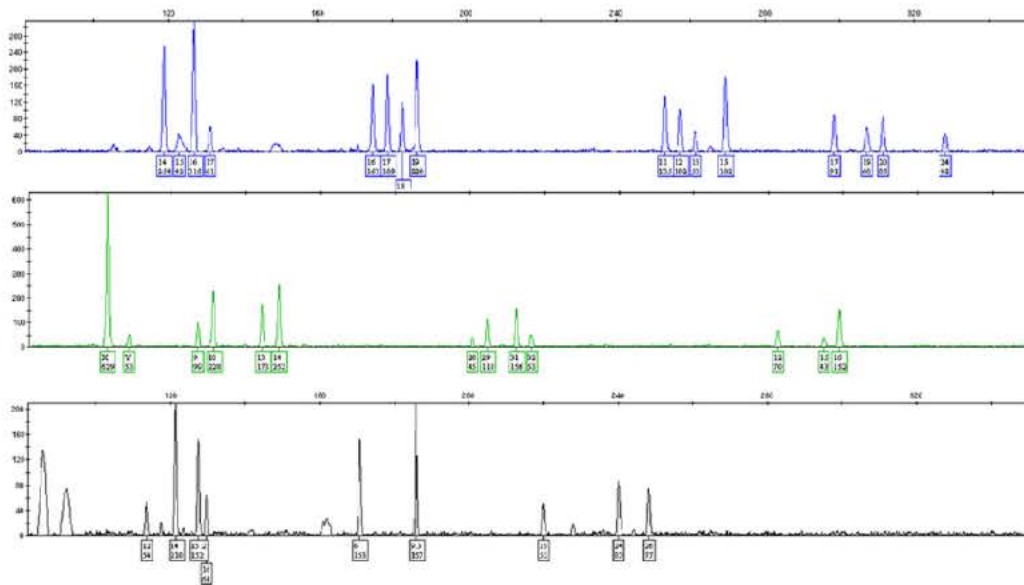


Fig. 2. The first case example epg.

model can accommodate both as required by internal laboratory policy. The Norwegian population database for SGM plus comprises 1000 individuals [34], hence application of a size bias correction has minimal effect. We do not apply theta because the examples provided are intended to be standard examples applied to a 'standard model' and are therefore benchmarks. The purpose of the paper is to provide a framework for the forensic community to carry out collaborative exercises. All examples illustrated were processed with SGM plus and the Norwegian frequency database was used.

7.1. Case 1

7.1.1. Step 1: Describe case circumstances and examine the epg

The crime stain is from an epithelial swab taken from the female victim and the electropherogram (epg) is shown in Fig. 2. There are two suspects accused of sexual assault, S₁ and S₂ respectively; both deny the offence. This epg is classified as a low template of two or more individuals since there are multiple alleles

Table 1

List of alleles with informative formatting and colour coding in order to provide a visual representation of the evidence.

Marker	Crime-stain alleles								Unique alleles
	Allele1	Allele2	Allele3	Allele4	S1	S1	S2	S2	
AMEL	X	Y			X	Y	X	Y	2
D3S1358	14	16	17	(15)	16	17	15	17	4
VWA	16	17	18	19	16	18	18	19	4
D16S539	11	12	13	15	12	13	12	12	4
D2S1338	17	19	20	(24)	19	20	17	18	4
D8S1179	9	10	13	14	9	13	13	13	4
D2IS11	29	31	32		28	32	30	30	5
D18S51	12	16	(15)		12	15	12	20	4
D19S433	12	14	15.2	16	12	16	12	15	5
TH01	6	9.3			6	9.3	6	9.3	2
FGA	19	24	26		19	21	20	21	5

Key:

- 1) Alleles that are shared between victim and S₁ or S₂ (green background).
- 2) Alleles that are found in the crime stain and not observed in any known individual (blue background, not applicable in this case).
- 3) Alleles that are below the detection threshold but appear to be distinct (bracketed).
- 4) Alleles that are found in the crime stain that match a known individual under H_d (victim) (red typeface).

per locus that fall within the criterion of the low template zone (between the LDT and the stochastic threshold (T)) we expect dropout may occur, but the profiles appear to be well represented.

7.1.2. Step 2: Record the alleles in the epg and reference samples and carry out case assessment relative to a pair of preliminary propositions

The alleles from the crime stain are recorded in Table 1. This includes all alleles above 50 rfu. Alongside are the reference genotypes from suspects S₁ and S₂. Formatted text and colour coding can be used to provide an informative but simple way to maximise the information about the case (we avoid H_p centred propositions to prevent bias). Note that the wording and choice of categories depend upon the case circumstances. The list of allele categories is as follows:

- 1) Alleles that are shared between known profiled contributors (green background).
- 2) Alleles that are found in the crime stain and not observed in any known individual (blue background).
- 3) Alleles that are below the detection threshold but appear to be distinct (bracketed).
- 4) Alleles that are found in the crime stain that match a known individual under H_d e.g. victim (red typeface).

All of the victim's alleles are present in the crime stain (red type face), except for D2 allele (24) which is less than 50 rfu, so no further representation is needed. The remainder (black type face) represent alleles that are either a) from a suspect under H_p, b) drop in alleles, and c) from an unknown contributor.

Adjacent to the crime stain, there are four columns of data that describe the reference profiles of S₁ and S₂, respectively, if H_p is true. Alleles that are shared between known individuals are highlighted (green).

7.1.3. Step 3: Establish the minimum number of contributors for the 'preliminary' propositions

There is no need within the interpretation framework to be definitive about the number of contributors within the epg. However, it is necessary to determine the minimum number of contributors across the entire set of DNA profiles considered in the evidence profile(s) and the reference samples that form the basis of

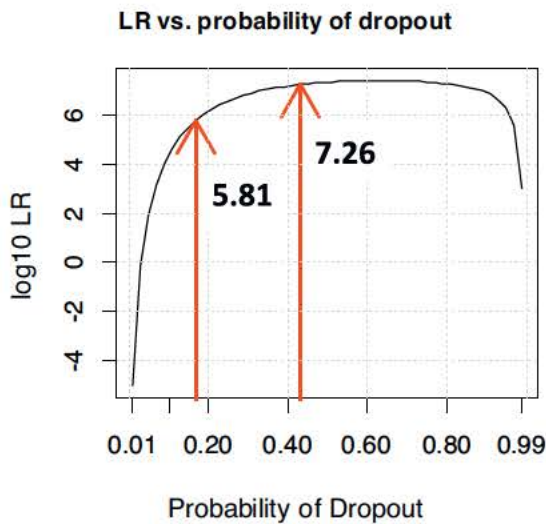


Fig. 3. Sensitivity analysis for the for case example illustrating 5 and 95 percentile dropout range (the lower percentile is reported in this case).

the propositions (which may differ between H_p and H_d). This proceeds as follows:

- a) The swab is from a victim (V). There are two suspects (S_1, S_2) under H_p ,
- b) The number of *unique* alleles across the sets C, V, S_1, S_2 is determined (Table 1). The minimum number of contributors from the sets under H_p is simply the (number of *unique* alleles/2) per locus. In this example, some loci have 5 unique alleles across sets hence there is a minimum of three individuals present under H_p .
- c) A similar calculation can be made under H_d where the sets of genotypes formed by S_1, S_2 are not used, but in our rationale, it is convenient to anchor the minimum number of contributors on H_p and to assume equivalence (this is revisited later in the procedure).
- d) Consequently, the preliminary propositions are formulated as $H_p = V, S_1, S_2$ and $H_d = V, U, U$.

7.1.4. Step 4: LRmix analysis

The $\log_{10}(\text{LR}_{\min}) = 5.81$ is derived for a drop out probability $\text{Pr}(D) = 0.17$. This value is in fact the 5 percentile calculated from an empirical distribution of the drop out probability conditioned on the expected number of alleles observed relative to the genotype of the hypothesised contributors, the procedure is described by Haned et al. [1] (Fig. 3).

7.1.5. Step 5: Case re evaluation and simplification of the propositions

The next part of the analysis involves simplifying the propositions. Although a probative LR favouring H_p has resulted from the preliminary analysis, this has incorporated both suspects S_1 and S_2 under H_p . However, the likelihood ratio itself does not provide any indication about the relative *weighting* of the two contributions provided by S_1, S_2 to the actual LR result. Consequently, the next step in the analysis is to *dissect* the propositions into their constituents in order to establish the weighting and to establish the consequent probative value of the evidence per contributor under H_p .

Visual examination of the evidence (Table 2) revealed that S_1 has more matching alleles than S_2 ; furthermore the crime stain could be explained under H_p if it was a simple mixture of V and S_1 (with three *dropped out* alleles). Individual S_2 is not required at all in the analysis, since there are no missing alleles observed in the

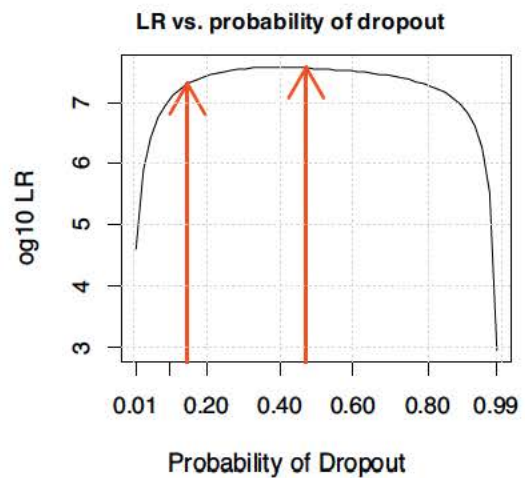


Fig. 4. Sensitivity analysis for next stage of the analysis considering S_1 as the only suspect under H_p .

crime stain ($H_p = V, S_1$). Although the number of unique alleles reduces the number of contributors to two, in order to be consistent, three contributors are evaluated and the propositions are simplified to: $H_p = S_1, V, U$ and $H_d = V, U, U$. (note the LR is much larger if two contributors are analysed under H_p and H_d data not shown, hence the choice of three contributors is demonstrably conservative).

Following this procedure, the new $\log_{10}(\text{LR}_{\min}) = 7.29$; $\text{Pr}(D_{\min}) = 0.15$ (Fig. 4).

Next we carry out a simplification procedure to determine the effect of S_2 on the LR: $H_p = S_2, V, U$; $H_d = V, U, U$. Now the $\log_{10}(\text{LR}_{\min}) = 2.6$, which is clearly 'exclusionary' (Fig. 5).

7.1.6. Step 6: Non contributor performance (Np) tests

N_p tests can be used to support the conclusion that evidence supporting S_1 is 'inclusionary' whereas evidence supporting S_2 is 'exclusionary' (Table 3) for complex propositions ($H_p = S_1, S_2, V$), replacing S_2 with random non contributors gave $\log_{10}(Np_{99}) = +8.2$, whereas S_1 replacement gave $\log_{10}(Np_{99}) = 7.0$. This showed that that S_2 could not be distinguished from random man and illustrates the principle that the LR calculated from a complex proposition cannot be used as probative evidence concurrently

Table 2
Re-evaluation of the evidence from Table 1.

Marker	Allele1	Allele2	Allele3	Allele4	S1	S1	No of unique alleles
AMEL	X	Y			X	Y	2
D3S1358	14	16	17	(15)	16	17	3
VWA	16	17	18	19	16	18	4
D16S539	11	12	13	15	12	13	4
D2S1338	17	19	20	(24)	19	20	4
D8S1179	9	10	13	14	9	13	4
D21S11	29	31	32		28	32	4
D18S51	12	16	(15)		12	15	3
D19S433	12	14	15.2	16	12	16	4
TH01	6	9.3			6	9.3	2
FGA	19	24	26		19	21	4

See Table 1 for the legend key.

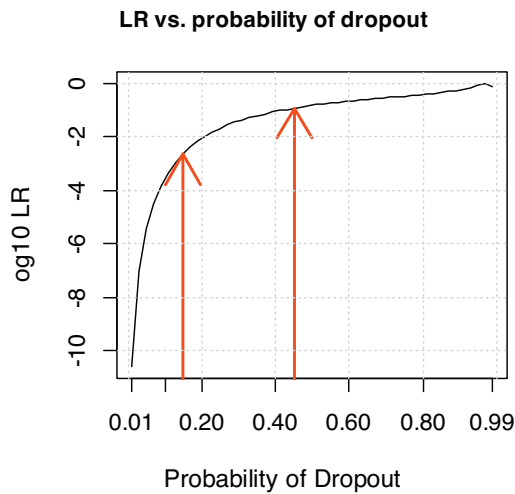


Fig. 5. Sensitivity test considering S_2 as the only suspect under H_p .

against all hypothesised contributors under H_p . The individual effects must be explored by simplifying the propositions as described. Table 3 summarises the analysis.

7.1.7. Step 7: Tabulate the results of the analysis

Note that a potential alternative to measure the strength of the evidence is to determine the discriminating metric $\log_{10}(dm) = \log_{10}(LR) - \log_{10}(Np_{99})$. Non contributor performance distributions do not have tails that coincide with $LR = 1$. It certainly does not follow that the best ‘specific model’ is one that results in the highest LR. The performance of the model is measured by the discriminating metric but this parameter cannot be used to inform the best choice of model since this decision is separate and a function of the court i.e. the circumstances of the case dictate the choices of model(s) to test, not the statistical analysis.

7.2. Case example 2 An example with five suspects

7.2.1. Step 1: Describe case circumstances and examine the epg

In this example the victim was murdered in an affray and there are five suspects that are apprehended. All deny the offence and all deny being present at the crime scene. An epithelial sample is taken from the ankle of the victim and reference samples are

Table 3

Summary of results from interrogation of relevant sets of propositions.

H_p	Three person mixture			Non-contributor performance Percentiles
	H_d	Random man substituted	$\log_{10}(LR)$	
S_1, S_2, V	V, U, U	S_1	5.5	(21, 15, 7)
S_1, S_2, V	V, U, U	S_2	5.5	(+0.17, +4.2, +8.2)
S_1, V, U	V, U, U	S_1	7.2	(10, 5, +0.14)
S_2, V, U	V, U, U	S_2	3	(10, 5, +0.14)

Non-contributor performance tests were carried out to determine the $\log_{10}(Np_1, Np_{50}, Np_{99})$ percentiles relative to the random man substitution to carry out the test.

obtained from the 5 suspects. The purpose of the examination is to determine if there is evidence of any of the suspects as contributor(s) to the crime sample. The epg is shown in Fig. 6; the victim’s alleles are denoted by a red asterisk.

7.2.2. Step 2: Tabulate the alleles in the epg and reference samples and carry out case assessment relative to a pair of preliminary propositions

Given that there are five suspects (Table 5), each needs to be considered separately. From examination of the epg at least two contributors can be inferred.

7.2.3. Step 3: Establish the minimum number of contributors for the preliminary propositions

Starting with suspect S_1 , three contributors are indicated from the set of unique alleles from the reference samples and crime sample (Table 4). Therefore under H_p we consider S_n, V, U where $n = 1 \dots 5$ and under H_d we compare V, U, U for all calculations.

7.2.4. Step 4: LRmix analysis

The advantage of the exploratory analysis is that there are no constraints on comparisons that can be made. All suspects can be compared against the crime stain evidence. When this is carried out each gives a very small (‘exclusionary’) LR, except for candidate S_5 where the $LR = 769,600$ (Table 6).

7.2.5. Step 5: Case re evaluation and simplification of the propositions

If S_5 is the contributor, the model can be simplified to a minimum of two contributors ($H_p = S_5, V; H_d = V, U$) and can be re evaluated to provide a $LR = 67$ million. A comparison of sensitivity plots is shown in Fig. 7.

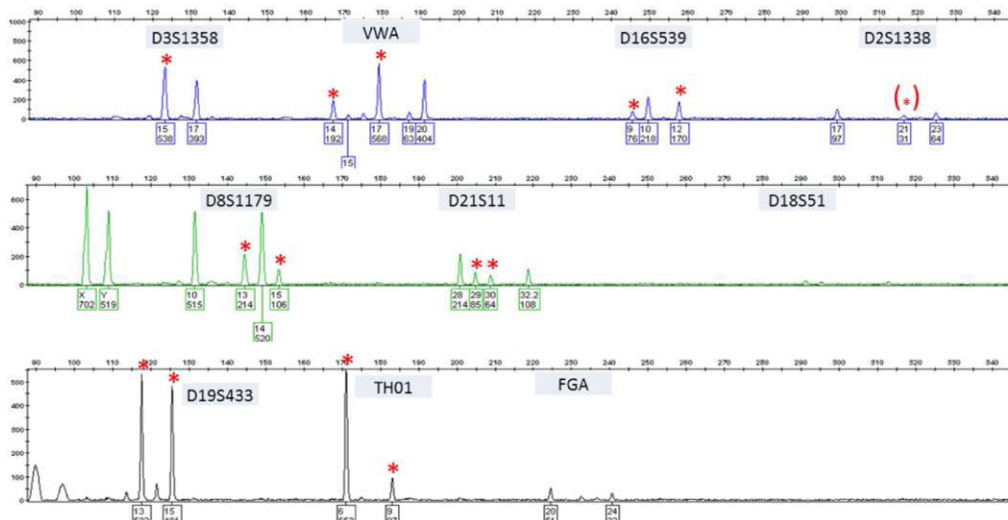


Fig. 6. Case 2 showing the epg. Victim’s alleles are marked with red asterisks.

Table 4
Comparison of a suspect (S_1) and the crime-stain alleles. The victim's alleles are in red type.

Marker	Allele1	Allele2	Allele3	Allele4	Allele5	Victim	Victim	S_1	S_1	No of unique alleles
AMEL	X	Y				X	Y	X	Y	
D3S1358	15	17				15	15	17	18	3
VWA	14	17	19	20	(15)	14	17	16	19	5
D16S539	9	10	12			9	12	10	13	4
D2S1338	17	23				21	22	19	23	5
D8S1179	10	13	14	15		13	15	13	15	4
D21S11	28	29	30	32.2	(21)	29	30	28	30	4
D18S51						15	15	15	15	1
D19S433	13	15				13	15	14	15	3
TH01	6	9				6	9	9	9	2
FGA	20					22	23	21	21	4

See Table 1 for the legend key.

Table 5
A compilation of the five suspects' genotypes.

Marker	S_1	S_1	S_2	S_2	S_3	S_3	S_4	S_4	S_5	S_5
AMEL	X	Y	X	Y	X	X	X	X	X	Y
D3S1358	17	18	15	16	16	18	17	18	15	17
VWA	16	19	16	17	15	18	14	17	17	20
D16S539	10	13	12	12	9	11	9	12	10	12
D2S1338	19	23	18	21	17	19	20	25	17	23
D8S1179	13	15	11	13	10	13	12	13	10	14
D21S11	28	30	30	32.2	28	29	31	31	28	32.2
D18S51	15	15	14	18	14	17	14	15	14	19
D19S433	14	15	14	14	14	16	14	15.2	13	15
TH01	9	9	8	9	7	9	7	7	6	6
FGA	21	21	24	24	22	24	20	20	20	24

7.2.6. Step 6: Non contributor performance tests

The analysis can be formerly presented as +7(16, 10, 3) and +5 (5, 2, +0.8) for two and three person contributors, respectively. Discriminatory metrics are: $\log_{10}(dm) = 10$ for the two persons mixture and $\log_{10}(dm) = 4$ for the three person mixture

7.3. Example 3

7.3.1. Step 1: Describe case circumstances and examine the epg

A victim is stabbed. A knife is recovered away from the crime scene in the suspects flat. The suspect denies involvement. There is a witness (S_1) present in the flat at the time of the incident. The knife is DNA profiled. There is insufficient evidence to assign a body fluid to the DNA profile (no blood is present) hence the contact traces are assumed epithelial cells. Inspection of the epg indicates a minimum of three person mixture (Fig 8).

7.3.2. Tabulate the alleles in the epg and reference samples and carry out case assessment relative to a pair of preliminary propositions

All alleles pertaining to the victim are observed in the crime stain (Table 7). In addition all alleles from known contributors under H_p are observed in the crime stain except for D21S11 (30) in

Table 6
A compilation of LR's substituting each suspect in turn into the LR formula with $PrD_{min} = 0.63$.

	S_1	S_2	S_3	S_4	S_5
Crime-stain (LRs)	0.56	0.003	0.004	$8 \times 10e^{-5}$	769,600

S_1 . There is one allele VWA(17) found in the crime stain, not found in any known contributor (potential drop in event under H_p).

7.3.3. Step 3: Establish the minimum number of contributors for the preliminary propositions

In addition to VWA (17), if conditioning on two known contributors V, S_1 ; then there are two alleles in D21S11 and one allele in FGA not explained under H_p . If the contributors are V, S_2 under H_p , then there are two alleles in D21S11, two alleles in D18, and two alleles in FGA not explained under H_p . Alternative propositions may include V, S_n, U where $n = 1$ or 2. The preliminary H_p propositions are that the profile consists of three person mixture, all of whom are known: victim (V); witness (S_1) and the offender (S_2). Because the weapon was recovered remote from the crime scene (premises of S_2 who denied any involvement) then it follows that the propositions under the defence hypothesis are that there is no DNA originating from any known individual at the crime scene, i.e. $H_d = U, U, U$.

7.3.4. Step 4: LRmix analysis

LRmix yields a $\log_{10}(LR) = 15$, which implies very strong evidence to support the former proposition (Fig. 9). It may be tempting for the prosecution to use such an impressive figure in order to mount a prosecution of S_2 (the alleged offender) but we demonstrate below why this is approach would be misleading.

7.3.5. Step 5: Non contributor performance tests (note steps 5 and 6 are reversed compared to previous example)

The proposition S_1, S_2, V can be dissected by applying three non contributor performance tests to each contributor in turn. For the

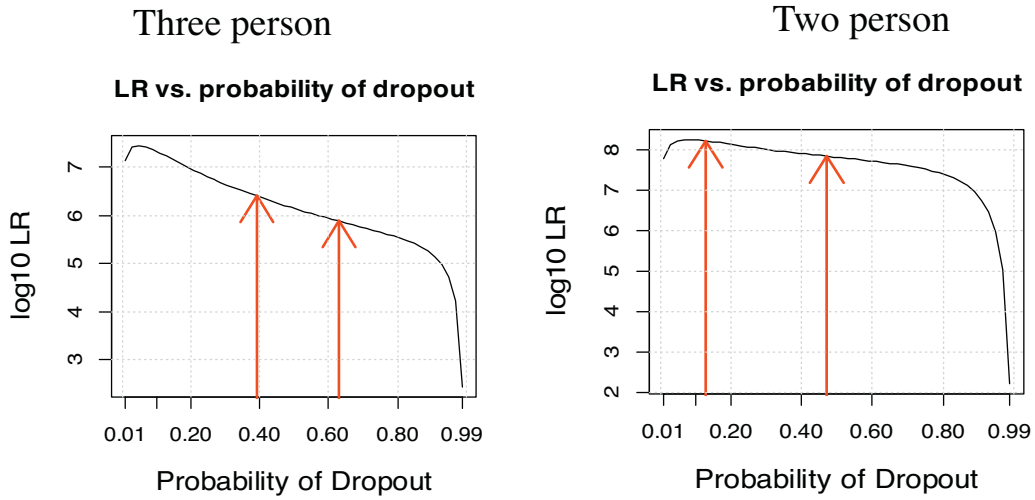


Fig. 7. Comparison of sensitivity plots for S_5 analysis.

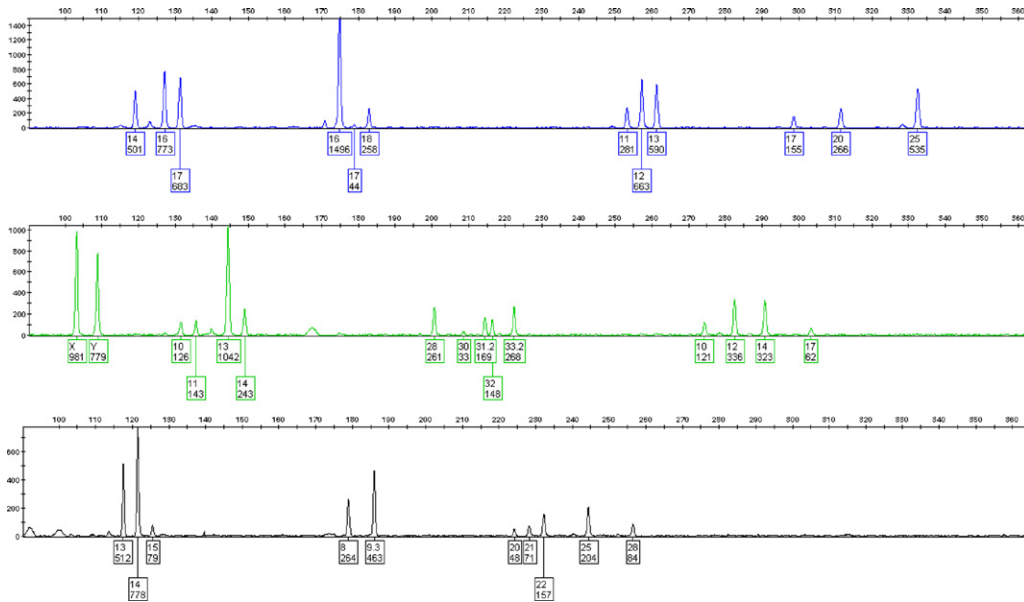


Fig. 8. Case 3 epg.

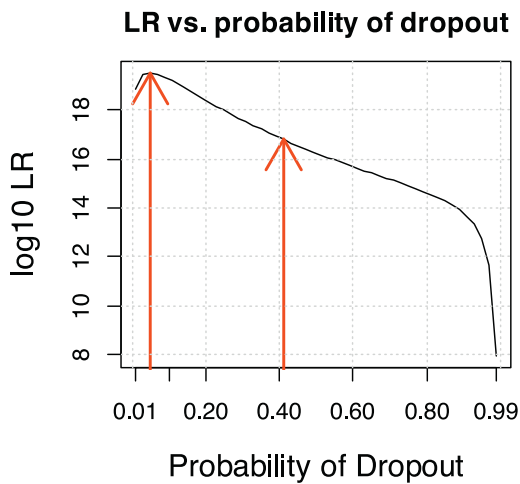


Fig. 9. Sensitivity analysis, Case 3, preliminary propositions tested.

three performance tests replacing S_1 , S_2 and V by a non contributor, the performance statistic was $\log_{10}(Np_{99}) = +8.5, +13.28, +6.62$, respectively. We demonstrate, therefore that substituting random man in the model gives rise to substantial likelihood ratios up to 13 orders of magnitude. However, the total $\log_{10}(LR) = 16.8$. The discriminatory metric, $\log_{10}(LR) - \log_{10}(Np_{99})$ gives: $S_{1dm} = 8.3$, $S_{2dm} = 3.52$ and $V_{dm} = 10.18$. Therefore, the greatest weights contributing to the LR can be ranked from high to low as: V , S_1 and S_2 , respectively.

We can generalise that a large LR does not preclude the presence of a random contributor under H_p since this does not become apparent unless the non contributor performance test is applied.

7.3.6. Step 6: Case re evaluation and simplification of the propositions

We condition on a three person mixture, but simplify the propositions under H_p by substituting known individuals with unknown individuals (Table 8). Under H_p we evaluate S_n, U, U where $n = 1.2$ and finally V in three consecutive calculations where (U, U, U) is included under H_d to provide three separate likelihood

Table 7
Comparison of known individuals (S_1 , S_2) and the crime-stain alleles. The victim's alleles are in red type.

Marker	Allele1	Allele2	Allele3	Allele4	Allele5	Victim	Victim	S_1	S_1	S_2	S_2	No of unique alleles
AMEL	X	Y				X	Y	X	Y	X	Y	
D3S1358	14	16	17			14	17	14	16	16	17	3
VWA	16	18				16	18	16	16	16	16	2
D16S539	11	12	13			11	13	12	13	12	13	2
D2S1338	17	20	25			17	20	20	25	25	25	3
D8S1179	10	11	13	14		13	14	10	11	13	13	4
D21S11	28	31.2	32	33.2	(30)	32	33.2	30	33.2	28	31.2	5
D18S51	10	12	14	17		12	14	10	17	12	14	4
D19S433	13	14	15			13	13	14	15	14	14	3
TH01	8	9.3				8	9.3	8	8	9.3	9.3	2
FGA	21	22	25	28	(20)	25	28	20	21	22	25	5

See Table 1 for the legend key.

Table 8
A summary of results for Case 3, compiling the propositions tested.

H_p conditions	H_d conditions	Non-contributor	(\log_{10}) percentile			Minimum bound LR	Discriminatory metric (dm)
<i>Complex set</i>		<i>Substitution</i>	0.01	0.50	0.99		
S_1, S_2, V	U, U, U	S_1	-1.07	3.06	8.5	16.8	8.3
S_1, S_2, V	U, U, U	S_2	4.51	8.24	13.28	16.8	3.52
S_1, S_2, V	U, U, U	V	-3.57	1.13	6.62	16.8	10.18
<i>Simplified set</i>							
S_1, U, U	U, U, U	S_1	-6.7	-3.02	0.72	4.91	4.19
S_2, U, U	U, U, U	S_2	-6.7	-3.02	0.72	3.01	2.29
V, U, U	U, U, U	V	-6.7	-3.02	0.72	7.16	6.44
<i>Complex conditioned set</i>							
V, S_1, S_2	V, U, U	S_1	-8.4	-4.20	1.79	9.63	7.84
V, S_1, S_2	V, U, U	S_2	-3.75	1.09	5.91	9.63	3.72
<i>Simplified conditioned set</i>							
V, S_1, U	V, U, U	S_1	-6.9	-2.83	0.57	4.43	5.07
V, S_2, U	V, U, U	S_2	-6.9	-2.83	0.57	2.71	2.14

Non-contributor performance (N_p) percentiles are listed in bold type. Underneath are corresponding \log_{10} (LRs).

ratio estimates. Only a single non contributor performance test is required to summarise the results, substituting S_n for random man. The LRs calculated for $\log_{10}(\text{LR})_{S_1} = 4.19$; $\log_{10}(\text{LR})_{S_2} = 2.29$; $\log_{10}(\text{LR})_V = 6.64$. Because $N_{p99} = 0.72$, all LRs appear to provide probative evidence in favour of H_p as the metric dm is positive.

7.3.7. Effect of conditioning on the victim

It was of interest to examine the effect of conditioning the victim under H_d . Under H_p , the propositions are the same as for the complex set, under H_d , V is included in the conditioning $\log_{10}(\text{LR}) = 9.63$ (evaluated using a minimum bound $\Pr(D_{\min}) = 0.41$). There are two non contributor performance plots where S_1 and S_2 are evaluated. $\log_{10}(N_{p99})_{S_1} = 1.79$ and $\log_{10}(N_{p99})_{S_2} = 5.91$. The metrics dm are 7.84 and 3.72, respectively.

7.3.8. Simplified conditioned set

Finally, we evaluate S_n, V, U propositions under H_p where $n = 1.2$; $\Pr(D_{\min}) = 0.43$. Calculated $\log_{10}(\text{LR})_{S_1} = 4.43 = \log_{10}(4.05)$ and $\text{LR}(S_2) = \log_{10}(2.71)$; $N_{p99} = \log_{10}(0.57)$.

7.3.9. Step 7: Tabulate the results of the analysis

See Table 8.

8. Court reporting

The essential step is to summarise the data for court reporting. Ideally LRmix allows for a dialogue between the experts and the

court where different pairs of propositions may be quickly evaluated. General guidance is as follows:

- Set the number of contributors to the minimum number required for the entire set of alleles under the prosecution proposition initially set the number of contributors to be equivalent under H_p and H_d .
- Always simplify the propositions if there is a complex H_p where two or more suspects are considered, always explore the effect of replacing each suspect in turn with a random contributor in order to explore the effect on the model. When there are two or more 'profiled' individuals under H_p , if one of them has no probative value then consider removal from the model and reduce the number of contributors.
- Evaluate the robustness of the model with non contributor performance tests to ensure that it is capable to distinguish between the suspect and random man (a high likelihood ratio does not necessarily provide this assurance). Calculate the discriminatory metric (dm) between N_{p99} and the calculated LR to ensure that it is positive.

8.1. A model statement (data from Section 2.7.3)

A form of words is as follows: I have analysed the data to evaluate the proposition that Mr X is a contributor to the crime stain Y compared to the alternative proposition that Mr X is not a contributor to crime stain Y using the conditions defined in an

LRmix model. These conditions are stated as follows to form a statistic that is known as the likelihood ratio:

- a) Mr X and the victim are both contributors to the sample.
- b) An unknown person and the victim are both contributors to the sample.

The evidence is 111 million times more likely if the first proposition (a) is true, compared to the alternative described by (b).

This figure has been evaluated with a performance test. To do this we replace Mr X with a random unrelated individual and we repeat the measurement of the likelihood ratio. We do this a total of 1000 times, with a different random individual each time. When this was carried out 99% of likelihood ratios estimated were less than 0.00001.

9. Discussion

As DNA profiling techniques become more sensitive, mixtures that comprise multiple contributors become the norm. To be able to deal with the complexities of interpretation, it is first essential to have in place a model that is able to carry out the necessary calculations. The features of such a model are:

- a) It must be able to incorporate multiple contributors, both known and unknown (these may differ between H_p and H_d propositions).
- b) The calculation must be able to determine numeric strength of evidence that favours defence or prosecution hypotheses.
- c) Calculations carried out need to be rapid.
- d) Some caution is required to interpret complex propositions with two or more known individuals under H_p , since the evidential weight per contributor is not provided or indicated by a single likelihood ratio that evaluates a combination of propositions.
- e) Interrogation with non contributor performance tests (as defined within this paper) can be used to demonstrate the performance of the model. It is proposed here that performance tests also serve the purpose of validation on a per case basis (Section 9.1), by providing a concurrent risk analysis. This flexibility is a desirable feature of any complex theory, since it is impossible to generalise across the entire range of propositions/profiles that may be encountered.

9.1. Validation

Although the use of simulation models as an aid to interpret evidence is relatively new in forensic science there is strong precedence in other (unrelated) areas of science that run parallel with the concepts introduced here. A highly informative discussion paper (which we recommend to readers interested in the subject) is provided by Rykiel et al. [35]. This paper addresses “the meaning of validation” specifically applied to simulation models used in testing ecological models. We start with his definition:

“validation is a demonstration that a model within its domain of applicability possesses a satisfactory range of accuracy consistent with the intended application of the model”.

Doubtless there will be much discussion about the efficacy of models in the near future. Different models have different underlying assumptions (e.g. Section 7.3.9) and we recognise that their outputs and performances will be different. Given that such a diversity of models exist that are based on divergent assumptions, how may they be compared? We now seek to answer this question. The more assumptions built into a model, the greater the need to characterise a DNA profiling process to generate the statistical

distributions that the model requires to function. For example, if *deconvolution* using peak heights is modelled, then distributions based on heterozygote balance are pertinent. However, the characterisation of DNA profiling methods is specific to a particular generic method which may themselves be subdivided into many ‘sub strategies’. For example, a multiplex may be processed using several different PCR cycling regimes. Injection times may be varied and so on. Ideally, characterisation of each ‘sub strategy’ is needed to inform distribution parameters, but in practice this becomes potentially too rigid a requirement, given the time and expense required to complete the exercise. Therefore, the assumptions that are employed in the model may not be valid across the range of mixtures that are to be analysed, but the question to consider is: “does it matter”? An additional question is whether there is any benefit to develop a model that may be esoterically pleasing, but provide little added value in terms of being able to evaluate the strength of evidence. Scientists are naturally keen to promote their methods, resulting in discussion, but unless there is an accepted way to compare different models, there is no way to address such debates. Currently, to our knowledge, there is no published information to resolve this issue. Consequently, our aim is to provide a framework that will enable probabilistic models to be compared, and by implication improved in a meaningful way. To do this we supply the following resources:

- a) Provide a ‘basic model’ as open source software.
- b) Provide version control: LRMix sources are available (within the Forensim package) from the R Forge collaborative platform, which offers software versioning, and code checks. This ensures that all changes made to the program are recorded and documented via a revision control system. The changes logs and all previous versions of the package can be downloaded from <https://rforge.r-project.org/projects/forensim/>.
- c) Provide a *standard set* of example data to create a ‘test set’ that can be universally applied to any model (see [supplementary files](#)).
- d) In addition we provide a method to enable comparative studies to be carried out across divergent methods of analysis, based on non contributor tests.

In order to provide a basis for comparison studies to be made, thereby assisting the validation process, we provide a full analysis of three cases. By making available all of the data files we make available the ‘specific model’ parameters that can be used by other model builders.

We encourage others to add to the standard set of data in order to facilitate the validation process (by means of comparative studies). These data sets will be hosted on Forensim’s website at <http://forensim.rforge.r-project.org/>.

There is no standard way to carry out the process of validation, but it typically employs testing a ‘probabilistic model’ a number of times under a diversity of conditions that are relevant to the intended application. The validation aims at demonstrating that the model meets some specified performance standard(s) under the specified conditions. Different validation criteria could be used, such as the consistency of the generated LR with other models, the behaviour of the model when the parameters of dropout or drop in are unrealistic, or when the profiles of the hypothesised contributors are not related to the case. A validation schema is listed in points (a–c) below, paraphrased from Rykiel et al. [35], and (d) is an additional suggestion specific for our area:

- a) *Face validity*: Is the model output and its behaviour reasonable?
- b) *Comparison to other models*: see an example in Haned et al. [1].
- c) *Sensitivity analysis and Extreme condition testing*: The model output should reflect extreme events e.g. when $\Pr(D)$ is set to

zero and the profile has evidence of dropout then the LR should be very low.

- d) *Non contributor performance tests*: If the *contributor of interest*, e.g. the suspect is replaced by simulated random man in the specific model, then the resulting LR distribution should be distinguished from the LR observed when the *contributor of interest* is analysed.

The algorithm used in the LRmix module was extensively checked using a fixed set of published examples [6,31,33]. Comparisons [1] were also carried out using the 'likeLTD' program available from David Balding [36].

In this paper we prioritise the assessment of the behaviour of the model when non contributors are hypothesised as possible donors under H_p and H_d . We use this as our *principle of validation* by *evaluating* the observed likelihood ratio using performance tests where the suspect or the *profile of interest* is substituted with random man in the context of the 'specific model'.

The performance tests described in Section 6 are used to accommodate our validation requirement. These tests are used to *evaluate* the LR and provide an important indication that the reported statistic has meaning on a per case basis. Indeed, the argument can be taken further since there is no reason why the performance test itself could not be used *instead* of the LR statistic. But this debate is reserved for future work.

Consider the advice of Rykiel [35]:

"...a model is declared validated within a specific context which is an integral part of the certification. If the context changes, the model must be re validated; however, that does not invalidate the model for the context in which it was originally validated"

Whereas performance testing is typically carried out using generalised case examples to test the model across the entire range of scenarios, we argue that generalisation across the entire possible range of casework examples that may be encountered is unrealistic to achieve. Therefore the development of case specific performance measures is needed to evaluate a likelihood ratio.

9.2. The need for standard models

There is a need for 'standard models' that are used by the forensic community. This need has been expressed, for instance, by 'Euroforgen' which is an EU funded Network of Excellence¹ The purpose of a 'standard model' is to act as a benchmark against which other models can be compared so that it can be demonstrated whether an improvement has resulted (or not). This will facilitate the introduction of new improvements by providing a benchmark against which all other probabilistic models may be compared.

There are a number of requirements for a 'standard model' as follows:

- The theoretical foundation must be transparent and must have precedence and force within the international community. The primary purpose is to provide an 'anchor method' that will enable other methods to be compared against note that the model used here follows the recommendations of the ISFG DNA commission [3,10].
- It must be open source or freely accessible so that its use is unrestricted. It is recognised that some programs will become

freely available, yet the source code may be protected because of legal reasons, or other 'policy' decisions.

- To provide a benchmark, a standard set of data is required that are available for testing using other models.
- A methodology is required to demonstrate how comparisons can be carried out before within and between probabilistic and specific models.
- A 'basic model' operating with minimal assumptions is desirable so that the effectiveness of models that take into account additional parameters may be objectively measured. A 'basic model' is ideally positioned to become a 'standard model'.
- There is scope for a 'standard model' to evolve if it can be demonstrated that improvements have substantial benefit to measure strength of evidence so that new 'standard models', with demonstrable improvements, may proliferate over time.
- There should be a concurrent evaluation on the limitations inherent within any 'specific model' (here we have illustrated this primarily with *non contributor* tests).

This currently means that the 'standard model' concept, as supported by the above mentioned Euroforgen network, introduced here is the same as the 'basic model' in our rationale. It provides a starting point whereby all other models may be compared and evaluated thereby facilitating the introduction of new (improved) methods into courts.

9.3. Specifications and model limitations

Validation is usually carried out relative to some specification in order to determine whether the validation has succeeded. Whereas a specification is easily generated for a reagent (e.g. where purity is measured in terms of parts per million of some contaminating substance) a specification for a complex computer program is not as easily described.

Our solution is to provide a method to evaluate a likelihood ratio result. The model is characterised by random man simulation and the LR is evaluated by the 99 percentile (N_p) of the distribution. The discriminatory metric is used to measure the difference between the two LR estimates. This metric enables the evaluation of the 'specific model' with respect to how well the person of interest under H_p is distinguished from random man. This also serves the purpose of defining the limitations of the 'specific model' and can also be used to compare different 'probabilistic models'. Therefore, by following this rationale, improvements to the 'basic model' are readily measured.

Note we do not consider relatedness issues here, e.g. propositions where the perpetrator is considered as a brother of a suspect (so this is a current limitation of the model).

10. Conclusion

In this paper we explore the analysis of complex propositions. In casework, the precise propositions to analyse are often unclear. Concurrent examination of an epg and the reference samples will usually give a primary indication of the numbers of contributors to incorporate into an analysis, but this is always a minimum number of contributors. Note that this step is a departure from the Clayton guideline [9] that recommends consecutive examination of epg and reference samples our approach is unbiased and unaffected by concurrent examination.

It is clear that complex propositions give no indication about the weighting of evidence provided by individual contributors. Indeed it is possible that one or more may have no probative value at all a log(negative) value reduces the overall LR, but the evidence still strongly favours H_p . Simplifying propositions, along

¹ Euroforgen is an EU funded network of excellence that supports open source initiatives to interpret DNA profiles Euroforgen is an EU funded network of excellence that supports open source initiatives to interpret DNA profiles <http://www.euroforgen.eu/>.

with evaluation with performance tests is the preferred way to report LR's calculated from complex propositions.

An advantage of the LRmix model is that there is no requirement for the known contributor and the crime stain to have (any) matching alleles. Under these circumstances the calculated likelihood ratio is always less than one, favouring the defence hypothesis of 'exclusion'. Another advantage is that the calculations of strength of evidence are hugely simplified, and the removal of subjectivity means that much greater consistency of reports should be achieved. The emphasis is firmly shifted towards the formulation and appraisal of propositions used to calculate the LR. To do this requires lawyer and court participation. The scientist acts to facilitate the 'discussion' in court. It is recognised that court jurisdictions vary widely across the world and it is difficult to generalise exactly how this 'discussion' would proceed. Within the UK, joint 'pre trial' review of the evidence by scientists working for the defence and the prosecution is strongly encouraged and provided that the experts were both proficient in the methodology, this would appear to be an ideal way to introduce this kind of evidence into court.

Finally we have discussed the difficult issues relating to validation. LRmix has been formally adopted by EuroforGen (Network of Excellence) as a 'standard basic model' in order to take advantage of the open source aspects that are inherent. Performance tests are introduced that can be used to measure the effectiveness of case specific models and can also be used to cross compare with other probabilistic models. We also provide a set of examples that can be used to act as benchmark standards.

Conflict of interest statement

None declared.

Acknowledgements

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.fsigen.2012.11.002>.

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RE: Fordham Article

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Isenberg, Alice R. (LD) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; "Hunt, Ted (ODAG)" <(b) (6)> (b)(6), (b)(7)(C)
(LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Date: Wed, 17 Jan 2018 09:37:28 -0500
Attachment Hunt Comment Fordham Law Review article Lab Div 01162018 doc (37 69 kB)

Hi Alice,

One tiny edit from Ted as to (b) (5). See if you think this is okay and if so, once we get the all clear from your leadership, please send (b) (5) incorporates the change for me to send to Rob Hur (I am happy to make the change my elf but want to avoid confu ion a to who ha the pen)

-K

From: Isenberg, Alice R. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI]
Sent: Friday, January 12, 2018
To: Antell, Kira M. (OLP) <(b) (6)> (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; Hunt, Ted (ODAG) <(b) (6)> (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)
Subject: RE: Fordham Article

Kira,
We have made all of the edits, flagging two of them for another review at DOJ. I assume you will forward this to ODAG as you did Ted's and Andrew's articles for another round of review? We have sent this to my EAD for final approval and gave him a deadline of Jan 19. I don't anticipate any problems there. I am also requesting a publication number and will need to add a caveat statement with that number when we get to final formatting. Is there anything else I need to do on this tasking to get it ready to cross the finish line?
Thanks for all of your assistance on this!
Alice

From: Antell, Kira M. (OLP) (b) (6)
Sent: Monday, January 08, 2018 11:10 AM
To: Isenberg, Alice R. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; Hunt, Ted (ODAG) (JMD) <(b) (6)>
Subject: Article

Hi Alice,

Attached are suggested edits to the FBI lab's article. We'd be happy to talk these through and explain any suggestions.
Thanks,
Kira

Kira Antell
Senior Counsel
Office of Legal Policy
U.S. Department of Justice
950 Pennsylvania Avenue, NW
Washington, DC 20530

(b) (6)
(b) (6)

Fordham Law Review Articles (2 of 3 articles attached)

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Hur, Robert (ODAG)" <(b) (6)>
Cc: "Hunt, Ted (ODAG)" <(b) (6)> "Goldsmith, Andrew (ODAG)" <(b) (6)> "Shapiro, Elizabeth (CIV)" <(b) (6)>
Date: Fri, 19 Jan 2018 17:04:26 -0500
Attachment ADG Article_01192018_DISTRIBUTED.doc (57.12 kB); FBI Lab Article_01192018_DISTRIBUTED.docx (34.65 kB)

Hi Rob,

As you know, Department speakers at the Boston College forensic evidence symposium were invited to provide articles to the Fordham Law Review Online. **IN order to ensure inclusion in the March edition, we need to transmit Department approved articles to Fordham NLT Monday, January 29.** I am attaching articles by Andrew and Alice Isenberg (FBI-Lab) for your review. Ted is revising his article and I will send it by separate cover on Monday (January 22)

Andrew's article is quite similar to his approved statements from the symposium but provides more in depth legal argument. Ted's article is a direct written response to the PCAST report drawn from previous public remarks but it is more granular than previously provided statements. The draft articles by Andrew and Ted were circulated last week to a small group of reviewers from CRM, CRM-Appellate, EOUSA, individuals at CrCWG, Cynthia Young and Zach Hafer at USAO-MA, and Betsy Shapiro. None of the reviewers had any concerns with the positions taken by Andrew or Ted but several provided thoughtful comments which were largely incorporated. The draft article by Alice has been reviewed by FBI Lab, FBI OGC, and Ted.

Andrew and I have also reached out to Cindy Shaw for ethics review prior to submission to Fordham.

The authors are available to discuss the articles and I am available to discuss the review process if it would be helpful. I look forward to hearing your thoughts. If at all possible, I'd like to receive your edits by next Friday (January 26). Don't hesitate to call or email.

Thank you,
Kira

Kira Antell
Senior Counsel
Office of Legal Policy
U.S. Department of Justice
950 Pennsylvania Avenue, NW
Washington, DC 20530

(b) (6)
(b) (6)

RE: Fordham Law Review Articles (2 of 3 articles attached)

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Hur, Robert (ODAG)" <(b) (6)>
Cc: "Hunt, Ted (ODAG)" <(b) (6)> "Goldsmith, Andrew (ODAG)" <(b) (6)>
"Shapiro, Elizabeth (CIV)" <(b) (6)>
Date: Mon, 22 Jan 2018 11:32:03 -0500
Attachment Hunt Fordham Law Review Article DISTRIBUTED doc (58.85 kB)

Hi Rob,

Attached is Ted's article. Hopefully the furlough will be short but in I have contacted Fordham to let them know our articles could be slightly delayed.

Thanks,
Kira

Duplicative Material



A new methodological framework to interpret complex DNA profiles using likelihood ratios

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ABSTRACT

Although likelihood ratio (LR) based methods to analyse complex mixtures of two or more individuals, that exhibit the twin phenomena of *drop out* and *drop in* has been in the public domain for more than a decade, progress towards widespread implementation in to casework has been slow. The aim of this paper is to establish a LR based framework using principles of the *basic model* recommended by the ISFG DNA commission. We use the tools in the form of open source software (LRmix) in the Forensim package for the R software. A generalised set of guidelines has been prepared that can be used to evaluate any complex mixture. In addition, a validation framework has been proposed in order to evaluate LRs that are generated on a case specific basis. This process is facilitated by replacing the reference profile of interest (typically the suspect's profile) with simulated random man using Monte Carlo simulations and comparing the resulting distributions with the estimated LR. Validation is best carried out by comparison with a standard. Because LRMix is open source we proposed that it is ideally positioned to be adopted as a standard basic model for complex DNA profile tests. This should not be confused with 'the best model' since it is clear that improvements could be made over time. Nevertheless, it is highly desirable to have a methodology in place that can show whether an improvement has been achieved should additional parameters, such as allele peak heights, are incorporated into the model. To facilitate comparative studies, we provide all of the necessary data for three test examples, presented as standard tests that can be utilised to carry out comparative studies. We envisage that the resource of standard test examples will be expanded over coming years so that a range of different case types that are included will be used in order to improve the efficacy of models; to understand their advantages; conversely, to understand any limitations and to provide training material.

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1. Introduction

In this paper we illustrate the application of exploratory data analysis using likelihood ratios (theory outlined by Haned et al. [1]), applied to the interpretation of complex DNA profiles. An important principle of the methodology is that the incorporation of the twin effects of *drop out* and *drop in* [2] into the interpretation strategy [3] enables a meaningful comparison to be made between any crime stain and any reference sample. This is possible because there is no longer any requirement to think in terms of 'match' or 'non match' [4]. A traditional analysis is a two step consecutive process: a) Is there a match? b) What is the strength of evidence if there is a match? A numeric strength of evidence is usually formulated to support a prosecution hypothesis ($LR > 1$) and this is

a weakness of the traditional approach. However, by using a suitable model that by passes the requirement to decide a definitive 'match' based on subjective criteria, there is no reason why the strength of evidence cannot also be calculated in favour of the defence hypothesis ($LR < 1$). Subjective assessments of cases are therefore avoided because the statistical model employed [5,6] is able to simultaneously measure strength of evidence that could favour the defence hypothesis, as well as the prosecution hypothesis.

In the past, mixture interpretation has been difficult to standardise. Different laboratories follow different mixture interpretation guidelines [7,8] and the diversity of casework and associated propositions encountered renders the generalisations of such guidelines difficult. It is therefore desirable to develop an interpretation framework that not only facilitates associating a weight to any type of DNA evidence, but also provides a way of testing the reliability of the obtained results. Haned et al. [1] have developed an exploratory approach, anchored in a likelihood ratio framework, which addresses these two requirements. Relying on

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their approach, the key features of the proposed framework are summarised as follows:

- a) There is no requirement to make an assessment about *whether* an analysis should be carried out based on subjective criteria to decide a 'match' or 'non match' with a reference sample. There is no inherent restriction on comparing any crime stain(s) with any reference sample.
- b) Because the analysis of crime and reference samples is concurrent, the Clayton recommendation [9] that consecutive examination of reference samples at the end of the interpretation process, is no longer a requirement.
- c) There is no need to filter any of the allelic peaks within our framework apart from selecting all alleles that are above the limit of detection threshold (LDT). If ambiguous allelic peaks are present (stutters) then they are incorporated directly into the analysis.
- d) The shift of focus is firmly towards the formulation of propositions (hypotheses provided by the defence and prosecution). Because propositions can only be described in pairs, it may not be obvious which to consider, especially with low template DNA analysis with no identifiable body fluid. To facilitate, we provide guidance to estimate the minimum number of contributors.
- e) The interpretation process is regarded as exploratory since the results can be conditioned on different circumstances that are considered to be relevant to the case.
- f) Performance testing is built into the interpretation process and is used to *evaluate* reported likelihood ratios; acting as a component of *validation* (we discuss this concept in detail in Section 9.1). It is proposed that the LRmix module fulfils the requirements to act as a *standard*. Consequently, it can be used to determine whether alternatives (or changes to existing models) result in improved performance.

To illustrate the principles, we evaluate three different cases in order to explore the effect of conditioning, and to demonstrate the importance of simplifying the hypotheses used to describe the circumstances of a case. These cases are also submitted as a set of standard test examples (see [electronic supplement](#)) that can be utilised as a resource for others to carry out comparative tests with other models, or model improvements, thereby fulfilling an important requirement for validation exercises.

2. Characterisation of low template DNA profiles

There has been recent debate about the characterisation of a low template DNA, but the position is now summarised by a recent ISFG DNA commission [10].

LT DNA profiles usually exhibit some degree of allele *drop out*. DNA profiles can be characterised and classified as LT DNA vs. standard DNA profiles by comparison of peak heights to a stochastic threshold (T), determined by logistic regression [11,12]. The threshold measures the *risk* of allelic dropout if allele peak heights are between the lower limit of detection threshold (LDT) and the stochastic threshold (T). In addition, allele *drop in* may be observed its frequency tends to increase with higher sensitivity of detection (e.g. elevated cycle number; increased injection time). Degradation can also affect a DNA profile so that it appears standard at low molecular weight loci, and low template at high molecular weight loci [13]. Alternatively, *differential degradation* may occur where the relative amounts of degradation vary per contributor and this in turn affects the mixture proportion (M_x) [14,15] across the DNA profile.

If all contributors are within the low template range then the relationship between the DNA quantity allelic peak heights tends

towards a uniform distribution, so that heterozygotes become increasingly unbalanced. These stochastic effects are predictable however, and computer simulations [16,17] have demonstrated a sound theoretical basis to explain heterozygote balance and allele drop out relative to DNA quantity.

2.1. Analysis of LT DNA profiles

Historically, LT DNA profiles were first interpreted using the consensus profile method [2] where only alleles observed in two or more replicate profiles were reported; a variation of the method was described by Benschop et al. [18–20]. In addition, composite profiles are sometimes reported: here profiles are combined in their entirety to form a single combined genotype the robustness of this strategy was investigated by Bright et al. [17]. Consequently, several methods are in current use to interpret LT DNA profiles. None is ideal because not all of the information in the DNA profile is utilised. It is not possible to incorporate the allele *drop out* and *drop in* phenomena in probabilistic terms. This may lead to anti conservativeness [21] and readers are referred to the ISFG DNA commission paper [10] for further clarification of the arguments. Therefore, there are strong reasons in favour of the introduction of 'new' probabilistic approaches, since all of the information in replicate profiles is analysed without the need to construct a consensus or composite profile [1,4]. The incorporation of *drop in* and *drop out* into the model fulfils the criteria suggested by the ISFG DNA commission [10], greatly reducing anti conservative risks since LRs < 1 can be assigned to loci. Whereas the complexity of applying consensus and composite methods restricted their use to profiles categorised as non mixtures and simple mixtures, probabilistic methods are not restricted by the number of replicates, or the number of contributors. This leads to the necessity to move the focus of the discussion to the formulation of propositions.

3. DNA profiling evidence, transfer and propositions

The interpretation of all DNA profiling evidence has to be considered in the context of the case circumstances. Increased sensitivity of detection quite often means that there is no body fluid or cell type that can be associated with the DNA profile if the profiling evidence has been recovered from a touched surface. When this occurs it seems to be common practice to attribute the profile to epithelial cells (but there is usually no direct evidence for this assumption). It is never implicit that the recovery of a DNA profile is associated with a crime event [22], and alternative methods of DNA transfer must always be a consideration when hypotheses are formulated, especially when LT DNA is analysed.

It can be generalised that contributors to a DNA profile will always comprise *known* individuals (victim(s), suspect(s) and witnesses) and zero or more *unknown* individual(s). When a profile consists of DNA from several contributors, it cannot be assumed that each was deposited concurrently on a surface (e.g. weapon). It is inevitable that depositions will be made before, during and/or after a crime event the reader is referred to [23] for an outline of these principles.

The number of contributors is itself often uncertain unknown individuals are more common in LT DNA profiles and the 'masking effect', where alleles are shared between different contributors [24], complicates the assessment. The more contributors there are, the more likely it is that the total will be underestimated. Maximum likelihood principles [19,25,26], can assist reporting officers in deriving the most plausible number of contributors that can explain the observed epgs. Additional tests, such as Y chromosome analysis, are often useful to determine the number of male contributors. Therefore the elucidation of the absolute

number of contributors is never precise. Nevertheless, it is usually valid to determine the *minimum number of contributors* and this is usually sufficient – see ISFG DNA commission [3]. To summarise, each case is considered on its own merits, and propositions based on the minimum number of contributors can be informed from a variety of sources.

4. An outline of models used to interpret ‘complex DNA profiles’

A ‘complex DNA profile’ is any profile that is, or may be, subject to allele *drop out* and/or allele *drop in*. Mixtures are usual and within our definition a model should be capable to analyse mixtures and replicate samples. A number of different LR based models have been described to interpret ‘complex DNA profiles’ [5,6,27–30]. They are traditionally classified into two categories based on the type of information they take into account: the so called continuous models [29,30] incorporate peak heights as continuous variables, and therefore account for both the qualitative and quantitative data provided by the epgs. Qualitative models only make use of the list of alleles observed in the epg. Continuous models are expected to extract more information from the available data than qualitative models, however, they rely on distributional assumptions of the signal intensities (peak heights), which makes their implementation in casework difficult. On the other hand, qualitative models are easier to implement as they rely on fewer assumptions. Because they are based on different assumptions, it is expected that different models will produce different LRs for a given case, for a given set of propositions. Comparative studies will be of interest in (near) future work to establish the relative performance of these different models. The qualitative model described here was first introduced by Curran et al. [5] and later extended by Haned et al. [1,31]. This model, freely available in the LRmix module of the Forensim package [31,32], facilitates the calculation of likelihood ratios for complex mixtures, i.e. LT DNA (partial) profiles with two or more known and unknown contributors. The model incorporates the probabilities of *drop out* and *drop in* into the LR calculation in order to account for the uncertainty about the composition of the crime sample. For a given set of propositions, the model yields a sensitivity analysis of the LR, where *drop out* and *drop in* probabilities are varied within their plausible ranges. The final output of LRmix, is a lower bound of the LR, corresponding to the most plausible values of *drop out* and *drop in* probabilities [1].

In the following section we describe performance tests that could in principle be used to facilitate comparative studies *between* different interpretation methods. Here they are used primarily to determine the *within* model performance on a case specific basis.

5. An outline of the interpretation process

1) Evidence is considered under two alternative propositions within the classical likelihood ratio (LR) framework.

$$LR = \frac{Pr(E|H_p)}{Pr(E|H_d)}$$

where E is the evidence; H_p is the prosecution hypothesis and H_d is the defence hypothesis.

2) There are two classes of conditional types:

- a) *Conditioning a known individual under H_d* : This is typically victim focussed – e.g. a swab may be taken from a victim and it is reasonable to condition H_d on the victim’s DNA profile. Sometimes H_d is suspect conditioned – e.g. a penile swab may be taken to search for victim’s DNA, so the purpose of the test under H_p would be to identify the victim’s DNA profile.

- b) *No known individuals conditioned under H_d* : e.g. a weapon has been used and removed either from the crime scene or remote from the crime scene – is the victim’s DNA profile recovered from the weapon? Is the suspect’s profile recovered?

- 3) *The minimum number of contributors*: is determined under H_p by counting all of the unique alleles in the crime stain profile and the set of ‘known’ individuals and dividing the total by two.
- 4) Typical hypotheses incorporate one or more suspects (S_n) under H_p (where $n = 1..y$ where y is the total number of suspects). However, the questioned profile e.g. S_1 is always replaced by an unknown individual (U) under the H_d propositions. We use a short hand to describe the propositions per H_p , H_d hypothesis. For example $H_p = V, S_1, U$ means that a victim, suspect 1 and unknown persons are incorporated into the LR analysis under H_p and $H_d = U, U, U$ means that three unknown individuals are incorporated into the LR analysis under H_d .
- 5) Within the framework described, for convenience, evidence may be considered *inclusionary* if the $LR > 1$ and *exclusionary* if $LR < 1$, without any formal requirement to decide a ‘match’ or ‘non match’.
- 6) It is convenient to consider $\log_{10}(LR)$ throughout.
- 7) A step wise approach is introduced in order to formalise the interpretation process.

6. Model validation and the use of performance tests

6.1. Model definition

We distinguish between the ‘probabilistic model’ and the ‘specific model’ where the former is the algorithm, comprising generalised assumptions and the theory that is *hard coded*. On the other hand, the ‘specific model’ refers to the parameters that are used to inform the ‘probabilistic model’. These are case specific. In the LRmix ‘specific model’ the parameters are as follows:

- a) The set of propositions to be evaluated under H_p and H_d defined as:
 - I) number of contributors;
 - II) number of known and unknown individuals.
- b) The genotype(s) of the known individuals.
- c) The genotype(s) of the crime stain.
- d) Probability of *drop in*.
- e) Probability of *drop out*.
- f) Some value of F_{st} or θ (optional).
- g) A size bias correction (optional).
- h) Frequencies from a population database.

We now describe a method to measure the performance of the ‘specific model’ by applying random man non contributor tests as follows.

6.2. Non contributor performance tests

Non contributor performance (N_p) tests are introduced here to assess the performance of a model relative to the specific conditional constraints that form the basis of the analysis [33]. The method is illustrated by cross reference to case example 2 (Section 7.2). Consider a pair of propositions: that consider $H_p =$ suspect (S) and victim (V) have contributed to the sample; and $H_d =$ an unknown person (U) and a victim (V) have contributed to the sample. The rationale behind the performance tests is to evaluate the output of the model: i.e. the LRs obtained by LRmix when the suspect profile is replaced by the profile of a random man. If the model works efficiently we expect that the LRs would

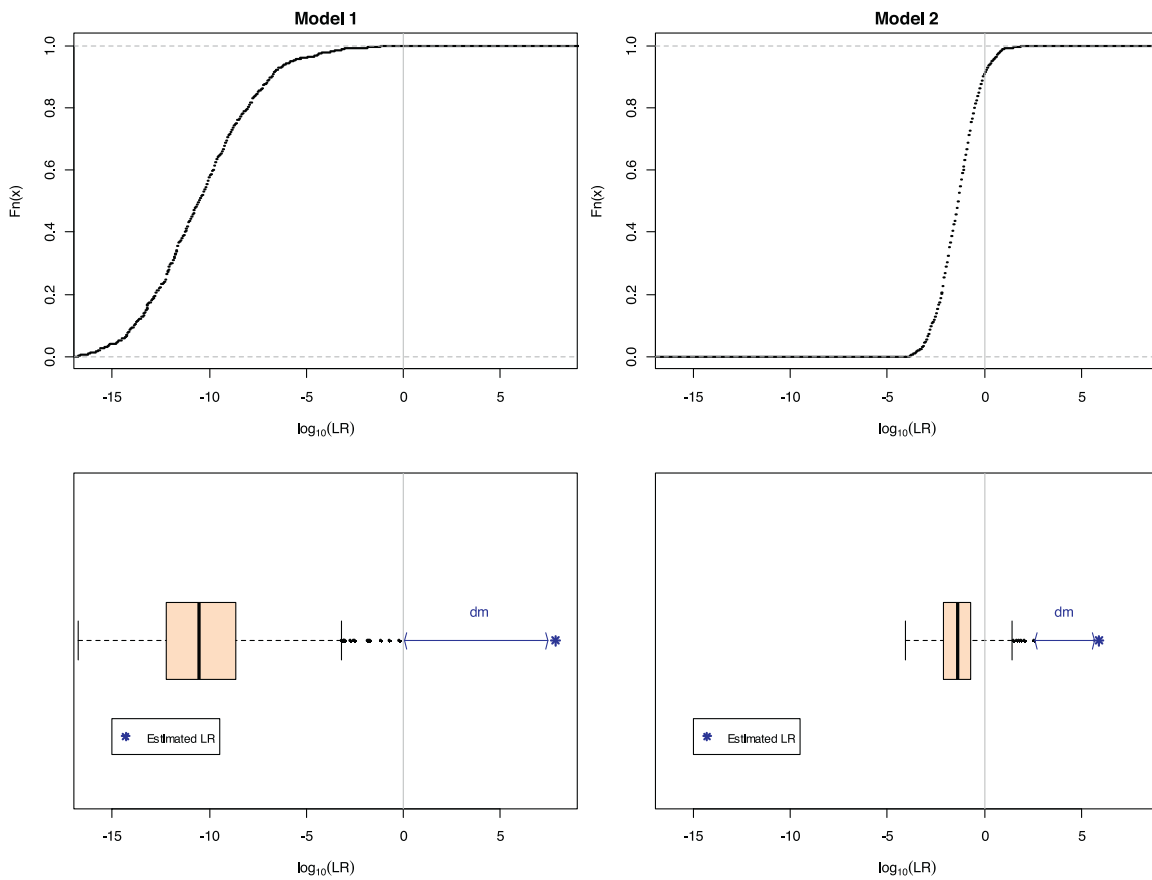


Fig. 1. Analysis of two LR hypotheses based on two person (Model 1) and three person (Model 2) propositions from case example 2 (Section 7.2). The empirical cumulative distribution functions are shown and the data are summarised in boxplots where the relative performance of the models can be defined by the discriminatory metric (*dm*). A proportion of LRs > log₁₀(0) are inclusionary in the three person model, and *dm* is also lower compared to the two person model (hence its power to discriminate is not as great).

be very small, $\ll 1$ if '*H_d*' is true'. The random man substitution simulates '*H_d*' is true', hence the frequency of inclusionary LRs > 1 can be used as an estimate of the false positive error rate determined from the cumulative density function (cdf) distribution of LRs > 1 (Fig. 1). This distribution can be used to define the performance of the specific model used.

Repeating the substitution procedure *n* times, yields a distribution of LRs of the aforementioned propositions, where the suspect profile has been replaced by a random profile, simulated by sampling the alleles at their respective frequencies in the population of interest. In this study, we take *n* = 1000 random profiles, and for each simulation, suspect *S* is substituted by the simulated profile, and a likelihood ratio calculated.

The LR result is evaluated by 1000 log₁₀(LR) taking the 1 percentile, 50 percentile and 99 percentile and representing these as a series of parameters in parentheses: (*Np*₁, *Np*₅₀, *Np*₉₉). For example, log₁₀(LR) = 5.98 (6, 3, +1) is short hand for log₁₀(LR) = 5.98 followed by log₁₀(*Np*₁) = 6; log₁₀(*Np*₅₀) = 3; log₁₀(*Np*₉₉) = +1. The plus sign is included for emphasis.

In Fig. 1, two sets of propositions are evaluated using the same probabilistic model. The propositions are either two persons or three persons respectively. The formally reported log₁₀LRs are 5.98 (6, 3, +1) and 8.04 (17, 9, 5) respectively. We introduce a discriminatory metric (*dm*) parameter to compare the *Np*₉₉ percentile with the estimated LR:

$$\log_{10}(dm) \leftarrow \log_{10}(\text{LR})_{\text{estimated}} - \log_{10}(Np_{99}).$$

Np distributions do not have tails that coincide with LR = 1 (the traditional inclusionary/exclusionary boundary). It certainly does

not follow that the best 'probabilistic' or 'specific model' is one that results in the highest LR. Neither does it follow that the greatest *dm* is the best supported model. The first step is for the court to decide the 'preferred model(s)'. The second step is to use *dm* to evaluate the likelihood ratio(s) to ensure that the reported LRs are meaningful – the purpose of the scientist is to guide and to facilitate the debate, without bias – in principle there is no limit to the number of pairs of propositions that may be evaluated and it is always better to be 'inclusive' rather than 'exclusive'.

The *dm* parameter is a useful evaluative indicator of the performance characteristics of any model – apart from choice of propositions, the court will wish to be assured that the model is capable to discriminate between random man and an alleged perpetrator – and this is its prime purpose.

To summarise: because performance tests are applied to the model on a *per case* basis, this also acts as an important component of 'specific model' evaluation, since a risk analysis that describes the limitations of the model is concurrently provided.

7. Casework examples to illustrate the process

We describe the analysis of three complex cases that are typical of those processed in laboratories. The aim is to outline a generic method to simplify the interpretation process by introducing an exploratory approach that is able to concurrently evaluate the diversity of propositions that is inherent with any casework. To keep things simple, we restrict examples to single tests without replicates, but this expansion is straight forward. Laboratories world wide have different practices to implement theta and size bias corrections – neither are discussed here, although the LRmix

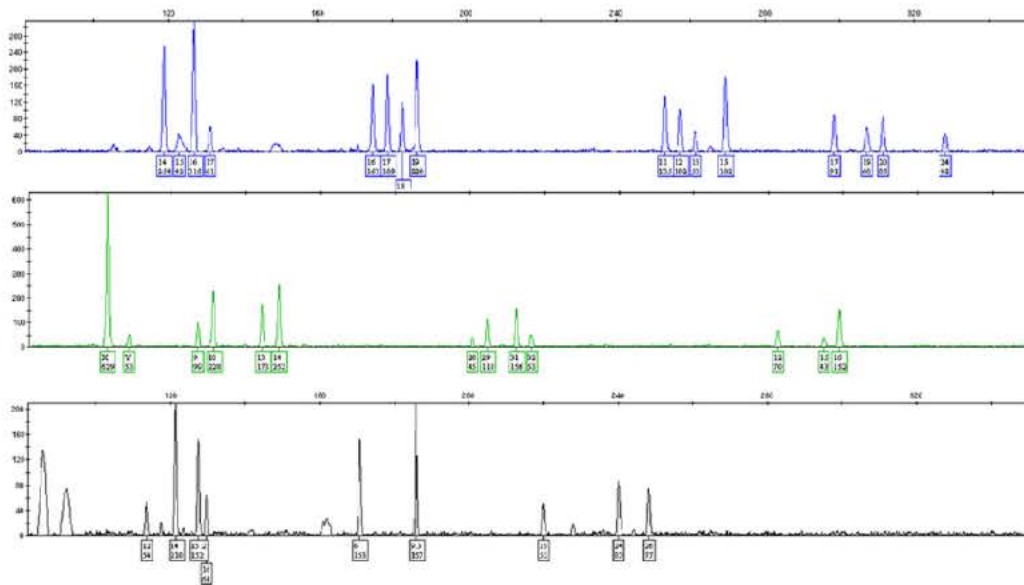


Fig. 2. The first case example epg.

model can accommodate both as required by internal laboratory policy. The Norwegian population database for SGM plus comprises 1000 individuals [34], hence application of a size bias correction has minimal effect. We do not apply theta because the examples provided are intended to be standard examples applied to a 'standard model' and are therefore benchmarks. The purpose of the paper is to provide a framework for the forensic community to carry out collaborative exercises. All examples illustrated were processed with SGM plus and the Norwegian frequency database was used.

7.1. Case 1

7.1.1. Step 1: Describe case circumstances and examine the epg

The crime stain is from an epithelial swab taken from the female victim and the electropherogram (epg) is shown in Fig. 2. There are two suspects accused of sexual assault, S₁ and S₂ respectively; both deny the offence. This epg is classified as a low template of two or more individuals since there are multiple alleles

Table 1

List of alleles with informative formatting and colour coding in order to provide a visual representation of the evidence.

Marker	Crime-stain alleles								Unique alleles
	Allele1	Allele2	Allele3	Allele4	S1	S1	S2	S2	
AMEL	X	Y			X	Y	X	Y	2
D3S1358	14	16	17	(15)	16	17	15	17	4
VWA	16	17	18	19	16	18	18	19	4
D16S539	11	12	13	15	12	13	12	12	4
D2S1338	17	19	20	(24)	19	20	17	18	4
D8S1179	9	10	13	14	9	13	13	13	4
D21S11	29	31	32		28	32	30	30	5
D18S51	12	16	(15)		12	15	12	20	4
D19S433	12	14	15.2	16	12	16	12	15	5
TH01	6	9.3			6	9.3	6	9.3	2
FGA	19	24	26		19	21	20	21	5

Key:

- 1) Alleles that are shared between victim and S₁ or S₂ (green background).
- 2) Alleles that are found in the crime stain and not observed in any known individual (blue background, not applicable in this case).
- 3) Alleles that are below the detection threshold but appear to be distinct (bracketed).
- 4) Alleles that are found in the crime stain that match a known individual under H_d (victim) (red typeface).

per locus that fall within the criterion of the low template zone (between the LDT and the stochastic threshold (T)) we expect dropout may occur, but the profiles appear to be well represented.

7.1.2. Step 2: Record the alleles in the epg and reference samples and carry out case assessment relative to a pair of preliminary propositions

The alleles from the crime stain are recorded in Table 1. This includes all alleles above 50 rfu. Alongside are the reference genotypes from suspects S₁ and S₂. Formatted text and colour coding can be used to provide an informative but simple way to maximise the information about the case (we avoid H_p centred propositions to prevent bias). Note that the wording and choice of categories depend upon the case circumstances. The list of allele categories is as follows:

- 1) Alleles that are shared between known profiled contributors (green background).
- 2) Alleles that are found in the crime stain and not observed in any known individual (blue background).
- 3) Alleles that are below the detection threshold but appear to be distinct (bracketed).
- 4) Alleles that are found in the crime stain that match a known individual under H_d e.g. victim (red typeface).

All of the victim's alleles are present in the crime stain (red type face), except for D2 allele (24) which is less than 50 rfu, so no further representation is needed. The remainder (black type face) represent alleles that are either a) from a suspect under H_p, b) drop in alleles, and c) from an unknown contributor.

Adjacent to the crime stain, there are four columns of data that describe the reference profiles of S₁ and S₂, respectively, if H_p is true. Alleles that are shared between known individuals are highlighted (green).

7.1.3. Step 3: Establish the minimum number of contributors for the 'preliminary' propositions

There is no need within the interpretation framework to be definitive about the number of contributors within the epg. However, it is necessary to determine the minimum number of contributors across the entire set of DNA profiles considered in the evidence profile(s) and the reference samples that form the basis of

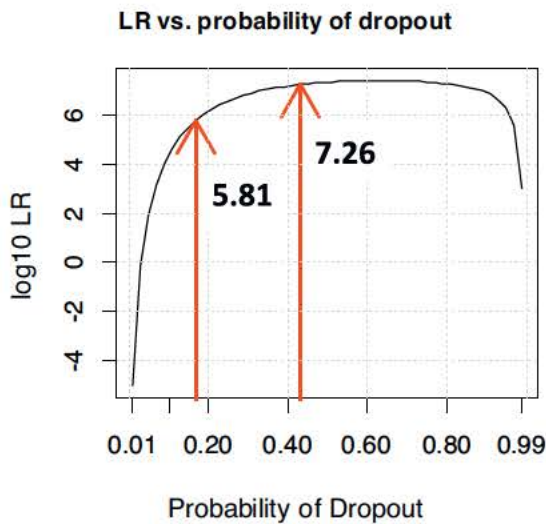


Fig. 3. Sensitivity analysis for the for case example illustrating 5 and 95 percentile dropout range (the lower percentile is reported in this case).

the propositions (which may differ between H_p and H_d). This proceeds as follows:

- a) The swab is from a victim (V). There are two suspects (S_1, S_2) under H_p .
- b) The number of *unique* alleles across the sets C, V, S_1, S_2 is determined (Table 1). The minimum number of contributors from the sets under H_p is simply the (number of *unique* alleles/2) per locus. In this example, some loci have 5 unique alleles across sets hence there is a minimum of three individuals present under H_p .
- c) A similar calculation can be made under H_d where the sets of genotypes formed by S_1, S_2 are not used, but in our rationale, it is convenient to anchor the minimum number of contributors on H_p and to assume equivalence (this is revisited later in the procedure).
- d) Consequently, the preliminary propositions are formulated as $H_p = V, S_1, S_2$ and $H_d = V, U, U$.

7.1.4. Step 4: LRmix analysis

The $\log_{10}(\text{LR}_{\min}) = 5.81$ is derived for a drop out probability $\text{Pr}(D) = 0.17$. This value is in fact the 5 percentile calculated from an empirical distribution of the drop out probability conditioned on the expected number of alleles observed relative to the genotype of the hypothesised contributors, the procedure is described by Haned et al. [1] (Fig. 3).

7.1.5. Step 5: Case re evaluation and simplification of the propositions

The next part of the analysis involves simplifying the propositions. Although a probative LR favouring H_p has resulted from the preliminary analysis, this has incorporated both suspects S_1 and S_2 under H_p . However, the likelihood ratio itself does not provide any indication about the relative *weighting* of the two contributions provided by S_1, S_2 to the actual LR result. Consequently, the next step in the analysis is to *dissect* the propositions into their constituents in order to establish the weighting and to establish the consequent probative value of the evidence per contributor under H_p .

Visual examination of the evidence (Table 2) revealed that S_1 has more matching alleles than S_2 ; furthermore the crime stain could be explained under H_p if it was a simple mixture of V and S_1 (with three *dropped out* alleles). Individual S_2 is not required at all in the analysis, since there are no missing alleles observed in the

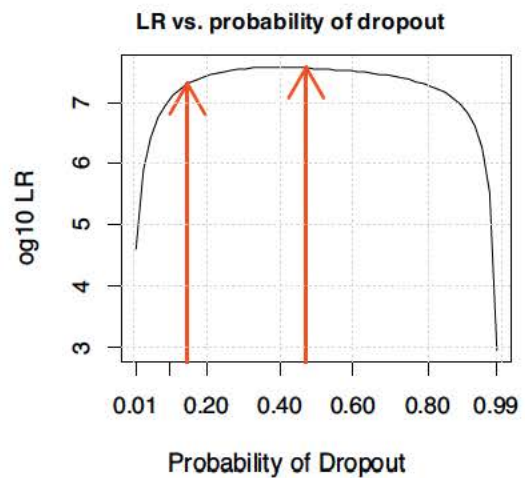


Fig. 4. Sensitivity analysis for next stage of the analysis considering S_1 as the only suspect under H_p .

crime stain ($H_p = V, S_1$). Although the number of unique alleles reduces the number of contributors to two, in order to be consistent, three contributors are evaluated and the propositions are simplified to: $H_p = S_1, V, U$ and $H_d = V, U, U$. (note the LR is much larger if two contributors are analysed under H_p and H_d data not shown, hence the choice of three contributors is demonstrably conservative).

Following this procedure, the new $\log_{10}(\text{LR}_{\min}) = 7.29$; $\text{Pr}(D_{\min}) = 0.15$ (Fig. 4).

Next we carry out a simplification procedure to determine the effect of S_2 on the LR: $H_p = S_2, V, U$; $H_d = V, U, U$. Now the $\log_{10}(\text{LR}_{\min}) = 2.6$, which is clearly 'exclusionary' (Fig. 5).

7.1.6. Step 6: Non contributor performance (Np) tests

Np tests can be used to support the conclusion that evidence supporting S_1 is 'inclusionary' whereas evidence supporting S_2 is 'exclusionary' (Table 3) for complex propositions ($H_p = S_1, S_2, V$), replacing S_2 with random non contributors gave $\log_{10}(Np_{99}) = +8.2$, whereas S_1 replacement gave $\log_{10}(Np_{99}) = 7.0$. This showed that that S_2 could not be distinguished from random man and illustrates the principle that the LR calculated from a complex proposition cannot be used as probative evidence concurrently

Table 2
Re-evaluation of the evidence from Table 1.

Marker	Allele1	Allele2	Allele3	Allele4	S1	S1	No of unique alleles
AMEL	X	Y			X	Y	2
D3S1358	14	16	17	(15)	16	17	3
VWA	16	17	18	19	16	18	4
D16S539	11	12	13	15	12	13	4
D2S1338	17	19	20	(24)	19	20	4
D8S1179	9	10	13	14	9	13	4
D21S11	29	31	32		28	32	4
D18S51	12	16	(15)		12	15	3
D19S433	12	14	15.2	16	12	16	4
TH01	6	9.3			6	9.3	2
FGA	19	24	26		19	21	4

See Table 1 for the legend key.

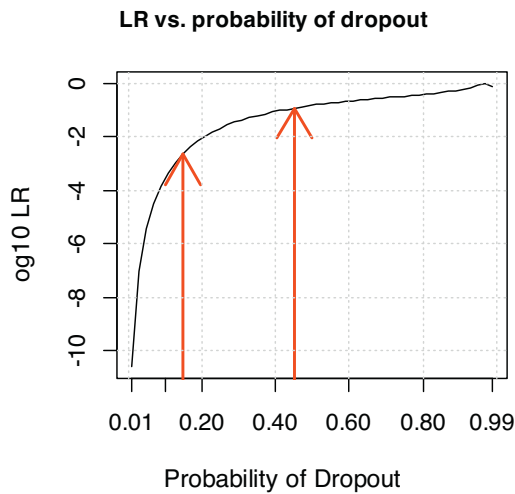


Fig. 5. Sensitivity test considering S_2 as the only suspect under H_p .

against all hypothesised contributors under H_p . The individual effects must be explored by simplifying the propositions as described. Table 3 summarises the analysis.

7.1.7. Step 7: Tabulate the results of the analysis

Note that a potential alternative to measure the strength of the evidence is to determine the discriminating metric $\log_{10}(dm) = \log_{10}(LR) - \log_{10}(Np_{99})$. Non contributor performance distributions do not have tails that coincide with $LR = 1$. It certainly does not follow that the best ‘specific model’ is one that results in the highest LR. The performance of the model is measured by the discriminating metric but this parameter cannot be used to inform the best choice of model since this decision is separate and a function of the court i.e. the circumstances of the case dictate the choices of model(s) to test, not the statistical analysis.

7.2. Case example 2 An example with five suspects

7.2.1. Step 1: Describe case circumstances and examine the epg

In this example the victim was murdered in an affray and there are five suspects that are apprehended. All deny the offence and all deny being present at the crime scene. An epithelial sample is taken from the ankle of the victim and reference samples are

Table 3

Summary of results from interrogation of relevant sets of propositions.

H_p	Three person mixture			Non-contributor performance Percentiles
	H_d	Random man substituted	$\log_{10}(LR)$	
S_1, S_2, V	V, U, U	S_1	5.5	(21, 15, 7)
S_1, S_2, V	V, U, U	S_2	5.5	(+0.17, +4.2, +8.2)
S_1, V, U	V, U, U	S_1	7.2	(10, 5, +0.14)
S_2, V, U	V, U, U	S_2	3	(10, 5, +0.14)

Non-contributor performance tests were carried out to determine the $\log_{10}(Np_1, Np_{50}, Np_{99})$ percentiles relative to the random man substitution to carry out the test.

obtained from the 5 suspects. The purpose of the examination is to determine if there is evidence of any of the suspects as contributor(s) to the crime sample. The epg is shown in Fig. 6; the victim’s alleles are denoted by a red asterisk.

7.2.2. Step 2: Tabulate the alleles in the epg and reference samples and carry out case assessment relative to a pair of preliminary propositions

Given that there are five suspects (Table 5), each needs to be considered separately. From examination of the epg at least two contributors can be inferred.

7.2.3. Step 3: Establish the minimum number of contributors for the preliminary propositions

Starting with suspect S_1 , three contributors are indicated from the set of unique alleles from the reference samples and crime sample (Table 4). Therefore under H_p we consider S_n, V, U where $n = 1 \dots 5$ and under H_d we compare V, U, U for all calculations.

7.2.4. Step 4: LRmix analysis

The advantage of the exploratory analysis is that there are no constraints on comparisons that can be made. All suspects can be compared against the crime stain evidence. When this is carried out each gives a very small (‘exclusionary’) LR, except for candidate S_5 where the $LR = 769,600$ (Table 6).

7.2.5. Step 5: Case re evaluation and simplification of the propositions

If S_5 is the contributor, the model can be simplified to a minimum of two contributors ($H_p = S_5, V; H_d = V, U$) and can be re evaluated to provide a $LR = 67$ million. A comparison of sensitivity plots is shown in Fig. 7.

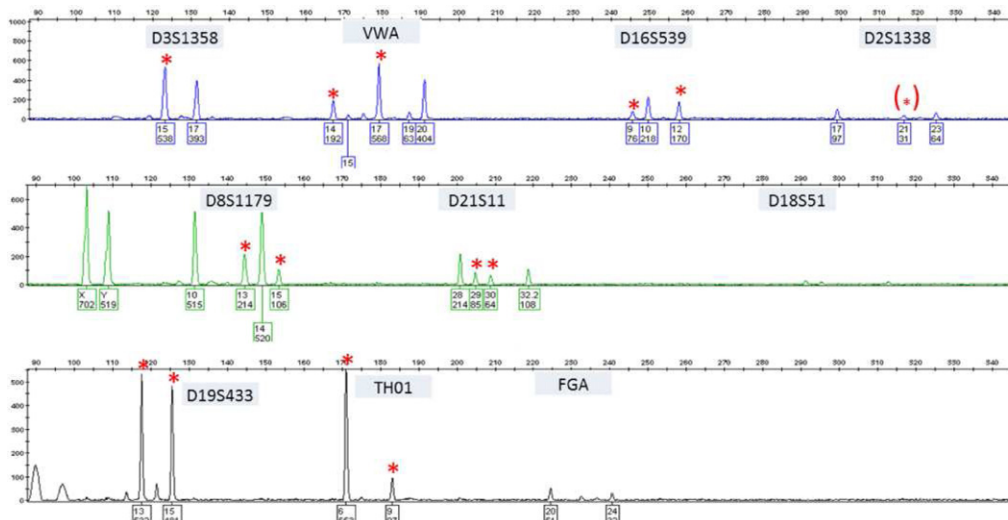


Fig. 6. Case 2 showing the epg. Victim’s alleles are marked with red asterisks.

Table 4
Comparison of a suspect (S_1) and the crime-stain alleles. The victim's alleles are in red type.

Marker	Allele1	Allele2	Allele3	Allele4	Allele5	Victim	Victim	S_1	S_1	No of unique alleles
AMEL	X	Y				X	Y	X	Y	
D3S1358	15	17				15	15	17	18	3
VWA	14	17	19	20	(15)	14	17	16	19	5
D16S539	9	10	12			9	12	10	13	4
D2S1338	17	23				21	22	19	23	5
D8S1179	10	13	14	15		13	15	13	15	4
D21S11	28	29	30	32.2	(21)	29	30	28	30	4
D18S51						15	15	15	15	1
D19S433	13	15				13	15	14	15	3
TH01	6	9				6	9	9	9	2
FGA	20					22	23	21	21	4

See Table 1 for the legend key.

Table 5
A compilation of the five suspects' genotypes.

Marker	S_1	S_1	S_2	S_2	S_3	S_3	S_4	S_4	S_5	S_5
AMEL	X	Y	X	Y	X	X	X	X	X	Y
D3S1358	17	18	15	16	16	18	17	18	15	17
VWA	16	19	16	17	15	18	14	17	17	20
D16S539	10	13	12	12	9	11	9	12	10	12
D2S1338	19	23	18	21	17	19	20	25	17	23
D8S1179	13	15	11	13	10	13	12	13	10	14
D21S11	28	30	30	32.2	28	29	31	31	28	32.2
D18S51	15	15	14	18	14	17	14	15	14	19
D19S433	14	15	14	14	14	16	14	15.2	13	15
TH01	9	9	8	9	7	9	7	7	6	6
FGA	21	21	24	24	22	24	20	20	20	24

7.2.6. Step 6: Non contributor performance tests

The analysis can be formerly presented as +7(16, 10, 3) and +5 (5, 2, +0.8) for two and three person contributors, respectively. Discriminatory metrics are: $\log_{10}(dm) = 10$ for the two persons mixture and $\log_{10}(dm) = 4$ for the three person mixture

7.3. Example 3

7.3.1. Step 1: Describe case circumstances and examine the epg

A victim is stabbed. A knife is recovered away from the crime scene in the suspects flat. The suspect denies involvement. There is a witness (S_1) present in the flat at the time of the incident. The knife is DNA profiled. There is insufficient evidence to assign a body fluid to the DNA profile (no blood is present) hence the contact traces are assumed epithelial cells. Inspection of the epg indicates a minimum of three person mixture (Fig 8).

7.3.2. Tabulate the alleles in the epg and reference samples and carry out case assessment relative to a pair of preliminary propositions

All alleles pertaining to the victim are observed in the crime stain (Table 7). In addition all alleles from known contributors under H_p are observed in the crime stain except for D21S11 (30) in

Table 6
A compilation of LR's substituting each suspect in turn into the LR formula with $\Pr D_{min} = 0.63$.

	S_1	S_2	S_3	S_4	S_5
Crime-stain (LRs)	0.56	0.003	0.004	$8 \times 10e^{-5}$	769,600

S_1 . There is one allele VWA(17) found in the crime stain, not found in any known contributor (potential drop in event under H_p).

7.3.3. Step 3: Establish the minimum number of contributors for the preliminary propositions

In addition to VWA (17), if conditioning on two known contributors V, S_1 ; then there are two alleles in D21S11 and one allele in FGA not explained under H_p . If the contributors are V, S_2 under H_p , then there are two alleles in D21S11, two alleles in D18, and two alleles in FGA not explained under H_p . Alternative propositions may include V, S_n, U where $n = 1$ or 2. The preliminary H_p propositions are that the profile consists of three person mixture, all of whom are known: victim (V); witness (S_1) and the offender (S_2). Because the weapon was recovered remote from the crime scene (premises of S_2 who denied any involvement) then it follows that the propositions under the defence hypothesis are that there is no DNA originating from any known individual at the crime scene, i.e. $H_d = U, U, U$.

7.3.4. Step 4: LRmix analysis

LRmix yields a $\log_{10}(LR) = 15$, which implies very strong evidence to support the former proposition (Fig. 9). It may be tempting for the prosecution to use such an impressive figure in order to mount a prosecution of S_2 (the alleged offender) but we demonstrate below why this is approach would be misleading.

7.3.5. Step 5: Non contributor performance tests (note steps 5 and 6 are reversed compared to previous example)

The proposition S_1, S_2, V can be dissected by applying three non contributor performance tests to each contributor in turn. For the

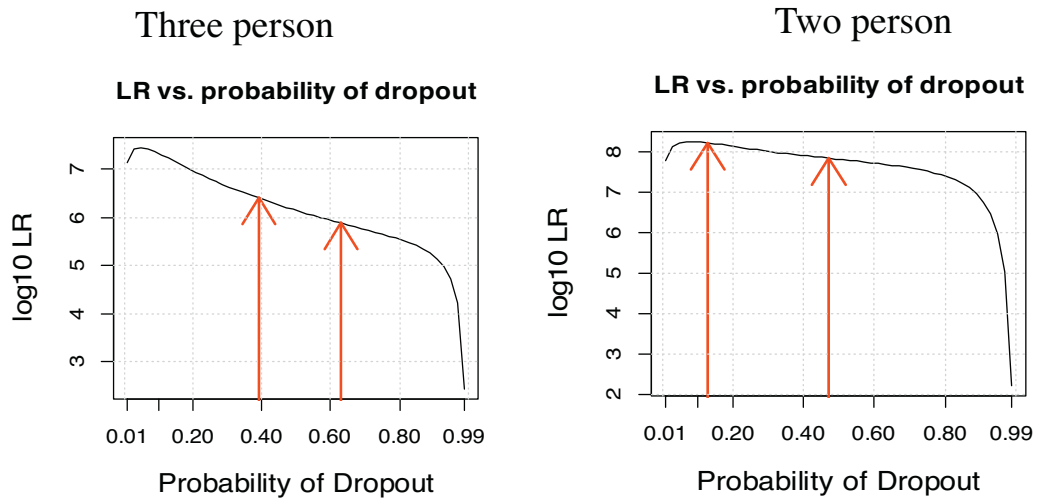


Fig. 7. Comparison of sensitivity plots for S_5 analysis.

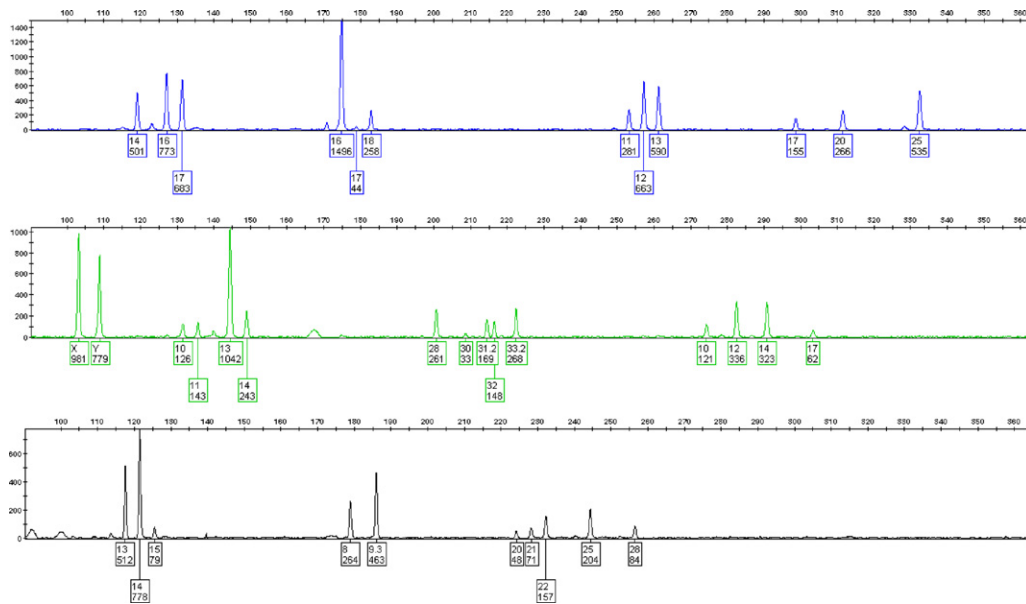


Fig. 8. Case 3 epg.

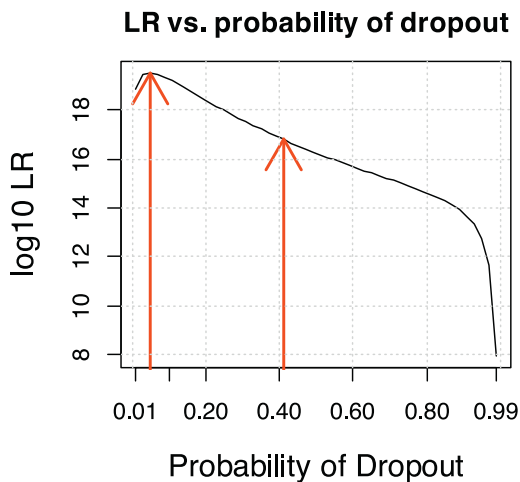


Fig. 9. Sensitivity analysis, Case 3, preliminary propositions tested.

three performance tests replacing S_1 , S_2 and V by a non contributor, the performance statistic was $\log_{10}(Np_{99}) = +8.5, +13.28, +6.62$, respectively. We demonstrate, therefore that substituting random man in the model gives rise to substantial likelihood ratios up to 13 orders of magnitude. However, the total $\log_{10}(LR) = 16.8$. The discriminatory metric, $\log_{10}(LR) - \log_{10}(Np_{99})$ gives: $S_{1dm} = 8.3$, $S_{2dm} = 3.52$ and $V_{dm} = 10.18$. Therefore, the greatest weights contributing to the LR can be ranked from high to low as: V , S_1 and S_2 , respectively.

We can generalise that a large LR does not preclude the presence of a random contributor under H_p since this does not become apparent unless the non contributor performance test is applied.

7.3.6. Step 6: Case re evaluation and simplification of the propositions

We condition on a three person mixture, but simplify the propositions under H_p by substituting known individuals with unknown individuals (Table 8). Under H_p we evaluate S_n, U, U where $n = 1.2$ and finally V in three consecutive calculations where (U, U, U) is included under H_d to provide three separate likelihood

Table 7
Comparison of known individuals (S_1 , S_2) and the crime-stain alleles. The victim's alleles are in red type.

Marker	Allele1	Allele2	Allele3	Allele4	Allele5	Victim	Victim	S_1	S_1	S_2	S_2	No of unique alleles
AMEL	X	Y				X	Y	X	Y	X	Y	
D3S1358	14	16	17			14	17	14	16	16	17	3
VWA	16	18				16	18	16	16	16	16	2
D16S539	11	12	13			11	13	12	13	12	13	2
D2S1338	17	20	25			17	20	20	25	25	25	3
D8S1179	10	11	13	14		13	14	10	11	13	13	4
D21S11	28	31 2	32	33.2	(30)	32	33 2	30	33.2	28	31.2	5
D18S51	10	12	14	17		12	14	10	17	12	14	4
D19S433	13	14	15			13	13	14	15	14	14	3
TH01	8	9.3				8	9.3	8	8	9.3	9.3	2
FGA	21	22	25	28	(20)	25	28	20	21	22	25	5

See Table 1 for the legend key.

Table 8
A summary of results for Case 3, compiling the propositions tested.

H_p conditions	H_d conditions	Non-contributor	(\log_{10}) percentile			Minimum bound LR	Discriminatory metric (dm)
<i>Complex set</i>		<i>Substitution</i>	0.01	0.50	0.99		
S_1, S_2, V	U, U, U	S_1	-1.07	3.06	8.5	16.8	8.3
S_1, S_2, V	U, U, U	S_2	4.51	8.24	13.28	16.8	3.52
S_1, S_2, V	U, U, U	V	-3.57	1.13	6.62	16.8	10.18
<i>Simplified set</i>							
S_1, U, U	U, U, U	S_1	-6.7	-3.02	0.72	4.91	4.19
S_2, U, U	U, U, U	S_2	-6.7	-3.02	0.72	3.01	2.29
V, U, U	U, U, U	V	-6.7	-3.02	0.72	7.16	6.44
<i>Complex conditioned set</i>							
V, S_1, S_2	V, U, U	S_1	-8.4	-4.20	1.79	9.63	7.84
V, S_1, S_2	V, U, U	S_2	-3.75	1.09	5.91	9.63	3.72
<i>Simplified conditioned set</i>							
V, S_1, U	V, U, U	S_1	-6.9	-2.83	0.57	4.43	5.07
V, S_2, U	V, U, U	S_2	-6.9	-2.83	0.57	2.71	2.14

Non-contributor performance (N_p) percentiles are listed in bold type. Underneath are corresponding \log_{10} (LRs).

ratio estimates. Only a single non contributor performance test is required to summarise the results, substituting S_n for random man. The LRs calculated for $\log_{10}(\text{LR})_{S_1} = 4.19$; $\log_{10}(\text{LR})_{S_2} = 2.29$; $\log_{10}(\text{LR})_V = 6.64$. Because $N_{p99} = 0.72$, all LRs appear to provide probative evidence in favour of H_p as the metric dm is positive.

7.3.7. Effect of conditioning on the victim

It was of interest to examine the effect of conditioning the victim under H_d . Under H_p , the propositions are the same as for the complex set, under H_d , V is included in the conditioning $\log_{10}(\text{LR}) = 9.63$ (evaluated using a minimum bound $\Pr(D_{\min}) = 0.41$). There are two non contributor performance plots where S_1 and S_2 are evaluated. $\log_{10}(N_{p99})_{S_1} = 1.79$ and $\log_{10}(N_{p99})_{S_2} = 5.91$. The metrics dm are 7.84 and 3.72, respectively.

7.3.8. Simplified conditioned set

Finally, we evaluate S_n, V, U propositions under H_p where $n = 1.2$; $\Pr(D_{\min}) = 0.43$. Calculated $\log_{10}(\text{LR})_{S_1} = 4.43 = \log_{10}(4.05)$ and $\text{LR}(S_2) = \log_{10}(2.71)$; $N_{p99} = \log_{10}(0.57)$.

7.3.9. Step 7: Tabulate the results of the analysis

See Table 8.

8. Court reporting

The essential step is to summarise the data for court reporting. Ideally LRmix allows for a dialogue between the experts and the

court where different pairs of propositions may be quickly evaluated. General guidance is as follows:

- Set the number of contributors to the minimum number required for the entire set of alleles under the prosecution proposition initially set the number of contributors to be equivalent under H_p and H_d .
- Always simplify the propositions if there is a complex H_p where two or more suspects are considered, always explore the effect of replacing each suspect in turn with a random contributor in order to explore the effect on the model. When there are two or more 'profiled' individuals under H_p , if one of them has no probative value then consider removal from the model and reduce the number of contributors.
- Evaluate the robustness of the model with non contributor performance tests to ensure that it is capable to distinguish between the suspect and random man (a high likelihood ratio does not necessarily provide this assurance). Calculate the discriminatory metric (dm) between N_{p99} and the calculated LR to ensure that it is positive.

8.1. A model statement (data from Section 2.7.3)

A form of words is as follows: I have analysed the data to evaluate the proposition that Mr X is a contributor to the crime stain Y compared to the alternative proposition that Mr X is not a contributor to crime stain Y using the conditions defined in an

LRmix model. These conditions are stated as follows to form a statistic that is known as the likelihood ratio:

- a) Mr X and the victim are both contributors to the sample.
- b) An unknown person and the victim are both contributors to the sample.

The evidence is 111 million times more likely if the first proposition (a) is true, compared to the alternative described by (b).

This figure has been evaluated with a performance test. To do this we replace Mr X with a random unrelated individual and we repeat the measurement of the likelihood ratio. We do this a total of 1000 times, with a different random individual each time. When this was carried out 99% of likelihood ratios estimated were less than 0.00001.

9. Discussion

As DNA profiling techniques become more sensitive, mixtures that comprise multiple contributors become the norm. To be able to deal with the complexities of interpretation, it is first essential to have in place a model that is able to carry out the necessary calculations. The features of such a model are:

- a) It must be able to incorporate multiple contributors, both known and unknown (these may differ between H_p and H_d propositions).
- b) The calculation must be able to determine numeric strength of evidence that favours defence or prosecution hypotheses.
- c) Calculations carried out need to be rapid.
- d) Some caution is required to interpret complex propositions with two or more known individuals under H_p , since the evidential weight per contributor is not provided or indicated by a single likelihood ratio that evaluates a combination of propositions.
- e) Interrogation with non contributor performance tests (as defined within this paper) can be used to demonstrate the performance of the model. It is proposed here that performance tests also serve the purpose of validation on a per case basis (Section 9.1), by providing a concurrent risk analysis. This flexibility is a desirable feature of any complex theory, since it is impossible to generalise across the entire range of propositions/profiles that may be encountered.

9.1. Validation

Although the use of simulation models as an aid to interpret evidence is relatively new in forensic science there is strong precedence in other (unrelated) areas of science that run parallel with the concepts introduced here. A highly informative discussion paper (which we recommend to readers interested in the subject) is provided by Rykiel et al. [35]. This paper addresses “the meaning of validation” specifically applied to simulation models used in testing ecological models. We start with his definition:

“validation is a demonstration that a model within its domain of applicability possesses a satisfactory range of accuracy consistent with the intended application of the model”.

Doubtless there will be much discussion about the efficacy of models in the near future. Different models have different underlying assumptions (e.g. Section 7.3.9) and we recognise that their outputs and performances will be different. Given that such a diversity of models exist that are based on divergent assumptions, how may they be compared? We now seek to answer this question. The more assumptions built into a model, the greater the need to characterise a DNA profiling process to generate the statistical

distributions that the model requires to function. For example, if *deconvolution* using peak heights is modelled, then distributions based on heterozygote balance are pertinent. However, the characterisation of DNA profiling methods is specific to a particular generic method which may themselves be subdivided into many ‘sub strategies’. For example, a multiplex may be processed using several different PCR cycling regimes. Injection times may be varied and so on. Ideally, characterisation of each ‘sub strategy’ is needed to inform distribution parameters, but in practice this becomes potentially too rigid a requirement, given the time and expense required to complete the exercise. Therefore, the assumptions that are employed in the model may not be valid across the range of mixtures that are to be analysed, but the question to consider is: “does it matter”? An additional question is whether there is any benefit to develop a model that may be esoterically pleasing, but provide little added value in terms of being able to evaluate the strength of evidence. Scientists are naturally keen to promote their methods, resulting in discussion, but unless there is an accepted way to compare different models, there is no way to address such debates. Currently, to our knowledge, there is no published information to resolve this issue. Consequently, our aim is to provide a framework that will enable probabilistic models to be compared, and by implication improved in a meaningful way. To do this we supply the following resources:

- a) Provide a ‘basic model’ as open source software.
- b) Provide version control: LRmix sources are available (within the Forensim package) from the R Forge collaborative platform, which offers software versioning, and code checks. This ensures that all changes made to the program are recorded and documented via a revision control system. The changes logs and all previous versions of the package can be downloaded from <https://rforge.r-project.org/projects/forensim/>.
- c) Provide a *standard set* of example data to create a ‘test set’ that can be universally applied to any model (see [supplementary files](#)).
- d) In addition we provide a method to enable comparative studies to be carried out across divergent methods of analysis, based on non contributor tests.

In order to provide a basis for comparison studies to be made, thereby assisting the validation process, we provide a full analysis of three cases. By making available all of the data files we make available the ‘specific model’ parameters that can be used by other model builders.

We encourage others to add to the standard set of data in order to facilitate the validation process (by means of comparative studies). These data sets will be hosted on Forensim’s website at <http://forensim.rforge.r-project.org/>.

There is no standard way to carry out the process of validation, but it typically employs testing a ‘probabilistic model’ a number of times under a diversity of conditions that are relevant to the intended application. The validation aims at demonstrating that the model meets some specified performance standard(s) under the specified conditions. Different validation criteria could be used, such as the consistency of the generated LR with other models, the behaviour of the model when the parameters of dropout or drop in are unrealistic, or when the profiles of the hypothesised contributors are not related to the case. A validation schema is listed in points (a–c) below, paraphrased from Rykiel et al. [35], and (d) is an additional suggestion specific for our area:

- a) *Face validity*: Is the model output and its behaviour reasonable?
- b) *Comparison to other models*: see an example in Haned et al. [1].
- c) *Sensitivity analysis and Extreme condition testing*: The model output should reflect extreme events e.g. when $\Pr(D)$ is set to

zero and the profile has evidence of dropout then the LR should be very low.

- d) *Non contributor performance tests*: If the *contributor of interest*, e.g. the suspect is replaced by simulated random man in the specific model, then the resulting LR distribution should be distinguished from the LR observed when the *contributor of interest* is analysed.

The algorithm used in the LRmix module was extensively checked using a fixed set of published examples [6,31,33]. Comparisons [1] were also carried out using the 'likeLTD' program available from David Balding [36].

In this paper we prioritise the assessment of the behaviour of the model when non contributors are hypothesised as possible donors under H_p and H_d . We use this as our *principle of validation* by *evaluating* the observed likelihood ratio using performance tests where the suspect or the *profile of interest* is substituted with random man in the context of the 'specific model'.

The performance tests described in Section 6 are used to accommodate our validation requirement. These tests are used to *evaluate* the LR and provide an important indication that the reported statistic has meaning on a per case basis. Indeed, the argument can be taken further since there is no reason why the performance test itself could not be used *instead* of the LR statistic. But this debate is reserved for future work.

Consider the advice of Rykiel [35]:

"...a model is declared validated within a specific context which is an integral part of the certification. If the context changes, the model must be re validated; however, that does not invalidate the model for the context in which it was originally validated"

Whereas performance testing is typically carried out using generalised case examples to test the model across the entire range of scenarios, we argue that generalisation across the entire possible range of casework examples that may be encountered is unrealistic to achieve. Therefore the development of case specific performance measures is needed to evaluate a likelihood ratio.

9.2. The need for standard models

There is a need for 'standard models' that are used by the forensic community. This need has been expressed, for instance, by 'EuroforGen' which is an EU funded Network of Excellence¹ The purpose of a 'standard model' is to act as a benchmark against which other models can be compared so that it can be demonstrated whether an improvement has resulted (or not). This will facilitate the introduction of new improvements by providing a benchmark against which all other probabilistic models may be compared.

There are a number of requirements for a 'standard model' as follows:

- The theoretical foundation must be transparent and must have precedence and force within the international community. The primary purpose is to provide an 'anchor method' that will enable other methods to be compared against note that the model used here follows the recommendations of the ISFG DNA commission [3,10].
- It must be open source or freely accessible so that its use is unrestricted. It is recognised that some programs will become

freely available, yet the source code may be protected because of legal reasons, or other 'policy' decisions.

- To provide a benchmark, a standard set of data is required that are available for testing using other models.
- A methodology is required to demonstrate how comparisons can be carried out before within and between probabilistic and specific models.
- A 'basic model' operating with minimal assumptions is desirable so that the effectiveness of models that take into account additional parameters may be objectively measured. A 'basic model' is ideally positioned to become a 'standard model'.
- There is scope for a 'standard model' to evolve if it can be demonstrated that improvements have substantial benefit to measure strength of evidence so that new 'standard models', with demonstrable improvements, may proliferate over time.
- There should be a concurrent evaluation on the limitations inherent within any 'specific model' (here we have illustrated this primarily with *non contributor* tests).

This currently means that the 'standard model' concept, as supported by the above mentioned EuroforGen network, introduced here is the same as the 'basic model' in our rationale. It provides a starting point whereby all other models may be compared and evaluated thereby facilitating the introduction of new (improved) methods into courts.

9.3. Specifications and model limitations

Validation is usually carried out relative to some specification in order to determine whether the validation has succeeded. Whereas a specification is easily generated for a reagent (e.g. where purity is measured in terms of parts per million of some contaminating substance) a specification for a complex computer program is not as easily described.

Our solution is to provide a method to evaluate a likelihood ratio result. The model is characterised by random man simulation and the LR is evaluated by the 99 percentile (N_p) of the distribution. The discriminatory metric is used to measure the difference between the two LR estimates. This metric enables the evaluation of the 'specific model' with respect to how well the person of interest under H_p is distinguished from random man. This also serves the purpose of defining the limitations of the 'specific model' and can also be used to compare different 'probabilistic models'. Therefore, by following this rationale, improvements to the 'basic model' are readily measured.

Note we do not consider relatedness issues here, e.g. propositions where the perpetrator is considered as a brother of a suspect (so this is a current limitation of the model).

10. Conclusion

In this paper we explore the analysis of complex propositions. In casework, the precise propositions to analyse are often unclear. Concurrent examination of an epg and the reference samples will usually give a primary indication of the numbers of contributors to incorporate into an analysis, but this is always a minimum number of contributors. Note that this step is a departure from the Clayton guideline [9] that recommends consecutive examination of epg and reference samples our approach is unbiased and unaffected by concurrent examination.

It is clear that complex propositions give no indication about the weighting of evidence provided by individual contributors. Indeed it is possible that one or more may have no probative value at all a log(negative) value reduces the overall LR, but the evidence still strongly favours H_p . Simplifying propositions, along

¹ EuroforGen is an EU funded network of excellence that supports open source initiatives to interpret DNA profiles EuroforGen is an EU funded network of excellence that supports open source initiatives to interpret DNA profiles <http://www.euroforGen.eu/>.

with evaluation with performance tests is the preferred way to report LR's calculated from complex propositions.

An advantage of the LRmix model is that there is no requirement for the known contributor and the crime stain to have (any) matching alleles. Under these circumstances the calculated likelihood ratio is always less than one, favouring the defence hypothesis of 'exclusion'. Another advantage is that the calculations of strength of evidence are hugely simplified, and the removal of subjectivity means that much greater consistency of reports should be achieved. The emphasis is firmly shifted towards the formulation and appraisal of propositions used to calculate the LR. To do this requires lawyer and court participation. The scientist acts to facilitate the 'discussion' in court. It is recognised that court jurisdictions vary widely across the world and it is difficult to generalise exactly how this 'discussion' would proceed. Within the UK, joint 'pre trial' review of the evidence by scientists working for the defence and the prosecution is strongly encouraged and provided that the experts were both proficient in the methodology, this would appear to be an ideal way to introduce this kind of evidence into court.

Finally we have discussed the difficult issues relating to validation. LRmix has been formally adopted by EuroforGen (Network of Excellence) as a 'standard basic model' in order to take advantage of the open source aspects that are inherent. Performance tests are introduced that can be used to measure the effectiveness of case specific models and can also be used to cross compare with other probabilistic models. We also provide a set of examples that can be used to act as benchmark standards.

Conflict of interest statement

None declared.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.fsigen.2012.11.002>.

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RE: Forensics Law Review Articles

From: "Hur, Robert (ODAG)" <(b) (6)>
To: "Bolitho, Zachary (ODAG)" <(b) (6)>, "Antell, Kira M. (OLP)" <(b) (6)>
"Terwilliger, Zachary (ODAG)" <(b) (6)>
Cc: "Hunt, Ted (ODAG)" <(b) (6)> "Goldsmith, Andrew (ODAG)" <(b) (6)>
"Shapiro, Elizabeth (CIV)" <(b) (6)>
Date: Mon, 29 Jan 2018 19:50:30 -0500

Good by me – thanks to all!

From: Bolitho, Zachary (ODAG)
Sent: Monday, January 29, 2018 6:35 PM
To: Antell, Kira M. (OLP) <(b) (6)> Terwilliger, Zachary (ODAG) <(b) (6)>
Cc: Hunt, Ted (ODAG) <(b) (6)> Goldsmith, Andrew (ODAG) <(b) (6)> Shapiro, Elizabeth (CIV) <(b) (6)> Hur, Robert (ODAG) <(b) (6)>
Subject: RE: For

If the ethics folks have signed off, I see no issues. Of course, I defer to Rob and Zach T. if they see any issues.

Thank ,
Zac

From: Antell, Kira M. (OLP)
Sent: Monday, January 29, 2018 4:44 PM
To: Bolitho, Zachary (ODAG) <(b) (6)> Terwilliger, Zachary (ODAG) <(b) (6)>
Cc: Hunt, Ted (ODAG) <(b) (6)> Goldsmith, Andrew (ODAG) <(b) (6)> Shapiro, Elizabeth (CIV) <(b) (6)> Hur, Robert (ODAG) <(b) (6)>
Subject: RE: Forensics Law Review Articles

Good afternoon,

Circling back on this. Any issue with moving forward? Ted has one minor edit to his article (addition of a cite) so I plan to submit tomorrow. Please do let me know as soon as possible if I need to hold submission.

Thanks,
Kira

From: Antell, Kira M. (OLP)
Sent: Friday, January 26, 2018 11:58 AM
To: Bolitho, Zachary (ODAG) <(b) (6)> Terwilliger, Zachary (ODAG) <(b) (6)>
Cc: Hunt, Ted (ODAG) <(b) (6)> Goldsmith, Andrew (ODAG) <(b) (6)> Shapiro, Elizabeth (CIV) <(b) (6)> Hur, Robert (ODAG) <(b) (6)>
Subject: Forensics Law Review Articles

Good afternoon,

In October, the Department presented at a forensics evidence symposium at Boston College. The purpose of the symposium was to discuss whether it was appropriate to amend Rule 702 for cases involving forensic evidence. The transcript of the symposium will be published in an upcoming issue of the *Fordham Law Review*. Department speakers were invited to provide hort article to the *Fordham Law Review Online* for March publication. Ted, Andrew, and Alice Isenberg from FBI lab have written articles.

We expect to submit these articles to Fordham on Monday by COB. Rob attended the symposium and hoped to have a chance to review the article but had a need to proceed with clearance given our relatively tight timeline. The ethic office indicates there are no issues on their end.

Ted's article is a direct written response to the PCAST report drawn from previous public remarks but it is more granular than previously provided statement. Andrew's article is quite similar to his approved statement from the symposium but provides more in depth legal arguments. Both of them contain Department legal and policy positions. Alice's article is a more technical review of lab procedures.

Draft articles by Andrew and Ted were reviewed by a small group of people from CIV (Betsy CC'd here), CRM, CRM-Appellate, and the Criminal Chiefs Working Group. FBI reviewed Alice's article. No one believed there were any issues with publication.

Please do let me know if you have questions or concerns prior to submission.

Thanks,
Kira

Kira Antell
Senior Counsel
Office of Legal Policy
U.S. Department of Justice
950 Pennsylvania Avenue, NW
Washington, DC 20530

(b) (6)
(b) (6)

Re: Forensics Law Review Articles

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Bolitho, Zachary (ODAG)" <(b) (6)>
Cc: "Terwilliger, Zachary (ODAG)" <(b) (6)> "Hunt, Ted (ODAG)" <(b) (6)>
"Goldsmith, Andrew (ODAG)" <(b) (6)> "Shapiro, Elizabeth (CIV)" <(b) (6)>
"Hur, Robert (ODAG)" <(b) (6)>
Date: Mon, 29 Jan 2018 20:59:08 -0500

Thanks all.

Sent from my iPhone

On Jan 29, 2018, at 6:35 PM, Bolitho, Zachary (ODAG) <(b) (6)> wrote:

Duplicative Material

NIST Human Factors in Handwriting - HUDDLE

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Isenberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>, "Czarnopys, Greg P. (ATF)" <(b) (6)>, "(b)(6), (b)(7)(C), (b)(7)(F) per DEA" <(b) (6)>, "Wroblewski, Jonathan (CRM)" <(b) (6)>, "Laporte, Gerald (OJP)" <(b) (6)>, "(OGC) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>, "Santos, Nelson A. (DEA)" <(b)(6), (b)(7)(C), (b)(7)(F) per DEA>
Cc: "Hunt, Ted (ODAG)" <(b) (6)>
Date: Thu, 07 Jun 2018 14:50:48 -0400
Attachments: Unnamed Attachment (5.02 kB); Working Group Version_Handwriting_WERBwith bibliography (002).pdf (773 MB)

CLOSE HOLD plea e do not di tribute thi document

From: Antell, Kira M. (OLP)
Sent: Thursday, June 7, 2018 2:46 PM
(b)(6), (b)(7)(C), (b)(7)(E) per FBI <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>; Czarnopys, Greg P. (ATF) <(b) (6)>; (b)(6), (b)(7)(C), (b)(7)(F) per DEA <(b) (6)>; Wroblewski, Jonathan (CRM) <(b) (6)>; Laporte, Gerald (OJP) <(b) (6)>; (OGC) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>; Santos, Nelson A. (DEA) <(b)(6), (b)(7)(C), (b)(7)(F) per DEA>
Cc: Hunt, Ted (ODAG) <(b) (6)>
Subject: NIST Human Factors in Handwriting - HUDDLE
Importance: High

Good afternoon,

NIST's Human Factors in Handwriting Examination Report is nearing completion. I knew the report was coming but I was not closely following it and was alerted to its content last week.

While there is much in the report of value, there are many portions that are problematic from forensic practitioner and legal standpoints. The Department has been given an opportunity to provide line edits.

I'd like to arrange a very quick huddle on this by phone this afternoon at 3:15 to discuss how we would like to proceed. Call in information to follow. If you can't make the call, I totally understand. I will follow up by email.

Thanks,
Kira

Kira Antell
Senior Counsel
Office of Legal Policy
U.S. Department of Justice
950 Pennsylvania Avenue, NW
Washington, DC 20530
(b) (6)
(b) (6)

RE: NIST Human Factors in Handwriting - HUDDLE

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI
To: "Antell, Kira M. (OLP) (JMD)" <(b) (6)>
Cc: "Hunt, Ted (ODAG) (JMD)" <(b) (6)>
Date: Thu, 07 Jun 2018 17:19:52 0400

Thanks. Glad you have interns to review citation material.

(b)(6), (b)(7)(C), (b)(7)(E) per FBI

Science Law Unit
Office of the General Counsel
Federal Bureau of Investigation
Desk
Cell

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From: Antell, Kira M. (OLP) [mailto:(b) (6)]
Sent: Thursday, June 07, 2018 5:00 PM
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI >; Czarnopys, Greg P. (ATF) <(b) (6)>; Wroblewski, Jonathan (CRM) <(b) (6)>; Santos, Nelson A. <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Subject: RE: NIST Human Factors in Handwriting - HUDDLE

Thank you to everyone and apologize for the late minute nature of this request.

Attached is a Word version of the NIST Human Factors Handwriting report and their reviewer instructions (provided only FYSA). We are preparing a Department response to this document.

Per our phone call, to the extent you are interested in participating in this response, I ask that you review the attached document and provide themes and comments in redline and comment bubble by 8:00 am Wednesday, June 13.

I know that you may not be able to get through the document that's fine. Please just send me what you have by Wednesday morning. I'll combine everything into a single document.

Practitioner Review	Legal Review
<ol style="list-style-type: none">Share this with QD personnel for their review for any issues from a practitioner perspective. Pay special attention to creation of new term, misuse of current standards, and dismissal of current practices.Provide <u>5-7 high level themes</u> in bullet point that you find problematic. Feel free to make high level suggestions.Provide comments in comment bubbles in the document (redline where appropriate) <p>FBI - to the extent you participate, please start at the front. ATF/DEA - to the extent you participate, please start at the back</p>	<ol style="list-style-type: none">Review as to legal issues – you may wish to focus on Chapter 3. I would pay special attention to creation of new duties for lab personnel, legal analysis, scope code of professional responsibility.Provide <u>5-7 high level themes</u> in bullet point that you find problematic. Feel free to make high level suggestions.Provide comments in comment bubbles in the document (redline where appropriate) <p>FBI - to the extent you participate, please start at the front. ATF/DEA - to the extent you participate, please start at the back</p>

OLP interns are going through selected footnotes (legal, case law, PCAST, NAS, NCFS, DOJ) to assess whether the original source support the assertion. Ted and I are also going through the whole document for legal and practitioner issues.

If you have any questions, do not hesitate to call or email!

Thanks,
Kira

Duplicative Material

RE: [Non-DoD Source] RE: Response to PCAST - response from referees

From: "Hunt, Ted (ODAG)" <(b) (6)>
To: "Isenberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C) per FBI>
Date: Fri, 19 Jan 2018 13 34 01 0500

Thank very much Alice

From: Isenberg, Alice R. (LD) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Sent: Friday, January 19, 2018 11:00
To: A (OLP) <(b) (6)> Hunt, Ted (ODAG) <(b) (6)>
Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Subject: FW: [Non-DoD Source] RE: Response to PCAST - response from referees

Kira and Ted,

I warn you that this email string may cure any insomnia you are experiencing and I hope to follow it up with a published article that explains the concepts in a more formal manner. Bottom line, this is a follow up to your request at the Wednesday meeting for papers that support the notion that a lab/scientist can draw inferences when the analysis goes beyond the cope of their validation (related to Butler' mi ture pre entation) It eem that there are academic out there working this issue. I'll follow up once (b)(6), (b)(7) returns to the office.

Thanks,
Alice

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)
Sent: Friday, January 19, 2018 8:44 AM
To: Isenberg, Alice R. (LD) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>; Delgado, Tina M. (LD) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Subject: Fwd: [Non-DoD Source] RE: Response to PCAST - response from referees

Don't currently have access to my references but see below for a brief description of Peter Gill's work relative to yesterday's inquiry.

(b)(6), (b)(7)(C), (b)(7)(E) per FBI

----- Original message -----

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Date: 1/3/18 8:37 AM (GMT-05:00)
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>, (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Subject: RE: [Non-DoD Source] RE: Response to PCAST - response from referees

Peter Gill' work in thi area i al o intere ting He ba ically replace the u pect' profile with a thou and randomly generate profiles in the prosecution hypothesis and sees what kinds of LR's result. His reasoning is that validations cannot extend to cover every possible range of mixtures one might encounter. This modeling thus serves as a sort of case specific validation that the LR observed is not a fluke due to the peculiarities of the mixture encountered.

I'm not sure I follow Joel's reasoning though. In general, a really large LR should typically not result due to chance if your software is working appropriately. Your study also supports this view. 1/LR should represent the maximum probability of observing an LR as large as the one you do have due solely to chance matching. (See also Duncan Taylor's comments.).

If you are searching many profiles through a database, that is another matter as you are performing many, many comparisons.

Sorry to fill up your in bo e but I am trying to clear my own mail ☺

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)
Sent: 02, 2018 12:51 PM
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>; (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Subject: Fwd: [Non-DoD Source] RE: Response to PCAST - response from referees

Al o FYI Joel (ame lab a Tim, below) ha n't offered up thi info in our ad hoc group di cu ion , but FYI USACIL ha "a project" anticipating to have "the answer" to false inclusionary LR's.....

----- Original message -----

From "Kalafut, Timothy S (Tim) CIV USARMY DFSC (US)" (b) (6)

Date: 12/28/17 6:21 PM (GMT-05:00)

To: Jo Bright <(b) (6)>

(b)(6) Claire McKenna <(b)(6), (b)(7)(C), (b)(7)(E) per FBI> (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
(b)(6) George Duncan <(b)(6)> @sheriff.org, (b)(6) Steven Myers <(b)(6)> "Hulme, Paul" <(b)(6)>
(b)(6) "Echard, Jillian" <(b)(6)> @ct.gov, Welti, Susan (DFS) <(b)(6)> @dc.gov,
(b)(6) @analabsinternational.com, "Grill, Thomas" <(b)(6)> @erie.gov, "Bundy, Jason" <(b)(6)>
(b)(6) @fdle.state.fl.us, "McMahon, Teresa" <(b)(6)> <(b)(6) Alan Magee, "Wright,
(b)(6) John Lowe" <(b)(6)> @isd.idaho.gov
(b)(6) Simon Malsom <(b)(6)> @oakgov.com, Len Eudene (OCME) <(b)(6)> @ocme.nyc.gov,
(b)(6) Kathleen Corrado, Peck, Brian J. (MCSCS) <(b)(6)> <(b)(6) Maria Kaplan @state.or.us, "Johnson,
(b)(6) Deven" <(b)(6)> @sacda.org, (b)(6) Shawn Montpetit @pd.sandiego.gov, Hassler, Michelle
(b)(6) @eriff.org, "Beam" <(b)(6)> - B1360 <(b)(6)> @Scottsdaleaz.gov, Colin Gallacher
(b)(6) Chase Baumgartner @dp.te.a.gov, (b)(6) Andrew McWhorter @dp.te.a.gov,
(b)(6) Joshua Stewart @dps.texas.gov, (b)(6) Naomi McDonald @dp.te.a.gov, (b)(6) Cieccko <(b)(6)> @co.anoka.mn.us,
(b)(6) Christina Buettner <(b)(6)> @wyo.gov, (b)(6) Kathleen Corrado, (b)(6) Scott McWilliams @wyo.gov,
(b)(6) Ben Mallinder <(b)(6)> Connor, Craig <(b)(6)> @wyo.gov, "Strong, Melissa"
(b)(6) @pd.sandiego.gov, NOEL SARAH <(b)(6)> <(b)(6)> @dupage_heriff.org
Cc: Rebecca Richards <(b)(6)> <(b)(6)> @dupage_heriff.org
(b)(6) Duncan Taylor <(b)(6)> <(b)(6)> @dupage_heriff.org, John Buckleton <(b)(6)> <(b)(6)> @dupage_heriff.org
(b)(6) <(b)(6)> <(b)(6)> @dupage_heriff.org, Catherine McGovern
(b)(6) <(b)(6)> <(b)(6)> @dupage_heriff.org, Maarten Kruijver <(b)(6)> <(b)(6)> @dupage_heriff.org, Hannah Kelly
(b)(6) <(b)(6)> <(b)(6)> @dupage_heriff.org

Subject: RE: [Non-DoD Source] RE: Response to PCAST - response from referees

I'll let Joel deal with it more directly since he's on SWGDAM, but at USACIL we're working on a tool to help with this.

I don't want to say too much yet - there's work to be done.

However, I don't think this is a new problem. There is nothing inherent about an LR that gives it an "uninformative" number that is different to an RMP. I personally went to court with an RMP of 1 in 2. I didn't think that was particularly useful, but that was the number.

I think the problem with an LR is that when we run many, many profiles of references through a deconvolution from STRmix, you might find that "magic" profile that hits on options with high weights. Those will give a "big" LR.

There's not much we can do about that. I'm not concerned at all about an LR of 500,000 from a "known non-contributor" - it's just that perfect profile that hits on high weights. I think what is more important is the "typical" random person's LR. If that's close to or bigger than your POI's LR, then maybe that becomes a problem.

I think the real problem is what it's always been - an adventitious inclusion compared to an inclusion from the actual donor. This has been and always will be the problem. If we could solve this - and only included true donors - then we wouldn't need to perform any calculation to give weight to the inclusion. We'd have the right guy. That's not realistic, so we have to give weight. Using the LR based on weighted genotypes seems our best option at this time.

I guess all I'm trying to say is that this is a question we need to solve - and I'm hoping we're moving in that direction - but the "maximum" LR using the top weighted genotypes is always going to be a very impressive number. I don't know that we need to worry about that number. We need something that tells us if an LR of 100 (or similar) for this POI in this particular mixture has meaning compared to some random profiles.

I really don't think a "one size fits all" number will be the best answer, but at this point I'm not sure what is better than that - yet. I'm hoping our project will help with that.

Tim Kalafut

From: Jo Bright [(b) (6)]

Sen (b)(6), (b)(7)(C), (b)(7)(E) per FBI (b)(6) D) (FBI); (b)(6) Claire McKenna @austintexas.gov; (b)(6) George Duncan @sheriff.org; (b)(6) Steven Myers; Hulme, Paul, EC Susan (DFS); (b)(6) @analabsinternational.com; Grill, (b)(6) Alan Magee; Wright, Darren; Jo (b)(6) Simon Malsom @oakgov.com; n, Eug ME); (b)(6) Kathleen Corrado; Peck, Brian J. (MCSCS); (b)(6) Maria Kaplan @state.or.us; n (DA); (b)(6) Shawn Montpetit @pd.sandiego.gov; Hassler, Michelle; e - B1360; Colin Gallacher (b)(6) Chase Baumgartner @dps.te.a.gov; (b)(6) Andrew McWhorter @dps.texas.gov; (b)(6) Joshua Stewart @dp.te.a.gov; (b)(6) Naomi McDonald @dp.te.a.gov; Cieccko; Kalafut, Timothy S (Tim) CIV USARMY DFSC (US); Christina Buettner; (b)(6) Kathleen Corrado; (b)(6) Scott McWilliams @wyo.gov; (b)(6) Ben Mallinder O'Connor, Craig (OCME); Strong, Melissa; NOEL SARAH (b)(6) @dupagesheriff.org; Cc: Rebecca Richards; Taylor, Duncan (AGD) ((b)(6) Duncan Taylor); John Buckleton; Catherine McGovern; Maarten Kruijver; Hannah Kelly
Subject: [Non-DoD Source] RE: Response to PCAST - response from referees

All active links contained in this email were disabled. Please verify the identity of the sender, and confirm the authenticity of all links contained within the message prior to copying and pasting the address to a Web browser.

Hi all
I have confirmed [REDACTED] numbers by rounding down all Hd true LR's that were >= 1 to a whole number and summing them. I get

LR support	# of non contributor tests returning LR's in specified range	% of non contributor tests returning LR's in specified range	% of false Hp support
[1]	90320	0.3197%	
[2,99]	88783	0.3143%	98.25%
[100,9999]	1561	0.0055%	1.73%
[10000,99999999]	20	0.0001%	0.02%
total	180684	0.6396%	

The only number I have not managed to replicate is the 0.32% (percent of non-contributor tests that returned false support for Hp). Pedantically, I have used the exact number of Hd true tests of 28,250,000 which may account for the difference. I hope everyone had a great break. All the best for the New Year!
Jo

Jo-Anne Bright PhD

Senior Science Leader

Institute of Environmental Science and Research Limited (ESR)
Mt Albert Science Centre 120 Mt Albert Road, Sandringham, Auckland 1025
Private Bag 92021, Auckland 1142, New Zealand

DDI: (b) (6) /T: (b) (6) EXTN (b) (6)
E: (b) (6) <(b) (6)>
www.eprchnz Caution <http://www.eprchnz>

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From: (b) (6), (b) (7) (C), (b) (7) (E) per FBI (LD) (FBI) [Caution mailto (b) (6), (b) (7) (C), (b) (7) (E) per FBI]
Sent: Thursday, 28 December 2017 9:45 AM
Jo Bright <(b) (6)>; (b) (6) Claire McKenna <claire.mckenna@austintexas.gov>; (b) (6) George Duncan <george.duncan@sheriff.org>;
(b) (6) Steven Myers <(b) (6)>; Pa (b) (6) <(b) (6)>; Echa (b) (6) <(b) (6)>; Welts, Susan <(b) (6)>;
(b) (6) <(b) (6)>; @dc.gov; (b) (6) @dhatlab.international.com; Grill, Thomas (b) (6) <(b) (6)>; Marie <(b) (6)>; Bundy, Jaon <(b) (6)>;
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(b) (6) <(b) (6)>; Maarten Kru <(b) (6)>; Hannah Kelly <(b) (6)>;

Hello friends,

I hope you all had a great holiday! From Jo's out-of-office auto-reply, I'm glad to see she's taking leave but afraid she may be out of contact. She had suggested I contact you with the question below. I wanted to share something with you that I think is very supportive of our STRmix usage and pertains to a topic that's coming up in a SWGDAM discussion on Jan 9th

Along with a few others that are also part of ESR's collaborative STRmix study in response to PCAST, I serve on a SWGDAM Ad Hoc Committee that's developing recommendations for reporting LR's, and a discussion on "What if any LR's

>1 might be considered inconclusive?" touched on information that I thought could be found in our work compiled by ESR.

Based on the Ad Hoc Group's survey of several users/group members, most labs that have established an inconclusive zone use a threshold of LR = 100. Based on ESR's finding of a maximum false Hp support LR of 505,000, I had wondered if we might have a false sense of security from our individual validations that supported this threshold of 100 and that perhaps inc zones might not accomplish what we think they do. The data below prove that I was incorrect in my concern, and we have 28 million tests that support 100!

Jo shared with me data on Hp support for Hd-true tests – and I'd like to ask her to verify my numbers for accuracy – but of the 0.32% of 28 million non-contributor tests that returned false support for Hp, it appears that 98.25% were in what the Ad Hoc group proposes to be defined as the Limited Support category (LR 2 – 99). Although the maximum false Hp-support value was 505,000, exceedingly few LRs (0.02%) from our compiled validation mixtures were of this magnitude.

This is very useful and supportive information, and if it could be factored into the SWGDAM recommendations, may I have your permission to use it? Something to the effect of – "The vast majority of tests that incorrectly provide greater support for Hp than Hd returned LRs in the "Limited Support" range." We have empirical data that I would like cite that supports this claim... >98%! The Y Committee had also used empirical data to support its recommendations in the updated Y Guidelines.

LR	Proposed Support Category	# non-contributors returning LRs in the specified LR ranges	% of 28M non-contributor tests returning LRs in the specified ranges	% of false Hp-support LRs
1	Inconclusive	90,320	0.32257%	
2 – 99	Limited	88,783	0.31708%	98.25%
100 – 9,999	Moderate	1,561	0.00558%	1.73%
10,000 – 999,999,999	Strong	20	0.00007%	0.02%
Total false Hp support			0.32273%	

(b)(6), (b)(7)(C), (b)(7)(E)

From: Jo Bright [Caution-mailto (b) (6) <Caution-mailto (b) (6) >]
Sent: Monday, November 27, 2017 12:42 AM
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Subject: Response to PCAST - response from referees

Hi all
Please find attached the referee response to our collated internal validation data to address the PCAST report. We have started crafting a polite response. In the interests of getting it turned around as quick as possible so it may be accepted as soon as possible we won't be sending the response for comment but I will send a copy of the final paper and response to referees when completed for your interest. If you have any comments you'd like to make please feel free to get back to me. Also, if you want a change of authorship, have gone 'live' in casework since the initial submission, or know of any 'state of the nation' type changes that would affect any content within the introduction please let me know. Note that we will DEFINITELY NOT be sharing any of the data (see referee 2 point i).
Kind regards,
Jo

Jo-Anne Bright PhD

Senior Science Leader

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Sent: Tuesday, 22 August 2017 6:14 AM

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Subject: AST - submitted

Hi all
You might have received an email with confirmation that the paper has been submitted yesterday. I have attached the submission here. I only entered names and emails into the system not qualifications (I do not have them all)... It appears that in lieu of a qualification the default honorific from the journal is "Dr". The review process could take months depending on who is tasked with the job. I will let you know when we hear back.
Thanks for everyone's input to date
Kind regards
Jo

From: Jo Bright
Sent: Thursday, 27 July 2017 10:23 a.m.
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Subject: Response to PCAST - submission for review

Hi All
We have completed the data analysis and write up of the work for the combined response to the PCAST. I have placed the document on Google docs for review. It is available at:
(b) (5)
Because of differences between Google docs and Word there are some formatting issues. I have made the entire document landscape to accommodate Table 1 but of course for submission it will be portrait but for those few pages. Landscape has meant some of the plots are now orphaned from their figure names sorry. We would appreciate any feedback. Please track your changes within the document. If you are adding in comments it would be helpful if you could add your name in case we need clarification on any points.
Can we please get feedback before 11th August (any time zone is ok!) with the aim of us submitting sometime the next week (workloads dependent). If you have any questions or cannot get access via Google docs please contact me (I am travelling the next two weeks but should have regular access to email).
Thanks for everyone's input to date.
Kind regards,
Jo

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From: Jo Bright
Sent: Wednesday, 10 May 2017 5:40 p.m.
Subject: Response to PCAST - a draft document on line for comment

Hello again
Thank for everyone's input into this project to date. We have completed all interpretation and reviewed the result and run diagnostics, chasing down anything that was not intuitive. We have 31 participating labs (and lab systems), and have analysed 2825 profiles with over 28 million Hd true (non-contributor) tests. So we have a lot of data... We have started plotting various different scenarios in order to answer the questions raised by PCAST. A draft version of this document is available at

(b) (5)

At this stage the minimum we need from you is confirmation of your detail (do we have the correct corresponding author from your laboratory?), email etc, and confirmation that you are still happy to continue being involved with this project. As you can imagine given the numbers of plots and data summaries it is now very hard for us to remove selected results! After next week this will be almost impossible so please get back to use as soon as possible if you cannot proceed for whatever reason. Please confirm the detail in the paper with a comment or respond to me directly.
In addition, please feel free to add and improve the current text directly on line within the document. Comments will appear as suggestions. If you do not have a Google account please include your name in the comment so we can tell where it comes from (otherwise they will be from 'anonymous'). We have a few more plots that we are investigating then we will start writing discussion/conclusion. Any thought you have in that space will also be gratefully received but of course not expected.

Thanks again for your contribution
Kind regards
Jo

Jo-Anne Bright PhD

Senior Science Leader

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From: Jo Bright
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John Buckleton; Catherine McGovern; Maarten Kruijver
Subject: Response to PCAST - a summary of STRmix internal validation

Hi All
Thank you for your participation to date with this important research. This is just a quick email that hopefully serves as an update to the project progress. We have 35 participating labs and over 2800 profiles submitted for interpretation. A breakdown of number of profiles by apparent NOC is given below:

3	4	5	Total
1692	1089	106	2887

We are currently running the last two lab worth of data. Meantime, we have started a review of all completed profiles, including checks of the diagnostics and for any large false negatives or positives. That process will likely take another 2 to 3 weeks after which we will start plotting results and writing. I will provide a further update when I get more information. Please let me know if you have any questions.

Kind regards
Jo

Jo-Anne Bright PhD

Senior Science Leader

Institute of Environmental Science and Research Limited (ESR)
Mt Albert Science Centre: 120 Mt Albert Road, Sandringham, Auckland 1025
Private Bag 92021, Auckland 1142, New Zealand

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Black Box/White Box slides from CSAFE Error meeting

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI
To: "Hunt, Ted (ODAG) (JMD)" <(b) (6)>
Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI, "Pokorak, Eric G. (LD) (FBI)"
(b)(6), (b)(7)(C), (b)(7)(E) per FBI, (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI), (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Date: Fri, 02 Feb 2018 15:27:57 -0500
Attachment (b)(6), (b)(7)(C), (b)(7)(E) per FBI CSAFE Under tandingBBWB 2018 01 pdf (1 04 MB)

Hi Ted,

Per your request, attached please find a copy of the presentation slides that (b)(6), (b)(7)(C) per FBI and I delivered at the CSAFE Error meeting on Jan. 19, 2018. I have received approval from Lab manager (b)(6), (b)(7)(C) per FBI the slides with you, but request that you do not disseminate them further without additional approval as we are in the process of writing a manuscript for publication on this topic.

Please let me know if you have any questions about the content of these slides.

With regards,

(b)(6), (b)(7)(C)

(b)(6), (b)(7)(C) per FBI
Research Chemist
FBI Laboratory
2501 Investigation Parkway
Quantico, VA 22135

Black Box Forensic Examiner Evaluations

Understanding The Details

(b)(6), (b)(7)(C) per FBI, FBI Laboratory
 (b)(6), (b)(7)(C) per FBI, Noblis

CSAFE Error Rates Symposium
 Arlington, Virginia
 January 2018

What are Black Box and White Box evaluations?

Black Box	<p><i>In general:</i></p> <ul style="list-style-type: none"> ■ Empirical tests of the accuracy (correctness) and reliability (inter- and intra-rater consistency) of a process ■ Limited to assessing the outputs resulting from specified inputs ■ Does not attempt to model or quantify how the process works <p><i>Specific to evaluation of forensic experts:</i></p> <ul style="list-style-type: none"> ■ Black box evaluations assess examiners' conclusions without regard to how they make those conclusions
White Box	<p><i>In general:</i></p> <ul style="list-style-type: none"> ■ Empirical tests of how a process is conducted ■ Intended to model, define, or quantify how a process works <p><i>Specific to evaluation of forensic experts:</i></p> <ul style="list-style-type: none"> ■ White box evaluations assess <ul style="list-style-type: none"> • how examiners conduct examinations • why examiners make conclusions

Why Black Box and White Box evaluations?	
Black Box	<ul style="list-style-type: none">■ <i>Why Black Box evaluations?</i><ul style="list-style-type: none">• To provide a baseline, overall understanding of accuracy and reliability• To provide the basis for validation and statistical analyses for processes that do not have validated quantitative models
White Box	<ul style="list-style-type: none">■ <i>Why White Box evaluations?</i><ul style="list-style-type: none">• To provide a detailed understanding of how examinations are conducted• To identify areas for improved processes, training, or quality assurance• To collect data needed to move toward more quantitative and more objective processes



PCAST: Why Black Box?

- *“The only way to establish the scientific validity and degree of reliability of a subjective forensic feature-comparison method—that is, one involving significant human judgment—is to test it empirically by seeing how often examiners actually get the right answer. Such an empirical test of a subjective forensic feature-comparison method is referred to as a ‘black-box test.’”*

In other words:

Black box studies are necessary to establish the validity of forensic examination that relies on human judgment.

5

PCAST: How many Black Box tests?

- *“In one case (firearms analysis), PCAST found only one empirical study that had been appropriately designed to evaluate the validity and estimate the reliability of the ability of firearms analysts [...] Because scientific conclusions should be shown to be reproducible, we judged that firearms analysis currently falls short of the scientific criteria for scientific validity.”*

In other words:

A single black box study is not adequate to establish validity.

6

Which: Black Box or White Box?

- *“PCAST applauds the work of the friction-ridge discipline, which has set an excellent example by undertaking both (i) path-breaking black-box studies to establish the validity and degree of reliability of latent-fingerprint analysis, and (ii) insightful “white-box” studies that shed light on how latent-print analysts carry out their examinations, including forthrightly identifying problems and needs for improvement.”*
- *“In the case of subjective methods whose validity and degree of reliability have already been established by appropriate empirical studies (such as latent-print analysis), PCAST agrees that continued investment in black-box studies is likely to be less valuable than investments to develop fully objective methods. Indeed, PCAST’s report calls for substantial investment in such efforts.”*

7

Which: Black Box or White Box?

- *“PCAST applauds the work of the friction-ridge discipline, which has set an excellent example by undertaking both (i) path-breaking black-box studies to establish the validity and degree of reliability of latent-fingerprint analysis, and (ii) insightful “white-box” studies that shed light on how latent-print analysts carry out their examinations, including forthrightly identifying problems and needs for improvement.”*
- *“In the case of subjective methods whose validity and degree of reliability have already been established by appropriate empirical studies (such as latent-print analysis), PCAST agrees that continued investment in black-box studies is likely to be less valuable than investments to develop fully objective methods. Indeed, PCAST’s report calls for substantial investment in such efforts.”*

In other words:

White box studies are valuable — but only after multiple black box studies have been conducted to establish validity.

8

- Sufficiently large group of participants
- Sufficiently large group of test samples that are **representative** of casework
- Ground truth is known to test designers (but not by participants – **blind**)
- Study design and criteria for evaluation specified **a priori**
- Multiple studies conducted by multiple groups – **reproducibility** of results
- Ability to calculate valid error rates – FPR and FNR
- Published in peer-reviewed scientific journal
- Testing conducted by a neutral third party
- Raw data available for review by external experts

9

Black Box evaluations: General approach

- Provide test samples to examiners and measure:
 - **Accuracy** — are examiners' conclusions correct?
 - **Reliability** — are examiners' conclusions consistent?
 - Reliability subdivides into
 - **Reproducibility**: do different examiners get the same conclusion on the same evidence?
 - **Repeatability**: does an examiner get the same conclusion on the same evidence on different occasions?

How hard can it be?
... they are not as deceptively simple as they seem!

- A variety of complexities need to be considered in designing and conducting Black Box studies, and in analyzing the results

11

Black Box: Ideals and Reality

Ideal Black Box

- Participants
 - Representative sample of practitioners
- Data
 - Representative sample of casework
 - “Ground truth” certainty of the source of each sample
- Test procedure
 - Test samples inserted into casework with examiners unaware they are being tested
 - Test procedure the same as actual casework, with procedures, terminology, and tools all familiar
 - Enough samples to accurately measure each examiner's conclusion rates

12

Black Box: Ideals and Reality

Ideal Black Box	Reality
<ul style="list-style-type: none"> ■ Participants <ul style="list-style-type: none"> • Representative sample of practitioners ■ Data <ul style="list-style-type: none"> • Representative sample of casework • "Ground truth" certainty of the source of each sample ■ Test procedure <ul style="list-style-type: none"> • Test samples inserted into casework with examiners unaware they are being tested • Test procedure the same as actual casework, with procedures, terminology, and tools all familiar • Enough samples to accurately measure each examiner's conclusion rates 	<ul style="list-style-type: none"> • If you can require the test of all examiners (single lab or small discipline) — <u>No Problem</u> • If you can randomly sample among all practitioners — <u>Fine</u> • If you have good demographic information on the population of examiners — <u>OK</u> • If you do not have good survey data on the examiner population — <u>Problem!</u> • Must follow human subject research rules and protect subjects' privacy — <u>Challenge</u>

13

Black Box: Ideals and Reality

Ideal Black Box	Reality
<ul style="list-style-type: none"> ■ Participants <ul style="list-style-type: none"> • Representative sample of practitioners ■ Data <ul style="list-style-type: none"> • Representative sample of casework • "Ground truth" certainty of the source of each sample ■ Test procedure <ul style="list-style-type: none"> • Test samples inserted into casework with examiners unaware they are being tested • Test procedure the same as actual casework, with procedures, terminology, and tools all familiar • Enough samples to accurately measure each examiner's conclusion rates 	<ul style="list-style-type: none"> • If you can randomly sample from all casework data (e.g. single agency) — <u>Fine</u> • If you have good metrics describing distributions of various attributes of data — <u>OK</u> • If the types and attributes of data vary significantly by agency or by case type — <u>Problem!</u> • If you do not have good understanding of data distributions in actual casework — <u>Problem!</u>

14

Black Box: Ideals and Reality

Ideal Black Box	Reality
<ul style="list-style-type: none"> ■ Participants <ul style="list-style-type: none"> • Representative sample of practitioners ■ Data <ul style="list-style-type: none"> • Representative sample of casework • "Ground truth" certainty of the source of each sample ■ Test procedure <ul style="list-style-type: none"> • Test samples inserted into casework with examiners unaware they are being tested • Test procedure the same as actual casework, with procedures, terminology, and tools all familiar • Enough samples to accurately measure each examiner's conclusion rates 	<ul style="list-style-type: none"> • <i>If trying to collect ground truth data without selection bias (making it not representative) — Hard</i> • <i>If trying to use operational data as ground truth data without selection bias or adding uncertainty — Hard</i> • <i>If trying to collect large amounts of ground truth data without introducing administrative errors — Hard</i>

15

Black Box: Ideals and Reality

Ideal Black Box	Reality
<ul style="list-style-type: none"> ■ Participants <ul style="list-style-type: none"> • Representative sample of practitioners ■ Data <ul style="list-style-type: none"> • Representative sample of casework • "Ground truth" certainty of the source of each sample ■ Test procedure <ul style="list-style-type: none"> • Test samples inserted into casework with examiners unaware they are being tested • Test procedure the same as actual casework, with procedures, terminology, and tools all familiar • Enough samples to accurately measure each examiner's conclusion rates 	<ul style="list-style-type: none"> • <i>If testing a single agency with homogeneous electronic casework — Fine</i> • <i>If physical items are necessary — Hard</i> • <i>If significant evidence management requirements — Problem!</i> • <i>If testing multiple agencies or heterogeneous casework — Problem!</i>

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Black Box: Ideals and Reality

Ideal Black Box

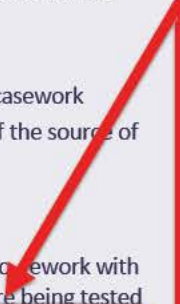
- Participants
 - Representative sample of practitioners

- Data
 - Representative sample of casework
 - "Ground truth" certainty of the source of each sample

- Test procedure
 - Test samples inserted into casework with examiners unaware they are being tested
 - Test procedure the same as actual casework, with procedures, terminology, and tools all familiar
 - Enough samples to accurately measure each examiner's conclusion rates

Reality

- If evaluating a single agency — Fine
- If procedures, terminology, and tools are standardized across all agencies — Fine
- If procedures, terminology, or tools vary widely among agencies — Problem!



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Black Box: Ideals and Reality

Ideal Black Box


- Participants
 - Representative sample of practitioners

- Data
 - Representative sample of casework
 - "Ground truth" certainty of the source of each sample

- Test procedure
 - Test samples inserted into casework with examiners unaware they are being tested
 - Test procedure the same as actual casework, with procedures, terminology, and tools all familiar
 - Enough samples to accurately measure each examiner's conclusion rates

Reality

- If you are trying to measure rates about 10% or greater — No problem
- If you are trying to measure rates ~1% — Hard
- If you are trying to measure rates much less than 1% — Problem!



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The easiest possible Black Box (summer daydream)

- Single agency
- Require all examiners to participate (or at least randomly sample examiners)
- Use standard operating procedures in the test
- Electronic casework making it easy to insert test data into operational workflow
- Random sample of casework data to test reproducibility/repeatability
- Only testing reproducibility (no need for ground truth)

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The HARDEST possible Black Box (summer nightmare)

- Single agency **Multiple agencies**
- Require all examiners to participate (or at least randomly sample examiners) **No way to randomly sample examiners**
- Use standard operating procedures in the test **Operating procedures vary significantly**
- Electronic casework making it easy to insert test data into operational workflow **Great variation in types of casework**
- Random sample of casework data to test reproducibility/repeatability **No way to randomly sample casework**
- Only testing reproducibility (no need for ground truth) **Testing accuracy (need ground truth)**

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■ Black Box tests provide a general understanding

- Initial tests provide baseline expectations for later Black Box (and White Box) tests
 - Rates (help focus and size future tests)
 - Specific questions for future detailed studies
 - Lessons learned
- How realistic the results are depends on how representative they are of
 - Examiners
 - Procedures
 - Data
- Multiple independent tests that corroborate results provide stronger support

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■ Black box evaluations do not attempt to assess how a specific examiner performs on specific data –

- But black box evaluations are a first step towards such detailed tests
- If you want to assess individual examiners, you need realistic proficiency tests — which may be modeled on black box tests

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- Some of the most problematic issues are because of variability of examiners, procedures, and sample attributes
 - Variability is always present in any measurement process
 - Variability in casework data is part of forensic science
- Some of this variability is because of a lack of standardization
 - Differences among examiners in proficiency, training, certification
 - Differences among agencies in procedures, terminology, implications of decisions
- Greater standardization should make future tests more representative of actual practices
 - Better surveys of who is actually practicing as an examiner in each field are highly desirable

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- Black box and white box tests are important for internal process improvement
- In response to Black box and white box results, agencies have revised
 - Operating procedures
 - Terminology
 - Training
 - Language used in testimony
 - Quality assurance procedures

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- Data selection

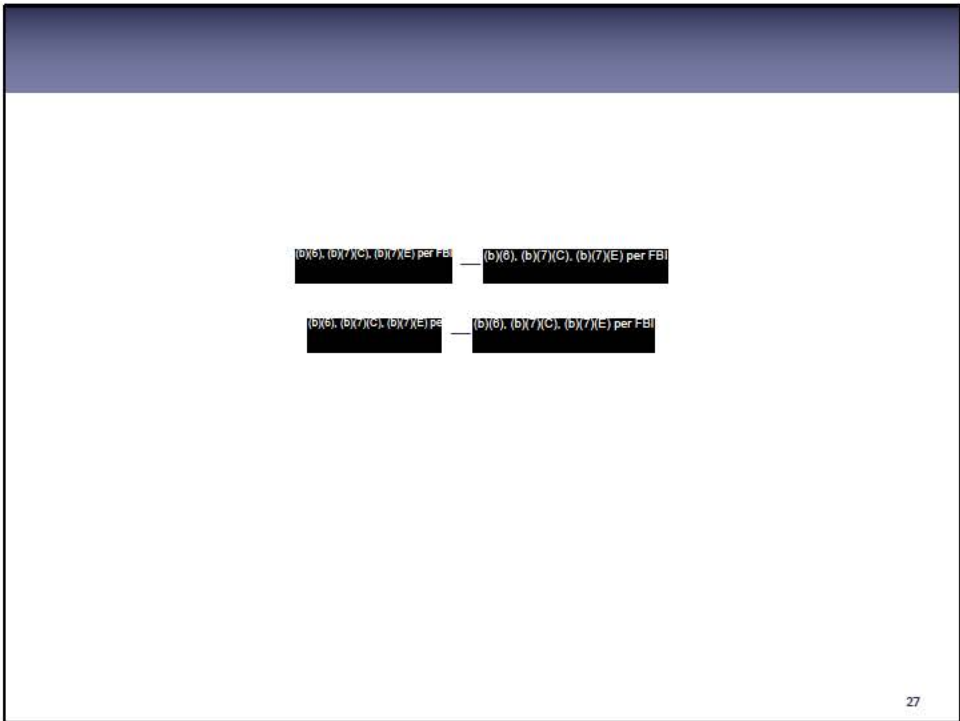
- “The problem with denominators”
- Deciding how much easy, novalue, and very difficult data to include drives the measured rates
- Given that (in many disciplines) many or most comparisons are obvious exclusions, when conducting tests (and calculating rates), how do you decide how many obvious exclusions to include?
- Some tests deliberately limit test data to be very difficult — these may be great at differentiating examiners, but say little about representativeness of the results
- Differences in data selection make meta-analyses or comparison of different tests challenging
 - E.g. a test based on selecting extremely difficult data should not be expected to yield the same results as a test with data broadly representative of casework

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Don't underestimate administrative complexity!

- It is critical to have quality assurance designed into the test for data collection, and test administration
 - e.g. don't have participants entering data by hand
- Don't underestimate time
 - Data analysis
 - Writing/presenting/publishing results
- Human subject research approval (IRB, privacy implications)
 - For both test data and test participants

26



RE: DC DFS- PCAST

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI
To: "Hunt, Ted (ODAG) (JMD)" <(b) (6)>
Date: Tue, 15 May 2018 11:05:48 -0400

Thanks. I've asked our folks to send this to Jeff Nyes for the upcoming MI Daubert. Also, do you know why DC DFS is doing this series of publications?

(b)(6), (b)(7)(C), (b)(7)(E) per FBI

Science Law Unit
Office of the General Counsel
Federal Bureau of Investigation
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From: Hunt, Ted (ODAG) [mailto:(b) (6)]
Sent: Tuesday, May 15, 2018 10:06 AM
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Subject: DC DFS- PCAST

(b)(6), (b)(7)(C), (b)(7)(E) per FBI

This came out a few days ago – in case you hadn't yet seen.

Ted

Ted R. Hunt
Senior Advisor to the Attorney General on Forensic Science
Office of the Deputy Attorney General
United States Department of Justice
950 Pennsylvania Ave. NW
Washington DC 20530

(b) (6)
(b) (6)

**IN THE CIRCUIT COURT OF COOK COUNTY
CRIMINAL DIVISION**

THE STATE OF ILLINOIS)	
)	17 CR 08092
V.)	
)	JUDGE KULL
RAYMOND SANCHEZ)	PRESIDING

**MOTION TO EXCLUDE SCIENTIFICALLY INDEFENSIBLE CLAIMS OF
FINGERPRINT “IDENTIFICATION”**

NOW COMES Mr. Raymond Sanchez, through his attorney, Cook County Public Defender Amy P. Campanelli, by her assistants Richard E. Gutierrez and David Holland, and respectfully asks this Court to preclude any testimony by the State’s fingerprint examiner, Charles Schauer, that he “*identified*”¹ the Defendant as the source of any latent prints offered in evidence. Given the term’s dubious history, as well as even its contemporary meaning in the field of fingerprint comparison, use of the word “identification” will convey an absolute/certain source attribution and will therefore overstate the probative value of fingerprint evidence, unduly prejudice the Defense, and mislead the trier of fact. In support thereof the Defendant asserts the following:

I.) INTRODUCTION

Despite fingerprint-comparison methodology’s acceptance as foundationally valid by both the courts² and the broader scientific community,³ the field’s inherent subjectivity and lack of robust population data still fail to justify absolutist associations between crime-scene latent prints and any single person (or put another way, cannot support narrowing the pool of

¹ See Charles A. Schauer, “*Fingerprint Examination Report: Supplement No.1, R.E. Walsh Case Review#REW-17-06, Agency Case#17-00218,*” (Aug. 11, 2017) (where the State’s fingerprint examiner states his conclusion as follows: “Exhibit 1A [the crime scene latent print] was *identified* to the fingerprint card of Raymond Y. Sanchez”) (attached as Exhibit I).

² See e.g., *People v. Luna*, 2013 IL App (1st) 072253, ¶81 (1st Dist. 2013).

³ See e.g., President’s Council of Advisers on Science & Technology, “*Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods,*” at 101 (Sept. 20, 2016).

individuals whose fingers might match a given latent print down from the whole of humanity to one, and only one, possible source).⁴ Although conscientious fingerprint examiners have recently acknowledged as much—and consequently have abandoned the most pernicious and patently-false *definitions* of “identification” (i.e. that fingerprint source attributions can be made to the exclusion of all others in the world, with 100% certainty, and subject to zero error)⁵—they persist in employing that same term—again, in the face of its long historical association with prior claims of infallibility.⁶ In fact, even the term’s allegedly-rehabilitated new meaning remains tethered to scientifically illegitimate assertions of certainty (admitting to only a purely theoretical chance of error by claiming that if a latent print is identified, then the “likelihood the impression was made by another (different) source is so remote that it is considered as a *practical impossibility*”).⁷

Such a merely “semantic refo[r]m” substantively “change[s] nothing or change[s] very little”⁸ and also fails to in any way compensate for the unwarranted esteem now bestowed on the

⁴ See e.g., American Association for the Advancement of Science, “*Forensic Science Assessments: A Quality and Gap Analysis-Latent Fingerprint Examination*,” Report prepared by William Thompson, John Black, Anil Jain, & Joseph Kadane, at 71 (2017) (“While latent print examiners may well be able to exclude the preponderance of the human population as possible sources of a latent print, there is no scientific basis for estimating the number of people who could not be excluded and, consequently, no scientific basis for determining when the pool of possible sources is limited to a single person”).

⁵ See e.g., Office of the Inspector General, “*A Review of the FBI’s Progress in Responding to the Recommendations in the Office of the Inspector General Report on the Fingerprint Misidentification in the Brandon Mayfield Case*,” U.S. Department of Justice, at 8 (2011) (Historically, latent fingerprint examiners expressed identification conclusions in terms of “100% certainty,” with zero likelihood that the latent fingerprint was made by a different person. Although the FBI laboratory has not lowered the standard required to make an identification, examiners no longer testify that they are “100% certain.”); Department of Justice, “*Approved Uniform Language for Testimony & reports for the Forensic Latent Print Discipline*,” at 2-3(2018) (“An examiner shall not assert that two friction ridge impressions originated from the same source to the exclusion of all other sources or use the terms ‘individualize’ or ‘individualization’...shall not assert a 100% level of certainty...”).

⁶ See Scientific Working Group on Friction Ridge Analysis, Study, & Technology (SWGFAST), “*Document #103: Individualization/ Identification Position Statement (Latent/Tenprint)*,” at 1 (2012) (acknowledging that “individualization has been used within the latent print community to mean ‘to the exclusion of all others’” but nevertheless retaining the term).

⁷ See SWGFAST, “*Document #10 Standards for Examining Friction Ridge Impressions and Resulting Conclusions (Latent/Tenprint)*,” at 4 (2013).

⁸ Simon A. Cole, “*Individualization is dead, long live individualization! Reforms of reporting practices for fingerprint analysis in the United States*,” 13 Law, Prob., & Risk 117, 144 (2014); see also William Tobin & Peter

field of fingerprint comparison due to its decades-long deployment of hyperbolic claims.⁹ As such, use of the words “identification” or “identified” will materially overstate the appropriate probative value of fingerprint evidence and mislead jurors into granting such an opinion undeserved weight.¹⁰ This Court should therefore utilize its substantial discretion under Illinois Rule of Evidence 403 to limit the scope of the conclusions offered by the State’s fingerprint examiner, Charles Schauer.

II.) FINGERPRINT COMPARISON METHODS PRESENTLY LACK THE DATA & OBJECTIVITY NECESSARY TO JUSTIFY DEFINITIVE CONCLUSIONS OF IDENTIFICATION.

For the vast majority of its decades-long existence, the discipline of fingerprint comparison (relying heavily on now-abandoned mysticism tied to a blind faith in the uniqueness of fingerprints)¹¹ clung resolutely to claims trumpeting the nigh-divinity of its method, with even

Blau, “Hypothesis Testing of the Critical Underlying Premise of Discernible Uniqueness in Firearms-Toolmark Forensic Practice” 53 *Jurimetrics* 121, 131 (2013) (calling on practitioners in the related, pattern-matching field of firearms examination to “curb the excesses” of their conclusions by noting that “the switch to weaker forms of source attribution (such as ‘practical certainty’) is a cosmetic change that does nothing to remedy the underlying scientific shortcomings of F/TM practice”)

⁹ See e.g., H.J. Swofford & J.G. Cino, “Lay Understanding of ‘Identification’: How Jurors Interpret Forensic Identification Testimony,” 68 *J. Forensic Identification* 29 (2018) (study concluding that “71% of potential jurors may be expected to interpret expert testimony containing the word ‘identification’...to imply a single source attribution ‘to the exclusion of all others’”); Jonathan J. Koehler, “Intuitive Error Rate Estimates for the Forensic Sciences,” 57 *Jurimetrics* 153, 162 (2017) (pool of jury-eligible participants estimated misidentification rate for fingerprints to be “1 in 5.5 million”).

¹⁰ See e.g., National Commission on Forensic Science, “Views of the Commission Regarding Use of the Term ‘Reasonable Scientific Certainty,’” Dep’t of Justice, at 3 (2016) (emphasizing that even the lesser term reasonable scientific certainty “cloaks” conclusions with unjustified levels of rigor and respectability and would confuse or mislead jurors concerning the weight owed forensic testimony); Budowle et al., “A Perspective on Errors, Bias, & Interpretation in the Forensic Sciences and Direction for Continuing Advancement,” 54 *J. Forensic Sci.* 798, 804 (2009) (conceding that with the use of terms like match or identification, there may be an “unintended contribution to bias (i.e., conveying more strength than intended)” and suggesting “instead the term ‘failure to exclude,’ which may seem to some more acceptable”).

¹¹ See PCAST, “Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods,” at 62 (Sept. 20, 2016) (“The issue is not whether objects or features differ; they surely do if one looks at a fine enough level. The issue is how well and under what circumstances examiners applying a given metrological method can reliably detect relevant differences in features to reliably identify whether they share a common source. Uniqueness studies, which focus on the properties of features themselves, can therefore never establish whether a particular method for measuring and comparing features is foundationally valid. Only empirical studies can do so.”); Michael J. Saks & Jonathan J. Koehler, “The Individualization Fallacy in Forensic Science Evidence” 61 *Vand. L. Rev.* 199, 208-09 (2008) (uniqueness “exists only in a metaphysical or rhetorical sense. It has no scientific validity, and it is sustained largely by the faulty logic that equates infrequency with uniqueness” & “various arguments have

leading law enforcement agencies, like SWGFAST and the FBI, encouraging examiners to testify in absolute terms by asserting that a suspect was the source of a print in evidence to the exclusion of all other people on earth and with 100% certainty and zero chance of error.¹² Such declarations always rested on unsure footing given that the field had never (and in fact to this day has never) conducted the types of large-scale population studies that would be necessary to develop numerical/objective thresholds for delineating precisely what level of similarity separates a fingerprint match from a fingerprint exclusion.¹³ But, despite disagreeing about even

been offered on behalf of the individualization hypothesis. None are scientifically compelling...approaches amount to nothing more than faith and intuition.”); William Tobin & Peter Blau, “*Hypothesis Testing of the Critical Underlying Premise of Discernible Uniqueness in Firearms-Toolmark Forensic Practice*,” 53 *Jurimetrics* 121, 122-23 (2013) (“The cited scholarly essays suggest that forensic individualization based on the claim of uniqueness has a scientifically indefensible conceptual foundation and is a fallacy promulgated by the forensic community. The authors, and relevant mainstream scientists and colleagues with specialized forensic expertise with whom the authors have collaborated, agree.”); John Thornton, “*The General Assumptions & Rationale of Forensic Identification*,” In *Modern Scientific Evidence: The Law & Science of Expert Testimony*, at 12 (1997) (uniqueness does “not seem susceptible of rigorous proof. But the general principle cannot be substituted for a systematic and thorough investigation of a physical evidence category”); Michael J. Saks, Jonathan L. Koehler, “*The Coming Paradigm Shift in Forensic Identification Science*,” 309 *Science* 892 (2005) (assumption of uniqueness “although lacking theoretical or empirical foundations” perseveres in forensics perhaps because “it offers important practical benefits” to practitioners); Mark Page *et al.*, “*Uniqueness in the Forensic Identification Sciences-Fact or Fiction?*” 206 *Forensic Sci. Int.* 12, 15 (2011) (the concept of uniqueness has more the qualities of a cultural meme than a scientific fact,” because, as the authors explain, “most of the studies attempting to prove the uniqueness of a particular forensic feature suffer flaws that render their conclusion questionable”); Christophe Champod, “*Fingerprint identification: advances since the 2009 National Research Council report*,” *Phil Trans. Royal Soc.* 370 (2015) (“what is clear from the post NRC report scholarly literature is that the days where invoking ‘uniqueness’ as the main (if not the only) supporting argument for an individualization conclusion are over”).

¹² See Office of Inspector General, “*A Review of the FBI’s Handling of the Brandon Mayfield Case*,” U.S. Department of Justice, at 111 (2006) (noting SWGFAST’s position that “probable, possible or likely individualization conclusions are outside the acceptable limits of friction ridge identification science”); FBI, “*An Analysis of Standards in Fingerprint Identification*,” FBI Law Enforcement Bulletin, (1972) (FBI published articles on fingerprint comparisons in which they asserted that “in the practice of fingerprint identification, there is no room for ‘probable’ identity”).

¹³ See AAAS, “*Forensic Science Assessments: A Quality and Gap Analysis-Latent Fingerprint Examination*,” at 21, & 62-63 (“While the existing scientific literature indicates a low likelihood that prints from different individuals share a large number of common features, the literature does not provide an adequate basis for assessing the rarity of any particular feature, or set of features, that might be found in a print...there is uncertainty about how many matching features and what types of matching features are necessary to reduce the potential donor pool to a single source”); National Academy of Sciences, “*Strengthening Forensic Science in the United States: A Path Forward*,” National Academies Press, at 139-40 & 188-89 (2009) (“population statistics for fingerprints have not been developed, and friction ridge analysis relies on subjective judgments by the examiner. Little research has been directed toward developing population statistics, although more would be feasible” & “In most forensic science disciplines, no studies have been conducted of large populations to establish the uniqueness of marks or features. Yet, despite the lack of a statistical foundation, examiners make probabilistic claims based on their experience. A statistical framework that allows quantification of these claims is greatly needed”); Glenn Langenburg, “*Scientific Research Supporting the Foundations of Friction Ridge Examinations*,” in *The Fingerprint Sourcebook*, at 14-19

the basic propriety of conditioning match conclusions on minimum numbers of shared features (as well as, if they have implemented objective criteria, where exactly to set the minimum similarities required),¹⁴ it was not until recently that practitioners so much as acknowledged the subjectivity of their method,¹⁵ and therefore its attendant susceptibility to error and bias.¹⁶

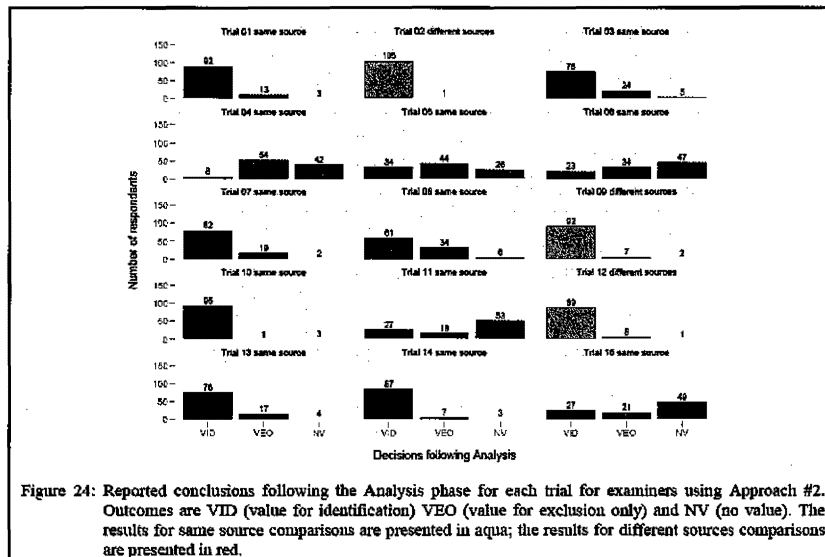
(Dept. of Justice 2012) (“From a statistical viewpoint, the scientific foundation for fingerprint individuality is incredibly weak” & “Although the theory of biological formation certainly supports the notion of friction ridge skin individuality, it must be supported by further empirical testing”) (internal citations & quotations omitted); Sharath Pankanti *et al.*, “On the Individuality of Fingerprints,” 24 *IEEE Trans. On Pattern Analysis & Machine Intelligence* 1010, 1011 (2002) (“the underlying scientific basis of fingerprint individuality has not been rigorously studied or tested”); C. Neumann *et al.*, “Quantifying the Weight of Evidence from a Forensic Fingerprint Comparison: A New Paradigm,” 175 *J. Royal Stat. Society* 1, 2 (2012) (“the evaluation of the weight of evidence associated with any particular fingerprint comparison lacks both a scientific foundation and transparency”); Sir Anthony Campbell, “The Fingerprint Inquiry Report,” APS Group of Scotland, at 605, 728 (2012) (“fingerprint evidence is a matter of opinion not fact” & “Examiners presently have insufficient objective evidence by which decisions as to the rarity of characteristics are assessed, and to the extent that such data is available, it is not utilized by examiners”); Organization of Scientific Area Committees, “OSAC Research Needs Assessment Form- Assessing the Sufficiency and Strength of Friction Ridge Features,” at 2 (2015) (“Currently there is not a reliable assessment of the discriminating strength of specific friction ridge feature types...not knowing the weight of each feature type prohibits comprehensive standards for friction ridge evaluation decisions”); Working Group on Human Factors in Latent Print Analysis, “Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach,” National Institute of Justice at 8, 208 (2012) (noting that “there is little research at present that provides objective metrics for determining” thresholds in print comparisons and “there is a strong need for systematic studies pertaining to the reproducibility and discriminating strength of fingerprint features...there is limited research that would allow a global assessment ... of the strength of minutiae configurations”).

¹⁴ See Joseph Polski *et al.*, “The Report of the International Association for Identification, Standardization II Committee,” (2010) (advising against the implementation of any system conditioning matches of a minimum number of points of commonality); Ulery, *et al.*, “Measuring What Latent Fingerprint Examiners Consider Sufficient Information for Individualization Determinations,” *Proceedings of the National Academy of Sciences*, at 1 (2014) (noting that “in some countries, a minimum minutia count (‘point standard’) is used as a criterion for individualization: a 2011 survey of 73 countries by INTERPOL found that 44 countries use a point standard, 24 of which require a minimum of 12 minutiae”).

¹⁵ Working Group on Human Factors, “Latent Print Examination and Human Factors,” at 8 (“At every step in [the fingerprint examination] process, human factors can affect the outcome. Latent print examiners rely heavily on their training and experience to make the required judgments. Subjectivity is an inextricable part of the process.”); see also PCAST, “Forensic Science in Criminal Courts,” at 9 (classifying fingerprint analysis as a “subjective methodology”); NAS, “Strengthening Forensic Science in the United State,” at 184 (“the outcome of a friction ridge analysis is not necessarily repeatable from examiner to examiner...this subjectivity is intrinsic”); Andre Moenssens & Stephen Meagher, “Fingerprints and the Law,” in *The Fingerprint Sourcebook*, at 13-19 (Dept. of Justice 2012) (“subjective judgment is involved in declaring a match”); Bradford T. Ulery *et al.*, “Measuring What Latent Fingerprint Examiners Consider Sufficient Information for Individualization Determinations,” at 1 (“Testimony on fingerprint evidence presented in court is based on the examiner’s expert opinion, not an objective metric”).

¹⁶ See *e.g.*, PCAST, *Forensic Science in Criminal Courts*,” at 5 & 101 (“[s]ubjective methods require particularly careful scrutiny because their heavy reliance on human judgment means they are especially vulnerable to human error, inconsistency across examiners, and cognitive bias” and as to fingerprints specifically, collecting numerous error rate studies and determining that “false positive rates that could be as high as 1 error in 18 cases ... because the examiners were aware they were being tested, the actual false positive rate in casework may be higher”); Simon Cole, “More than Zero: Accounting for Error in Latent Fingerprint Identification,” 95 *J. Crim. L. & Criminology* 985, 1029-30 (2005) (conducting meta-analysis of data from proficiency tests given to over 3000 fingerprint examiners and computing a false positive rate of identification of 4.4%); Bradford T. Ulery *et al.*, “Accuracy &

In fact, multiple (and long overdue) research studies have now confirmed that significant variability permeates not only the ultimate conclusions of even highly-experienced examiners as to whether a latent print can be identified or excluded as originating from a particular source individual (with one study demonstrating that examiners disagree up to 50% of the time on difficult cases),¹⁷ but also the arena of more basic and preliminary questions such as whether the features in a fingerprint are sufficiently clear and complete to even be suitable for analysis:



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Reliability of Forensic Latent Fingerprint Decisions,” Proceedings of the National Academy of Sciences, at 7738 (2011) (first large scale study of fingerprint accuracy ever conducted finding that 3% of examiners committed false identifications and nearly all examiners, 85%, falsely excluded prints); Bradford T. Ulery *et al.*, “*Repeatability and Reproducibility of Decisions By Latent Print Examiners,*” Proceedings of the National Academy of Sciences, at 8 (2012) (examiners disagreed with one another about 50% of the time on difficult cases and about 20% of the time on the easiest cases, moreover examiners changed their own opinions when taking a second look at evidence around 30% of the time); Neumann *et al.*, “*Improving the Understanding and the Reliability of the Concept of ‘Sufficiency’ in Friction Ridge Examination,*” U.S. D.O.J., at 56 (2013) (variation between examiners in every one of 15 trials); Iriel E. Dror & David Charlton, “*Why Experts Make Errors,*” 56 Journal of Forensic Identification 600 (2006) (biasing case information swayed even experienced examiners’ judgments about the source of fingerprints).

¹⁷ See e.g., Bradford T. Ulery *et al.*, “*Accuracy & Reliability of Forensic Latent Fingerprint Decisions,*” Proceedings of the National Academy of Sciences, at 7738 (2011) (first large scale study of fingerprint accuracy ever conducted finding that 3% of examiners committed false identifications and nearly all examiners, 85%, falsely excluded prints); Bradford T. Ulery *et al.*, “*Repeatability and Reproducibility of Decisions By Latent Print Examiners,*” Proceedings of the National Academy of Sciences, at 8 (2012) examiners disagreed with one another about 50% of the time on difficult cases and about 20% of the time on the easiest cases, moreover examiners changed their own opinions when taking a second look at evidence around 30% of the time); Cedric Neumann *et al.*, “*Improving the Understanding and the Reliability of the Concept of ‘Sufficiency’ in Friction Ridge Examination,*” U.S. Department of Justice, at 56 (2013) (variation between examiners in every one of 15 trials).

¹⁸ See Neumann *et al.*, “*Improving the Understanding and the Reliability of the Concept of ‘Sufficiency’ in Friction Ridge Examination,*” at 53, 85 (conducting trials with 164 fingerprint examiners and finding significant variation in

And actually, when asked to complete a baseline task in their field and identify the features relevant to their analysis of fingerprints, examiners vary widely in terms of the features actually observed (both the number and location of features) as well as the significance of their findings (i.e. different examiners have different thresholds for the number of features in correspondence necessary to justify an identification of a print), with the most recent and comprehensive study on the topic ultimately finding that examiners manage to select any particular feature on the same print only 47% of the time when (as is common in casework) there are issues of clarity, and only 63% of the time even in clearer areas of prints.¹⁹

As if such findings were insufficient to knock claims of infallibility from their perch among fingerprint examiners, additional research (and real world miscarriages of justice) have even more pointedly demonstrated the now-undeniable potential for error, for misidentifications, when practitioners engage in the daunting enterprise of comparing fingerprints. For starters, both empirical studies and real-world misidentifications demonstrate that fingerprint examiners' conclusions change—often to incorrect results—when they (1) are exposed to as little as mundane contextual information like investigative facts (i.e. did the suspect have an alibi), (2) view a suspect's standard print before full review of the latent print in question, or (3) are tripped up by incidental similarity of prints found by searching large-scale databases.²⁰ And in fact,

their suitability determinations—in one trial examiners split nearly 50/50—leading authors to opine that “it appears urgent to develop and provide guidelines and training defining more robustly the concept of minutiae”).

¹⁹ See Ulery, “*Measuring What Latent Fingerprint Examiners Consider Sufficient*,” at 9, 11 (for some prints included in the study examiners minutiae counts ranged from 5 to 20 or more features, leading the authors of the study to state: “Although we expected variability in minutiae counts, we did not expect the counts to vary as much as they did, especially in those critical cases in which examiners do not agree on their determination and precise counting might be pivotal. The differences in minutiae count understate the variability between annotations because annotations not only differ substantially in total minutiae counts, but also in which specific minutiae were selected”). Ulery *et al.*, “*Interexaminer variation of minutia markup on latent fingerprints*,” 264 *Forensic Science International* 89, 94-95 (2016).

²⁰ See Dror & Charlatan, “*Why Experts Make Errors*,” 56 *Journal of Forensic Identification*, at 612 (in 6 of 48 trials examiners changed previous conclusions when presented with information regarding defendant confessions or alibis, leading researchers to conclude that findings “demonstrate that fingerprint experts were vulnerable to biasing information when they were presented within relatively routine day-to-day contexts, such as corroborative (or

every study to have measured the baseline probability of misidentifications by fingerprint examiners has confirmed that (biased by contextual data or not) even highly-qualified and conscientious practitioners, not just never, but frequently, commit errors:

Table 1: Error Rates in Studies of Latent Print Analysis*

Study	False Positives			
	Raw Data	Freq. (Confidence bound)	Estimated Rate	Bound on Rate
Early studies				
Langenburg (2009a)	0/14	0% (19%)	1 in ∞	1 in 5
Langenburg (2009b)	1/43	2.3% (11%)	1 in 43	1 in 9
Langenburg et al. (2012)	17/711	2.4% (3.5%)	1 in 42	1 in 28
Tangen et al. (2011) ("similar pairs")	3/444	0.68% (1.7%)	1 in 148	1 in 58
Tangen et al. (2011) ("dissimilar pairs")	0/444	0% (0.67%)	1 in ∞	1 in 148
Black-box studies				
Ulery et al. 2011 (FBI)**	6/3628	0.17% (0.33%)	1 in 604	1 in 306
Pacheco et al. 2014 (Miami-Dade)	42/995	4.2% (5.4%)	1 in 24	1 in 18
Pacheco et al. 2014 (Miami-Dade) (excluding clerical errors)	7/960	0.7% (1.4%)	1 in 137	1 in 73

* "Raw Data": Number of false positives divided by number of conclusive examinations involving non-mated pairs. "Freq. (Confidence Bound)": Point estimate of false positive frequency, and upper 95 percent confidence bound. "Estimated Rate": The odds of a false positive occurring, based on the observed proportion of false positives. "Bound on Rate": The odds of a false positive occurring, based on the upper 95 percent confidence bound—that is, the rate could reasonably be as high as this value.
 ** If inconclusive examinations are included for the FBI study, the rates are 1 in 681 and 1 in 344, respectively.

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conflicting) evidence of confession to the crime"); Itiel E. Dror *et al.*, "Contextual information renders experts vulnerable to making erroneous identifications," 156 *Forensic Science International* 74, 76 (2006) (four of five examiners changed previous conclusions when presented information masking prints as those from a famous misidentification, leading to findings that "fingerprint identification decisions of experts are vulnerable to irrelevant and misleading contextual information"); Itiel E. Dror *et al.*, "Cognitive issues in fingerprint analysis: Inter- and intra-expert consistency and the effect of a 'target' comparison," 208 *Forensic Science International* 10, 16 (2011) (study "demonstrates that the presence of a comparison print can affect the analysis of the latent mark"); OIG "A Review of the FBI's Handling of the Brandon Mayfield Case," at 138 (error in most famous fingerprint misidentification of all time, Brandon Mayfield, occurred in part because features "were adjusted or influenced during the comparison phase by reasoning 'backward' from features that are visible in the Mayfield exemplars"); Itiel E. Dror & Jennifer Mnookin, "The use of technology in human expert domains: challenges and risks arising from the use of automated fingerprint identification systems in forensic science," 9 *Law, Probability, & Risk* 47 (2010) ("the chances of finding by [through an AFIS search] pure coincidence a lookalike print, a print originating from another person but that is nevertheless extremely similar to the latent print, is much higher than when comparing the latent print to just as a few dozens, hundreds or even thousands of prints prior to the introduction of AFIS"); Itiel E. Dror *et al.*, "The Impact of Human Technology Cooperation & Distributed Cognition in Forensic Science: Biasing Effects of AFIS Contextual Information on Human Experts," 57 *Journal of Forensic Science* 343, 351 (2012) (empirical study of examiner performance using AFIS discovered that "when false identifications occur, they are closely centered at the top of the list, further showing the biasing effects of position. Such false identifications occurred even when a more similar print (the actual matching one) was present in a lower position on the same list" and "false identifications are more likely as the comparison print is more similar to the latent").

²¹ PCAST, "Forensic Science in Criminal Courts," at 98. These studies are actually more disturbing than they might otherwise appear given that their results constitute nothing more than "lower bound estimates" for the frequency of

Moreover, it should further concern the Court that misidentifications have not remained confined to the boundaries of artificial studies, instead infecting the real-world application of fingerprint comparisons to the prosecution of crimes. While fingerprint examiners may claim infallibility or near to it, misidentifications have occurred with unsettling frequency, and even under the auspices of the world's most prestigious laboratories (for example, in one of the most high-profile instances of a fingerprint error, the FBI's mistaken work led to the unjust arrest of a U.S. citizen, Brandon Mayfield, in relation to a terrorist bombing in Spain; he would escape prosecution only because Spanish authorities later linked the latent print in question to the true culprit, an Algerian national named Ouhnane Daoud).²²

Thus, taking all these issues of subjectivity, variability, error, and misidentification together (or really for that matter even taking each in isolation) fingerprint examiners simply have no empirical or scientific basis to claim certainty, whether practical or absolute, in their opinions. Instead and in truth, the best data available from the field demonstrates that false

misidentifications: "because the examiners were aware they were being tested, the actual false positive rate in casework may be higher." Michael J. Saks & Jonathan L. Koehler, "*The Coming Paradigm Shift in Forensic Identification Science*," 309 *Science* 892 (2005) ("Indeed these existing data [on error rates] are probably best regarded as lower-bound estimates of error rates. Because the tests are relatively easy ...and because participants know that mistakes will be identified and punished, test error rates ...are lower than those in everyday casework."); see also PCAST, "*Forensic Science in Criminal Courts*," at 149; Adina Schwartz, "*Challenging Firearms and Toolmark Identification- Part Two*," *The Champion* XXXII (9): 44-52, 47 (2008) ("results on the CTS tests provide an inflated, rather than an accurate, estimate of the competence of examiners").

²² See e.g., Robert B. Stacey "A Report on the Erroneous Fingerprint Individualization in the Madrid Train Bombing Case," 54 *Journal of Forensic Identification* 706 (2004) (discussing Mayfield misidentification); OIG "A Review of the FBI's Handling of the Brandon Mayfield Case," U.S. Department of Justice (2006) (same); Simon Cole, "*More than Zero: Accounting for Error in Latent Fingerprint Identification*," 95 *J. Crim. L. & Criminology* 985 (2005) (collecting and discussing over twenty cases of fingerprint misidentification despite the fact that the author limited the cases discussed to ones where the fingerprint community had established consensus agreement to the fact that an error had occurred). As was true about above in regards to studies underestimating false identification rates, so too do the numbers of real-world misidentifications *discovered* surely provide an unjustly rosy picture of the reality of misidentifications perpetrated by field of fingerprint comparisons. See Simon A. Cole, "*Forensic Statistics, Part II 'Implicit Testing': Can Casework Validate Forensic Techniques?*," 46 *Jurimetrics J.* 117, 123 & 126-27 (2006) ("Because the ground truth is not known in casework, a case cannot serve as a test of the accuracy of a forensic assay used in it" & "known misattributions are very likely to only be a small subset of actual misattributions"); Andre A. Moenssens, "*Novel Scientific Evidence in Criminal Cases: Some Words of Caution*," 84 *J. Crim. L. & Criminology* 1, 12-13 (1993) (noting that misidentifications occur but "mistakes of this kind are not very likely to be discovered").

associations likely occur, not at a rate so negligible as to be dismissed as practically impossible, but rather, roughly 1 in every 18 times examiners *believe* they have accurately identified the source of a latent print.²³ The discipline of fingerprint comparison may wish to keep its collective head buried in the sand and ignore that reality, but this Court should not allow their conceit to pollute the search for justice in this case, or any other.

III.) SCIENTIFIC AUTHORITIES HAVE REPEATEDLY PUSHED FINGERPRINT EXAMINERS TO REFORM THEIR TESTIMONIAL PRACTICES, MOST RECENTLY BY CALLING ON THEM TO ABANDON ALL USE OF THE TERM “IDENTIFICATION.”

Unfortunately, the discipline of fingerprint examination made no independent effort to bring its conclusions in line with the scientific record. Instead that push did not begin in earnest until 2009 when the broader scientific community started taking note of its forensic kin, including fingerprint comparisons, in the wake of a scathing report released by the National Academy of Sciences²⁴ (an organization long considered, and established by law as, the “leading scientific advisory body ...[to] the Legislative Branch”).²⁵ More specifically, Congress ordered the NAS to investigate the status of several forensic science disciplines based on the recognition that “significant improvements are needed in forensic science.”²⁶ To that end NAS formed a team of acclaimed scientists, legal minds, and forensic specialists who for two years heard testimony from practitioners (including fingerprint examiners) and tirelessly “considered the

²³ PCAST, “*Forensic Science in Criminal Courts*,” at 101.

²⁴ See National Academy of Sciences, “*Strengthening Forensic Science in the United States: A Path Forward*,” National Academies Press (2009).

²⁵ PCAST, “*Forensic Science in Criminal Courts*,” at 144. This Court should consider the opinions of the NAS authoritative. Not only have they been cited as such by the United States Supreme Court and other judges across the country, see e.g., *Melendez-Diaz v. Massachusetts*, 557 U.S. 305 (2009); *United States v. Mouzone*, 696 F. Supp. 2d 536, 570 (D. Maryland 2009), but the mission and history of the NAS ought to afford it ample reverence given that it has been tasked by Congress since the days of Abraham Lincoln “with providing independent, objective advice to the nation on matters related to science and technology” and has produced landscape-shifting studies of the forensic sciences (including the use of coroners offices, DNA statistics, and the shortcomings of bullet-lead analysis) since the 1920s. See <http://www.nasonline.org/about-nas/mission/>; see also David Kaye, “*The good, the bad, the ugly: The NAS report on strengthening forensic science in America*,” 50 *Science & Justice* 8, 8-9 (2010).

²⁶ NAS, “*Strengthening Forensic Science in the United States*,” at xix.

peer-reviewed, scientific research purporting to support the validity and reliability of existing forensic disciplines.”²⁷

Ultimately, its authors reached unanimity with regard to the deficiencies of forensic identification (and especially pattern matching) approaches,²⁸ describing such methodologies as more akin to rough heuristics than validated science,²⁹ and noting in broad strokes that “no forensic method [other than DNA] has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source.”³⁰ Most applicably to this motion, the NAS expressed concern that because “population statistics for fingerprints have not been developed, and friction ridge analysis relies on subjective judgment” it follows that “the outcome of a friction ridge analysis is not necessarily repeatable from examiner to examiner.”³¹ Thus, the group unequivocally rejected the practice of overreaching to claim certainty by noting, not only that “claims of absolute, certain confidence in identification are unjustified...[and] should be replaced by more modest claims about the meaning and significance of a ‘match,’”³² but also that “[b]y acknowledging that there can be uncertainties in this process, the concept of ‘uniquely associated with’ must be replaced with probabilistic association, and other sources of the crime scene evidence cannot be completely discounted.”³³

The writing already on the walls and its hands forced, the field of fingerprint examination at least responded to the watershed moment that was the publication of the NAS report by at long

²⁷ The Honorable Harry T. Edwards, “*The National Academy of Sciences Report on Forensic Sciences: What it Means for the Bench & Bar*,” Presentation to the Superior Court of DC, at 1-2 (2010).

²⁸ *Id.* at 1 (“the substance of the Committee’s Report was really not hard to write. The problems that plague the forensic science community have been well understood for quite some time”).

²⁹ National Academy of Sciences, “*Strengthening Forensic Science in the United States: A Path Forward*,” *National Academies Press*, at 128 (2009).

³⁰ *Id.* at 7.

³¹ *Id.* at 139.

³² *Id.* at 142.

³³ *Id.* at 184.

last acknowledging the need for greater humility in its conclusions. In fact, multiple arms of the field raced to modernize their recommendations on the appropriate bounds of testimony, with SWGFAST noting that “the ability of a latent print examiner to individualize a single latent print impression, with the implication that they have definitively excluded all other humans in the world, is not supported by research,”³⁴ and the International Association of Identification advising members “to avoid stating their conclusions in absolute terms when dealing with population issues.”³⁵ Perhaps because these changes left in place not only the term identification itself but even that conclusion’s association with certainty³⁶—the community of practitioners largely bought in such that major law enforcement agencies³⁷ and the majority of labs eventually left claims like “the exclusion of all others” behind.³⁸

But commentators were quick to point out the minimal impact of such meaningless and belated concessions, calling out groups like SWGFAST and the IAI for enacting merely “semantic reforms”³⁹ and “cosmetic change[s]”⁴⁰ without abandoning the very terms

³⁴ SWGFAST, “*Document #103: Individualization/ Identification Position Statement (Latent/Tenprint)*,” at 1 (2012).

³⁵ Robert Garrett, “*Memorandum from the President of the International Association of Identification*,” (2009).

³⁶ See SWGFAST, “*Document #10 Standards for Examining Friction Ridge Impressions*,” at 4 (2013).

³⁷ See e.g., OIG, “*A Review of the FBI’s Progress in Responding to the Recommendations in the Office of the Inspector General Report on the Fingerprint Misidentification in the Brandon Mayfield Case*,” at 8 (FBI “examiners testify that they are confident in the conclusion, would not expect to see the same amount of information repeated if the fingerprints originated from different people, and find no physical evidence causing them to doubt that the fingerprints are from the same source”); Defense Forensic Science Center, “*Information Paper, Subject: Use of the Term Identification in Latent Print Technical Reports*,” (Nov. 3, 2015) (noting that “several well respected and authoritative scientific committees and organizations have recommended forensic science laboratories not report or testify, directly or by implication, to a source attribution to the exclusion of all others in the world or to assert 100% certainty and state conclusions in absolute terms when dealing with population issues” and instead adopting language as follows: “The latent print on Exhibit # and the record finger/palm prints bearing the name XXXX have corresponding ridge detail. The likelihood of observing this amount of correspondence when two impressions are made by different sources is considered extremely low.”); Department of Justice, “*Approved Uniform Language for Testimony & Reports for the Forensic Latent Print Discipline*,” (2018) (forbidding examiners to testify in terms of absolute certainty or individualization and instead requiring that when practitioners report a “source identification” they instead explain that it is “is a statement of an examiner’s belief (an inductive inference) that the probability that the two impressions were made by different sources is so small that it is negligible”).

³⁸ AAAS, “*Forensic Science Assessments, A Quality & Gap Analysis*,” at 60 (“many if not most latent print examiners in the United States have already ceased making such claims” of 100% certainty and the like).

³⁹ Cole, “*Individualization is dead*,” 13 *Law, Prob., & Risk* at 144 (2014); see Simon Cole, “*Forensics without uniqueness, conclusions without individualization: the new epistemology of forensic identification*,” 8 *Law, Prob., &*

“identification” and “individualization” that the field itself had worked for so long and with such vigor to link to notions of absolute infallibility. Even some of the discipline’s own, most-authoritative and esteemed leaders, like Dr. Christophe Champod and Henry Swofford, made their opposition to the sufficiency of the SWGFAST-style changes clear.⁴¹ And in so doing they made sure to emphasize the black-and-white mathematics behind their position, discussing, among other points, that while true identifications (where a certain arrangement of friction ridge skin legitimately would not be expected to appear in more than one individual on earth) would require random match probabilities at least as small as 1 in 100 billion,⁴² in the fingerprint realm “only random match probabilities of one in a billion or larger can be justified through systematic research. Articulating any smaller probability (down to the probability of zero) is nothing more than a leap of faith or playing God.”⁴³

A flood of blue ribbon panels accompanied these whistleblowers, and have time and time again urged fingerprint examiners to take the only responsible and scientifically sound course

Risk 233, 234 (2009) (“forensic identification--historically and still today--rests upon indefensible conceptual foundations”).

⁴⁰ Tobin & Blau, “*Hypothesis Testing of the Critical Underlying Premise of Discernible Uniqueness in Firearms-Toolmark Forensic Practice*” 53 *Jurimetrics* at 131.

⁴¹ See Champod, “*Identification & Individualization*,” in *Encyclopedia of Forensic Sciences* (2009) (“identification conclusion require examiners to “articulate probabilities outside the reach of the current systematic research” & even “conclusions that use terms such as *very likely* or *almost certain* in relation to a proposition are only logically possible when the nonscientific evidence is taken into account”); H.J. Swofford, “*The Emerging Paradigm Shift in the Epistemology of Fingerprint Conclusions*,” 65 *J. Forensic Identification* 201, 209 (2015 (recommending a “move away from categoric statements of ‘identification’ or ‘individualization’, which carry implications of absolute source attribution” because although progress away from old definitions of such terms “is certainly notable, it does not entirely meet the objective and presents a situation for potential contradictory interpretations of fingerprint conclusions by the investigator or layperson”); Thompson *et al.*, “*Expertise in Fingerprint Identification*,” 58 *J. Forensic Sci.* 1519 (2013) (“It is clear that an alternative to the current model of fingerprint testimony is required”).

⁴² See AAAS, “*Forensic Science Assessments, A Quality & Gap Analysis*,” at 62-63.

⁴³ Christophe Champod, “*Fingerprint examination: towards more transparency*,” 7 *L., Prob., & Risk* 111 (2008). It should be noted that a host of other forensic groups and scholars agreed that overblown conclusions like “identification” were inappropriate. See e.g. Budowle *et al.*, “*A Perspective on Errors, Bias, & Interpretation in the Forensic Sciences and Direction for Continuing Advancement*,” 54 *J. Forensic Sci.* 798, 804 (2009) (with the use of terms like match there may be an “unintended contribution to bias (i.e., conveying more strength than intended)” and suggesting “instead the term ‘failure to exclude,’ which may seem to some more acceptable”); John M. Collins, “*Stochastics-The Real Science Behind Forensic Pattern Identification*,” *The Crime Lab Report* (2009) (noting the scientific irresponsibility of extreme source attribution conclusions, suggesting instead that examiners more conservatively acknowledge the subjectivity of their work and state only: “I have never seen, nor would I expect to see, this amount of similarity in ... different sources”).

available by further moderating their conclusions and rejecting use of the term “identification.” First up was a panel (The Working Group on Human Factors), largely comprised of leaders from within the discipline of fingerprint examination, and sponsored jointly by the Department of Justice and the National Institute of Standards and Technology, which undertook years of study in order to produce a 200 page report outlining the strengths and weaknesses of the field.⁴⁴ It, like NAS, urged the abandonment of absolute conclusions in favor of more modest testimony, emphasizing that “[b]ecause empirical evidence and statistical reasoning do not support a source attribution to the exclusion of all other individuals in the world, latent print examiners should not report or testify, directly *or by implication*, to a source attribution to the exclusion of all others in the world.”⁴⁵ But actually, it went further by rejecting claims of negligible rates of error and instead recommending that examiners familiarize themselves with, and provide testimony concerning, the empirical evidence regarding the potential for misidentification in order to moderate and legitimize the discipline’s conclusions: “[a] testifying expert should be familiar with the literature related to error rates. . . [t]he expert should not state that errors are inherently impossible or that a method inherently has a zero error rate.”⁴⁶

And the last two years have seen perhaps their own watershed moment as regards source-attribution testimony, with landmark reports, which reject the term “identification” as well as its association with practical certainty, being issued by the President’s Council of Advisors on

⁴⁴ See Working Group on Human Factors, “*Latent Print Examination and Human Factors*,” at x, xi, 127.

⁴⁵ *Id.* at 72 (emphasis added).

⁴⁶ *Id.* at 32-33, 124, & 127. In fact another arm of the DOJ, specifically the National Commission on Forensic Science, also took a stand against overblown testimony when in 2016 it rejected even the use of the lesser phrase “to a reasonable degree of scientific certainty” in part because jurors “might equate it with certainty at the level demanded by the ‘beyond a reasonable doubt’ standard of proof.” NCFCS, “*Views of the Commission regarding Use of the Term ‘Reasonable Scientific Certainty’*,” at 3 (2016). And the Reporting and Testimony Subcommittee of that organization even more directly opined that “Forensic science experts should not state that a specific individual or object is the source of the forensic evidence...other individuals or objects could possess or have left a similar set of observed features.” NCFCS Reporting & Testimony Subcommittee, “*Views of the Commission: Statistical Statements in Forensic Testimony*,” at 5 (2016).

Science & Technology (“the leading scientific advisory body established by the Executive branch”)⁴⁷ as well as the American Association for the Advancement of Science (one of the world’s largest and most reputable scientific organizations).⁴⁸ Beginning with PCAST, that panel noted that terms like “match” and “identification” ultimately convey “inappropriately high probative value,” and thus should be replaced by “a more neutral term” that more directly acknowledges the possibility for error.⁴⁹ And it rejected not just assertions of absolute certainty, but a host of *lesser* conclusions (including claims suggesting that the chance of error is

⁴⁷ PCAST, “*Forensic Science in Criminal Courts*,” at x. This Court should consider the PCAST report authoritative. The Obama-era-iteration of the PCAST consisted primarily of some of our nation’s leading and most-respected scientists, including: a geneticist from MIT/Harvard who was the principal contributor in efforts to map the human genome, an engineer and Vice President of the National Academy of Engineering, a mathematician and former CEO of The Aerospace Corporation, a doctor who was the first female president of the American College of Physicians, a chemist who directs the Institute for Nanotechnology at Northwestern University, the director of The Laboratory for Geochemical Oceanography at Harvard University, a doctor of biochemistry and professor emeritus at the University of California Berkeley, and a physicist who is a Senior Vice President at a leading aerospace and technology corporation (to name but a few). See <https://obamawhitehouse.archives.gov/administration/eop/ostp/pcast/about/members>. For several decades, the PCAST has reported to the then-sitting U.S. President on a wide range of scientific issues, including, but not limited to, nanotechnology, internet broadband development, cloning, and the uses of science and technology to combat terrorism. See <https://obamawhitehouse.archives.gov/administration/eop/ostp/pcast/docsreports>. In short, the PCAST represents one of the most important and authoritative collections of scientists in the country. And its final report on the pattern matching disciplines has, since its publication, been endorsed by the nation’s most prestigious forensic body (the American Academy of Forensic Sciences), an international consortium of forensic experts, and Judge Alex Kozinski of the United States Court of Appeals for the Ninth Circuit, who went so far as to say that the report “will fundamentally change the way many criminal trials are conducted” and “will likely upend many people’s beliefs” about once-trusted forensic disciplines. Kozinski, “*Rejecting Voodoo Science in the Courtroom*,” Wall Street Journal (Sept. 19, 2016); see *Motorola Inc. v. Murray*, 147 A.3d 751, 759 (D.C. 2016) (J. Easterly concurring) (“Fortunately, in assessing the admissibility of forensic expert testimony, courts will have the aid of landmark reports [including PCAST’s]... These reports provide information about best practices for scientific testing, an objective yardstick against which proffered forensic evidence can be measured, as well as critiques of particular types of forensic evidence”); <https://news.aafs.org/policy-statements/presidents-council-of-advisors-on-science-and-technology-pcast-report/>; The Forensic Institute, “*Commentary on PCAST 2016*,” available at <http://www.theforensicinstitute.com/news-articles/views-and-opinions/commentary-of-pcast-2016>.

⁴⁸ See AAAS, “*Forensic Science Assessments: A Quality and Gap Analysis*,” at i. As with PCAST and NAS this Court should treat the AAAS report as authoritative. Since 1848, AAAS has vigorously pushed for scientific progress “through initiatives in science policy, international programs, science education, public engagement, and more.” *Id.*; see also Alan Fersht, “*The Most Influential Journals: Impact factor & Eigenfactor*,” 106 PNAS 6883 (2009) (describing the journal as one of three that “have by far and away the most overall influence on science...one of the most influential drivers of scientific progress”). It currently “includes nearly 250 affiliated societies and academies of sciences, serving 10 million individuals” and also publishes the peer-reviewed journal “*Science*,” which boasts the largest paid circulation of any general science journal in the world. *Id.* In fact, even the United States Supreme Court has acknowledged AAAS as a font of scientific expertise by identifying the organization as a valuable source for reliable referrals of court-appointed experts. See *GE v. Joiner*, 522 U.S. 136, 149-50 (1997).

⁴⁹ PCAST, “*Forensic Science in Criminal Courts*,” at 46.

“minimal” or “a practical impossibility”), noting that “judges, when permitting an expert to testify ... should ensure that testimony ... it is limited to what the empirical evidence supports. [s]tatements suggesting or implying greater certainty are not scientifically valid and should not be permitted.⁵⁰ In fact, for fingerprints specifically, PCAST recommended that opinions regarding source by examiners should be

“accompanied by accurate information about limitations on the reliability of the conclusion—specifically, that (1) only two properly designed studies of the foundational validity and accuracy of latent fingerprint analysis have been conducted, (2) these studies found false positive rates that could be as high as 1 error in 306 cases in one study and 1 error in 18 cases in the other, and (3) because the examiners were aware they were being tested, the actual false positive rate in casework may be higher.”⁵¹

Only by so doing, the PCAST emphasized, could fingerprint examiners defensibly act with “clarity and restraint” and afford jurors a legitimate opportunity to grasp the scientific reality that “the fact that two samples satisfy a method’s criteria for a proposed match does not mean that the samples are from the same source.”⁵²

And the AAAS report, which focused solely on fingerprint comparisons, would independently reach the same conclusions. Relying on the risk of juror confusion, as well as the same mathematical realities discussed earlier by Champond,⁵³ that organization unequivocally denounced use of the word “identification” and its attendant assertions of practical certainty:

“The scientific literature does not, however, provide an adequate basis for assessing the rarity of any particular feature, or set of features, that might be found in a fingerprint. Examiners may well be able to exclude the preponderance

⁵⁰ *Id.* at 19.

⁵¹ *Id.* at 149.

⁵² *Id.* at 6.

⁵³ See AAAS, “Forensic Science Assessments, A Quality & Gap Analysis,” at 63 (“The determination that the observable details of a fingerprint are ‘unlikely to be repeated’ rests on the ability of latent print examiners to make extraordinarily precise estimates of the frequency of those details in the human population. Latent print examiners would need, for example, to be able to distinguish a set of details that occurs with a frequency of 1 in 100 billion or less from a set that occurs with a frequency of 1 in 10 billion or more. If latent print examiners cannot make such distinctions accurately, then they cannot determine whether a particular set of details is likely or unlikely to be repeated, and therefore have no basis for making the claim”).

of the human population as possible sources of a latent print, but there is no scientific basis for estimating the number of people who could not be excluded and there are no scientific criteria for determining when the pool of possible sources is limited to a single person...Consequently, we have concluded that latent print examiners should avoid claiming that they can associate a latent print with a single source.”⁵⁴

In fact, AAAS went so far as to provide fingerprint examiners with a model for scientifically-responsible reporting of their conclusions, advising them to candidly discuss error rates, but to say nothing more definitive than:

“The latent print on Exhibit ## and the record fingerprint bearing the name XXXX have a great deal of corresponding ridge detail with no differences that would indicate they were made by different fingers. There is no way to determine how many other people might have a finger with a corresponding set of ridge features, but it is my opinion that this set of features would be unusual.”⁵⁵

Such recommendations represent the culmination of years of study by some of the finest available minds of our time, and clearly indicate that the term “identification” falls well outside the bounds of scientific legitimacy. That so many have had to come from scientists outside the field of fingerprint examination demonstrates only that the field itself cannot be left alone to appropriately moderate its conclusions.⁵⁶ That task, for better or worse, now falls to the courts.

IV.) USE OF THE TERM “IDENTIFICATION” WILL GROSSLY OVERSTATE THE PROBATIVE VALUE OF FINGERPRINT EVIDENCE & WILL UNDULY PREJUDICE THE DEFENSE.

It should by now be clear that when fingerprint examiners claim the ability to “identify” the source of a latent print, they are not simply engaging in mild exaggeration of their discipline’s capabilities, but instead, are peddling patent falsehoods. Such assertions (whether or

⁵⁴ *Id.* at 60.

⁵⁵ *Id.* at 67.

⁵⁶ Examples of fingerprint examiners and laboratories that rebut this notion of course exist. The U.S. Army’s crime lab, for instance, years ago moved far away from absolute source attribution. See Defense Forensic Science Center, “Information Paper, Subject: Use of the Term Identification in Latent Print Technical Reports,” (Nov. 3, 2015). And, though its choice of language ultimately remained deeply problematic, see Rush Holt, “Letter from AAAS C.E.O to Rod Rodenstein, Deputy Attorney General” (Mar. 26, 2018), the DOJ at least removed the words “practical impossibility from its definition of identification. See DOJ, “Approved Uniform Language for Testimony & Reports for the Forensic Latent Print Discipline,” (2018). But these instances have come far too infrequently, and have had too little influence on the larger community of fingerprint examiners, to absolve the discipline of blame for the innappropriate testimony that too often still features in courtrooms across the United States.

not defined overtly as involving practical certainty) simply do not square with the currently-demonstrable statistical likelihood of coincidental similarity between random prints, much less the far-more substantial possibility of error during an examiner's exercise of subjective judgment—and that is to say nothing of the compounded chance for a misidentification when, as is always true during the course of casework, both avenues for error can manifest simultaneously. Thus, while fingerprint examiners may continue to be “reluctant to abandon the claim that they can ‘identify’ the source of a latent print”⁵⁷ the wanton speculation required for them to so conclusively implicate any particular defendant in no way deserves the imprimatur of this Court.⁵⁸⁵⁹

And Illinois Rule of Evidence 403, which requires exclusion of evidence “if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or

⁵⁷ AAAS, “Forensic Science Assessments, A Quality & Gap Analysis,” at 60.

⁵⁸ See *Modelski v. Navistar Int'l Transp. Corp.*, 302 Ill. App. 3d 879, 886 (1st Dist. 1999) (emphasizing that expert “testimony grounded in guess, surmise, or conjecture, not being regarded as proof of a fact, is irrelevant as it has no tendency to make the existence of a fact more or less probable.”); *People v. Sargeant*, 292 Ill. App. 3d 508, 511 (1st Dist. 1997) (excluding the “inconclusive, tentative, and speculative” testimony of a handwriting expert).

⁵⁹ Although the report of the State's fingerprint examiner uses the word “identified,” his stance with regards to said term's meaning (and thus his place along the spectrum of reform in his field) remains far more ambiguous. Mr. Schauer's report itself does not define the term “identified,” and unfortunately his tendered protocols contradict themselves as regards its meaning. All equate the term “identification” with its even more problematic cousin “individualization,” see DOJ, “Approved Uniform Language,” at 2 (keeping the term identification, but rejecting individualization because it would “wrongly imply that a source identification is based on a statistically-derived or verified measurement or comparison of all friction ridge skin impression features in the world's population”), but worse, while one protocol offers the caveat, in line with SWGFAST, that an identification is merely “the decision that the likelihood the impression was made by another (different) source is so remote that it is considered as a **practical impossibility**,” a separate protocol even more indefensibly defines the same term as occurring “when a latent print examiner, trained to competency, determines that two friction ridge impressions originated from the same source, **to the exclusion of all others**.” R.E.Walsh & Associates, Inc., “Protocols Addendum A: Quality Assurance Guidelines for Latent Print Examiners,” at 6 (Mar. 9, 2015) (emphasis added) (attached as Exhibit II); R.E.Walsh & Associates, Inc., “Protocols Addendum B: Standards for Examining Friction Ridge Impressions & Resulting Conclusions (Latent/Tenprint),” at 5 (Mar 9, 2015) (emphasis added) (attached as Exhibit III); R.E.Walsh & Associates, Inc., “Protocols Addendum D: Standard Terminology of Friction Ridge Examination (Latent/Tenprint),” at 7-8 (Mar. 9, 2015) (equating identification and individualization and defining the latter merely as an examiner's conclusion that two ridge impressions “originated from the same source) (attached as Exhibit IV). Despite these incongruities, however, it appears from a more recent interview with Mr. Schauer that he has abandoned the least defensible of such conclusions. See “*Illinois v. Akindele: Summary of Interview of Charles Schauer*,” (Feb. 9, 2016) (attached as Exhibit V). This motion therefore operates under the assumption that Mr. Schauer will not make claims of objectivity, zero-error, exclusion of all others, or absolute certainty; of course, all the arguments made throughout this motion apply with even greater force to those outmoded conclusions.

misleading the jury,” provides an ideal vehicle for preventing any spurious claims by the State’s fingerprint examiner in this matter. As the Illinois Supreme Court has recognized, the admissibility of expert testimony in any given case will always “depend on the State’s ability to lay a proper foundation and to demonstrate the qualifications of its witness, subject to the balancing of probative value with the risk of unfair prejudice,”⁶⁰ and the very First District opinion to most recently affirm the admissibility of fingerprint evidence under Frye actually left the door wide open for attorneys to attack and seek exclusion of overreaching opinions by examiners on a case-by-case basis, noting that “the viability of specific efforts to exclude claims of zero error or testimony regarding the certainty of a match in future cases ...[will] depend on the specific testimony and the support offered for those claims.”⁶¹ In fact, both courts and commentators have noted that expert testimony actually requires heightened, rather than diminished, vigor with regard to applying Rule 403 given the “natural inclination of the jury to equate science with truth and, therefore, accord undue significance to any evidence labeled scientific.”⁶²

Such conclusions, moreover, find added support in scientific findings about the perceptions of jurors, and demonstrate the heightened risk of undue prejudice and confusion

⁶⁰ People v. McKown, 236 Ill.2d 278, 305 (2010); *see also* Luna, 2013 IL App (1st) 072253, at ¶72; People v. Floyd, 2014 IL App (2d) 120507, ¶22-24 (2d Dist. 2014); Murray v. Motorola, Inc., 2014 D.C. Super. LEXIS 16, 33-35, 56-58 (D.C. Super. Ct. 2014); United States v. Frazier, 387 F.3d 1244, 1263 (11th Cir. 2004); United States v. Van Wyk, 83 F. Supp. 2d 515 (D.N.J. 2000); United States v. Santillan, 1999 WL 1201765 (N.D. Ca 1999); United States v. Reynolds, 904 F.Supp. 1529, 1558 (E.D. Oka. 1995); People v. Shreck, 22 P.3d 68, 70 (Colo. 2001); Daubert v. Merrell Dow Pharms., 509 U.S. 579, 595 (1993); Bowers, “*Forensic Testimony: Science, Law and Expert Evidence*,” Academic Press (2014); Mnookin, “*The Courts, NAS, & the Future of Forensic Sciences*,” 75 Brooklyn L. R. 51-55 (2010).

⁶¹ Luna, 2013 IL App (1st) 072253, ¶ 72 (1st Dist. 2013); *see also* People v. Robinson, 2013 IL App (1st) 102476, ¶ 91 (1st Dist. 2013) (“we conclude the trial court did not err in ruling the testimony [regarding firearms examination] in this case was admissible and did not require a *Frye* hearing, **particularly where** the trial judge barred the witnesses from testifying their opinions were ‘within a reasonable degree of scientific certainty’”) (emphasis added).

⁶² New, 2014 IL 116306, at ¶26; *see also* People v. Newberry, 166 Ill.2d 310, 316-17 (1995) (“The State asserts that [the defendant] is not without recourse because he can still assail the State’s test results by...cross-examining the State’s experts about the procedures they followed. While these opportunities may exist, the relief they offer is illusory. Whatever the actual reliability of the tests performed in the lab -- and the reliability may not be great -- the laboratory analysis of the evidence will carry great weight with the jury”).

stemming from the use of terms like “identification.” The PCAST report, for example, emphasizes that “[c]ompared to many types of expert testimony, testimony based on forensic feature-comparison methods poses unique dangers of misleading jurors,” because “[t]he vast majority of jurors have no independent ability to interpret the probative value of results based on the detection, comparison, and frequency of scientific evidence...they would be completely dependent on expert statements garbed in the mantle of science.”⁶³ And in the context of fingerprint examinations more specifically, robust empirical findings actually bear out the troubling reality that “[p]ublic perceptions of latent print examination have undoubtedly been shaped by decades of overstatement” meaning that “people generally think a reported association between a latent and reference print constitutes a virtually infallible identification.”⁶⁴ In fact, the vast majority of potential jurors should be expected to interpret the word “identification” specifically as conveying absolute certainty,⁶⁵ and to come to trial with a grossly inflated sense of the reliability of fingerprint evidence (likely believing that errors would occur only about once per every 5.5 million cases).⁶⁶

⁶³ PCAST, “*Forensic Science in Criminal Courts*,” at 45.

⁶⁴ AAAS, “*Forensic Science Assessments, A Quality & Gap Analysis*,” at 71; see also Brandon Garrett & Gregory Mitchell, “*How Jurors Evaluate Fingerprint Evidence: The Relative Importance of Match Language, Method Information, and Error Acknowledgment*,” 10 J. Empirical Legal Studies, 484, 498 (2011) (noting that proponents of fingerprint evidence “benefit from a widespread assumption among jurors that no two fingerprints are alike” as well, more generally, preconceptions that fingerprint science does not produce errors).

⁶⁵ See H.J. Swofford & J.G. Cino, “*Lay Understanding of “Identification”*,” 68 J. Forensic Identification 29 (2018) (study concluding that “71% of potential jurors may be expected to interpret expert testimony containing the word ‘identification’...to imply a single source attribution ‘to the exclusion of all others’”).

⁶⁶ See Koehler, “*Intuitive Error Rate Estimates for the Forensic Sciences*,” 57 *Jurimetrics* 153, 162 (2017); see also William C. Thompson & Eryn J. Newman, “*Lay Understanding of Forensic Statistics: Evaluation of Random Match Probabilities, Likelihood Ratios, & Verbal Equivalents*,” 39 L. & Hum. Behav. 332 (2015) (juror evaluation of DNA evidence influenced by preconceived notions about the discipline & factfinders are susceptible to statistical fallacies, both prosecution and defense varieties); Jonathan J. Koehler, “*If the Shoe Fits They Might Acquit: The Value of Forensic Science Testimony*,” 8(s1) J. of Empirical Legal Studies 21-48 (2011) (“As detailed in the NRC report the ‘science’ part of forensic science has not kept pace with the extraordinary claims made on its behalf. As a result, jurors have little idea what the chance is that a forensic scientist’s conclusions are wrong, how often different objects share particular characteristics, or how much weight to give the forensic science as proof of identity.” Further noting that jurors “are slow to revise incorrect probabilistic hypotheses” “fall prey to logical fallacies” and “failed to appreciate the role that error plays in interpreting the value of a reported match”); Dawn McQuiston-Surrett & Michael J. Saks, “*Communicating Opinion Evidence in the Forensic Identification Sciences: Accuracy & Impact*,”

Nor will such misconceptions be amenable to correction by the normal workings of the adversarial process. While it may be tempting for this Court to dismiss concerns regarding exaggerations by the State's fingerprint expert as mere issues of weight as opposed to admissibility, such a hands-off approach could only be justified if cross-examination actually possessed the potential to expose the weaknesses underlying fingerprint examination and meaningfully impact a jury's perception of the strength of the State's forensic evidence. Yet, a significant quotient of recent scientific research runs contrary to such a leap of faith.⁶⁷ Study after study demonstrates that, in fact, even robust and pointed cross-examination that is well-designed to expose weaknesses in forensic practitioners' methods has little to no power to do so,⁶⁸ especially when experts phrase their conclusions in unshakable terms like "identification."⁶⁹

59 Hastings L.J. 1159, 1170 (2008) ("most jurors have an exaggerated view of the nature and capabilities of forensic identification").

⁶⁷ Joseph Sanders, *Reliability Standards—Too High, Too Low, or Just Right? The Merits of the Paternalistic Justification for Restrictions on the Admissibility of Expert Evidence*, 33 Seton Hall L. Rev. 881, 936-938 (2003) (noting, in summary of the author's analysis of a wide swath of literature, that the results "lend support to the argument that rulings excluding unreliable evidence promote jury accuracy even if we assume jurors are as good as judges in assessing reliability on jurors that" and that "the empirical research does lend some support to the paternalistic justification for restrictions on the admissibility of unreliable expert testimony.").

⁶⁸ Koehler, "*If the Shoe Fits They Might Acquit*," ("Contrary to predictions, none of the source and guilt dependent measures in the main experiment were affected by the introduction of cross examination. There was no effect for cross examination on source confidence, source probability, guilt confidence, guilty probability, or verdict. Likewise there was no effect for cross examination across the two individualization conditions on any of the dependent measures."); Sanders, "*Reliability Standards—Too High, Too Low, or Just Right?*," at 913, 934-36 (Concluding that multiple studies bear out the sobering reality that even robust cross examination of experts affects neither ultimate verdicts nor even juror confidence in said verdicts); Dawn McQuiston-Surrett & Michael J. Saks, "*The Testimony of Forensic Identification Science: What Expert Witnesses Say & What Factfinders Hear*," 33 Law & Hum. Behav. 436 (2009) (Authors conducted a study and reviewed others, ultimately finding "little or no ability of cross-examination to undo the effects of an expert's testimony on direct examination, even if the direct testimony is fraught with weaknesses and the cross is well designed to expose those weaknesses." Interestingly, the authors conclude that cross examination can effect juror evaluation of expert evidence if it is presented honestly as a subjective guess, but that "...the unshakeableness of the traditional forms: match and similar-in-all-microscopic-characteristics produce something of a ceiling effect, which resist moderation by the presentation of other information."); Shari Seidman Diamond, *et al.*, "*Juror Reactions to Attorneys At Trial*," 87 J. Crim. L. & Criminology 17, 41 (1996) (experiment, using 1925 jury-eligible residents of Cook County, which varied the strength of an attorney's cross examination of an expert witness found that: "Although juror perceptions of the attorney appear susceptible to influence by the attorney's efforts during cross-examination, the strong cross-examination had no effect on the verdict.").

⁶⁹ PCAST, "*Forensic Science in Criminal Courts*," at 45-46 ("The potential prejudicial impact is unusually high, because jurors are likely to overestimate the probative value of a "match" between samples" thus the term match conveys "inappropriately high probative value, a more neutral term should be used for an examiner's belief that two samples come from the same source."); Koehler, "*If the Shoe Fits They Might Acquit*," ("people are more persuaded

The researchers responsible for said studies themselves conclude that their “results should give pause to anyone who believes the adversarial process will always undo the effects of weak expert testimony.”⁷⁰ And judges have acknowledged as much, noting that while “cross-examination is a minimal constitutional safeguard ... it is far from adequate.”⁷¹ But more than that, courts have gone beyond simply sermonizing about the dangers of exaggerated forensic evidence, with hosts of jurisdictions actually limiting the testimony of forensic examiners.⁷² And

by statistical testimony that ignores various error risks than by testimony that is objectively stronger by virtue of taking those risks into account”); Sanders, “*Reliability Standards—Too High, Too Low, or Just Right?*,” at 935 (Concluding that testimony couched in terms of an expert’s experience, was “more impervious to cross-examination and opposing experts.”); Saks, “*Communicating Opinion Evidence in the Forensic Identification Sciences*,” at 1177 (“The conclusions of examiners in all areas of forensic identification other than DNA typing reach their conclusions on the basis of subjective guesstimations (clinical rather than actuarial), they present their opinions in nonquantitative, usually categorical, terms, and by all indications laypersons are generally quite persuaded by their testimony.”); McQuiston-Surrett & Saks, “*The Testimony of Forensic Identification Science*,” 33 *Law & Hum. Behav.* 436 (“Participants in the conditions [hearing testimony in terms of a match or that targets were similar in all microscopic characteristics] which led to the highest estimates that the crime scene hair came from the defendant paradoxically gave the highest estimates of the incidence of the same hair traits in the reference population. This reinforces the inference that those two testimonial conditions lead to the least understanding of the basic concepts of forensic identification while leading to the highest inculpatory judgments” & “These data suggest that the two traditional forms in which forensic identification testimony is expressed [again referring to match of the similar-in-all-microscopic-characteristics language] are most damaging to the defense, while communicating a comfortingly simple and easily grasped (though not very informative and presumably misleading) understanding of the basis for the identification opinion.”); John Thornton, “*The General Assumptions & Rationale of Forensic Identification*,” In *Modern Scientific Evidence: The Law & Science of Expert Testimony*, at 16 (1997) (when an expert “and bases [an] opinion on ‘years of experience’ the practical result is that the witness is immunized against effective cross examination”); Sanders, “*Reliability Standards—Too High, Too Low, or Just Right?*,” at 934.

⁷⁰ McQuiston-Surrett & Saks, “*Communicating Opinion Evidence in the Forensic Identification Sciences*,” at 1188; see also Sanders, *Reliability Standards—Too High, Too Low, or Just Right?*,” at 936 (same).

⁷¹ The Honorable Harry T. Edwards, “*The National Academy of Sciences Report on Forensic Sciences: What it Means for the Bench & Bar*,” Presentation to the Superior Court of DC (2010); see *People v. Zayas*, 131 Ill. 2d 284, 292 (1989) (in ruling hypnotically-assisted-recall testimony inadmissible court emphasized the likelihood and danger of prior juror exposure to misleading information about hypnosis); *People v. Baynes*, 88 Ill. 2d 225, 244 (Ill. 1981) (“There is significant risk the jury will regard [polygraph] evidence as conclusive...It is questionable whether any jury would follow limiting instructions because the polygraph evidence is likely to be shrouded with an aura of near infallibility, akin to the ancient oracle of Delphi.”) (internal citations & quotations omitted); *United States v. Glynn*, 578 F.Supp.2d 567 (S.D.N.Y. 2008) (“cross-examination is inherently handicapped by the jury’s own lack of background knowledge, so that the Court must play a greater role, not only in excluding unreliable testimony, but also in alerting the jury to the limitations of what is presented.”); *Murray*, 2014 D.C. Super. LEXIS at ¶60 (“the court cannot be confident that effective advocacy can eliminate the risk that a jury would be misled by [the expert’s] testimony and reach a result on an improper basis.”); American Bar Association, “*Forensic Sciences: Judges as Gatekeeper*,” at 29-30 (2015).

⁷² See *Commonwealth v. Joyner*, 4 N.E.3d 282, 289 (Mass. 2014) (holding that that fingerprint examiners should avoid expressing opinions of absolute certainty); *United States v. Taylor*, 663 F.Supp.2d 1170, 1180 (D. NM 2009) (“because of the limitations on the reliability of firearms identification evidence discussed above, Mr. Nichols will not be permitted to testify that his methodology allows him to reach this conclusion as a matter of scientific certainty. Mr. Nichols also will not be allowed to testify that he can conclude that there is a match to the exclusion,

although some such cases have addressed only the admissibility of absolute certainty statements, a great many have trekked further and precluded all manner of overblown source attributions ranging from claims of practical certainty to mere assertions of identification.⁷³ This Court should follow suit.

either practical or absolute, of all other guns.”); United States v. Ashburn, 88 F.Supp.3d 239, 249 (E.D.N.Y. 2015) (quoting the finding of the NAS Committee that forensic ballistic comparison “suffers from certain ‘limitations,’ including the lack of sufficient studies to understand the reliability and repeatability of examiners’ methods . . .” and precluding “expert witness from testifying that he is ‘certain’ or ‘100%’ sure of his conclusions that certain items match ... that a match he identified is to ‘the exclusion of all other firearms in the world,’ or that there is a ‘practical impossibility’ that any other gun could have fired the recovered materials.”); Massachusetts v. Pytou Heang, 942 N.E.2d 927, 945-46 (2010) (allowing testimony to a reasonable degree of ballistics certainty but precluding statements describing firearms examination as a science or phrasing of conclusions to an absolute or practical certainty); United States v. Monteiro, 407 F.Supp.2d 351, 375 (D. Mass. 2006) (limiting testimony to “reasonable degree of ballistic certainty”); United States v. Diaz, 2007 U.S. Dist. LEXIS 13152, at *41-42 (N.D. Cal. 2007) (precluding matches to the exclusion of all other guns in the world); United States v. Love, No. 2:09-cr-20317-JPM (W.D. Tenn. Feb. 8, 2011) (excluding testimony regarding absolute or practical certainty); United States v. Allis, No. CR2-08-223(1) (S.D. Ohio Dec. 7, 2009) (forbidding any claim of a match to one firearm to the exclusion of all other guns and limiting examiner to descriptions of her methodology and observations of casings); Christophe Champod, “*Fingerprint identification: advances since the 2009 National Research Council report*,” at 5 (describing the “increasing tendency among courts to refrain from accepting fingerprint evidence as facts that can be expressed with 100% certainty or suggesting that the evidence alone is enabling the exclusion of all others in the world except the concerned individual”); Cole, “*Individualization is dead*,” 13 L., Prob., & Risk at 134 (collecting cases limiting fingerprint testimony).

⁷³ See United States v. Oskowitz, 294 F. Supp. 2d 379, 384 (E.D.N.Y. 2003) (“Many other district courts have similarly permitted a handwriting expert to analyze a writing sample for the jury without permitting the expert to offer an opinion on the ultimate question of authorship.”); United States v. Rutherford, 104 F. Supp. 2d 1190, 1194 (D. Neb. 2000) (expert limited to “explaining the similarities and dissimilarities between the known exemplars and the questioned documents” and “precluded from rendering any ultimate conclusions on authorship of the questioned documents and is similarly precluded from testifying to the degree of confidence or certainty on which his opinions are based”); United States v. Hidalgo, 229 F. Supp. 2d 961, 967 (D. Ariz. 2002) (“Because the principle of uniqueness is without empirical support, we conclude that a document examiner will not be permitted to testify that the maker of a known document is the maker of the questioned document. Nor will a document examiner be able to testify as to identity in terms of probabilities.”); U.S. v. McVeigh, 1997 WL 47724 3 (D. Colo. 1997) (holding that a pattern recognition expert could not testify to ultimate source attribution for unknown handwriting evidence); United States v. Green, 405 F. Supp. 2d 104, 124 (D. Mass. 2005), citing United States v. Hines, 55 F. Supp. 2d 62 (D. Mass. 1999) (permitting testimony only regarding an examiner’s observations **without any** accompanying conclusions about the source of a projectile); United States v. Glynn, 578 F.Supp.2d 567 (S.D.N.Y. 2008) (noting that, given the lack of data supporting the discipline “ballistics lacked the rigor of science,” and limiting testimony of match to a conclusion of “more likely than not” instead of even “reasonable ballistics certainty” to ensure that “a conviction in a criminal case may not rest *exclusively* on ballistics testimony.”); United States v. Mouzone, 696 F.Supp.2d 536, 569 & 572-73 (D. Maryland 2009) (concluding that neither conclusions of absolute nor practical certainty of a match were factually warranted and noting that the most accurate reading of recent cases on firearms examination is that courts have recognized “as the NRC Forensic Science Report clearly did, that if firearms toolmark evidence is characterized exclusively as ‘science,’ it has a long way to go before it legitimately can claim this status ... the concerns expressed by the NRC ought to be heeded by courts in the future”); United States v. Willock, 696 F.Supp.2d 536, 546 (D. Maryland 2010) (adopting report and recommendation of magistrate in Mouzone, and enforcing “a complete restriction on the characterization of certainty”); United States v. St. Gerard, APO AE 09107, at 4 (U.S. Army Trial Judiciary, 5th Judicial Circuit June 7, 2010) (the probative value of [the expert’s] proffered testimony that it would be practically impossible for a tool other than the seized AK-47 to have

Given that, at all events, the State's fingerprint examiner must testify to the nuances of his methodology and the points of similarity he observed as part of the foundation for any opinion,⁷⁴ addition of term "identification" adds little in the way of probative value (and none of it legitimate). In contrast, the empirical record regarding juror reactions to fingerprint evidence establishes that the only way to avoid undue prejudice and ensure that factfinders discern the appropriate weight of fingerprint evidence is to, if necessary, force examiners to accurately, and without hyperbole, explain the limits of their field.⁷⁵ Thus, a more than substantial record exists to justify the exercise of this Court's discretion under Rule 403. And, given that a jury will likely view the very presentation of fingerprint evidence at trial as an indication of this Court's tacit approval of the examiners methods and conclusions,⁷⁶ neutrality is simply not an option.

V.) CONCLUSION

Illinois courts have long required even DNA experts (who hail from a field benefiting from far more rigorous and substantial foundational research than is available concerning fingerprints)⁷⁷ to avoid testifying in terms of conclusory match opinions, and in their place, to

made the marks on the cartridge case would be substantially outweighed by the unfair prejudice associated with its unreliability."), available at http://www.swgfast.org/Resources/101126_US-v-Gerard.pdf; United States v. Jackson, 1:11-CR-411-WSD, (N.D. Ga. July 25, 2012) (disallowing expression of source attribution "to a practical certainty" and limiting to "consistent with"); Missouri v. Goodwin-Bey, No. 1531-CR00555-01 (Dec. 16, 2016) (limiting testimony "to the point this gun could not be eliminated as the source of the bullet.").

⁷⁴ See People v. Safford, 392 Ill. App. 3d 212, 225-26 (1st Dist. 2009) (foundation for admission of fingerprint evidence requires discussion of the points of comparison relied on); United States v. Saunders, 826 F.3d 363, 369-70 (7th Cir. 2016) (expert must disclose points of comparison and be subject to cross concerning said features).

⁷⁵ See Garrett & Mitchell, "How Jurors Evaluate Fingerprint Evidence," at 505 ("when the examiner admitted that fingerprint examiners sometimes make mistakes and that the identification in this case could thus be wrong, participants reduced their judgments about the likelihood that the defendant committed the crime, reduced their estimates of the probability that the defendant left his prints at the crime scene, and had less confidence in their guilt judgments"); AAAS, "Forensic Science Assessments, A Quality & Gap Analysis," at 71 (recommending that examiners "take affirmative steps, when reporting their findings, to address ... common misconceptions").

⁷⁶ See N.J. Schweitzer & Micheal J. Saks, "The Gatekeeper Effect: The Impact of Judges' Admissibility Decisions on the Persuasiveness of Expert Testimony," 15 *Psychology, Public Policy, & Law* 1 (2009) (concluding after multiple experiments that jurors are "less critical of and more persuaded by expert evidence when it was presented within a trial" potentially because they assume such evidence had already undergone vetting by judges).

⁷⁷ See e.g., Erin Murphy, "What 'Strengthening Forensic Science' today means for tomorrow: DNA exceptionalism and the 2009 NAS Report," 9 *Law, Prob., & Risk* 7, 17 (2010) ("DNA evidence has changed how we think of conventional forensic evidence: DNA is the gold standard, the model forensic discipline").

provide a numerical/statistical sense of the weight owed particular genetic evidence⁷⁸—this despite the fact that said statistics now, often soar into the nonillions and decillions, thereby dwarfing the earth’s population by several orders of magnitude.⁷⁹ And while it may be reasonable to refrain from punishing the discipline of fingerprint examination by and through the mechanism of wholesale exclusion simply because it has not yet conducted sufficient research to enable similar statistically-derived opinions, it is another matter entirely to instead reward the field by allowing fingerprint examiners to actually go further and inexplicably offer stronger and more definitive conclusions than experts from more scientifically-robust forensic disciplines (especially considering that available data concerning fingerprint variability hints that the statistical value of matches in that realm will never even remotely approach the discriminating power possible with DNA). But that is precisely the “perverse” result fashioned by permitting fingerprint examiners to suggest certainty in their conclusions and deploy the word “identification.”⁸⁰ Thus, the time is ripe—perhaps even long overdue—for courts to actuate their

⁷⁸ See *People v. Pike*, 2016 IL App (1st) 122626, ¶ 48 (1st Dist. 2016) (“[a] statistic is necessary to understand the significance of the inclusion as a potential contributor”).

⁷⁹ See e.g., *Commonwealth v. McKelvin*, 170 A.3d 1262 (Pa. Super. Ct. 2017) (statistic for a random match of “1 in 10 decillion from the Caucasian community, and 1 in 180 nonillion from the African American population”).

⁸⁰ Cole, “*Forensics without uniqueness, conclusions without individualization: the new epistemology of forensic identification*,” 8 *Law, Prob., & Risk* at 249 (“The argument that individualization is somehow legitimate for disciplines for which it is more difficult to generate rarity estimates is fallacious; the difference pertains to the nature of the research effort, not the nature of the evidence. More than that, the argument is perverse: its result would be that the disciplines making claims of ‘individualization’ are not those with data to support those claims (because data would never support such extreme claims), but rather those disciplines which in their historical development have been indifferent to both data and probabilistic thinking.”); see D. Michael Risinger & Michael J. Saks, “*A House With No Foundation*,” *Issues in Science & Technology*, Vol. XX, Issue I (2003) (noting that, bolstered by judicial decisions admitting the testimony of practitioners without conducting searching inquiries or demanding foundational validity, forensic communities have dismissed research that might uncover limitations as a “net loss”); PCAST, “*Forensic Science in Criminal Courts*,” at 26 (explaining that decisions excluding DNA evidence actually forced practitioners to team with molecular biologists and develop rigorously scientific standards and practices); Paul C. Gianelli, “*Crime Labs Need Improvement*,” *Issues in Science & Technology*, Vol. XX, Issue I (2003) (opining that forgiving admissibility approaches to forensic science have resulted in a present reality where “clinical laboratories must meet higher standards to be allowed to diagnose strep throat than forensic labs must meet to put a defendant on death row”).


role as gatekeepers of scientific evidence⁸¹ and bring the treatment of fingerprint evidence into conformity with the standards required of other forensic disciplines. By doing so now, this Court will ensure the scientific legitimacy of the forensic opinions confronting Mr. Sanchez while providing the trier of fact with the most comprehensible and honest accounting of the appropriate weight of fingerprint comparisons.

⁸¹ See Roach v. Union Pacific Railroad, 2014 IL App (1st) 132015, ¶ 55 (1st Dist. 2014); see Decker v. Libell, 193 Ill. 2d 250, 254 (2000) (even when assessing expert testimony “trial judge serves in a familiar role as ‘gatekeeper,’ barring testimony that is not sufficiently relevant or reliable to be admitted into evidence”); Verbance v. Altman, 324 Ill. App. 3d 494, 502 (2d Dist. 2001) (“In examining case law concerning the admissibility of an expert’s testimony, particularly that by medical treaters, we concluded that the court frequently employs a totality-of-the-circumstances approach in determining whether the testimony is sufficiently reliable to be submitted to the jury. We noted that, as the gatekeeper of expert opinions disseminated to the jury, the trial court plays a critical role in excluding testimony that does not bear an adequate foundation of reliability”) (*citing* Soto v. Gaytan, 313 Ill. App. 3d 137, 147 (2d Dist. 2000)); People v. Taylor, 335 Ill. App. 3d 965, 973 (2d Dist. 2002) (“As the gatekeeper of expert opinions disseminated to the jury, the trial court must look behind the expert’s conclusion and analyze the adequacy of the foundation” & “the trial court is not required to blindly accept an expert’s assertion that his or her testimony has an adequate foundation”).

Wherefore, Mr. Sanchez requests that this Court limit the testimony and conclusions of the State's fingerprint examiner, Charles Schauer, so as to preclude scientifically unacceptable statements of "identification." Instead this Court should require said examiner to offer applicable error rates during his testimony, and should cabin his conclusion statements in accordance with the recommendations, discussed above, of AAAS.⁸²

Respectfully Submitted,

AMY P. CAMPANELLI
Cook County Public Defender

BY: 
Richard E. Gutierrez
Assistant Public Defender

AMY P. CAMPANELLI, Cook County Public Defender
Richard E. Gutierrez, Assistant Public Defender
David Holland, Assistant Public Defender
Attorneys for the Defendant, Raymond Sanchez
1500 Maybrook Drive,
Maywood, IL 60153
Attorney Number 30295

⁸² The arguments made throughout this motion should be considered, not only in the sense that they impact the prejudice calculus of Rule 403, but also for their constitutional implications, because under the Due Process Clause of the Fourteenth Amendment "reliability is the linchpin of determining the admissibility" of evidence. *See Manson v. Brathwaite*, 432 U.S. 98, 114 (1977). Given the gross and unfounded speculation necessary for a fingerprint examiner to reach an "identification" conclusion, such testimony would fundamentally diminish the reliability of the proceedings against Mr. Sanchez, therefore imperiling his due process rights to a fair trial.

RE: Did your circulate your draft remarks

From: "Hunt, Ted (ODAG)" <(b) (6)>
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Date: Wed, 11 Oct 2017 18:02:10 -0400

Hi (b)(6), (b)(7)(C),

Yes, I will be here late afternoon this Friday.

We will have a couple more moot before we're fully on point and ready to go, so I will definitely let you know

Ted

-----Original Message-----

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Sent: Wednesday, October 11, 2017
To: Hunt, Ted (ODAG) (b) (6)
Subject: RE: Did your circulate your draft remarks

Are you in on Friday afternoon late? I hope to have your PAR to sign. Also - if there is another moot, I'd love to participate. I got here late and didn't want to walk in late so I just dialed in

(b)(6), (b)(7)(C), (b)(7)(E) per FBI

General Counsel

Unit Chief

Forensic Science Law Unit

Tel: (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cell: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

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Original Message

From: Hunt, Ted (ODAG) [mailto:(b) (6)]
Sent: Wednesday, October 11, 2017 4:20 PM
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Subject: RE: Did your circulate your draft remarks

Hi (b)(6), (b)(7)(C),

My focus wasn't on accreditation, which I agree is a losing argument - I'm referencing 17025 only to the extent that it sets forth the consensus scientific international standard by which method validation is to be accomplished -- and unlike the PCAST Report, is not prescriptive about exactly how that must be done. I'm sensitive to the fact that we need to directly respond to the manner by which feature comparison methods can be appropriately validated, and that quality assurance measures don't get us there.

Ted

-----Original Message-----

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Sent: Wednesday, October 11, 2017
To: Hunt, Ted (ODAG) (b) (6)
Subject: Did your circulate your draft remarks

Earlier I'm on call (didn't want to walk in late) but would like to review. There are a number of challenges to relying on accreditation as "we're ok because we are accredited and conform to ISO standards" since this only means the lab has developed standards and works in conformity to those standards - not an evaluation of those standards as being good science. I came in on the tail end of your presentation so maybe this is moot.

(b)(6), (b)(7)(C), (b)(7)(E) per FBI

Office of the General Counsel

Unit Chief

Forensic Science Law Unit

Tel: (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cell: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

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RE: Request from Ted Hunt

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI, "Hunt, Ted (ODAG) (JMD)" <(b) (6)>
Date: Mon, 09 Jul 2018 17 52 34 0400

(b)(6), (b)(7) The expectation is that this is a 101 for your discipline presentation to include what legal challenges you may have encountered post PCAST. Ted should be back in the office so I'll ask him to clarify. Only state prosecutors and fed AUSAs will be attending.

(b)(6), (b)(7)(C), (b)(7)(E) per FBI
Chief, Forensic Science Law Unit
Office of the General Counsel
Federal Bureau of Investigation
Desk: (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cell: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

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From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)
Sent: Mon, 9 Jul 2018 3:01 PM
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI GC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Subject: Re: Request from Ted Hunt

(b)(6), (b)(7)(C)

Do you have any additional information regarding the expectations/objectives of my presentation at this conference? In order to prepare, I searched for the conference online and located the site for what I believe to be the conference (National Forensic Science Symposium) - <http://www.naag.org/nagtri/nagri-courses/national/national-forensic-science-symposium.php>. This site describes the training as "an intensive 3.5-day forensics 'boot camp' for prosecutors" which will "explain the science behind forensic science disciplines including DNA, latent prints, and firearms/toolmarks"

Do you expect any more communication from Ted regarding this conference?

Thanks,

(b)(6), (b)(7)

(b)(6), (b)(7)(C), (b)(7)(E) per FBI

ner
QDU | Footwear/Tire Group
FBI Laboratory
2501 Investigation Parkway
Quantico, VA 22135
(b)(6), (b)(7)(C), (b)(7)(E) per FBI O
(b)(6), (b)(7)(C), (b)(7)(E) per FBI C

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI)
Sent: Tue, 10 Jul 2018 9:22 AM
To: P (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI); Ise (b)(6), (b)(7)(C), (b)(7)(E) per FBI D) (FBI)
Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI); (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)
Subject: Re: Request from Ted Hunt

Thanks and I've let Ted know.

----- Original message -----

From: "Pokorak, Eric G. (LD) (FBI)" <(b) (6), (b) (7)(C)>

Date: 7/3/18 8:45 AM (GMT-05:00)

To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI); "Isenberg, Alice R. (LD) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI); (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)

Subject: RE: Request from Ted Hunt

(b)(6), (b)(7)(C), (b)(7)(E) per FBI will cover this request for QDU.

Thank you.

-----Original Message-----

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI)

Sent: Monday, July 2, 2018 5:46 PM

To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI); Isenberg, Alice R. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI); (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Subject: RE: Request from Ted Hunt

Eric: Thanks and I'll let Ted know.

(b)(6), (b)(7)(C), (b)(7)(E) per FBI

Chief, Forensic Science Law Unit

Office of the General Counsel

Federal Bureau of Investigation

Desk: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Cell: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

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-----Original Message-----

From: Pokorak, Eric G. (LD) (FBI)

Sent: Monday, July 02, 2018 5:17 PM

To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI); Isenberg, Alice R. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI); (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Subject: RE: Request from Ted Hunt

(b)(6), (b)(7)(C)

We will support this request. (b)(6), (b)(7)(C), (b)(7)(E) per FBI is out his week, so I ask for some time to provide you the name of the examiner. I'll update you in short order.

Thank you,

Eric

-----Original Message-----

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI)

Sent: Monday, July 02, 2018 5:03 PM

To: Isenberg, Alice R. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; Pokorak, Eric G. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Subject: Request from Ted Hunt

Ted has asked whether FBI LD could provide a presenter on Shoeprints and Tire treads at the upcoming National Association of Attorneys General/NDAA forensic conference on August 8th from 2:30-3:15. I am uncertain whether this will be at Main Justice on that day or at the DC Lab and indicated I would pass this along to you. Currently (b)(6), (b)(7)(C), (b)(7)(E) per FBI will be 15 DOJ attorneys and the rest of the participants will be state Assistant DAs. (We are currently providing (b)(6), (b)(7)(C), (b)(7)(E) per FBI /DNA; (b)(6), (b)(7)(C), (b)(7)(E) per FBI /LPU; (b)(6), (b)(7)(C), (b)(7)(E) per FBI /emerging issues). I reiterated that it was not the best use of FBI examiner time to have him break out sessions as requested earlier by NAAG.

FYI: Ted indicated he would not volunteer to provide assistance with this conference next year.

(b)(6), (b)(7)(C), (b)(7)(E) per FBI

Chief, Forensic Science Law Unit

Office of the General Counsel

Federal Bureau of Investigation

Desk: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Cell: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

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(b)(6), (b)(7)(C), (b)(7)(E) per FBI

Dear 



As co-author of the article *Internal validation of STRmix™ - A multi laboratory response to PCAST*, we are pleased to let you know that the final version – containing full bibliographic details – is now available online.

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RE: FSWG

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Isenberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Cc: "Hunt, Ted (ODAG)" <(b) (6)> (OGC) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Date: Tue, 23 Jan 2018 12:24:31 -0500

Thank very much for this. It does look interesting. It may be helpful to have an SME call down the road.

From: Isenberg, Alice R. (LD) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Sent: Tuesday, January 23, 2018 8:44 AM
To: Alice R. Isenberg <(b) (6)> Hunt, Ted (ODAG) <(b) (6)> (OGC) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Subject: FW: FSWG

Kira,
I cobbled together more input from a variety of SMEs in the Lab regarding validations of mixtures. If any of it doesn't make sense out of context, just let me know. I can always get a call together if it's important.
Alice

Attached is a paper which may be of some interest though it is not a complete answer. It contains Peter Gill's suggestions on how to evaluate whether your model is performing well with a given mixture.

Peter Gill's work in this area is also interesting. He basically replaces the suspect's profile with a thousand randomly generated profiles in the prosecution hypothesis and sees what kinds of LR's result. His reasoning is that validations cannot extend to cover every possible range of mixtures one might encounter. This modeling thus serves as a sort of case specific validation that the LR observed is not a fluke due to the peculiarities of the mixture encountered.

I'm not sure I follow Joel's reasoning though. In general, a really large LR should typically not result due to chance if your software is working appropriately. Your study also supports this view. 1/LR should represent the maximum probability of observing an LR as large as the one you do have due solely to chance matching.

If you are searching many profiles through a database, that is another matter as you are performing many, many comparisons.

§ Addressing problem of some labs providing numbers in excess of what their validations supported. This has been a criticism of binary method, i.e., that lab would calculate a CPI for a 4 person mixture, but their validations only covered up to 3 contributors. There was no restriction or guidance as to whether this was a good or bad practice, then in 2015 ASCLD/LAB said you have to have validated what you report out in terms of number of contributors. The only guidance has been SWGDAM, saying you should test a representative sample encountered in casework (yet number of contributors not specified).

The SWGDAM prob gen guidelines are a good guide to avoid this criticism with Probabilistic Genotyping (PG). There is no indication that anyone validating PG has exceeded the bounds of their validation. Recall, however, that John Butler is quoted as saying that lab are jumping into PG without knowing what they're doing. He has failed to recognize that everyone has in fact performed a validation, presumably under SWGDAM guidance, and has data aplenty to support (and limit) their usage of PG. ESR (New Zealand lab that created STRmix) worked with the FBI during validation (a service provided with all STRmix purchases), and they are intimately familiar with the SWGDAM guidelines because they participated in the discussions of the Ad Hoc Group. In other words, I suspect that STRmix validations, at least, have been done well. Can't speak for TrueAllele and others, but they are exceedingly few.

Are there any papers that support the notion that a lab/scientist can draw inferences when the analysis goes beyond the level of their validation?

A NIST statistician with no DNA involvement, Hari, shared his assessment with the Mixture Resource Group (that Butler organized) on what types of mixtures have been tested. Clearly this is a premature assessment since it would only be based on published studies, very few of which are actual validations. With poor explanation, he shared his view as a mathematician that we have not covered various areas in his statistical space. FBI SME asked whether there is any practical need of filling all such spaces. For example, if it's a 2 person mixture with a clear

major way above dropout levels, that behaves like a single source profile in PG and a scientist is therefore not going to spend as much time on those kinds of comparisons as they would for minor contributor and higher contributor number. FBI SME asked what was “the pace” not covered, and Hari couldn’t answer the question. John Butler seemed to put a lot of credence into Hari’s assessment, so this may be fueling his contention of presumed gaps in PG validation. The FBI’s recent publication (which Hari did not have) countering the PCAST claims would refute this concern. 31 lab, 2800 mixture tested in validation
[http://www.fsignetics.com/article/S1872-4973\(18\)30010-3/fulltext](http://www.fsignetics.com/article/S1872-4973(18)30010-3/fulltext)

RE: Draft Fordham Forensics Articles - comments by January 18

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
To: "Antell, Kira M. (OLP) (JMD)" <(b)(6)> "Hafer, Zachary (USAMA)" <(b)(6)>
<(b)(6)> "Young, Cynthia (USAMA)" <(b)(6)> "Goodhand, David (CRM)" <(b)(6)>
<(b)(6)> "Ibrahim, Anitha (CRM)" <(b)(6)> "Hul er, Raymond (CRM)" <(b)(6)>
<(b)(6)> "Wroblewski, Jonathan (CRM)" <(b)(6)>
<(b)(6)> "Smith, David L. (USAEO)" <(b)(6)>
Cc: "Hunt, Ted (ODAG) (JMD)" <(b)(6)> "Isenberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
"Goldsmith, Andrew (ODAG) (JMD)" <(b)(6)> "Shapiro, Elizabeth (CIV)" <(b)(6)>
Date: Wed, 10 Jan 2018 16:42:10 -0500

Kira, Ted, Andrew I think these are both very well written and my only small comment relates to Ted's article which I've left him in a vm

(b)(6), (b)(7)(C), (b)(7)(E) per FBI
Chief, Forensic Science Law Unit
Office of the General Counsel
Federal Bureau of Investigation
Desk: (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cell: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Confidentiality Statement: This message is transmitted to you by the Office of the General Counsel of the Federal Bureau of Investigation. The message, along with any attachments, may be confidential and legally privileged. If you are not the intended recipient of this message, please destroy it promptly without further retention or dissemination (unless otherwise required by law). Please notify the sender of the error by a separate e-mail or by calling (b)(6), (b)(7)(C), (b)(7)(E) per FBI.

From: Antell, Kira M. (OLP) [mailto:(b)(6)]
Sent: Tuesday, January 09, 2018
To: Hafer, Zachary (USAMA) <(b)(6)>; Young, Cynthia (USAMA) <(b)(6)>
<(b)(6)> "Goodhand, David (CRM)" <(b)(6)>; Ibrahim, Anitha (CRM) <(b)(6)>
<(b)(6), (b)(7)(C), (b)(7)(E) per FBI> "Wroblewski, Jonathan (CRM)" <(b)(6)>
<(b)(6)> "Smith, David L. (USAEO)" <(b)(6)> "Isenberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Cc: Hunt, Ted (ODAG) (JMD) <(b)(6)> "Goldsmith, Andrew (ODAG) (JMD)" <(b)(6)> "Shapiro, Elizabeth (CIV)" <(b)(6)>
Subject: Draft Fordham Forensics Articles - comments by January 18

Duplicative Material

Fwd: Draft Fordham Forensics Articles - comments by January 18

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Hunt, Ted (ODAG)" <(b) (6)>
Date: Wed, 17 Jan 2018 07:04:39 -0500
Attachment: Hunt Article 01092018_DISTRIBUTED.docx (53.03 kB); ATT00001.htm (216 bytes); ADG Article 01092018_DISTRIBUTED.docx (56.57 kB); ATT00002.htm (168 bytes)

I think the fn are okay in this version.

Sent from my iPhone

Begin forwarded message:

From: "Antell, Kira M. (OLP)" <(b) (6)>
Date: January 9, 2018 at 2:30:06 PM EST
To: "Hafer, Zachary (USAMA)" <(b) (6)>; "Young, Cynthia (USAMA)" <(b) (6)>; "Ibrahim, Anitha" <(b) (6)>; "Goodhand, David (CRM)" <(b) (6)>; "(b) (6), (b)(7)(C), (b)(7)(E) per FBI" <(b) (6)>; "(OGC) (FBI)" <(b) (6)>; "(b)(6), (b)(7)(C), (b)(7)(E) per FBI", Hulser, Raymond <(b) (6)>; "(CRM)" <(b) (6)>; "vvroblewski, Jonathan (CRM)" <(b) (6)>; "mith, David L. (USAE0)" <(b) (6)>; "(CRM)" <(b) (6)>
Cc: "Hunt, Ted (ODAG)" <(b) (6)>; "I enberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>; "Gold mith, Andrew (ODAG)" <(b) (6)>; "Shapiro, Elizabeth (CIV)" <(b) (6)>
Subject: Draft Fordham Forensics Articles - comments by January 18

Duplicative Material

FW: Draft Fordham Forensics Articles - comments by January 18

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Hunt, Ted (ODAG)" <(b) (6)>
Date: Wed, 17 Jan 2018 16:17:31 -0500

From: Smith, David L (USAEO) [mailto:(b) (6)]
Sent: Wednesday, January 17, 2018 4:14 PM
To: Antell, Kira M (OLP) (b) (6)
Subject: RE: Draft Fordham Forensics Articles - comments by January 18

Kira,

(b) (5)

et him know that (b)(5) per EOUSA

From: Antell, Kira M. (OLP) [mailto:(b) (6)]
Sent: Wednesday, January 17, 2018 12:00 PM
To: Malis, Jonathan M. (USADC) <(b) (6)>; Kirsch, Matthew (USACO) <(b) (6)>; Porter, Gene (USAMOW) <(b) (6)>
Cc: Smith, David L. (USAEO) <(b) (6)>; Young, Cynthia (USAMA) <(b) (6)>
Subject: Draft Fordham Forensics Articles - comments by January 18

Good afternoon,

In October, the Department presented at a forensic evidence symposium at Boston College for the Advisory Committee on Evidence Rules. The purpose of the symposium was to begin to discuss whether it was appropriate to amend Rule 702 for cases involving forensic evidence. OLP and CIV briefed the CrCWG about this event over the summer.

The Department was represented at the symposium by Andrew Goldsmith and Ted Hunt (both of ODAG), Zach Hafer (USAO-MA), and Alice Isenberg (FBI-Lab). OLP, CIV, CRM, CRM-Appellate, EOUSA, and Cynthia Young (USAO-MA) (CC'd here) assisted in preparing the presenters in advance. Many of us attended the symposium as well.

The transcript of the symposium will be published in an upcoming issue of the Fordham Law Review. Department speakers were also invited to provide articles to the Fordham Law Review Online.

Draft articles by Andrew and Ted were circulated last week to a small group of reviewers including Cynthia. Ted's article is a direct written response to the PCAST report drawn from previous public remarks but it is more granular than previously provided. Andrew's article is quite similar to his approved statement from the symposium but provides more in-depth legal arguments. Both of them contain Department legal and policy positions.

Cynthia suggested that it would be helpful to have additional criminal chiefs review these articles before they are sent to Fordham for publication. I would be grateful if you could review the effort article and let me know if you have concern by COB on Friday. Happy to speak with you by phone at any point.

Thanks,
Kira

Kira Antell
Senior Counsel
Office of Legal Policy
U.S. Department of Justice
950 Pennsylvania Avenue, NW
Washington, DC 20530

(b) (6)
(b) (6)

FW: Using the PCAST to Exclude, Limit, or Minimize Expert Testimony and Opinion

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI, "Hunt, Ted (ODAG)" <(b) (6)>
Date: Fri, 11 Aug 2017 16:23:38 -0400

Did I already send this to you? The Summer 2017 issue has a pro seutor perspective as well

Currently available to download:

Using the PCAST to Exclude, Limit, or Minimize Expert Testimony and Opinion

Eric Alexander Vos

[Criminal Justice; American Bar Association](#); Summer 2017

Download the article [here](#)

RE: Additional observations on the verbal scale

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
 To: (b)(6) @pd.sandiego.gov, "Lien, Eugene (OCME)" <(b)(6)@ocme.nyc.gov>, Joel Sutton
 <(b)(6)>, (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI, Peter Gill
 (b)(6), Lie Schiermeier wood (b)(6), (b)(6), (b)(7)(C), (b)(7)(E) per FBI, RUSSELL VOSSBRINK <(b)(6)>, "Steven Myers
 (b)(6), (b)(7)(C), (b)(7)(E) per FBI" <(b)(6)>, (b)(6) @dc.gov, "Hunt, Ted (ODAG) (JMD)"
 <(b)(6)>
 Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
 Date: Wed, 05 Sep 2018 18:41:14 -0400

Steven is way better at basic math than me!!!! He sent: " Super-minor adjustment: 1561/1581 is about 98.73%, not 98.25% The overall point does n't change, though " Thank you, Steven!

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)
 Sent: Wednesday, September 05, 2018 6:30 PM
 (b)(6) <(b)(6)>, OCME <(b)(6)>, Joel Sutton
 (b)(6) <(b)(6)>, (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI, Peter Gill <(b)(6)>;
 (b)(6), (b)(7)(C), (b)(7)(E) per FBI (b)(6), (b)(6), (b)(7)(C), (b)(7)(E) per FBI
 (b)(6) <(b)(6)>, (b)(6) @dc.gov; Hunt, Ted (ODAG) (JMD)
 <(b)(6)>
 Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
 Subject: Observations on

In a lecture last week to CADOJ I mentioned that all the delineations for the ranges in the SWGDAM verbal scale are empirically based (on Bright's PCAST paper) except for 10,000, which is arbitrary but at least consistent with the AFSP/ENFSI scale.

98.25% of adventitious Hp support is [2,99), as we discussed as a group in our definition of "limited support."

Steven noticed that for what remains – in [100, ∞) – 98.25% (again, coincidentally) of adventitious Hp support within this range occurs at [100,9999)
 ...which gives some meaning to the 10,000 mark that's not arbitrary.

I like that.

LR support	# of non contributor tests returning LR's in specified range	% of non contributor tests returning LR's in specified range	% of false Hp support
[1,2)	90320	0.3197%	
[2,99)	88783	0.3143%	98.25%
[99,9999)	1561	0.0055%	1.73%
[10000, ∞)	20	0.0001%	0.02%
total:	180684	0.6396%	

Where [1,2) is 1 up to but not including 2 and [2,99) is 2 inclusive up to but not including 99 etc.

DC DFS- PCAST

From: "Hunt, Ted (ODAG)" <(b) (6)>
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Date: Tue, 15 May 2018 10:05:39 -0400
Attachment DC DFS SAB Re pon e to PCAST Report DNA pdf (421 87 kB)

(b)(6), (b)(7)(C)

This came out a few days ago – in case you hadn't yet seen.

Ted

Ted R. Hunt
Senior Advisor to the Attorney General on Forensic Science
Office of the Deputy Attorney General
United States Department of Justice
950 Pennsylvania Ave. NW
Washington, DC 20530

(b) (6)
(b) (6)

FW: FATM subcommittee standard of "source conclusions and criteria"

From: "Kaye, David" <(b) (6)@dsl.psu.edu>
To: "Hunt, Ted (ODAG)" <(b) (6)>
Date: Sun, 27 Aug 2017 13:26:00 -0400
Attachments: FATM-SrcConcs&Crit-170505-LRC-170827.docx (81.3 kB)

Hi all,

I am attaching a draft set of comments on the FATM subcommittee's pre-SDO standard for "source conclusions and criteria." It took an extra week to complete because it incorporates (as an appendix) a memorandum on legal developments regarding firearms identifications. The memorandum includes a section on the PCAST report. I wrote the memorandum to demonstrate the need for the subcommittee and the SAC to address the comments carefully. Please submit any proposed amendments **by Wednesday afternoon** so I can consider them before putting a final version on Kavi for a ballot that night.

Thanks,

David

P.S., Nearly 40% of the committee has not voted on the comments on the training standard. Polls close tomorrow.

FW: FATM subcommittee standard of "source conclusions and criteria"

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
To: "Hunt, Ted (ODAG)" <(b)(6)>
Date: Wed, 30 Aug 2017 10 13 05 0400
Attachments: FATM-SrcConcs&Crit-170505-LRC-170827.docx (81.3 kB)

From: Kaye, David (b)(6) @dsl.psu.edu]
Sent: Sunday, August 27, 2017 12:58 PM
To: Barry Scheck <(b)(6)@innocenceproject.org>; Christine Funk <(b)(6)@christinefunk.net>; Christopher Plourd (b)(6); Dick Reeve (b)(6); Dick Reeve (b)(6) <(b)(6)@rmrcfl.net>; Jennifer Friedman <(b)(6)>; John Ellis (b)(6); Kaye, David (b)(6)@dsl.psu.edu; Kent Cattani <(b)(6)>; Lynn Garcia <(b)(6)>; Ron Reinstein <(b)(6)>; (b)(6), (b)(7)(C) (OGC) (FBI) (b)(6), (b)(7)(C) per FBI
Subject: FATM subcommittee standard of "source conclusions and criteria"



FW: Ruling involving PCAST

From: "Isenberg, Alice R. (LD) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI
To: "Hunt, Ted (ODAG) (JMD)" (b)(6) "Antell, Kira M. (OLP) (JMD)"
Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Date: Fri, 17 Aug 2018 11:53:57 -0400
Attachment: Court Order 8 12 18 PCAST.pdf (176 42 kB)

Ted and Kira,
I thought you might find this ruling interesting –apologies if you have received it through other channels.

Also, I have pasted notes below from the latest NIST Mixture Resource Group meeting earlier this week for your situational awareness.

Alice

(b)(6), (b)(7)(C), (b)(5) per FBI participated in the monthly meeting of the Mixture Resource Group (MRG) for the NIST Foundation Review (b)(6), (b)(7)(C), (b)(5) per FBI

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)
Sent: August 15, 2018 7:33 AM
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cc: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; Seubert, Heather (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; Pokorak, Eric G. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; Isenberg, Alice R. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Subject: CAST

Duplicative Material

FW: Ruling involving PCAST

From: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI
To: "Hunt, Ted (ODAG) (JMD)" <(b) (6)>
Date: Wed, 15 Aug 2018 09:06:39 -0400
Attachment: Court Order 8 12 18 PCAST pdf (176 42 kB)

Firearms brought this ruling to my attention regarding the PCAST document

Attached is a ruling out of Denver a few days ago, it does not shed a good light on PSCAT report:

"In addition to the fact that the report is hearsay, it is a report to the federal executive branch, not to the judicial branch, and it was written with the stated purpose of trying to find things that could be improved in the forensic sciences. Goal driven efforts to find things to criticize tend to present an unbalanced picture and tend to disregard, sometimes inadvertently, contrary evidence.4"

(b)(6), (b)(7)(C), (b)(7)(E) per FBI
nce Law Unit
Office of the General Counsel
Federal Bureau of Investigation
Desk: (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cell: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

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DISTRICT COURT CITY & COUNTY OF DENVER, COLORADO 1437 Bannock Street Denver, Colorado 80202	DATE FILED: August 12, 2018 2:26 PM CASE NUMBER: 2016CR7798
THE PEOPLE OF THE STATE OF COLORADO Plaintiff v. MAKHAIL PURPERA Defendant	<p style="text-align: center;">▲ COURT USE ONLY ▲</p> <hr/> Case Number: 2016CR7798 Courtroom: 4H
RULINGS ON MOTIONS	

THIS MATTER comes before the Court on several motions filed by the Defendant on June 29, 2018, August 8, 2018, and August 9, 2018. The Court, having reviewed the related pleadings, having considered the testimony, evidence, and argument presented at hearings on August 6 and 9, 2018, and having reviewed its file and relevant case law, finds and rules as follows:

The parties are proceeding to trial within a few days, and it is important that a ruling on the issues raised at the recent hearing enters so that the parties can prepare for trial. Accordingly, as discussed following the hearing, this is an expedited ruling that is less formal and, in some areas less thorough, than most written rulings would be.

Motion to Preclude Proposed Expert Testimony, or in the Alternative to Conduct a *Shreck* Hearing Relating to Prosecution Witness Charles Reno [D-10]

The standard for admitting scientific evidence in Colorado is set forth by *People v. Shreck*, 22 P.3d 68 (Colo. 2001). More specifically, pursuant to *Shreck*, the determination whether to admit such evidence is governed by CRE 702 and 403. *Id.* at 77. The focus of the

inquiry under CRE 702 is whether the evidence is reliable and relevant. *Id.* In making that determination, a court should consider whether the scientific principles are reasonably reliable, and whether the witness testifying about them is qualified to opine on such matters. *Id.* In determining whether the evidence is relevant, a court should consider whether the testimony would be useful to the jury. *Id.*

Ultimately, the methodology used by the People’s firearms comparison expert, Charles Reno, is found to be reliable. Mr. Reno discussed not only his own proficiency in matching bullets and cartridges to particular firearms but also a controlled study in which multiple examiners conducted comparisons of hundreds of cartridges with an exceptionally low error rate. Importantly, in that study, almost all the errors were attributable to five particular examiners. Although the defense argues that the level of expertise and experience of those five examiners is unknown, the reasonable conclusion to be drawn from the circumstantial evidence is that those particular examiners were less skilled and less qualified than the examiners who were virtually flawless in their ability to match cartridges to particular firearms. Therefore, the broader conclusion to be drawn from the study is that sufficiently skilled examiners can match fired bullets and spent cartridges with a high degree of accuracy. In turn, this indicates that the methodology, when employed by a sufficiently skilled examiner, is very reliable. Even the 2016 report by the President’s Counsel of Advisors on Science and Technology (the “PCAST Report”) relied upon by the defense¹ references a study in which there were only two false positive identifications after over 10,000 comparisons. In fact, the most negative study referenced by the

¹ For the reasons discussed below, to the extent the PCAST report is considered, it is given limited weight in certain areas.

PCAST Report involved 22 false positive identifications after almost 2,200 comparisons. Although this is just over a 1% error rate, “reasonably reliable” is not synonymous with “flawless” or “without error.”

Since the methodology, when employed by a sufficiently skilled examiner, is reasonably reliable, the next question is whether Mr. Reno is qualified to opine that a particular bullet or cartridge matches to a particular firearm. In this regard, he has almost 20 years of experience and has examined almost 2,000 fired bullets and over 4,000 spent cartridges. Every year during that time he undertook a proficiency examination conducted by an outside firm, and he always passed that examination. Also, his determinations that a bullet or cartridge matches a particular firearm is always verified by a second examiner. He has extensive training going back to the year 2000, he has been certified by the Association of Firearm and Tool Mark Examiners (“AFTE”) since 2012, and he has received notable awards from the ATF and the International Association of Chiefs of Police for his work at the Denver Crime Gun Intelligence Center. As such, he is clearly qualified.

Much of the defense opposition to the methodology employed by Mr. Reno results from the fact that, although the underlying basis of firearms examination is founded on objective principles, the determination of a match is subjective. This circumstance, however, is true of a substantial number of expert opinions, such as fingerprint analysis; handwriting analysis; medical and psychological diagnosis;² determination of the manner, means, or time of death;

² In this regard, the Court disagrees with the suggestion that medical and psychological diagnoses are based upon strictly objective criteria with no application of the judgment and experience of the doctor or psychologist. If this were the case, all doctors and psychologists should reach the same diagnosis for a given patient. *See also United States v. Glynn*, 578 F.Supp.2d 567, 573 (S.D.N.Y. 2008) (exercising a considerable degree of subjective judgment is true of many kinds of accepted expertise)—a case cited and relied upon by the Defendant.

blood spatter interpretation; or property valuation. Engineers, scientists, doctors, and diagnosticians often have to interpret data or test results, which necessarily involves a subjective interpretation based upon the individuals skill and experience. Along these lines, CRE 702 permits qualification of an expert based upon experience, not just education or training. The fact that a firearms examiner's criteria, and therefore his accuracy, will improve as he compares more and more bullets and cartridges is wholly consistent with the concept that experts can opine based upon their knowledge acquired through experience.

The defense also contrasts ballistics comparison with DNA evidence, however, the nature of STR DNA analysis is fundamentally different, and it involves statistical assertions that are simply not found, if even possible, in any other areas in forensic science. If opinion testimony had to include this same type of objectively verifiable percentage for every opinion, almost no other expert conclusions outside the field of DNA analysis would be admissible.

The defense argues that Mr. Reno should be required to phrase his conclusion in such a way as to include the AFTE criteria for a match. This is an issue that is better handled by cross examination. In fact, as noted in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 596 (1993), if the Defendant believes there are weaknesses in the foundations of the evidence, vigorous cross examination, presentation of contrary evidence, and careful instruction on the burden of proof are appropriate means of attacking it. In this regard, the cross examination of Mr. Reno at the motions hearing³ effectively and clearly demonstrated the Defendant's concerns in ways that would easily be understood by the jurors in this case.

³ Some of the cross examination at the hearing related to the PCAST Report. Mr. Reno did not take the position that the PCAST was a reliable authority on firearms identification, and it does not appear to fall under CRE 803(18). The report may fall under the provisions of CRE 703, but that seems unlikely based on the hearing testimony. Accordingly, some of the specific cross examination questions used at the hearing may not be available at trial. This

With regard to the PCAST Report relied upon by the defense, part of the purpose of an evidentiary hearing is to present information on a contested issue so that it may be explored and potentially challenged. The PCAST Report is hearsay not subject to an exception, including CRE 803(18). While its attachment to the Motion to Preclude established that there was a factual issue to be resolved at a hearing, attaching an exhibit to a motion does not make it the equivalent of an admitted exhibit or otherwise circumvent rules of evidence. Although some of the information in the report is used in the analysis above, that is because the information was discussed by Mr. Reno at the hearing without objection. In addition to the fact that the report is hearsay, it is a report to the federal executive branch, not to the judicial branch, and it was written with the stated purpose of trying to find things that could be improved in the forensic sciences. Goal driven efforts to find things to criticize tend to present an unbalanced picture and tend to disregard, sometimes inadvertently, contrary evidence.⁴ In this regard, Mr. Reno was critical of many of the report's conclusions regarding firearms analysis and noted that none of the authors of the report had experience in that field. With regard to the Gianelli article, *Ballistics Evidence Under Fire*, attached to the motion, it is also hearsay. Further, it was not discussed by Mr. Reno at the hearing, and it presents, at best, inadmissible legal opinions.

fact notwithstanding, Mr. Reno acknowledged much of the same information, such as study results, presented by the PCAST Report. An expert witness can certainly testify to his own knowledge of the field in which he has expertise. In other words, even if the PCAST Report itself and the opinions of its authors may not be admissible, Mr. Reno can likely testify to the underlying information.

⁴ In other words, people often find what they are looking for because they want to find it.

The Defendant also cites to a number of federal cases. First, it is of note that most of the cases cited by the defense regarding firearms analysis are opinions by federal trial courts.⁵ Even opinions by federal circuit courts of appeal are not binding on this Court and are only potentially persuasive authority. Further, the cases are the same as those discussed in the Gianelli article. That article, revealingly entitled *Ballistics Evidence Under Fire*, has a clear, one-sided aim of showing that some courts have recently become more critical of firearms evidence and it presents only cases supporting that premise.⁶ Nevertheless, of the cases cited by the Defendant, portions of *United States v. Monteiro*, 407 F. Supp. 2d 351 (D. Mass. 2006) are persuasive. In *Monteiro*, the federal trial judge held a six day hearing on the issue and found that the underlying scientific principles of firearm identification are valid. *Id.* at 355. That judge went on to decide that, because of the subjective nature of the determination whether a spent cartridge matches to a particular gun, a firearms examiner has to be qualified through training, experience, or proficiency testing to provide expert testimony. *Id.* These conclusions are consistent with the information presented in the present case, and Mr. Reno has demonstrated more than sufficient qualifications arising from training, experience, and proficiency training. The judge in *Monteiro*, however, ultimately precluded the testimony in that case, not due to any concerns with the reliability of the methodology of firearms analysis, but because the expert did not document his reasons for concluding there was a match and did not subject his determination to review by

⁵ The one appellate decision, *United States v. Williams*, 506 F.3d 151 (2d Cir. 2007), actually upheld that the firearms evidence at issue was reliable and admissible. Although the opinion does state that the Second Circuit was not taking the position that “any proffered ballistic expert should be routinely admitted,” *id.* at 161, there is nothing in the opinion expressing concern regarding the methodology of firearms identification.

⁶ Most of the opinions, with the exception of *Williams* have been either rejected, limited, or distinguished by other federal and state opinions.

another trained examiner in the laboratory. In the present case, Mr. Reno did have a second, certified examiner review the bullets and cartridges who also determined they matched. It is the Court's recollection that Mr. Reno indicated that he took photographs, although that testimony may have instead related to the ability to take photographs. In any event, however, the testimony at the hearing in this case made clear that even photographs do not fully capture the detail that can be perceived by the examiner's eye. Although it may be AFTE practice (the Court does not recall that such evidence was presented at the hearing), documentation in the form of photographs, sketches, or notes, does not impact whether the methodology is reasonably reliable or whether the examiner is sufficiently qualified to make a reliable comparison. Moreover, the bullets, spent cartridges, and the firearm were all retained and subject to examination and retesting if necessary. As such, the Court disagrees with the decision of the judge in *Monteiro* that an examiner must necessarily keep photographs, sketches, or notes in order for his identification to be admissible.

Lastly, with regard to CRE 403, the probative value of the evidence is overwhelming. If believed by the jury, the evidence establishes that the handgun recovered in the possession of the Defendant was the one used to shoot the victim in this case, which is a central issue in this case. The reliability of the methodology used to match bullets and casings with particular firearms substantially reduces the risk of unfair prejudice. More importantly, the principles upon which firearms identification is founded and the fact that the determination involves a subjective analysis based upon the experience of the examiner are easily understandable and can be effectively presented through direct and cross examination such that there is little risk of the jury uncritically adopting Mr. Reno's opinions without due consideration of these issues.

Accordingly, any risk of unfair prejudice or confusion of the issues does not outweigh the probative value of the evidence.

For the above reasons, the Motion to Preclude is denied.

Motion to Preclude Improper Expert Testimony [D-13]

If a police officer presents expert opinion testimony at trial, a contemporaneous objection must be made.

Motion to Suppress Evidence Acquired During Illegal Searches of Cell Phone [D-14]

Issues presented in a motion to suppress are resolved by a preponderance of the evidence standard. *See People v. Delage*, 2018 CO 45. The proponent of a motion to suppress has the burden of establishing that his own Fourth Amendment rights were violated by the challenged search or seizure. *People v. Spies*, 615 P.2d 710, 711 (Colo. 1980). For a defendant to have standing to seek suppression of the fruits of a search, government officials must have violated a legitimate expectation of privacy held by the defendant. *Id.* at 714. Such a determination is appropriately based upon the totality of the circumstances in the case. *Id.*

The challenged search of the cell phone does not involve any information stored in the cell phone by the Defendant. Instead, the search of the SIM card revealed the phone number programmed into the SIM card. In order for the Defendant to have a legitimate expectation of privacy in the phone number or the contents of the SIM card, he must at least have had some valid and recognizable proprietary or possessory interest in the information. The only evidence proposed by the Defendant⁷ that he had any interest related to the cell phone is that he was in

⁷ For the reasons discussed below, the Defendant's request for an evidentiary hearing is denied. Instead, the Motion to Suppress is being evaluated based upon the factual assertions made in the Motion and the information otherwise presented at previous hearings in this action.

possession of it and had used it in the days preceding his arrest, and that he had tucked the phone away in his backpack. None of those facts establish a *legitimate* proprietary or possessory interest related to the phone unless the Defendant owned the phone or was given permission from its owner to use and possess it. The fact that phone number establishes that the phone belonged to a person who had been shot and killed less than two weeks before the Defendant was found to be in possession of the phone, and the absence of any evidence that the Defendant had any relationship with that person—aside from the assertion by witness Miles Davis that the Defendant claimed to have shot and killed a man and left his body in the location where the person’s body was later found—would be evidence that makes it more likely true than not that the Defendant did not own the phone and was not given permission by its owner to use or possess the phone.⁸

The defense analogy of a cell phone that is possessed and used by a college student but paid for by the student’s parents is rejected. The analogy involves a situation in which the person using the phone has been given authority to use and possess it by another, which is inapplicable to the circumstances in this case.

The fact that the cell phone was found tucked away in the Defendant’s backpack could be evidence that the Defendant was taking measures to maintain its privacy, although it could be the result of other factors. Nevertheless, assuming the former to be true, the situation shows that the Defendant did not want others to know that he had the cell phone, not that he was taking efforts to keep the phone number of the cell phone private. More importantly, the situation is akin to

⁸ Although such a finding should not strictly be necessary, the proposed evidence would also make it more likely true than not that, at a minimum, the Defendant stole the phone.

that in *Rakas v. Illinois*, 439 U.S. 128 (1978), and the mere fact that a person was exercising control over an item does not establish that he has a legitimate expectation of privacy in its contents. In this case, physically hiding another person's cell phone does not grant the person hiding it a legitimate expectation of privacy in the phone's number.

The Defendant's argument to the effect that he must be presumed to have an expectation in privacy in the cell phone because he is presumed to be innocent in this case misapplies the standards for resolving a motion to suppress. As noted above, it is the Defendant's burden to show that he has standing to challenge a search. Considering the totality of the circumstances, regardless of whether the Defendant killed the victim in either case, the cell phone belonged to Mr. Murphy and the Defendant had no legitimate expectation of privacy in the contents of the SIM card.

The Defendant's request for a hearing is denied. Trial begins on Tuesday and there is not a realistic opportunity to conduct a hearing on the Motion to Suppress, which was filed on August 8. The identical motion was filed in the Defendant's Arapahoe County case 2017CR1461 on July 31, which was a week before the recent motions hearing in this case held on August 6. Had the Motion been filed in this action on July 31, a hearing likely could have been arranged. Additionally, this action was filed in November 2016, it is on its third trial setting, and the motions filing deadline was originally May 1, 2017, then was extended to September 22, 2017. Although subsequent motions have been filed without leave of court and have been addressed, filing a motion days before trial, and after a different last-minute hearing has been completed, carries with it the risk that another evidentiary hearing cannot be accommodated. The Defendant asserts that the ruling on the People's 404(b) motion was not issued until July 20, however, the

People's motion was not a request to permit the evidence—it was notice under CRE 404 that they intended to introduce the evidence. At that point the Defendant was on notice that the information might be admitted at trial. Although the Defendant objected and sought preclusion of the CRE 404(b) evidence, such an objection does not serve to bar the evidence unless and until the objection is sustained. Even if that were not the case, the decision overruling the Defendant's objection was still made prior to the filing of the identical Motion to Suppress in Arapahoe County and was prior to the last-minute hearing on regarding the Motion to Preclude. Finally, even setting all of the above aside, the purpose of an evidentiary hearing is to resolve disputed issues of fact. Presuming the factual assertions in the Motion to Suppress to be true, there is still no indication that the Defendant had a recognizable interest in the cell phone or the information in the SIM card, and the Defendant did not have a legitimate expectation of privacy in the contents of the SIM card. As such, an evidentiary hearing was not necessary even if there was an opportunity to conduct one.

For the reasons discussed above, the Defendant lacks standing to challenge the search of the SIM card and the Motion to Suppress is denied.

Motion Requesting Preclusion of Testimony of Unendorsed Prosecution Witnesses [D-15]

The Motion was resolved at the hearing on August 9.

Motion to Preclude Improper Opinion Testimony

As ruled at the hearing on August 9, whether the arm wound to Patrick Murphy, the victim in the Arapahoe County case, was defensive is irrelevant to the purposes for which information related to the killing of Mr. Murphy is being allowed in this case. Accordingly, Detective Taylor may not testify that the wound was defensive.

Motion for Jury Questionnaire and Expanded Voir Dire [D-19]

In limited situations, such as when questionnaires can be distributed prior to the day of trial, jury questionnaires can assist attorneys with *voir dire* without delaying the start of the trial. Even in those situations, however, the use of questionnaires rarely, if ever, shortens the time spent then questioning the panel. In this case, the *voir dire* will likely take the morning and part of the afternoon to complete. Adding time for jurors to fill out questionnaires, for the questionnaires to be copied and collated, and for the attorneys to meaningfully review the information for a hundred potential jurors, will likely extend jury selection into the second day of trial. Additionally, the proposed case specific questions regard illicit drug use, violence committed with a firearm, and violence against homeless persons. These are topics that potential jurors should be willing to freely discuss during *voir dire* and their answers are not likely to somehow taint the beliefs of other jurors. Accordingly, the request to use questionnaires is denied.

On the other hand, so long as the questioning in *voir dire* is truly designed to assist in identifying jurors on whom to exercise peremptory challenges or challenges for cause and is consistent with the related provisions of the Trial Procedures Order,⁹ the parties are granted 60

⁹ The Jury Selection section of the Trial Procedures Order states:

The purpose of *voir dire* is to enable the attorneys to determine whether any prospective jurors have beliefs that would cause them to be biased such that they would not be fair and impartial. In fact, it has been held in Colorado that the only proper purpose of *voir dire* is to determine the bias or prejudice of a potential juror. *People v. Shipman*, 747 P.2d 1, 3 (Colo. App. 1987). Accordingly, *voir dire* may not be used to advocate or persuade jurors in support of a party's theory of the case. Additionally, *voir dire* may not be used to determine how potential jurors would decide specific, contested issues in the case (as opposed to attempting to identify beliefs or biases). Finally, although *voir dire* may be used to determine whether jurors can impartially and conscientiously apply the law, it may not be used to instruct them on the law.

minutes per side to conduct *voir dire*. If a party uses part of its *voir dire* to advocate, instruct, or persuade jurors, the time will be reduced to 45 minutes for that party.

Dated this 12th day of August, 2018

BY THE COURT:

A handwritten signature in black ink, appearing to read "John W. Madden, IV", written over a horizontal line.

John W. Madden, IV
District Court Judge

Objections to questions or statements during *voir dire* that serve to advocate or educate rather than identify jurors upon which to exercise challenges are likely to be sustained. Moreover, it is the intent and effect of the questioning in *voir dire* that is of consequence. As such, questions that are creatively phrased to superficially discuss jurors' beliefs, but which actually serve to educate or advocate, are still subject to being precluded.

RE: FSWG Meeting on March 29, 2018 at 9:30 a.m.

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Laporte, Gerald (OJP)" <(b) (6)> "Smith, David L. (USAE0)" <(b) (6)>
<(b) (6)>, "Geddes, Elizabeth (USANYE)" <(b) (6)>, (b)(6), (b)(7)(C) per BOP
(b)(6), (b)(7)(C) per BOP (b) (6), "Hulser, Raymond (CRM)" <(b) (6)>
<(b) (6)>, "McGrath, Jonathan (OJP)" <(b) (6)>
(b)(6), (b)(7)(C), (b)(7)(F) per USMS (USMS)" <(b) (6)>, "Czarnopys, Greg P. (ATF)" <(b) (6)>
<(b) (6)>, (b)(6), (b)(7)(C) per BOP (BOP)" <(b) (6)>, "Penland, Elizabeth (OLP)" <(b) (6)>, "Isenberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>, "Wroblewski, Jonathan (CRM)" <(b) (6)>, "Santos, Nelson A. (DEA)" <(b)(6), (b)(7)(C) per DEA>, "Ibrahim, Anitha (CRM)" <(b) (6)>, (b)(6), (b)(7)(C), (b)(7)(F) per DE
(b)(6), (b)(7)(C), (USMS)" <(b) (6)>, "Smith, Andrew (USMS)" <(b) (6)>
(b) (6), "Downing, Richard (CRM)" <(b) (6)>, (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>, (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OTD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>, (b)(6), (b)(7)(C), (b)(7)(F) per DEA (OGC) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>, (b)(6), (b)(7)(C), (b)(7)(F) per DE (BOP)" <(b) (6)>, "King, Damon (CRM)" <(b) (6)>, (b)(6), (b)(7)(C), (b)(7)(F) per DEA
Cc: "Hunt, Ted (ODAG)" <(b) (6)>
Date: Fri, 23 Mar 2018 14:08:29 -0400
Attachments: Letter from the Innocence Project_03222018.pdf (349.17 kB);
Glass_ULTR_3.6_03232018_DISTRIBUTED FOR REVIEW ANNOTATED.pdf (196.5 kB)

Good afternoon,

We received another letter on the Latent ULTR, this one from the Innocence Project. It is attached here. I have also attached the annotated draft Glass ULTR (Word version distributed for component review by separate cover). I will see everyone next week. Please feel free to call or email with questions or comments.

Thank,
Kira

From: Antell, Kira M. (OLP)
Sent: Tuesday, March 20, 2018 5:39 PM
To: Laporte, Gerald (OJP) <(b) (6)>; Smith, David L. (USAE0) <(b) (6)>; Geddes, Elizabeth (USANYE) <(b) (6)>; Hulser, Raymond (CRM) <(b) (6)>; McGrath, Jonathan (OJP) <(b) (6)>; Czarnopys, Greg P. (ATF) <(b) (6)>; Penland, Elizabeth (OLP) <(b) (6)>; Isenberg, Alice R. (LD) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>; Wroblewski, Jonathan (CRM) <(b) (6)>; Santos, Nelson A. (DEA) <(b)(6), (b)(7)(C) per DEA>; Ibrahim, Anitha (CRM) <(b) (6)>; Smith, Andrew (USMS) <(b) (6)>; Downing, Richard (CRM) <(b) (6)>; (OGC) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>; (OTD) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>; (OGC) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>; King, Damon (CRM) <(b) (6)>;
Cc: Hunt, Ted (ODAG) <(b) (6)>
Subject: FSWG Meeting on March 29, 2018 at 9:30 a.m.

Good afternoon,

I am looking forward to seeing everyone next week. Please note that we will be joined by Andrew Goldsmith to speak about minimizing discovery issues associated with the new testimony monitoring framework. Please do make sure that your legal counsel is represented at this meeting. In addition, yesterday we received a letter from former members of the NCFs about the ULTR for Latent Prints. We will talk about this next week but if you have any questions in the interim, don't hesitate to call or email. Finally, I expect to circulate at least one April ULTR this week by separate cover.

- Attached are three documents.
- Draft Agenda (as always, the agenda could shift in the intervening days)
 - Testimony monitoring framework
 - Letter from NCFs former NCFs Commissioner

Please note the updated call information. It is on the agenda and on the invite.
Conference Line (b) (6)

Passcode: (b) (6)

Kira Antell
Senior Counsel
Office of Legal Policy
U.S. Department of Justice
950 Pennsylvania Avenue, NW
Washington, DC 20530

(b) (6)
(b) (6)



Barry C. Scheck, Esq.
Peter J. Neufeld, Esq.
Directors

Maddy deLone, Esq.
Executive Director

Innocence Project
40 Worth Street, Suite 701
New York, NY 10013

Tel 212.364.5340
Fax 212.364.5341

www.innocenceproject.org

March 22, 2018

Mr. Ted Hunt, Senior Forensic Advisor
Ms. Kira Antell, Senior Counsel, Office of Legal Policy
U.S. Department of Justice
950 Pennsylvania Avenue, NW
Washington, DC 20530

Re: Uniform Language for Testimony and Reporting (ULTR) for the Latent Print Discipline

Dear Mr. Hunt and Ms. Antell,

Duplicative Material see bates stamp numbers 20220314-12526 to 20220314-12530

Re: Federal Rules of Evidence

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Isenberg, Alice R. (LD) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cc: "Hunt, Ted (ODAG)" <(b) (6)> (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Date: Mon, 02 Oct 2017 19:46:51 -0400

Thank Alice! I really appreciate it I'll let you know ASAP

(b)(6), (b)(7)(C), (b)(7)(E) (initial omission inadvertent)

Sent from my iPhone

On Oct 2, 2017, at 7:30 PM, Isenberg, Alice R. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI wrote:

Kira,
Yes, I am available and am happy to pull out my talking points and sharpen them up. I'll even promise that the FBI will pay for my travel expenses! Just let me know if and when you get a green light.
Thanks for thinking of us,
Alice

----- Original message -----

From: "Antell, Kira M. (OLP)" (b) (6)
Date: 10/2/17 5:38 PM (GMT-05:00)
To: "Isenberg, Alice R. (LD) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cc: "Hunt, Ted (ODAG) (JMD)" <(b) (6)>
Subject: Federal Rule of Evidence

Hi Alice,

I've mentioned that the committee in charge of the federal rule of evidence is holding a conference on potential change to rule 702 for forensic experts. The conference is on Friday, 10/27 in Boston. Bruce Budowle was planning to attend but is now unable to travel. This created an opportunity for another perspective. I looked at the agenda and was struck that there was no representation from the forensics community and suggested that the Department should provide a practitioner to speak about the modern practice of forensic, the kind of validation tests that are performed, and the rigorous competency and proficiency testing that is done.

Unclear whether we can wrangle and invite but if we can, do you think you would be able to provide this position? Andrew Goldsmith and Ted are doing the actual PCAST rebuttal and legal arguments but I think there is a need to hear from someone who can actually describe how forensic analysis is done

Thanks,

Kira

Kira Antell

Senior Counsel

Office of Legal Policy

U.S. Department of Justice

950 Pennsylvania Avenue, NW

Washington, DC 20530

(b) (6)

(b) (6)

RE: Federal Rules of Evidence

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: "Isenberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Cc: "Hunt, Ted (ODAG)" <(b) (6)> <(b)(6), (b)(7)(C), (b)(7)(E) per FBI> (OGC) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Date: Tue, 03 Oct 2017 09:43:03 -0400

Alice,

Do you have a short bio I can send to Capra in the event we get the invite?

Thank ,
Kira

From: <(b)(6), (b)(7)(C), (b)(7)(E) per FBI> (OGC) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Sent: Monday, October 2, 2017 8:41 PM
To: Antell, Kira M. (OLP) <(b) (6)> Isenberg, Alice R. (LD) (FBI) <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Cc: Hunt, Ted (ODAG) <(b) (6)>
Subject: Re: Federal Rules of Evidence

Thanks and just hope the moderator can keep Lander to his allotted time.

----- Original message -----

From: "Antell, Kira M. (OLP)" <(b) (6)>
Date: 10/2/17 5:47 PM (GMT-07:00)
To: "Isenberg, Alice R. (LD) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Cc: "Hunt, Ted (ODAG) (JMD)" <(b) (6)> <(b)(6), (b)(7)(C), (b)(7)(E) per FBI> (OGC) (FBI)" <(b)(6), (b)(7)(C), (b)(7)(E) per FBI>
Subject: Re: Federal Rules of Evidence

Thanks Alice! I really appreciate it. I'll let you know ASAP.

<(b)(6), (b)(7)(C), (b)(7)(E) per FBI> (initial omission inadvertent)

Sent from my iPhone

Duplicative Material - See Document ID 20220314-09454



Re: Forensics Training and Education

From: "Antell, Kira M. (OLP)" <(b) (6)>
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cc: "Isenberg, Alice R. (LD) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI, "Hunt, Ted (ODAG)" <(b) (6)>
Date: Thu, 02 Nov 2017 18 17 29 0400

That' outrageou Maybe we can try to peak late in the afternoon or catch up on Monday morning

Sent from my iPhone

On Nov 2, 2017, at 1 44 PM, (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI wrote

Kira: I'm in meetings tomorrow from 9:30 until probably 3 (b)(5) per FBI

(b)(6), (b)(7)(C), (b)(7)(E) per FBI

Chief, Forensic Science Law Unit

Office of the General Counsel

Federal Bureau of Investigation

Desk (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Cell: (b)(6), (b)(7)(C), (b)(7)(E) per FBI

Confidentiality Statement: This message is transmitted to you by the Office of the General Counsel of the Federal Bureau of Investigation. The message, along with any attachments, may be confidential and legally privileged. If you are not the intended recipient of this message, please destroy it promptly without further retention or dissemination (unless otherwise required by law). Please notify the sender of the error by a separate e-mail or by calling (b)(6), (b)(7)(C), (b)(7)(E) per FBI.

From: Antell, Kira M. (OLP) (b) (6)]
Sent: Thursday, November 02, 2017 1:18 PM
To: (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI
Cc: e R. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI Hunt, Ted (ODAG) (JMD) <(b) (6)>
Subject: Re: Forensics Training and Education

Also, (b)(6), (b)(7)(C) - how did the NM hearing go? can we talk by phone tomorrow?

Sent from my iPhone

On Nov 2, 2017, at 1:12 PM, Isenberg, Alice R. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI wrote:

Absolutely. Feel free to contact her directly at (b)(6), (b)(7)(C), (b)(7)(E) per FBI.

Alice

From: Antell, Kira M. (OLP) [REDACTED] (b) (6)]
Sent: Thursday, November 02, 2017 11:19 AM
To: Isenberg, Alice R. (LD) (FBI) [REDACTED] (b) (6), (b) (7)(C), (b) (7)(E) per FBI
Cc: [REDACTED] (OGC) (FBI) [REDACTED] (b) (6), (b) (7)(C), (b) (7)(E) per FBI; Hunt, Ted (ODAG) (JMD) <[REDACTED] (b) (6)>
Subject: [REDACTED] nsics Training and Educati

Thank Alice [REDACTED] (b) (6), (b) (7)(C), (b) (7)(E) per FBI for an exceptional presenter and a real asset to FBI. I am glad to hear that her talents are being leveraged widely. That said, given the particular sensitivity of work with the FJC and of training federal judges, it would be helpful to learn more about this project. Would it be possible to arrange for a phone conversation with [REDACTED] (b) (6), (b) (7)(C), (b) (7)(E) per FBI on this?

Sent from my iPhone

On Nov 2, 2017, at 10:59 AM, Isenberg, Alice R. (LD) (FBI) [REDACTED] (b) (6), (b) (7)(C), (b) (7)(E) per FBI wrote

Hi Kira,

I'm not sure how much you know about [REDACTED] (b) (6), (b) (7)(C) per FBI's role here. In addition to being a caseworking examiner, she is the program manager of the Latent Print Technical Advisory Group, which does enormous amounts of training for LP examiners as well as various groups of legal folks. The training her group does for LP examiners usually involves strategies for Daubert or other admissibility hearings (i.e. how to work with attorneys to make sure the appropriate info is shared in court). They receive requests for this training from all over the country and try to get as much bang for the buck as possible by pulling several agencies into one training session [REDACTED] (b) (6), (b) (7)(C) per FBI and many other examiners in the FBI Lab also receive requests to do forensic science 101 training (fill in the blank with the discipline) for lawyers, judges, etc. In the past we have provided training at the NAC, for APRI, for the DC circuit judges, and for a variety of other organizations. We find that we have some examiners who are especially proficient at explaining concepts who get repeated requests from groups year after year. We've also been very involved with the USABook project across the past year. All this is to say that while I was not aware of this particular training activity, I know that it is ongoing across the entire lab whenever we have the resources to provide it. Your question was kind of open-ended, so if you need additional info, just let me know.

Alice

From: Antell, Kira M. (OLP) [REDACTED] (b) (6)]
Sent: Wednesday, November 01, 2017 3:23 PM
To: Isenberg, Alice R. (LD) (FBI) [REDACTED] (b) (6), (b) (7)(C), (b) (7)(E) per FBI
Cc: [REDACTED] (OGC) (FBI) [REDACTED] (b) (6), (b) (7)(C), (b) (7)(E) per FBI; Hunt, Ted (ODAG) (JMD) [REDACTED] (b) (6)
Subject: Fwd: Forensics Training and Education

Hi Alice,

Did you know [REDACTED] (b) (6), (b) (7)(C) per FBI was working on something for federal judges with FJC?

(See below underlined)

-K

Sent from my iPhone

Begin forwarded message:

From: (b) (6)
Date: November 1, 2017 at 2:58:10 PM EDT
To: "Antell, Kira M. (OLP)" <(b) (6)>
Cc: (b)(6) Elizabeth Lambert FJC, (b)(6) Elizabeth Lambert FJC, Shapiro, Elizabeth (CIV)" (b) (6)
Subject: Re: Forensics Training and Education

Hi Kira,

Sorry we did not have a chance to meet at the NAS program. I expected to see you at the Advisory Committee meeting, but life became too complicated for me to attend. I am sorry that I missed the meeting. It sounded like a spirited change of idea

We are at the initial stage of developing a series of proposals for judicial educational programs in forensic sciences. We are presently finishing an education on fingerprint evidence, and taped some of the scenes with (b)(6), (b)(7)(C) per FBI of the FBI who was excellent. We hope to have that video released by the end of the month or so. We would like to include something on the DOJ recommendations for uniform language in expert report and testimony. Do you expect to release the recommendations soon?

In addition the National Academies is gearing up for a new edition of the Reference Manual on Scientific Evidence. I expect that the new edition will include more on forensic sciences, though that will be a decision of the steering committee of judges and scientists assembled by the National Academies.

We will keep you informed of our progress in these areas. Feel free to call if you wish to chat about any of these issues.

Regards,
Joe

~~~~~  
Joe S. Cecil, Ph.D., J.D.  
Division of Research  
Federal Judicial Center  
One Columbus Circle, NE  
Washington, DC 20002-8002  
(b) (6)



## Fordham Law Review Articles (2 of 3 articles attached)

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**From:** "Antell, Kira M. (OLP)" <(b) (6)>  
**To:** "Hur, Robert (ODAG)" <(b) (6)>  
**Cc:** "Hunt, Ted (ODAG)" <(b) (6)> "Goldsmith, Andrew (ODAG)" <(b) (6)> "Shapiro, Elizabeth (CIV)" <(b) (6)>  
**Date:** Fri, 19 Jan 2018 17:04:26 -0500  
**Attachment** ADG Article\_01192018\_DISTRIBUTED.doc (57.12 kB); FBI Lab Article\_01192018\_DISTRIBUTED.docx (34.65 kB)

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Hi Rob,

As you know, Department speakers at the Boston College forensic evidence symposium were invited to provide articles to the Fordham Law Review Online. **IN order to ensure inclusion in the March edition, we need to transmit Department approved articles to Fordham NLT Monday, January 29.** I am attaching articles by Andrew and Alice Isenberg (FBI-Lab) for your review. Ted is revising his article and I will send it by separate cover on Monday (January 22)

Andrew's article is quite similar to his approved statements from the symposium but provides more in-depth legal argument. Ted's article is a direct written response to the PCAST report drawn from previous public remarks but it is more granular than previously provided statements. The draft articles by Andrew and Ted were circulated last week to a small group of reviewers from CRM, CRM-Appellate, EOUSA, individuals at CrCWG, Cynthia Young and Zach Hafer at USAO-MA, and Betsy Shapiro. None of the reviewers had any concerns with the positions taken by Andrew or Ted but several provided thoughtful comments which were largely incorporated. The draft article by Alice has been reviewed by FBI Lab, FBI OGC, and Ted.

Andrew and I have also reached out to Cindy Shaw for ethics review prior to submission to Fordham.

The authors are available to discuss the articles and I am available to discuss the review process if it would be helpful. I look forward to hearing your thoughts. If at all possible, I'd like to receive your edits by next Friday (January 26). Don't hesitate to call or email.

Thank you,  
Kira

Kira Antell  
Senior Counsel  
Office of Legal Policy  
U.S. Department of Justice  
950 Pennsylvania Avenue, NW  
Washington, DC 20530

(b) (6)  
(b) (6)

# RE: Fordham Article

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**From:** "Antell, Kira M. (OLP)" <(b) (6)>  
**To:** "Isenberg, Alice R. (LD) (FBI)" (b)(6), (b)(7)(C), (b)(7)(E) per FBI  
**Cc:** (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; "Hunt, Ted (ODAG)" <(b) (6)> (b)(6), (b)(7)(C)  
(LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI  
**Date:** Wed, 17 Jan 2018 09:37:28 -0500  
**Attachment** Hunt Comment Fordham Law Review article Lab Div 01162018 doc (37 69 kB)

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Hi Alice,

One tiny edit from Ted as to (b) (5). See if you think this is okay and if so, once we get the all clear from your leadership, please send (b) (5) incorporates the change for me to send to Rob Hur ( I am happy to make the change my elf but want to avoid confu ion a to who ha the pen)

-K

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**From:** Isenberg, Alice R. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI]  
**Sent:** Friday, January 12, 2018  
**To:** Antell, Kira M. (OLP) <(b) (6)> (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; Hunt, Ted (ODAG) <(b) (6)> (b)(6), (b)(7)(C), (b)(7)(E) per FBI (LD) (FBI)  
**Subject:** RE: Fordham Article

Kira,  
We have made all of the edits, flagging two of them for another review at DOJ. I assume you will forward this to ODAG as you did Ted's and Andrew's articles for another round of review? We have sent this to my EAD for final approval and gave him a deadline of Jan 19. I don't anticipate any problems there. I am also requesting a publication number and will need to add a caveat statement with that number when we get to final formatting. Is there anything else I need to do on this tasking to get it ready to cross the finish line?  
Thanks for all of your assistance on this!  
Alice

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**From:** Antell, Kira M. (OLP) (b) (6)  
**Sent:** Monday, January 08, 2018 11:10 AM  
**To:** Isenberg, Alice R. (LD) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI  
**Cc:** (b)(6), (b)(7)(C), (b)(7)(E) per FBI (OGC) (FBI) (b)(6), (b)(7)(C), (b)(7)(E) per FBI; Hunt, Ted (ODAG) (JMD) <(b) (6)>  
**Subject:** Article

Hi Alice,

Attached are suggested edits to the FBI lab's article. We'd be happy to talk these through and explain any suggestions.  
Thanks,  
Kira

Kira Antell  
Senior Counsel  
Office of Legal Policy  
U.S. Department of Justice  
950 Pennsylvania Avenue, NW  
Washington, DC 20530

(b) (6)  
(b) (6)

## Amy Ely's response to PCAST

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**From:** Kristine Hamann <(b) (6)@pceinc.org>  
**To:** "Hunt, Ted (ODAG)" <(b) (6)>  
**Date:** Fri, 15 Sep 2017 15:45:09 -0400  
**Attachment:** 20160923 Memo re PCAST Report NAAG Amy Ely pdf (234.86 kB)

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Hi Ted,

Here is Amy's response to the PCAST report. She has not widely disseminated it, but she has made it available to prosecutors.

I look forward to seeing you in DC.

Best,  
Kris

**ANALYSIS OF SEPTEMBER 19, 2016 PCAST REPORT: “FORENSIC SCIENCE IN CRIMINAL COURTS: ENSURING SCIENTIFIC VALIDITY OF FEATURE-COMPARISON METHODS”**

**September 23, 2016**

***By Amie Ely, National Association of Attorneys General,  
Director of NAGTRI Center for Ethics & Public Integrity***

**I. PCAST Members and Senior Advisors**

The President's Council of Advisors on Science and Technology (PCAST) refers to itself as “the leading external scientific advisory body established by the Executive Branch.” “Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods” (herein “Report”), released September 19, 2016, at 144.

All of the 19 Members of PCAST are scientists. Only one has practiced forensic science.<sup>1</sup> Members’ areas of expertise range from mathematics and genome research, to physics and computer engineering, to aerospace and environmental change. Despite this lack of training and experience, at least five Members have previously spoken about or written on the need for radical overhaul of the current judicial approach to forensic evidence admissibility.

Eric S. Lander, Co-Chair of the Council, is a mathematician and researcher in genome biology. Lander is the only PCAST Member to have served as an expert witness in forensics, as he has testified on behalf criminal defendants in the past.

In a case that began his long relationship with the Innocence Project, Lander testified, as one of several defense experts, regarding the admissibility of DNA evidence in the prosecution of Joseph Castro, who was charged with murdering a pregnant woman named Vilma Ponce and her 2-year old daughter. *See, e.g., People v. Castro*, 544 N.Y.S.2d 985, 985, 989 (Bronx S. Ct. 1989). A small bloodstain, which prosecution experts were prepared to testify came from Ms. Ponce, was found on Castro’s watch. After a lengthy hearing, Bronx Supreme Court Judge Gerald Scheindlin suppressed the DNA evidence and announced a new legal test for admissibility of DNA evidence. This decision was inconsistent with several other decisions admitting similar DNA evidence—one of which was later affirmed by the New York Court of Appeals in a decision that rebuked the *Castro* case. *People v. Wesley*, 83 N.Y.2d 417, 436 n.2 (NY 1994) (“We disagree with the conclusion of the court in *People v. Castro*”).<sup>2</sup>

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<sup>1</sup> One other Member, S. James Gates, Jr., is a staff member of the National Commission on Forensic Science, which was established by the DOJ in 2013. Gates is a theoretical physicist who studies string theory. His 101-page C.V. reveals no familiarity with—or even interest in—any areas of forensic science. *See* Curriculum Vitae: Sylvester James Gates, Jr., *available at* [http://www.umdphysics.umd.edu/images/CV/gates\\_cv.pdf](http://www.umdphysics.umd.edu/images/CV/gates_cv.pdf).

<sup>2</sup> In an interesting footnote to the *Castro* case: Joseph Castro pled guilty about a month after the DNA evidence was suppressed, and admitted that the blood on his watch did, indeed, belong to the woman he stabbed to death. *See* “DNA Forensic Testing Industry Faces Challenges to Credibility,” *The Scientist*, Nov. 1989, *available at* <http://www.the-scientist.com/?articles.view/articleNo/10722/title/DNA-Forensic-Testing-Industry-Faces-Challenge-To-Credibility/>.



The analysis in *Castro* was also criticized by the Second Circuit Court of Appeals, which noted that Judge Scheindlin arbitrarily “added another layer to make [the] already conservative test [set forth in *Frye*,<sup>3</sup> the case followed by New York state courts] even more stringent.” See *United States v. Jakobetz*, 955 F.2d 786, 794 (2d Cir. 1992).<sup>4</sup> Concluding that even with “novel, complex, and confusing evidence” like the then-nascent field of DNA, “the jury must retain its fact-finding function,” the Circuit warned against erecting “a difficult hurdle” to admissibility that “excludes highly relevant evidence simply because it is complicated.” *Id.* at 796. It then applied Federal Rule of Evidence 702 to conclude that the challenged DNA evidence had been properly admitted by the federal district court and affirmed the conviction. *Id.* at 797.

Since *Castro*, Lander has been an activist for the need to reevaluate forensic evidence in criminal trials. As a recent example: in an April 2015 *New York Times* editorial, “Fix the Flaws in Forensic Science,” he wrote, “Troubling, about a quarter of the cases examined by the Innocence Project (on whose board I now serve) involved forensic scientists who had erroneously claimed to identify defendants with near-certainty by matching hair samples, fibers, shoe prints or bite marks.” Available at <http://www.nytimes.com/2015/04/21/opinion/fix-the-flaws-in-forensic-science.html>. In the same editorial, which was published five months before PCAST was given the mandate to examine forensic science, Lander wrote “No expert should be permitted to testify without showing three things: a public database of patterns from many representative samples; precise and objective criteria for declaring matches; and peer-reviewed published studies that validate the methods.”

Perhaps unsurprisingly, as summarized below, the recommendations made by PCAST largely mirror those outlined by Lander in his *NYT* editorial.

In addition to its scientific members, PCAST was advised by lawyers and judges PCAST referred to as “Senior Advisors.” The Senior Advisors include several federal judges and lawyers who have expressed dissatisfaction with forensic science. For example, one of the co-chairs, Judge Harry Edwards (D.C. Cir.), was a co-chair of a committee that prepared a 2009 report titled “Strengthening Forensic Science in the United States: A Path Forward,” available at <https://www.ncjrs.gov/pdffiles1/nij/grants/228091.pdf>, that was critical of forensic science and is relied upon in the PCAST Report. Edwards’s report concluded that “much forensic evidence—including, for example, bitemarks and firearm and toolmark identifications—is introduced in criminal trials without any meaningful scientific validation, determination of error rates, or reliability testing to explain the limits of the discipline.” Edwards Report at 107-08.

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<sup>3</sup> *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

<sup>4</sup> The Second Circuit noted that the Eighth Circuit, in a decision that was vacated, briefly adopted the *Castro* analysis. *Jakobetz*, 955 F.2d at 794-95 (citing *United States v. Two Bulls*, 925 F.2d 1127 (8th Cir. 1991). In a later case, the Eighth Circuit held that even if *Two Bulls* had “any precedential value, it ended with *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 125 L. Ed. 2d 469, 113 S. Ct. 2786 (1993).” *Pioneer Hi-Bred Int’l v. Holden Found. Seeds, Inc.*, 35 F.3d 1226, 1229 (8th Cir. 1994). Accordingly, *Castro* should be treated as an anomaly that has been universally rejected—a legal reality not acknowledged in the PCAST Report.

Another PCAST Senior Advisor is Ninth Circuit Judge Alex Kozinski. In an editorial supporting the PCAST Report, which was published on the *Wall Street Journal* website several hours before the Report was made public, Kozinski opined that the Report “will immediately influence ongoing criminal cases, as it provides a road map for defense lawyers to challenge prosecution experts.” See Alex Kozinski, “Rejecting Voodoo Science in the Courtroom,” *Wall Street Journal*, available at <http://www.wsj.com/articles/rejecting-voodoo-science-in-the-courtroom-1474328199>.

## II. The Report

PCAST released its Report, titled “Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods,” near midnight on September 19, 2016. This report followed an August 26, 2016 draft that was widely leaked to the press but, as far as we know, not provided through any official channels to stakeholders directly impacted by its conclusions.

As described in greater length below, after creating requirements to assess whether various forensic disciplines are “scientifically valid,” the Report then considers whether the following forensic feature comparison methods meet the test it created: (1) DNA analysis of single-source and simple-mixture samples, (2) DNA analysis of complex-mixture samples, (3) bitemarks, (4) latent fingerprints, (5) firearms toolmark identification, and (6) footwear analysis.<sup>5</sup> The Report concludes that only DNA analysis of single-source and simple-mixture samples and latent fingerprint science are “foundationally valid”; that some means of analyzing complex-mixture samples are, to be colloquial, better than others; and that bitemarks, firearms toolmark identification, and footwear analysis all lack scientific validity.

### A. The Report’s Requirements for “Scientific Validity”

The Report argues that the following requirements should be met before certain areas of forensic science are determined to be “scientifically valid” and thus worthy of admission in federal criminal cases. See Report at 65-66. Because these requirements employ terms of art that PCAST uses in its later analysis and recommendations, the model is summarized and those terms of art are defined here.

#### 1. Foundational Validity

##### a. Procedure

*First*, the method itself is capable of identifying features in evidence samples (e.g., identifying the characteristics of a latent fingerprint left at a scene); *second* the method can be used to compare features in two samples (e.g., comparing the latent with a known fingerprint from a suspect); and *third*, the method contains guidance about at what level of similarity the features in the two samples should be declared to be some the same source.

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<sup>5</sup> The Report also refers to a recent DOJ hair analysis evaluation. *Id.* at 67.

b. “Empirical Estimates”

“*Appropriately designed studies*<sup>6</sup> from multiple groups” that establish (1) the method’s false positive rate (e.g., how often the suspect fingerprint is incorrectly declared to match the latent); and (2) the method’s sensitivity (e.g., the probability that it declares a proposed identification between samples that actually come from the same source). *Id.* at 65.

*N.B.*: For “objective” methods (defined here to be only DNA analysis), demonstrating reliability of the individual steps is sufficient to fulfill the foundational validity requirement. For “subjective” methods (here, bitemarks, latent fingerprints, firearms identification, and footwear analysis) “black-box” studies<sup>7</sup> are the only way to establish foundational validity; “[i]n the absence of such studies, a subject feature-comparison method cannot be considered scientifically valid.”

**2. Validity as Applied**

If, and only if, the forensic feature-comparison method has been established as “foundationally valid,” its validity must be established as applied in every case in which it is used. In essence, this means that the examiner must have passed appropriate proficiency testing and must have applied the appropriate procedures in the specific case in which s/he is testifying. The examiners must also, e.g., report the overall false positive rate and sensitivity.

**B. The Report’s Findings Regarding Forensic Disciplines**

After establishing its requirements for forensic methods to be considered foundationally valid and valid as applied, the Report then considers whether the following forensic feature comparison methods are “scientifically valid and reliable”: (1) DNA analysis of single-source and simple-mixture samples, (2) DNA analysis of complex-mixture samples, (3) bitemarks, (4) latent fingerprints, (5) firearms identification, and (6) footwear analysis.<sup>8</sup> *Id.* at 67-122.

PCAST notes that it “expects that some forensic feature-comparison methods may be rejected by courts as inadmissible because they lack adequate evidence of scientific validity.” *Id.* at 122. Here are the Report’s findings:

**1. DNA Analysis of Single-Source and Simple-Mixture Samples**

Single-source DNA—a DNA sample from only one person—and simple-mixture DNA—DNA from two people, such as DNA from rapist and a victim obtained from a rape kit—are

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<sup>6</sup> The Report contains “a number of criteria” that should be satisfied by a study, including that it is “conducted or overseen by individuals or organizations with no stake in the outcome” and that “there should be multiple independent studies by separate groups reaching similar conclusions.” *Id.* at 66. Presumably, this would mean that studies done by the very forensic scientists who practice in the areas criticized by the Report would be deemed inappropriately designed, and that until more than one “independent” study has been completed and published, the forensic areas are insufficiently scientifically rigorous to be admitted in court.

<sup>7</sup> “Black-box studies” are defined as “empirical stud[ies] that assesses a subjective method by having examiners analyze samples and render opinions about the origin or similarity of samples.” *Id.* at 48.

<sup>8</sup> The Report also refers to a recent DOJ hair analysis evaluation. *Id.* at 67.

**foundationally valid.** For a particular DNA analysis to be valid “as applied”, the Report states, a testifying expert must have “undergone rigorous and relevant proficiency testing,” should disclose in report whether s/he was told any facts about the case that “might influence the conclusion”; “should disclose, upon request, all information about quality testing and quality issues in his or her laboratory.” *Id.* at 69; *see also id.* at 147.

## 2. DNA Analysis of Complex-Mixture Samples

The Report is relatively agnostic about whether the analysis of DNA from “complex mixtures”—that is, from more than two contributors—is foundationally valid. It concludes that one “subjective” method, Combined-Probability-of-Inclusion, “**is not foundationally valid,**” but allows that courts might nonetheless consider admitting evidence obtained from that method if the analysts followed “rules specified” in a recent paper. *Id.* at 82. A second “objective” method, Probabilistic Genotyping, is described as “**a relatively new and promising approach**” for which foundational validity has not yet been established. *Id.* at 82; *see also id.* at 148. It nonetheless concludes that additional studies by “multiple groups, *not associated with the software developers*” are necessary to establish whether Probabilistic Genotyping is foundationally valid. *Id.* at 79.

## 3. Bitemarks

The Report concludes that bitemark analysis does “**not meet the standards for foundational validity,**” and cites several studies that supported that conclusion. *Id.* at 82; *see also id.* at 148. The Report adds that it is unlikely that bitemark analysis could ever be scientifically valid and “advise[s] against” devoting resources into additional professionalization and study. *Id.* at 87.

## 4. Latent Fingerprints

The Report “applauds the FBI’s efforts” in completing several black-box studies to assess the foundational validity of latent fingerprint analysis and “white-box” studies designed to assess validity as applied. After reviewing eight latent fingerprint studies, the Report concludes that only two were “properly designed” and recommends that jurors be informed there were “only two properly designed studies of the accuracy of latent fingerprint analysis,” and that those studies revealed false positives as high as one-in-18—what it refers to as “substantial.”<sup>9</sup> *Id.* at 96, 101. The Report also recommends, without any empirical support, that jurors also be told that, because examiners in the studies “were aware they were being tested, the actual false

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<sup>9</sup> The study from which the one-in-18 error rate is cited is unpublished, and this conclusion is at odds with that reached by the study itself, as the authors concluded that 35 of the 42 false positives—out of 995 examinations—were likely because the participants made clerical errors. *Id.* at 94-95. If the study’s author’s conclusions were respected, the error rate would be one error in 73 cases, rather than one out of 18. Moreover, the study included some verification by a second examiner—a process used by the FBI. *Id.* at 90. In that verification portion, every single error was caught by the second examiner. *Id.* at 96 n.285. Thus, in cases in which a second examiner verifies the conclusions of the first, the data suggests that the false positive rate is vanishingly small. The Report nonetheless suggests that jurors be informed that fingerprint examiners may incorrectly report a match in over 5% of the cases they examine.



positive rate in casework may be higher.” *Id.* at 101, 149. Nevertheless, the Report concludes that latent fingerprints are **foundationally valid**. *Id.* at 149.

The Report also concludes that examiners must “complete and document their analysis of a latent fingerprint before looking at any known fingerprint” and “separately document any additional data relied upon” to compare the latent and known fingerprints added after the comparison began.<sup>10</sup> *Id.* at 100. As the Report required for DNA examiners, it states that each fingerprint examiner must undergo “regular and rigorous proficiency testing,” for his or her analysis in a case to be valid as applied. Moreover, the Report states that it must be established in every case that the latent prints are “of the quality and completeness represented in foundational validity studies,” and instructs that “courts should assess the measures taken to mitigate bias during casework” by “ensuring that examiners are not exposed to potentially biasing information...” *Id.* at 101, 149.

### 5. Firearms Identification

The Report concludes that firearms analysis—that is, determining whether a bullet was fired from a particular firearm—“**currently falls short of the criteria for foundational validity**” because only one “appropriately designed study” exists. (That study found a false positive rate of one-in-66, but because PCAST found the other seven studies it reviewed to be incorrectly designed, it didn’t consider firearms identification to have been subjected to sufficiently rigorous testing to permit juries to consider evidence or testimony from firearms analysts. *Id.* at 112). The Report adds:

Whether firearms analysis should be deemed admissible based on current evidence is a decision that belongs to the courts. If firearms analysis is allowed in court, the scientific criteria for validity as applied should be understood to require clearly reporting the error rates seen in appropriately designed black-box studies (estimated at 1 in 66, with a 95 percent confidence limit of 1 in 46, in the one such study to date).

*Id.* at 112, 150. If firearms analysis is allowed in court, PCAST’s validity analysis requires, once again, a proficient expert who discloses any facts of which s/he was aware that might influence her/his conclusion. *Id.*

### 6. Footwear Analysis

The Report does not address whether examiners can reliably determine “class characteristics” of shoes—e.g., if a shoeprint was made by a size 12 Nike Air Jordan released in 2014. Instead, it considers whether a court should introduce expert testimony that a particular piece of footwear—e.g., the size 12 Nike in the defendant’s closet—made a particular shoeprint. Because none of the three studies PCAST located were, in its estimation, correctly designed, it concluded that any conclusions reached by footwear analysts were “**unsupported by any meaningful evidence or estimates of their accuracy and thus are not scientifically valid.**”

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<sup>10</sup> Only if that process is used, the Report suggests, is latent fingerprint analysis foundationally valid. *Id.* at 101.

*Id.* at 150. The Report did not include any specific directions to courts—unlike for firearms analysis.

## 7. Hair Analysis

PCAST relied entirely on the materials the DOJ cited for the DOJ’s Proposed Uniform Language for Testimony and Reports for the Forensic Hair Examination Discipline (the “DOJ Proposal”).<sup>11</sup> While the Report does not explicitly state that hair analysis lacks foundational validity, it disagrees with the DOJ Proposal, which concludes that “microscopic hair comparison has been demonstrated to be a valid and reliable scientific methodology...” *Id.* at 118. In rather pointed language, PCAST states that the studies the DOJ cited in support of that conclusion “do not provide a scientific basis for concluding... a valid and reliable process” *id.* at 120, as they were “strongly criticized by other studies for flawed methodology,” *id.* at 118.

The PCAST Report then suggests that the DOJ faces “constraints” in undertaking scientific evaluations of forensic science “because critical evaluations by the DOJ might be taken as admissions that could be used to challenge past convictions or present prosecutions,” underscoring the need for “a science-based agency” not involved with the criminal justice system to carry out “evaluations of scientific validity and reliability.” *Id.* at 122.

### C. The Report’s Recommendations to the Federal Government

After concluding that several forensic science disciplines lack foundational validity, the Report makes recommendations to federal science-based agencies, the FBI Laboratory, the U.S. Attorney General and her prosecutors, and the federal bench. In summary, those recommendations are that the science-based agencies and the FBI secure millions of dollars to do more research and then do that research; and that the Attorney General and federal judges do not seek to admit, or admit into evidence, evidence from the forensic disciplines that PCAST has determined lack “foundational validity.”

#### 1. Science-Based Agencies

The Report recommends that NIST (the National Institute of Standards and Technology) take the lead in designing and implementing studies, and in assessing the foundational validity and reliability of laboratory techniques and practices. *Id.* at 124, 128. It also recommends that NIST prepare an annual report “evaluating the foundational validity of key forensic feature-comparison methods, based on available, published empirical studies.” *Id.* at 124, 128-129. The Report suggest that NIST should help “propel” a “transformation” in complex DNA analysis, latent fingerprint analysis, and firearms analysis from subjective (human read) to objective (machine read) analyses. *Id.* at 125.

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<sup>11</sup> DOJ’s Forensic Science Discipline Review is studying the areas of forensic science in the PCAST Report, but uses a much more transparent procedure to solicit feedback and criticism from the stakeholders who will be impacted by any FSDR recommendations. The impact of the PCAST Report on the FSDR process is difficult to predict.

NIST has been working with the forensic science community to establish the Organization of Scientific Area Committees for Forensic Science (OSAC).<sup>12</sup> *Id.* at 126, 129-130. PCAST criticizes OSAC as being “dominated by forensic professionals” and “concludes that OSAC lacks sufficient independent scientific expertise and oversight to overcome the serious flaws in forensic science.” *Id.* at 126. It recommends that OSAC be restructured and specifies a new committee that should be formed within OSAC that would be composed entirely of non-forensic scientists and statisticians. *Id.* It also recommends that any standards under review by OSAC be made available without cost to, e.g., indigent defendants. *Id.*

The Report notes that funding for research in forensic science is “extremely small,” and recommends “[s]ubstantially larger funding...” *Id.* at 127. PCAST says the “President should request and Congress should provide” \$14 million more to NIST than is currently appropriated. *Id.* at 129.

## 2. The FBI Laboratory

PCAST recommends that the FBI increase the research community’s access to its forensic database. *Id.* at 132-33. It also recommends that the FBI’s Research and Development budget be “increased to a total of \$20 million”<sup>13</sup> in order to facilitate an expanded research program. *Id.* at 135.

## 3. The Attorney General

The Report recommends that the DOJ “ensure that testimony about forensic evidence presented in court scientifically valid.” *Id.* at 136, 140. The Report suggests that DOJ: undertake a review of forensic feature-comparison methods (beyond those reviewed in this report) to identify which methods used by DOJ lack appropriate black-box studies necessary to assess foundational validity. Because such subjective methods are presumptively not established to be foundationally valid, DOJ should evaluate (1) whether DOJ should present in court conclusions based on such methods and (2) whether black-box studies should be launched to evaluate those methods.

*Id.* at 136.

The Report states that if there are “not adequate empirical studies and/or statistical models to provide meaningful information about the accuracy of a forensic feature-comparison method, DOJ attorneys and examiners should not offer testimony based on the method. If it is necessary to provide testimony concerning the method, they should clearly acknowledge to courts the lack of such evidence.” *Id.* at 141. **The corollary to this, based on the above, is that**

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<sup>12</sup> NIST describes OSAC here: <https://www.nist.gov/forensics/organization-scientific-area-committees-forensic-science>.

<sup>13</sup> Or perhaps \$30 million; the Report is inconsistent. *Compare id.* at 132 (\$20 million) *with id.* at 135 (“The President should request and Congress should provide increased appropriations to the FBI to restore the FBI Laboratory’s budget for forensic science research activities from its current level to \$30 million and should evaluate the need for increased funding for other forensic-science research activities in the Department of Justice.”).

**PCAST is recommending that the DOJ not seek to introduce evidence from the following disciplines: DNA analysis of complex-mixture samples—particularly those done with Combined Probability of Inclusion methods—bitemarks, firearms identification, footwear analysis, and hair analysis.<sup>14</sup>**

In underscoring why its recommendations should be followed, Report states, without citation to any source, that improper forensic testimony has “led to many wrongful convictions.” *Id.* at 140.

The Report then criticizes, again, the DOJ’s hair science review process and suggests that the DOJ’s proposed uniform language for testimony and report for forensic footwear and tire impressions “have serious problems.” *Id.* at 137-138. It then recommends that the Attorney General “revise and reissue for public comment” these proposals “to bring them into alignment with standards for scientific validity.” *Id.* at 140-141.

#### **4. The Federal Judiciary**

PCAST summarizes its recommendation to federal judges regarding “scientific criteria” for admissibility as follows:

Scientific validity and reliability require that a method has been subjected to empirical testing, under conditions appropriate to its intended use, that provides valid estimates of how often the method reaches an incorrect conclusion. For subjective feature-comparison methods, appropriately designed black-box studies are required, in which many examiners render decisions about many independent tests (typically, involving “questioned” samples and one or more “known” samples) and the error rates are determined. Without appropriate estimates of accuracy, an examiner’s statement that two samples are similar—or even indistinguishable—is scientifically meaningless: it has no probative value, and considerable potential for prejudicial impact. Nothing—not personal experience nor professional practices—can substitute for adequate empirical demonstration of accuracy.

*Id.* at 143.

While the Report purports to make only scientific, not legal recommendations, it is hard to view the “scientific criteria” as doing anything but requiring a legal conclusion regarding admissibility consistent with PCAST’s recommendations regarding “foundational validity.” Indeed, PCAST itself links “foundational validity” to Federal Rule of Evidence 702(c) and “validity as applied” to Rule 702(d). *Id.* at 145.

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<sup>14</sup> While the Report does not explicitly conclude that hair analysis lacks foundational validity, it strongly suggests that conclusion—and, in inviting the DOJ to do its own analysis, it is difficult to see where such an analysis under the PCAST “standards” would find hair analysis foundationally valid.



PCAST notes that, in seeking “advice from our panel of Senior Advisors” regarding whether to afford legal precedent any weight, it was “advised that the Supreme Court has made clear that a court may overrule precedent if it finds that an earlier case was ‘erroneously decided and that subsequent events have undermined its continuing validity.’” *Id.* at 144 n. 387, 144. In the Report, PCAST claims to “express[] no view on the legal question of whether any past cases were ‘erroneously decided.’” PCAST then states that, “from a scientific standpoint, subsequent events have indeed undermined the continuing validity of conclusions that were not based on appropriate empirical evidence,” thus **inviting federal judges to overrule settled precedent regarding the admissibility of DNA analysis of complex-mixture samples, bitemarks, firearms identification, footwear analysis, and hair analysis.** *Id.* at 144.

### III. Responses to the Report

#### A. The U.S. Department of Justice

U.S. Attorney General Loretta Lynch has stated that the DOJ “will not be adopting the recommendations related to the admissibility of forensic science evidence.” The statement, which is released to media outlets when they seek a comment about the PCAST Report, reads in full:

Over the past several years, the Department of Justice has taken unprecedented steps to strengthen forensic science, including new investments in forensic science research, draft guidance to lab experts when they testify in court, and reviews of forensic testimony in closed cases. We remain confident that, when used properly, forensic science evidence helps juries identify the guilty and clear the innocent, and the Department believes that the current legal standards regarding the admissibility of forensic evidence are based on sound science and sound legal reasoning. We understand that PCAST also considered the issue of certain legal standards, alongside its scientific review. While we appreciate their contributions to the field of scientific inquiry, the Department will not be adopting the recommendations related to the admissibility of forensic science evidence.

#### B. The Federal Bureau of Investigation

The FBI has released a one-page response to the Report, available at <https://www.fbi.gov/file-repository/fbi-pcast-response.pdf/view>. In that response, it agrees with PCAST that “forensic science plays a critical role in the criminal justice system” and thus “needs to be held to high standards,” and that additional funding is needed to “develop stronger ties between the academic research community and the forensic science community.”

The FBI then criticizes both the Report’s “broad, unsupported assertions regarding science and forensic science practice,” and PCAST’s decision to “create[] its own criteria for scientific validity.” The response also notes, correctly, that PCAST doesn’t even apply this invented and subjective criteria “consistently or transparently” and that PCAST ignores “numerous published research studies which seem to meet PCAST’s criteria...”

### C. The Media

The media response to the Report has taken the assertions and recommendations at face value. Articles and Op-Eds published this week include:

- “White House Advisory Council Report Is Critical of Forensics Used in Criminal Trials,” *Wall Street Journal*.<sup>15</sup> The Report “sets the stage for criminal-defense challenges of long-held evidentiary methods and promises increased courtroom battles with prosecutors over the use of expert witnesses.”
- Judge (and PCAST Senior Advisor) Harry T. Edwards, “A wake-up call on the junk science infesting our courtrooms,” *Washington Post*.<sup>16</sup> The Report “persuasively explains” that “bite mark analysis, firearms identification, footwear analysis and microscopic hair comparisons ... have not yet been proved to be reliable forms of legal proof.” Edwards adds “What is noteworthy about the new report is that it is written solely by eminent scientists who carefully assess forensic methods according to appropriate scientific standards.”
  - *Note*: this is likely to be the piece that resonates most with judges.
- “Obama’s science advisors: Much forensic work has no scientific foundation,” *Ars Technica*.<sup>17</sup> “The report finds that all of the techniques have problems when it comes to operating on a firm scientific footing, so PCAST makes strong recommendations for how to get forensic science to take its name seriously.” (Also accepts Lander’s claim that the *Castro* case led to “reforms and analysis that eventually put the field on firm scientific footing”)

### IV. Next Steps for Prosecutors

The Report is likely to lead to defense challenges regarding the admissibility of forensic evidence in “live” criminal cases and attacks on convictions—both as direct appeals and as collateral challenges.<sup>18</sup> It is also likely to confuse the public, particularly given the one-sided treatment in the media of the recommendations it makes. That said, it could serve as a bit of a “call to arms” for prosecutors to jointly address the legal challenges to the admissibility of valid and reliable forensics evidence and to better inform themselves about the benefits and limits of forensic science.

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<sup>15</sup> <http://www.wsj.com/articles/white-house-advisory-council-releases-report-critical-of-forensics-used-in-criminal-trials-1474394743>

<sup>16</sup> [https://www.washingtonpost.com/opinions/a-wake-up-call-on-the-junk-science-infesting-our-courtrooms/2016/09/19/85b6eb22-7e90-11e6-8d13-d7c704ef9fd9\\_story.html?utm\\_term=.996c9e5cbee6](https://www.washingtonpost.com/opinions/a-wake-up-call-on-the-junk-science-infesting-our-courtrooms/2016/09/19/85b6eb22-7e90-11e6-8d13-d7c704ef9fd9_story.html?utm_term=.996c9e5cbee6)

<sup>17</sup> <http://arstechnica.com/science/2016/09/obamas-science-advisors-much-forensic-work-has-no-scientific-foundation/>

<sup>18</sup> For example, the Report may be used to argue that a defense attorney who stipulated to the admissibility of—or did not vigorously attack—ballistics toolmark evidence was constitutionally ineffective.

### **A. Addressing Legal Challenges: A Preliminary Assessment**

The Report’s legal analysis—while couched as a recommendation based on science—runs counter to settled caselaw regarding the admissibility of expert evidence. The analysis that follows is quite preliminary and does not purport to be an exhaustive review of the relevant legal standards or an assessment of how those standards have been applied throughout the states.

The Report suggests judges consider forensic evidence through a lens like that the Second Circuit rejected in *Jakobetz*: one that adds the additional element added by the judge in *Castro*—and one rejected by other courts throughout the land. The Report invites judges to usurp the role of jurors as factfinders—and, frankly, the role of defense counsel as informed partisans—by erecting “difficult hurdle[s]” that would “exclude[] highly relevant evidence simply because it is complicated.” *United States v. Jakobetz*, 955 F.2d 786, 796 (2d Cir. 1992). Moreover, while the Report cites *Daubert v. Merrell Dow Pharms.*, 509 U.S. 579 (1993), it does not properly describe the clear directions the Supreme Court provided to judges assessing the admissibility of expert testimony.

#### **1. Daubert Standard**

Federal courts and some state courts follow *Daubert* and Federal Rule of Evidence 702, which direct judges to apply “a more liberal standard of admissibility for expert opinions than did *Frye v. United States*, 293 F. 1013, 1014 (D.C. Cir. 1923),” *Williams*, 506 F.3d at 161-62 (quoting *Daubert*, 509 U.S. at 588). As a recent Second Circuit Court of Appeals summarized the *Daubert* test:

An expert witness is “permitted wide latitude to offer opinions, including those that are not based on firsthand knowledge or observation,” but only after a trial judge has determined “whether the expert is proposing to testify to (1) scientific knowledge that (2) will assist the trier of fact to understand or determine a fact in issue”...

*Querub v. Moore Stephens Hong Kong*, 15-2100 (Civ), 2016 U.S. App. LEXIS 9213 (2d Cir. N.Y. May 20, 2016) (unpublished) (quoting *Daubert*, 509 U.S. at 591-92).

As an example, the Second Circuit considered whether ballistics testimony—like that found by PCAST to lack “foundational validity”—was properly admitted by a trial court. *United States v. Williams*, 506 F.3d 151, 160-62 (2d Cir. 2007). The court below had denied the defendant’s request for a full-blown *Daubert* hearing regarding the testimony, and had instead ruled on the papers submitted by the parties, which included:

- citations by the Government to other recent decisions admitting similar evidence
- information from the Government about the expert’s training and experience, including her years spent examining firearms (12); her “hands-on training” from her supervisor; her attendance at seminars on firearms examiner; publication of her writings in a peer-reviewed journal; the number of firearms she’d examined (2,800); and her prior expert testimony on 20-30 occasions

*Id.* at 161. The Circuit easily concluded that the trial judge had fulfilled her gatekeeping function, given the information provided by the Government, and that there was no need for the “formality of a separate hearing.” *Id.*

## 2. *Frye* Standard

Other state courts apply the stricter *Frye* standard, including New York and Maryland. But as noted by the New York Court of Appeals in *Wesley*—and the Second Circuit in *Jakobetz*—even that standard does not erect the high hurdle proposed by the PCAST Report. *Wesley*, 83 N.Y.2d at 436; *Jakobetz*, 955 F.2d 794.

Under *Frye*, 293 F. 1013, scientific opinion testimony is admissible if the scientific principles involved are generally accepted in the relevant scientific community. The Criminal Practice Manual describes *Frye* as holding that: “expert testimony concerning scientific evidence must rest on a scientific principle that is demonstrably reliable and not still in the experimental stages[.]” 2 Crim. P. Man. §733:3 (LexisNexis 2016).

*Frye* states:

Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.

293 F. at 1014. Thus, a ruling on admissibility under *Frye* distinguishes between the case-specific application of scientific principles and the underlying scientific principles themselves. It is not the expert’s opinion in a particular case, but rather “the thing from which the deduction is made [which] must be sufficiently established to have gained general acceptance in the particular field in which it belongs.” *Frye*, 293 F. at 1014.

For example, in Maryland, “an expert opinion must be based on a scientific method or principle that has gained general acceptance in the *relevant* scientific community.” *Ross v. Hous. Auth. of Balt. City*, 430 Md. 648, 660 n.10, (Md. 2013) (emphasis added). Even under this standard, as the Maryland Court of Appeals has held, “the validity and reliability of a scientific technique may be so broadly and generally accepted in the scientific community that a trial court may take judicial notice of its reliability. Such is commonly the case today with regard to ballistics tests, fingerprint identification, blood tests, and the like.” *Reed v. State*, 283 Md. 374, 391 A.2d 364 (1978) (adopting standard set forth in *Frye*).

Given that the PCAST Report is authored by scientists who are in no way members of the “relevant scientific community” in the disciplines they disavow, an argument can be made that none of their “findings” undercut the validity of, e.g., ballistics evidence. In many ways, the PCAST Members are akin to experts in mergers and acquisitions suggesting reforms to the



probable cause standard: they may be quite smart and well-versed in their field, but the fact that they happened to also be members of the same profession gives them no standing to dictate a sea change in areas in which they have no expertise.

**B. Educating Prosecutors and Forensic Scientists**

The PCAST Report has underscored the importance of prosecutors understanding the potential and limits of forensic science. The studies cited about bitemark analysis suggest that it is largely discredited—or “bad science.” As no good prosecutor ever wants an innocent person to be incarcerated based on faulty science—or any other inaccurate evidence—the PCAST Report can provide a useful stimulus for prosecutors to become informed about the proper use of forensic science in criminal investigations and trials.

As a result, the Report should stimulate conversations among federal, state, and local prosecutors about the legal issues in admitting forensics testimony—that is, how to thoughtfully address the inevitable “PCAST Motions” that will be made in an effort to remove valid and reliable evidence from jurors’ purview and to disturb settled verdicts. This highlights the need for trainings to ensure that prosecutors understand the scientific and logical support for, and factual bases of, forensic testimony they would seek to admit and defend.

# Amie Ely wants to share PCAST

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**From:** no-reply@sharepointonline.com  
**To:** (b)(6) Ted Hunt (ODAG)  
**Cc:** (b)(6) Ely @naag.org  
**Date:** Fri, 20 Jul 2018 10:39:02 -0400

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## Link to share drive

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**From:** Amie Ely <(b) (6)@naag.org>  
**To:** "Hunt, Ted (ODAG)" <(b) (6)>  
**Date:** Fri, 20 Jul 2018 10:40:03 -0400

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(b) (6)

Materials are in the PCAST Responses folder.

## RE: Amy Ely's response to PCAST

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** Kristine Hamann <(b) (6)@pceinc.org>  
**Date:** Fri, 15 Sep 2017 15:52:49 -0400

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Thank Kri ,

Ye , thi i a good ummary/re pon e and I think I've een thi before not the one I wrote

Look forward to eeing you oon

Ted

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**From:** Kristine Hamann [(b) (6)]@pceinc.org  
**Sent:** Friday, September 1, 2017, 11:41 AM  
**To:** Hunt, Ted (ODAG) <(b) (6)>  
**Subject:** Amy Ely' re po

Hi Ted,

Here is Amy's response to the PCAST report. She has not widely disseminated it, but she has made it available to prosecutors.

I look forward to seeing you in DC.

Best,  
Kris



# Budowle PCAST

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**From:** Ted Hunt <(b) (6)>  
**To:** "Hunt, Ted (ODAG)" <(b) (6)>  
**Date:** Sat, 30 Sep 2017 17:52:27 -0400  
**Attachment** Budowle Re pon e to PCAST Report 06 17 2017 (002) pdf (618 37 kB)

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June 17, 2017

To whom it may concern:

When the President's Council of Advisors on Science and Technology (PCAST) Report first was published in 2016, it was obvious that the report was not particularly helpful from a scientific perspective as it was myopic, full of error, and did not provide data to support its contentions. A more significant concern regarding the failings of the PCAST Report was that it claimed its focus was on science, but obviously was dedicated substantially to policy. Initially I considered writing a critique about the failings of the PCAST Report to assist the community. But the problems with this report were so obvious that I did not think it would be necessary to devote time to such an effort. Indeed my prediction was correct in that the report would be (and has been) rejected by the scientific community as well as overwhelmingly by the courts. However, the PCAST Report is being relied on by the Public Defender Service in U.S. v. Benito Valdez (Motion to Exclude the Testimony of the Government's proposed expert witness in Firearms Examination and Memorandum of Points and Authorities in Support, dated June 2, 2017) as a scientifically sound review of the state of the forensic sciences. Therefore, it has become necessary to address the serious limitations of the PCAST Report and convey that it is an unsound, unsubstantiated, non-peer-reviewed document that should not be relied upon for supporting or refuting the state of the forensic sciences.

My credentials to be able to opine on the failings of the PCAST Report are based on my work of more than 30 years in research, development, validation, and implementation of DNA typing methodologies for forensic applications (my CV is attached). I received a Ph.D. in Genetics in 1979 from Virginia Polytechnic Institute and State University. From 1979-1982, I was a postdoctoral fellow at the University of Alabama at Birmingham and carried out research predominately on genetic risk factors for such diseases as insulin dependent diabetes mellitus, melanoma, and acute lymphocytic leukemia. In 1983, I joined the research unit at the FBI Laboratory Division to carry out research, development, and validation of methods for forensic biological analyses. The positions I held at the FBI include: research chemist, program manager for DNA research, Chief of the Forensic Science Research Unit, and the Senior Scientist for the Laboratory Division of the FBI. I have contributed to the fundamental sciences as they apply to forensics in analytical development, population genetics, statistical interpretation of evidence, and in quality assurance. Some of my technical efforts have been: 1) development of analytical assays for typing myriad protein genetic marker systems, 2) designing electrophoretic instrumentation, 3) developing molecular biology analytical systems to include RFLP typing of VNTR loci and PCR-based SNP, VNTR and STR assays, and direct sequencing methods for mitochondrial DNA, 4) new technologies such as use of massively parallel sequencing; and 5) designing image analysis systems. I worked on laying some of the foundations for the current

statistical analyses in forensic biology and defining the parameters of relevant population groups. I have published approximately 600 articles (more than any other scientist in the area of forensic genetics), made more than 730 presentations (many of which were as an invited speaker at national and international meetings), and testified in well over 250 criminal cases in the areas of molecular biology, population genetics, statistics, quality assurance, validation, and forensic biology. In addition, I have authored or co-authored books on molecular biology techniques, electrophoresis, protein detection, forensic genetics, and microbial forensics. I was directly involved in developing the quality assurance standards for the forensic DNA field in the United States. I have been a chair and member of the Scientific Working Group on DNA Methods, Chair of the DNA Commission of the International Society of Forensic Genetics, and a member of the DNA Advisory Board. I was one of the original architects of the CODIS National DNA database, which maintains DNA profiles from convicted felons, from evidence in unsolved cases, and from missing persons.

Some of my efforts over the last 16 years also are in counter terrorism, including identification of victims from mass disasters, microbial forensics and bioterrorism. I was an advisor to New York State in the effort to identify the victims from the WTC attack. In the area of microbial forensics, I was the chair of the Scientific Working Group on Microbial Genetics and Forensics, whose mission was to set QA guidelines, develop criteria for biologic and user databases, set criteria for a National Repository, and develop forensic genomic applications. I also have served on the Steering Committee for the Colloquium on Microbial Forensics sponsored by American Society of Microbiology, was an organizer of four Microbial Forensics Meetings held at The Banbury Center in the Cold Spring Harbor Laboratory, and participated on several steering committees for NAS sponsored meetings.

In 2009 I became Executive Director of the Institute of Applied Genetics and Professor at the University of North Texas Health Science Center at Fort Worth, Texas. I currently direct the Center for Human Identification. I also direct an active research program in the areas of human forensic identification, microbial forensics, emerging infectious disease, human microbiome, molecular biology technologies, and pharmacogenetics (or molecular autopsy). I also currently am an appointed member of the Texas Forensic Science Commission.

Of note, the PCAST Committee relied on my work and as a noted expert which is supported by the report's citation of my work several times all in a favorable manner. Indeed, I am the scientist at the FBI that is mentioned as Dr. Lander's co-author to bolster his credentials in the forensic sciences (see footnotes 17 and 20). My work is cited in footnotes 33, 149, 183, 185, 187, and 209.

The report lacks scientific substance. It is cloaked with a veneer of science but in actuality is an attempt to set policy. The report discusses and advocates validation (a topic all should agree is important). Yet the topic is only addressed superficially providing definitions that already are well known with generalizations and terms it calls criteria. Nothing novel was provided by the report (see examples in references 1-7 that already have discussed the same criteria but to a greater degree than in the report). Moreover, the report does not provide any substantial guidance on how to perform validation studies for any of the disciplines it addresses. There are basic validation criteria such as sample size, power analyses, types of samples, sensitivity, specificity, dynamic range, purity of analyte, etc. that the report does not address per se or only touches upon (and instead uses black box studies for its only endeavor into sampling uncertainty and for a

misguided attempt at addressing the potential for error). The PCAST Committee could have done a service to the community if it had selected some validation studies that it claims to have reviewed (although such claims are suspect as there is no documentation supporting the claims) and described specifically those studies that the PCAST Committee deemed inappropriate and/or inadequate. Then, the PCAST Committee could have laid out how those studies should have been performed with the real substantive criteria and examples that are necessary to perform a validation study. Leading by example would have been helpful; instead the report just dismisses most of the work performed in 2000 plus articles that it claims (sic) to have reviewed. The report criticizes the forensic community for a lack of validation studies but does not describe what is lacking in any substantive way.

The Report does not describe data from each of the disciplines that could be relied upon. It is difficult to believe that in 2000 papers, the PCAST Committee claims to have relied upon, that there are no data of value. There are no indications that the PCAST Committee actually assessed the data in the literature. There is little if any documentation in this regard which should be extremely troubling to all given the PCAST Committee's strong positions of the importance of validation, documentation, and peer-reviewed publication for the forensic science community. The PCAST Committee clearly takes a "do as I say, not as I do" position. The report contains no discussion on the criteria that were used to assess the literature, the criteria that were used to dismiss the literature as inadequate, and no documentation that any data (if existing) are readily available to support that the PCAST committee performed a sound, full and complete review. Again, these issues are most disconcerting because it is apparent that the PCAST Committee in its undertaking did not hold itself up to the same standards of validation, documentation, and peer-review that it espouses the forensic community should embrace (compounded as a number of the criticisms in the report are unfounded). The report provides some guidance on basic statistics, such as estimating false positive rates (which are not novel). However, this lecturing on proper statistics is troubling to say the least as the report misuses statistics in its own cursory efforts.

The following are examples from the report to support my above claims. They are not comprehensive as it is unnecessary to go page-by-page to indicate the serious problems with the PCAST Report. A few examples should suffice to demonstrate why this report has been so underwhelming and been ignored by most scientists and the courts. In pointing out the failings of the report I will focus on topics that transcend the disciplines and specifically on my area of expertise, i.e., DNA; I could not adequately address the other disciplines and what data do or do not exist in those forensic science areas. I leave specifics of other disciplines to those with requisite expertise. However, I stress that since the report misinforms on forensic DNA applications, which is considered the "gold standard" and well-documented in the scientific literature (even the report acknowledges that), then there is a strong indication that perhaps the report missed the mark on the other disciplines as well.

I take the position that improvements in forensic sciences are needed. Indeed, all science continues to improve. It is never static. In my field of DNA typing, I and others have been and currently are working on developing better/improved methods, such as the use of next generation sequencing and new software tools. It would be improper to say that any method is perfect and cannot be made better. That position, though, is not a wholesale condemnation of the forensic sciences. Each discipline, or better yet each application, should be assessed in context as a holistic system (not solely based on validation as the report seemingly myopically espouses) and



the types/quality of samples encountered in specific cases. The report's generalization of issues avoids addressing an extremely important question – was the analysis/interpretation in this case performed correctly?

The first two examples presented below are particularly egregious and point to the dearth of substance in the report. The report states on page 2

“In the course of its study, PCAST compiled and reviewed a set of more than 2,000 papers from various sources—including bibliographies prepared by the Subcommittee on Forensic Science of the National Science and Technology Council and the relevant Working Groups organized by the National Institute of Standards and Technology (NIST); submissions in response to PCAST's request for information from the forensic-science stakeholder community; and PCAST's own literature searches.”

On page 67 of the report it is stated

“PCAST compiled a list of 2019 papers from various sources—including bibliographies prepared by the National Science and Technology Council's Subcommittee on Forensic Science, the relevant Scientific Working Groups (predecessors to the current OSAC), and the relevant OSAC committees; submissions in response to PCAST's request for information from the forensic-science stakeholder community; and our own literature searches.”

There were two citations to support the review of the 2000 or so papers that the PCAST relied upon:

[www.nist.gov/forensics/workgroups.cfm](http://www.nist.gov/forensics/workgroups.cfm).

[www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast\\_forensics\\_references.pdf](http://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensics_references.pdf).

Neither of these sites appear to show (or allow for ready identification) what those articles were that the PCAST Committee reviewed and then relied upon. More so, there are no criteria and no data in the report or at these sites on what the PCAST Committee actually read, noted, reviewed, quantified, calculated, accepted, rejected, and/or debated. The report advocates emphatically and repeatedly the virtues of validation, documentation, and peer-review. Yet the report does not contain such information and thus does not meet as a minimum the requirements that it lambasted the forensic science community for lacking. This inconsistency between recommended requirements and lack of performance by the PCAST Committee is most noted as there is substantial documentation in the forensic science community (in many disciplines) but not in this report.

This lack of documentation should be considered in light of the report's statements on pages 1 and 22

“PCAST concluded that there are two important gaps: (1) the need for clarity about the scientific standards for the validity and reliability of forensic methods and (2) the need to

evaluate specific forensic methods to determine whether they have been scientifically established to be valid and reliable.”

The report also states on pages 4 and 21

“It is the proper province of the scientific community to provide guidance concerning scientific standards for scientific validity, and it is on those *scientific* standards that PCAST focuses here.”

Yet the PCAST Committee did not provide its data to support the validity of its own work. There simply is no accounting of the PCAST Committee’s work to demonstrate it assessed the 2000 papers and how it came to the conclusions it rendered.

This evident failing is exacerbated by the reports statement on page 6

“The forensic examiner must have been shown to be *capable* of reliably applying the method and must *actually* have done so. Demonstrating that an expert is *capable* of reliably applying the method is crucial—especially for subjective methods, in which human judgment plays a central role. From a scientific standpoint, the ability to apply a method reliably can be demonstrated only through empirical testing that measures how often the expert reaches the correct answer. Determining whether an examiner has *actually* reliably applied the method requires that the procedures actually used in the case, the results obtained, and the laboratory notes be made available for scientific review by others.”

No one knows what method(s) the PCAST Committee used; but it is clear that it did not hold itself to the same standard either by *capability* or *actually* performing. This report cannot be held up for scientific review (as indicated on page 6 of the report – see immediately above). There are no notes or results available.

As the report says repeatedly (see pages 6 and 32)

“We note, finally, that neither experience, nor judgment, nor good professional practices (such as certification programs and accreditation programs, standardized protocols, proficiency testing, and codes of ethics) can substitute for actual evidence of foundational validity and reliability.”

The academic and professional standings of the PCAST Committee members are not a substitute for good practices (none of which are documented). No one should take seriously this report because it has little substance to support its contentions.

The second most egregious example is the misuse and disregard for statistics. It may appear to the casual observer that the PCAST Committee is steeped in statistics and thus all statistics presented must be meaningful. For example, the report dedicates Appendix A for some discussion on statistics. But this guidance is rather basic and not particularly helpful to guide the community for any specific discipline or application. Yet when it comes to substance the PCAST Committee fails again which is evident in its own use of statistics. Consider the statements in the report on page 3

“Reviews by the National Institute of Justice and others have found that DNA testing during the course of investigations has cleared tens of thousands of suspects and that DNA-based re-examination of past cases has led so far to the exonerations of 342 defendants. Independent reviews of these cases have revealed that many relied in part on faulty expert testimony from forensic scientists who had told juries incorrectly that similar features in a pair of samples taken from a suspect and from a crime scene (hair, bullets, bitemarks, tire or shoe treads, or other items) implicated defendants in a crime with a high degree of certainty.”

Then on page 26

“DNA-based re-examination of past cases, moreover, has led so far to the exonerations of 342 defendants, including 20 who had been sentenced to death, and to the identification of 147 real perpetrators.”

A similar statement is found on page 44 (footnote 94). These findings appear to support the assertion on page 44 of the report

“It is *important* because it has become apparent, over the past decade, that faulty forensic feature comparison has led to numerous miscarriages of justice.”

I do not dispute that there have been 342 post-conviction exonerations. I am not sure what the number of exonerations is when the report says “many relied in part on faulty expert testimony” – because the report does not quantify what is meant by many. However, one wrongful analysis or testimony is one too many, and every effort should be made to minimize forensic science errors. The exoneration of 342 convicted felons is serious and topic in its own right (and again way too many). But this number is statistically meaningless and out of context. The PCAST Committee should have recognized this obvious aspect of the use of numbers. The PCAST Committee did not perform any statistical analyses or even appear to collect the data necessary to put these numbers in proper perspective. The PCAST Committee should have identified how many cases in total that have been reviewed to date (especially given that the report discusses the proper way to calculate a false positive rate, the Committee does not follow through with the same verve). This number of 342 may be and is likely a very small percentage of the total number of cases reviewed, especially since the innocence project has been around for 25 years (see <https://25years.innocenceproject.org/>). Moreover, the PCAST Committee did not convey how many post-conviction analyses that have been performed over the past 25 years in which there was no evidence of improper scientific performance, findings or faulty testimony. It would seem that such obvious basic information eluded the PCAST Committee. Those cases that were reviewed over the past 25 years in which no misuse of forensic science analyses were detected would indicate that perhaps the forensic science field is not so scientifically corrupt as the report implies. More so it would indicate that proper results can be obtained (at least most of the time).

The report discusses error rates substantially using statements such as on page 6

“Similarly, an expert’s expression of *confidence* based on personal professional experience or expressions of *consensus* among practitioners about the accuracy of their field is no substitute for error rates estimated from relevant studies.”

The PCAST Report also recommends

“For subjective feature-comparison methods, because the individual steps are not objectively specified, the method must be evaluated as if it were a “black box.”

Smrz et al (8) (a paper of which I am a co-author) recommended the black box approach after the review of the FBI Laboratory’s latent print misidentification related to the Madrid bombing incident, and the PCAST Report advocates the use of such black box studies. I concur that a black box approach has some value but strongly caution that one must consider the proper utility of such studies. The authors of the PCAST Report calculated upper bound error rates based on the results of the very few black box studies they discuss; the PCAST Committee seemingly implies that these upper bound error rates are somehow meaningful to report in every case analysis. A black box study can demonstrate generally whether or not a method can yield reliable results where a human is substantially involved in the interpretation of results. But it does not necessarily help address error that may or may not have occurred during a specific case analysis.

There are several problems with such a simplistic generalization that the authors of the PCAST Report have taken regarding use of black box studies. A black box study only tests those individuals involved in the study. Therefore, the performance of the rest of the analysts of the forensic science community is not covered by the study, and the results of the study may not apply to those analysts. Some individuals perform better than others in black box studies. The average rate inflates the performance of the poorer analysts and deflates the performance of the better analysts tested in the study. Therefore, the error rate values calculated by the PCAST authors likely do not apply to most analysts. Moreover, the information content and quality of results from a forensic science analysis vary from sample to sample. Treating all sample results equally and applying a single error rate does not convey the chance for error in a particular analysis. As the PCAST Report states (see below) DNA mixture interpretation is more challenging than interpretation of single source DNA profiles. If the PCAST Committee recognizes that differences in the quality of DNA evidence affect difficulty of interpretation, then the PCAST Committee should have been able to realize that the same holds for black box study results and different quality evidence (another obvious inconsistency in the report).

A known error rate or proficiency test mistake is at best some indirect measure of the verity of the proposed results in any given sample analysis, but can never be a direct measure of the reliability of the specific result(s) in question (9). Consider a hypothetical crossing of a street where there is a 1% error (arbitrary for sake of discussion) of being hit by a car. At the beginning of the journey crossing the road there is a 1% error of being hit. While crossing the road the chance can increase or decrease depending on circumstances (possibly being greater at the center of the road and less within lanes). If the individual successfully crosses the road, then the error drops to zero. Of course, different roads (such as a busy interstate vs a rural back road) have different *a priori* chances of error (i.e., similar to the quality of evidence affects the degree of difficulty). Ultimately the issue of crossing the road is did the individual successfully cross the road or get hit. The same holds for casework, i.e., is there an error or is there not an error in the performance or analysis. Given that the black box studies mentioned in the report did have a good degree of success, there is support that a process can generate a reliable result. Thus it still comes back to determining if an error of consequence was committed in a specific case. Oddly not mentioned in the PCAST Report is that most of the forensic disciplines addressed carry out non-consumptive forms of examination. Therefore, the most direct way to measure the truth of



the purported results is to have another expert conduct his/her own review, as is advocated by the National Research Council Report II for DNA analyses (10). Re-analysis would be more meaningful instead of espousing hypothetical error rates, which may not apply to the actual results and/or analysts involved. Indeed, the above mentioned black box studies and the missing data on total number of cases from innocence project case reviews do support that tests can yield reliable results but that most of the problems (as discussed below for DNA mixtures) have been due to misapplication. Therefore, case peer-review can be an effective approach to identify misapplications. However, the PCAST Report seems to ignore the value of this practice which demonstrates the reports myopic assessment of the forensic sciences and lack of consideration of a holistic systems approach.

The PCAST Report singles out validation as essentially the sole basis for reliability. Instead under a systems approach there are several components that impact an outcome, and the reliance on these several features increases validity and reliability in any one case. Quality performance is an essential component for obtaining reliable results and for reducing the chance of error. Quality assurance provides an infrastructure to promote high performance, address errors that arise, and improve processes. In addition to validation studies, there are other mechanisms such as technical review of a case that reduce error. This technical review is performed within the laboratory before issuing a report and also outside the laboratory when an expert witness is acquired by the opposing side to assess results and interpretations. The PCAST Report seems to ignore the value of these additional quality measures and the strength of the adversary system. Error rates are difficult to calculate; they are fluid. When an error of consequence (i.e., a false “match”) occurs, under a sound quality assurance program corrective action is taken (to include review of cases analyzed by the examiner prior to and post the discovery of the error). When the corrective action is such that the individual will no longer commit that error, it no longer impacts negatively on the individual’s future performance. In fact, he/she is better educated and less likely to err. The calculation of a current error rate then should not include past error(s). Having said that, past error should not be ignored; if desired, it could be raised in court or other deliberations. The defense (or prosecution), if it believes it useful, should make use of such information during a cross-examination of an expert. But the PCAST Report does not address the shortcomings of the calculated error rate as it uses it; it treats the upper bound error rate calculation from black box studies as if they are robust and specific (which they are not).

Notably the PCAST Report tends to dismiss experience and judgment, implying it has little value. I agree that experience and judgment standing alone should be considered with caution. However, the vast majority of forensic science disciplines work in a systems approach, i.e., many facets to the process; experience is but one factor among several to effect a quality result. Even though the PCAST Report dismisses experience it again shows its inconsistencies about the province of experience. Consider the following statements on page 55 of the report

“In some settings, an expert may be scientifically capable of rendering judgments based primarily on his or her “experience” and “judgment.” Based on experience, a surgeon might be scientifically qualified to offer a judgment about whether another doctor acted appropriately in the operating theater or a psychiatrist might be scientifically qualified to offer a judgment about whether a defendant is mentally competent to assist in his or her defense.”

“By contrast, “experience” or “judgment” cannot be used to establish the scientific validity and reliability of a metrological method, such as a forensic feature-comparison method. The frequency with which a particular pattern or set of features will be observed in different samples, which is an essential element in drawing conclusions, is not a matter of “judgment.” It is an empirical matter for which only empirical evidence is relevant. Moreover, a forensic examiner’s “experience” from extensive casework is not informative—because the “right answers” are not typically known in casework and thus examiners cannot accurately know how often they erroneously declare matches and cannot readily hone their accuracy by learning from their mistakes in the course of casework.”

Even to a lay person these statements should be obviously inconsistent, troubling and point to the inadequacy of the PCAST Committee addressing the topic of forensic science reliability. I fail to see why the medical and psychology fields can have another expert review another’s work (on what may be life and death decisions) and opine on the analyses/interpretations; yet a qualified forensic science analyst cannot perform a technical review of forensic work to assess analyses/interpretations (especially since the report has ignored data that support that at some level forensic testing is reliable). The logic of the PCAST Committee escapes me.

The PCAST Report discusses DNA typing and the limitations that have been encountered with mixture interpretation. For example on page 75 the report states

“DNA analysis of complex mixtures—defined as mixtures with more than two contributors—is inherently difficult and even more for small amounts of DNA.”

I concur that it is more challenging to interpret DNA mixtures compared with single-source DNA profiles. But the report fails to add that difficult does not necessarily translate into impossible or that proper interpretations can be made. The difficulties with mixture interpretation were not due to a lack of good, valid approaches to employ as there were valid approaches and also not due to the fact that there is some subjective judgment with interpretations. The issue, and it is a serious one, was that many of the practitioners in the forensic DNA community were inadequately trained, did not seek out solutions, or instead chose to wait for guidance (see pages 77-78 of the PCAST report and discussion on Texas and mixture interpretation). These issues were similar to the mixture interpretation problems at the Department of Forensic Sciences in Washington, DC (in which I was the scientist who identified the problems).

The PCAST Report assails the use of the Combined Probability of Inclusion (CPI) which is one of the methods used by the community and endorsed by the DNA Advisory Board (11) 17 years ago. However, the discussion of the Texas Forensic Science Commission (TFSC) (of which I was deeply involved in the review of mixture interpretation for the State) and how it pursued and addressed inappropriate interpretation of mixtures actually implies that valid methods do exist; otherwise how could a group of international experts (of which I was one of the experts) assess the situation, determine that there are problems in the application of interpretation guidelines, and provide guidance to the community to implement sound procedures?

The PCAST Committee on page 78 of the report states

“The TFSC also convened an international panel of scientific experts—from the Harvard Medical School, the University of North Texas Health Science Center, New Zealand’s

forensic research unit, and NIST—to clarify the proper use of CPI. These scientists presented observations at a public meeting, where many attorneys learned for the first time the extent to which DNA-mixture analysis involved subjective interpretation. Many of the problems with the CPI statistic arose because existing guidelines did not clearly, adequately, or correctly specify the proper use or limitations of the approach.”

The report properly focuses on lack of detailed guidelines on interpretation and does not suggest that the principles of how to calculate the CPI are erroneous. Indeed, nowhere in the report are there any data to indicate that the CPI is foundationally erroneous.

Yet, the report then states on page 78

“In summary, the interpretation of complex DNA mixtures with the CPI statistic has been an inadequately specified—and thus inappropriately subjective—method. As such, the method is clearly not foundationally valid.”

The allegation that the CPI is not foundationally valid demonstrates the lack of understanding (and again the lack of documentation of review) by the PCAST Committee. In fact, these statements also demonstrate another report inconsistency – this time about the principles of statistical calculations related to DNA profiles. On page 72 the report states

“The process for calculating the random match probability (that is, the probability of a match occurring by chance) is based on well-established principles of population genetics and statistics.”

The random match probability is one approach to calculating a statistic for single-source samples and appears to be endorsed by the PCAST Committee as well-established and thus valid. Yet, the PCAST Committee takes the opposite position for the CPI stating it is not foundationally valid. If one reads my colleagues and my most recent paper on the CPI (12), cited in the PCAST Report, it is clear that the principles of the foundational validity of the CPI are the same as those for the random match probability. Consider a similar situation which is the chance of drawing four aces in a row from a standard deck of cards is estimated to be 1 in 270,275. This value is based on probability theory and does not require an empirical testing to be published in the peer reviewed literature to support its validity. The CPI and random match probability use the same population frequency data and the same well-established principles of population genetics and statistics. While this is another example of myopia by the PCAST Committee, it borders on the bizarre that the PCAST Committee failed to understand the foundations of DNA statistics.

All know the PCAST Committee had access to the most recent paper on the use of the CPI (and the references within that paper) as it is stated on page 78 of the report

“Because the paper appeared just as this report was being finalized, PCAST has not had adequate time to assess whether the rules are also *sufficient* to define an objective and scientifically valid method for the application of CPI.”

I note that the CPI is a rather simple concept and its foundations are basic. It is surprising that the PCAST Committee, which touts its vast expertise, could not readily assess the paper. Given the importance of their report and this topic it also is surprising that they would not have done so before finalizing their report.

The PCAST Report recognizes that probabilistic genotyping is an advancement to improve or reduce subjectivity in DNA mixtures (see page 79). I concur. But the report states on page 79

“Appropriate evaluation of the proposed methods should consist of studies by multiple groups, *not associated with the software developers*, that investigate the performance and define the limitations of programs by testing them on a wide range of mixtures with different properties.”

Also the report states on page 81

“Because empirical evidence is essential for establishing the foundational validity of a method, PCAST urges forensic scientists to submit and leading scientific journals to publish high-quality validation studies that properly establish the range of reliability of methods for the analysis of complex DNA mixtures.”

Publication is part of the peer-review process and I support publication by the developers and others who adopt the method. But the PCAST Committee has placed a requirement that is unrealistic to meet which is publication by the user laboratories. It is likely that a few at most laboratories will be able to publish their validation testing of the software. Anyone who serves on editorial boards of scientific journals should know that journals are unlikely to publish additional studies because they are not considered novel. Yet, the PCAST Committee failed to recognize this fact.

It is important to stress that the report contains no criticisms of probabilistic genotyping and still there are no data contained in the report that demonstrate that the PCAST Committee actually reviewed (or better yet tested) the current probabilistic genotyping software programs (even though it claims to have done extensive review, such as the undocumented 2000 papers).

Forensic laboratories are required to perform validation studies, and there are substantial data on mixtures that support the validity of mixture interpretation and use of probabilistic genotyping. Mixture studies are required to be performed by every laboratory engaged in analyzing such evidence as part of their validation studies. Many of these studies lack novelty and thus will never be published in peer-review journals. However, the PCAST Committee could have contacted a number of forensic DNA laboratories who have implemented one of the probabilistic genotyping software programs (as there were laboratories operating or near implementation of the tools at the time of the report’s publication) to gain access to the validation data to determine whether there are sufficient data to support the already peer-reviewed published work. There is no indication that the PCAST Committee made any effort to become informed to opine on the reliability and validity of probabilistic genotyping.

The PCAST Committee simply ignored a wealth of validation data residing in crime laboratories. If the PCAST Committee had taken a holistic approach, they would have considered the totality of data in determining whether there is support for the validity and reliability of probabilistic genotyping. Peer-review publications by the developers and validation data by the users combined clearly support the software and its applications. Indeed, this failure of the PCAST Committee of not considering all available data is reminiscent of a similar situation that occurred 25 years ago with another report – the National Research Council I Report (NRC I) (13). The NRCI Report proposed a non-scientific, *ad hoc* way to calculate statistics called the ceiling principle. The ceiling principle had no genetics foundation or validity and was roundly rejected. One of the bases for the proposed ceiling principle approach (espoused by the NRC I Committee) was a lack of population data. There were substantial population data in crime



laboratories world-wide at the time the NRC I Report was published; but the NRC I Committee did not seek out the data. As soon as the NRC I Report was published, I reached out to my colleagues around the world and gathered the existing data which were then compiled into a five volume compendium (14). If the NRC I Committee had chosen to consider extant population data, they might have prepared a more informed Report. The outcome was that the National Academy of Sciences convened a second committee and produced the sound NRC II Report (10), which was steeped in fundamental population genetics and statistical applications. The findings of the NRC II Report in part were based on the data I compiled in the five volume compendium which were available prior to the publication of the rejected NRC I Report. The PCAST Report has taken the same blinded approach and ignored extant data with a similar outcome as 25 years ago – a report that provides little value for assessing the state-of-the-art and even less value for providing guidance to improve the forensic sciences.

In conclusion, the few examples above demonstrate that the PCAST Report 1) is **not** scientifically sound, 2) is **not** based on data, 3) is **not** well-documented, 4) misapplies statistics, 5) is full of inconsistencies, and 6) does **not** provide helpful guidance to obtain valid results in forensic analyses.

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8. Smrz, M.A., Burmeister, S.G., Einseln, A., Fisher, C.L., Fram, R., Stacey, R.B., Theisen, C.E., and Budowle, B.: Review of FBI latent print unit processes and recommendations to improve practices and quality. *J. Forens. Ident.* 56(3):402-434, 2006.
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I declare under penalty of perjury that the forgoing is true and correct to the best of my knowledge.



Bruce Budowle, Ph.D.  
Director  
Center for Human Identification  
University of North Texas Health Science Center  
Fort Worth, Texas 76107  
Email: (b) (6) @unthsc.edu  
Tel: (b) (6)

# Draft

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** (b) (6) Ted Hunt  
**Date:** Fri, 25 Aug 2017 19:11:58 -0400  
**Attachment:** DRAFT doc (12 33 kB)

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Ted R. Hunt  
Senior Advisor on Forensic Science  
Office of the Deputy Attorney General  
United States Department of Justice  
950 Pennsylvania Ave, NW  
Washington, D.C. 20530

(b) (6)  
(U) (0)

## RE: Upcoming Travel

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** "Brinkley, Winnie (ODAG)" <(b) (6)>  
**Date:** Wed, 27 Sep 2017 17:07:16 -0400  
**Attachment** 171026 Hunt TravAuth Bo ton MA doc (13 43 kB); 171023 Hunt TravAuth Philadelphia doc (13 32 kB)

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Winnie,

My revisions to the travel requests are attached above.

Thank ,

Ted

---

**From:** Brinkley, Winnie (ODAG)  
**Sent:** Wednesday, Septe PM  
**To:** Hunt, Ted (ODAG) <(b) (6)>  
**Subject:** Upcoming Travel

Ted,

I have drafted the travel authorization memos for your trip to Philadelphia and Boston. Please review and make any necessary edits.

Also, here are the train options for October 23:

### Washington to Philadelphia

184 Northeast Regional departs at 9 20am and arrives 11 12am  
174 Northeast Regional departs at 10:10am and arrives 12:01pm.

### Philadelphia to Washington

93 Northeast Regional departs at 3:27pm and arrives 5:15pm.  
19 Crescent departs at 3:55pm and arrives 5:55pm  
85 Northeast Regional departs at 4:30pm and arrives 6:25pm.  
173 Northeast Regional departs at 4:55pm and arrives 6:51pm.

Winnie Brinkley  
Staff Assistant  
U.S. Department of Justice  
Office of the Deputy Attorney General  
950 Pennsylvania Avenue NW  
Washington, D.C. 20530  
Tel: (b) (6) (direct)  
Fax: (202) 307-0097



October 2, 2017

**MEMORANDUM**

TO: James Crowell  
Chief of Staff and  
Associate Deputy Attorney General  
Office of the Deputy Attorney General

FROM: Ted R. Hunt  
Senior Advisor to the Attorney General on Forensic Science  
Department of Justice  
Office of the Deputy Attorney General

SUBJECT: Travel Authorization for Boston, Massachusetts – October 26-27, 2017

I am attending a symposium sponsored by the Advisory Committee on the Federal Rules of Evidence to be held in Boston on October 27. The purpose of the symposium is to discuss whether FRE 702 should be amended, a separate rule drafted for forensic science, a note to the rule be added, or a best practice manual drafted for the judiciary. I am on a panel and will provide the Department's view on the PCAST Report. A preparation meeting with other Department speakers at the symposium will occur at the U.S. Attorney's Office in Boston the day before the symposium, on October 26.

This trip will be paid for by the Deputy Attorney General's Office. The estimated expenses are \$1,500.00 which will include: airfare, lodging, meal per diem, and miscellaneous. There is a conference registration fee of \$500.00 to be paid by the Deputy Attorney General's Office. My plan is to depart October 26, and return October 27, 2017.

Please let me know if you have any questions.

APPROVE: \_\_\_\_\_

DISAPPROVE: \_\_\_\_\_

OTHER: \_\_\_\_\_

Attachment(s)

October 2, 2017

**MEMORANDUM**

TO: James Crowell  
Chief of Staff and  
Associate Deputy Attorney General  
Office of the Deputy Attorney General

FROM: Ted R. Hunt  
Senior Advisor to the Attorney General on Forensic Science  
Department of Justice  
Office of the Deputy Attorney General

SUBJECT: Travel Authorization for Philadelphia, Pennsylvania – October 23, 2017

I have been invited to a meeting with law enforcement representatives from IACP, ASCIA, and MCCA on forensic science to be held in Philadelphia on October 23. This meeting is designed to gather information for the forensic science needs assessment (and subsequent Report) announced by the DAG during his speech to the IAI in Atlanta this past August. This meeting is being facilitated by the Office of Legal Policy (OLP) and NIJ.

This trip will be paid for by the Deputy Attorney General's Office. The estimated expenses are \$500.00 which will include: train fare, meal per diem, and miscellaneous. My plan is to depart and return on October 23, 2017.

Please let me know if you have any questions.

APPROVE: \_\_\_\_\_

DISAPPROVE: \_\_\_\_\_

OTHER: \_\_\_\_\_

Attachment(s)

## AAAS Quote

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** "Antell, Kira M. (OLP)" <(b) (6)>  
**Date:** Mon, 18 Sep 2017 11:26:51 -0400

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Here's a quote from the AAAS report that is a bit helpful in that it (b)(5)

[REDACTED]

[REDACTED]

[REDACTED]

Ted R. Hunt  
Senior Advisor to the Attorney General on Forensic Science  
Office of the Deputy Attorney General  
United States Department of Justice  
950 Pennsylvania Ave, NW  
Washington, D.C. 20530

(b) (6)  
(u) (v)

# AAFS DAG Speech

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** "Antell, Kira M. (OLP)" <(b) (6)>  
**Date:** Mon, 22 Jan 2018 09:52:16 -0500  
**Attachment** Hunt Comment AAFS DAG Speech 01122018 doc (33 03 kB)

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Kira,

Solid speech. I've added some comments re a few thoughts I had. Once you fill it out with the rest of your text, I will get started with Swanson to round it out.

Thanks,

Ted

Ted R. Hunt  
Senior Advisor to the Attorney General on Forensic Science  
Office of the Deputy Attorney General  
United States Department of Justice  
950 Pennsylvania Ave. NW  
C 20530

(b) (6)  
(b) (6)



## Accepted: PCAST & FRE Meeting with NAAG

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** "Antell, Kira M. (OLP)" <(b) (6)>  
**Date:** Thu, 05 Oct 2017 09:43:41 -0400  
**Attachment** Unnamed Attachment (1.33 kB)

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# Accepted: PCAST & FRE Meeting with NAAG

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**Where:** RFK Building, 950 Pennsylvania Avenue NW, OLP Conference Room 4236  
**When:** Thu Oct 05 16:00:00 2017 -04:00  
**Until:** Thu Oct 05 16:45:00 2017 -04:00  
**Required Attendee** PARTSTAT ACCEPTED Common Name Hunt, Ted (ODAG) MAILTO (b) (6)

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## Agenda\_Forensics and Bitemarks Briefing\_02092018

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**From:** "Antell, Kira M. (OLP)" <(b) (6)>  
**To:** "Hunt, Ted (ODAG)" <(b) (6)>  
**Date:** Fri, 09 Feb 2018 10:01:41 -0500  
**Attachment** Agenda Foren ic and Bitemark Briefing 02092018 doc (24 42 kB)

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Hi Ted,

Attached is the agenda we discussed with the edit as to the start time. Feel free to make any edits before you share.

Thanks,  
Kira

## Comments on OLP Packet

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** "Antell, Kira M. (OLP)" <(b) (6)>  
**Date:** Wed, 27 Dec 2017 15:42:40 -0500  
**Attachment:** Hunt Comment Department TM Framework 122721017 (003).doc (26.26 kB); Hunt Comment OLP Summary\_Latent ULTR and TM\_12272017\_FOR T.HUNT REVIEW (003).docx (99.84 kB); Hunt Comments-Latent Print ULTR\_12272017 (003).docx (37.9 kB)

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Kira,

- 1) The OLP summary – I know this is an OLP document, but I went ahead and made some non-substantive edit suggestions to the LP and TM summaries.
- 2) LP ULTR – very minor grammatical changes.
- 3) TM policy – very minor grammatical changes. I did add one word, requirement #3. Take a look. I don't think the sentence makes much sense without adding the word, (b) (5).

Let me know if you have any questions.

Thx. Ted

Ted R. Hunt  
Senior Advisor to the Attorney General on Forensic Science  
Office of the Deputy Attorney General  
United States Department of Justice  
950 Pennsylvania Ave. NW  
C 20530

(b) (6)  
(b) (6)



## My Comments-Law Review Articles

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** "Antell, Kira M. (OLP)" <(b) (6)>  
**Date:** Thu, 04 Jan 2018 18:38:36 -0500  
**Attachment** Hunt Edit Fordham Law Review article LabDiv 122017 FINAL to DOJ doc (39.48 kB); Hunt Comments-ADG Article 01032018 (ADG edits)\_KMA\_v2.docx (61.62 kB)

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Comments are attached. Some of them are a bit direct in order to be succinct and clear, and aren't meant to be critical—I'm just easily confused. Added just a few light revisions as well. Let's talk them over before forwarding to others.

Thx.

Ted

Ted R. Hunt  
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United States Department of Justice  
950 Pennsylvania Ave. NW  
Washington, DC 20530

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## Fordham Law Review-Lab Div.

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** "Antell, Kira M. (OLP)" <(b) (6)>  
**Date:** Tue, 16 Jan 2018 19:33:55 -0500  
**Attachment** Hunt Comment Fordham Law Review article Lab Div 01162018 doc (38 18 kB)

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My comments/revisions are attached.

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## David Kaye on Ballistics

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**From:** Kristine Hamann <(b) (6)@pceinc.org>  
**To:** Ted Hunt <(b) (6)>, "Antell, Kira M. (OLP)" <(b) (6)>  
**Date:** Thu, 15 Mar 2018 13:25:42 -0400  
**Attachment:** 20180203 Firearm Mark Evidence Looking Back and Looking Ahead Case Western Law Review Kaye.pdf (223.11 kB)

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Hi Ted and Kira,

In light of our earlier discussion on testimony by forensic expert, here is a recent article by David Kaye. With the growth of ATF sponsored Crime Gun Intelligence Centers, the use of ballistic evidence at trial is on the rise. But, as Kaye notes, the PCAST report doesn't seem to be having a big impact in court.

Hope all is well.

Best,  
Kris

[Kristine Hamann](#)  
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## RE: David Kaye on Ballistics

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** Kristine Hamann <(b) (6)@pceinc.org>  
**Date:** Fri, 16 Mar 2018 14:47:24 -0400

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Hi Kri ,

Thank very much will take a look thi weekend

Ted

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**From:** Kristine Hamann <(b) (6)@pceinc.org]  
**Sent:** Thur day, March 15, 2018, 1:51 PM  
**To:** Hunt, Ted (ODAG) <(b) (6)>; Antell, Kira M. (OLP) <(b) (6)>  
**Subject:** David Kaye on B

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# Firearm-mark Evidence: Looking Back and Looking Ahead

Case Western Reserve Law Review  
Vol. 68, 2018 (forthcoming)

David H. Kaye  
Distinguished Professor of Law and Weiss Family Scholar  
Penn State Law (University Park)

Paul Giannelli has written—with clarity and conviction—on just about every type of scientific evidence commonly used in criminal cases. To celebrate his extraordinary contributions, this essay surveys the development of the law on one type of feature-matching evidence that repeatedly attracted Paul’s attention. This summary reinforces and extends Paul’s work on what I will call firearm-mark evidence.<sup>1</sup> By inspecting toolmarks on bullets or spent cartridge cases, firearms examiners can supply valuable information on whether a particular gun fired the ammunition in question. But the limits on this information have not always been respected in court, and a growing number of opinions have tried to address this fact. Reviewing this development is significant not merely because the evidence is commonly employed in criminal cases, but also because of a recent, highly publicized<sup>2</sup> argument against its admission from some of the national’s leading scientists and technologists<sup>3</sup> and because it can inform a pending effort to improve the federal rules as they apply to forensic-science identification evidence.<sup>4</sup>

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<sup>1</sup> “Although this subject is popularly known as ‘ballistics,’ that term is not correct.” PAUL C. GIANNELLI ET AL., 1 SCIENTIFIC EVIDENCE § 14.01, at 755 (5th ed. 2012).

<sup>2</sup> *E.g.*, Alex Kozinski, *Rejecting Voodoo Science in the Courtroom*, Wall St. J., Sept. 19, 2016.

<sup>3</sup> Executive Office of the President, PCAST, Report to the President on Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods, Sept. 2016 [hereinafter cited as 2016 PCAST Report].

<sup>4</sup> 86 FORDHAM L. REV. (forthcoming Mar. 2018).

As we shall see, the courts have moved from a position of skepticism of the ability of examiners to link bullets and other ammunition components to a particular gun to full-blown acceptance of claims of identification “to the exclusion of all other firearms.”<sup>5</sup> With one notable exception, the challenges to firearm-mark evidence over the past decade or so, have generated nothing more than occasional restrictions on the degree of confidence that firearms experts can express in court. They have not altered the paradigm of supplying source conclusions instead of statements about the degree to which the evidence supports these conclusions.<sup>6</sup> After reviewing the stages in the judicial reception of firearm-mark evidence, this article concludes by describing a more scientific, quantitative, evidence-based form of testimony that should supplant or augment the current experience-based decisions of skilled witnesses.

## I. Rejection of Expert Source Attributions

For a time, courts did not admit testimony that items originated from a particular firearm. Some courts reasoned that jurors could make the comparisons and draw their own conclusions. In *People v. Weber*,<sup>7</sup> for example, the trial court struck from the record an examiner’s testimony “that in his opinion the two bullets taken from the bodies were fired from this pistol, leaving that

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<sup>5</sup> *E.g.*, In re Barrett, 840 F.3d 1223, 1238 (10th Cir. 2016) (“Ballistics expert Terrance Higgs tied the bullet fragment that killed Eales to Defendant’s .223 Colt H Bar Sporter rifle, ‘to the exclusion of all guns that are made or that will be made.’”); United States v. Law, 252 F.3d 1357, 2001 WL 422948 at \*1 (5th Cir. 2001) (“ballistics expert testified that the cartridge recovered at the earlier robbery and the cartridge used in the Griffin carjacking were used in the same weapon ‘to the exclusion of all other firearms in the world.’”).

<sup>6</sup> In this context, a source conclusion is a statement about the truth or probability of the hypothesis that a specific, known gun fired the bullet in question. Statements of support stop short of drawing a conclusion about the hypothesis. Instead, they describe the probability of the evidence (the extent to which the features of the items being compared are observed to correspond) under competing source hypotheses. See DAVID H. KAYE ET AL., THE NEW WIGMORE ON EVIDENCE: EXPERT EVIDENCE ch. 14 (2d ed. 2011); David H. Kaye, *Statistical Hypothesis Testing in Law and Forensic Science: A Memorandum*, 130 HARV. L. REV. F. 127 (2017); *infra* Part VI.

<sup>7</sup> 86 P. 671 (Cal. 1906).

as a question for the jury to determine by an inspection of the bullets themselves.”<sup>8</sup> In this 1904 trial, the court did not question the expert’s ability to discover toolmarks that could be probative of identity, but it saw no reason to believe that the expert would be better than lay jurors at drawing inferences from that information.<sup>9</sup> Other courts allowed such opinions, but not if they were stated as “facts.”<sup>10</sup>

## II. Acceptance of Expert Source Attributions

With the recognition that the line between “opinions” and “facts” had little substance and with the demise of the rigid rule prohibiting “ultimate facts”—which were said to “invade the province of the jury”<sup>11</sup>—courts came to admit conclusive source attributions. Firearms examiners reasoned that “[i]t may be quite common for two or more prominent individual marks on bullets from two entirely different guns to match exactly, but the chance that there will be a correspondence of a great many of the individual characteristic marks on two bullets that came from different guns is so remote as to amount to a practical impossibility.”<sup>12</sup> By the 1950s, it was understood that “the modern tendency of the courts [is] to allow the introduction of expert testimony to show that the bullet or cartridge found at the scene of a crime was fired from a

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<sup>8</sup> *Id.* at 697.

<sup>9</sup> The court explained that “the comparison of the . . . bullets . . . is not a matter of expert testimony, but one within the ordinary capacities of the average juror or citizen.” *Id.*

<sup>10</sup> E. LeFevre, *Expert Evidence to Identify Gun from Which Bullet or Cartridge Was Fired*, 26 A.L.R. 2d 892 (1952) (§ 3). For example, in *State v. Martinez*, 198 P.2d 256 (N.M. 1948), the state supreme court held that testimony that “positively that the evidence bullet (death bullet) was fired out of [defendant’s] gun” was an instance of inadmissible “conclusions stated as facts and not as opinions.” *Id.* at 260-61.

<sup>11</sup> *E.g.*, *Grismore v. Consolidated Prods. Co.*, 5 N.W.2d 646, 647 (1942) (overruling *State v. Steffen*, 230 N.W. 536, 538 (Iowa 1930)).

<sup>12</sup> JULIAN S. HATCHER, *TEXTBOOK OF FIREARMS INVESTIGATION, IDENTIFICATION AND EVIDENCE* 288 (1st ed. 1935); *cf.* ALBERT S. OSBORN, *QUESTIONED DOCUMENTS* 227-30 (1910) (duplication of class and individual characteristics of handwriting can be “practically impossible” because the joint probability is a “negligible quantity”).

particular gun, where it is definitely shown that the witness by whom the testimony is offered is, by experience and training, qualified to give an expert opinion on firearms and ammunition.”<sup>13</sup> Firearms (and other types of) examiners were known to testify that their judgments are not subject to any margin of error<sup>14</sup> and are scientific certainties.<sup>15</sup> Of course, expert testimony was not required to be so extreme; testimony that a bullet merely could or might have come from a particular firearm also was admissible.<sup>16</sup>

### III. Heightened Scrutiny Following *Daubert*

Beginning in the 1990s, scientists and lawyers began to question the theories of individualization and discernible uniqueness of firearms toolmarks. They asked how examiners (operating without standards explicitly defining what degree of similarity in a set of features warrants a source attribution) could *know*—in the sense described in *Daubert v. Merrell Dow Pharmaceuticals*<sup>17</sup>—that a given gun fired the recovered items. A series of challenges to the admissibility of source attributions by firearms examiners ensued, and professional examiners

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<sup>13</sup> LeFevre, *supra* note 9, § 5.

<sup>14</sup> *Watkins v. Commonwealth*, 331 S.E.2d 422, 434 (Va. 1985). The Virginia Supreme Court saw no problem with “this positive statement” which “merely affects the weight of his testimony” and “does not necessarily invalidate or even weaken the results of his ballistics testing.” *Id.*

<sup>15</sup> *United States v. Natson*, 469 F.Supp.2d 1253, 1261 (N.D.Ga. 2007) (FBI supervisory special agent Paul Tangren identified “opined that he held this opinion to a 100% degree of certainty.”).

<sup>16</sup> PAUL GIANNELLI ET AL., *supra* note 1, § 14.06[a], at 773; Jay M. Zitter, Admissibility of Testimony that Bullet Could or Might Have Come from Particular Gun, 31 ALR4th 486 (1984) (§ 1).

<sup>17</sup> 509 U.S. 579 (1993). *Daubert* interpreted the phrase “scientific knowledge” in Federal Rule of Evidence 702 to mean “derived by the scientific method . . . supported by appropriate validation—i.e., ‘good grounds,’ based on what is known.” *Id.* at 590. An untold number of cases have attempted to apply these generalities. *See, e.g.*, Giannelli et al., *supra* note 1; KAYE ET AL., *supra* note 6, § 7.3.



responded with an “Admissibility Resource Kit” to “assist firearm examiners in better preparing for evidence admissibility hearings that began to greatly proliferate in 2002.”<sup>18</sup>

Initially, the courts were unfazed by the post-*Daubert* skepticism about what they comfortably knew as “a recognized method of ballistics testing”<sup>19</sup> that “has been accepted in criminal cases for many years.”<sup>20</sup> But then a number of federal district courts expressed misgivings about holistic judgments of “sufficient agreement of individual characteristics.”<sup>21</sup> No court excluded all evidence of similarities, but several struggled to find ways to allow examiners to assist the jury without testifying that cartridge components definitely came from the known firearm or that nothing else was scientifically or practically possible. The first such case during this period was *United States v. Green*.<sup>22</sup> In a summary of cases in this period, Paul called the

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<sup>18</sup> SWGGUN Admissibility Resource Kit (ARK), <https://afte.org/resources/swggun-ark>; cf. Kirsten Jackson, *The Daubert Era*, in *SCIENTIFIC EXAMINATION OF QUESTIONED DOCUMENTS* 37, 41 (Jan Seaman Kelly & Brian S. Lindblom eds. 2d ed. 2006) (attributing success in rebuffing “over 30 *Daubert* challenges” to handwriting identification to “the *Daubert* Group” formed by the American Board of Forensic Document Examiners).

<sup>19</sup> *United States v. Hicks*, 389 F.3d 514, 526 (5th Cir. 2004) (“the matching of spent shell casings to the weapon that fired them has been a recognized method of ballistics testing in this circuit for decades”).

<sup>20</sup> *United States v. Foster*, 300 F. Supp. 2d 375, 377 n.1 (D. Md. 2004) (reasoning that “the ‘human ability to recognize a similar pattern and distinguish between dissimilar patterns’ makes identification possible” and that “[b]allistics evidence has been accepted in criminal cases for many years”). Some courts frankly declined to require compliance with all the *Daubert* factors. *E.g.*, *United States v. Santiago*, 199 F. Supp. 2d 101, 112 (S.D.N.Y. 2002) (acceptance “in the community of forensics experts” can substitute for acceptance in “a scientific community”). For more strategies used to avoid the strictures of *Daubert* for criminalistics identification evidence, see David H. Kaye, *How Daubert and Its Progeny Have Failed Criminalistics Evidence and a Few Things the Judiciary Could Do About It*, 86 *FORDHAM L. REV.* \_\_\_ (2018).

<sup>21</sup> SWGGUN Admissibility Resource Kit (ARK): Summary of the Examination Method, <https://afte.org/resources/swggun-ark/summary-of-the-examination-method>; cf. AFTE Theory of Identification as It Relates to Toolmarks, <https://afte.org/about-us/what-is-afte/afte-theory-of-identification> (“sufficient agreement” for “subjective” “individualization/identification” occurs “when the agreement in individual characteristics exceeds the best agreement demonstrated between toolmarks known to have been produced by different tools and is consistent with agreement demonstrated by toolmarks known to have been produced by the same tool”).

<sup>22</sup> 405 F. Supp. 2d 104 (D. Mass. 2005).

opinion, written by U.S. District Judge Nancy Gertner, “riveting.”<sup>23</sup> It restricted the firearms examiner to testifying about the matching features—a reversion to the *Weber* era.<sup>24</sup> The expert admitted that in applying the Association of Firearms and Toolmark Examiners’ (AFTM’s) theory of sufficiency,<sup>25</sup> “it’s just your opinion? You determine which marks you’re going to pay attention to and which ones you’re not?”<sup>26</sup> The court found the examiner’s assurance “that this match could be made ‘to the exclusion of every other firearm in the world’” to be “extraordinary, particularly given [the] data and methods.”<sup>27</sup> In view of the method’s subjectivity, potential for bias, and lack of data on error rates, the district court perceived “no accurate way of evaluating the testimony.”<sup>28</sup>

No other modern, published opinion has confined the examiner to reporting on similarities and differences in the toolmarks.<sup>29</sup> Instead, a few concerned courts focused on how firmly an examiner could characterize source attributions. In *United States v. Monteiro*,<sup>30</sup> another federal district judge in the same district adopted the more lenient rule that “the expert may testify that the cartridge cases were fired from a particular firearm to a reasonable degree of

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<sup>23</sup> Paul C. Giannelli, *Ballistics Evidence Under Fire*, Crim. Just., Winter 2011, at 50.

<sup>24</sup> *See supra* Part I.

<sup>25</sup> *See supra* note 20.

<sup>26</sup> *Green*, 405 F. Supp. 2d at 112 n.15.

<sup>27</sup> *Id.* at 107.

<sup>28</sup> *Id.* at 121 (footnote omitted).

<sup>29</sup> For discussion of unadorned “‘features only’ testimony” and single-stage “‘not excluded’ or ‘match’” testimony for scientific identification evidence, see KAYE ET AL., *supra* note 6, §§ 15.3 & 15.4.

<sup>30</sup> 407 F.Supp.2d 351 (D. Mass. 2006),

ballistic certainty. However, the expert may not testify that there is a match to an exact statistical certainty.”<sup>31</sup>

Seeking a less opaque formulation, District Judge Jed Rakoff in *United States v. Glynn*<sup>32</sup> excluded testimony of “a reasonable degree of ballistic certainty”<sup>33</sup> in favor of a weaker statement of “more likely than not.”<sup>34</sup> This conclusion-lite testimony, along with other evidence in the case, led to a conviction and life sentence.<sup>35</sup>

The *Glynn* court denied that firearms source attributions “could . . . be called ‘science,’”<sup>36</sup> because when asked “what constitutes ‘sufficient agreement’ between two pieces of ballistic evidence to declare a match, [the government’s expert] admitted that the assessment is subjective, in that ‘it is an opinion of mine and whether or not someone else would agree with it is up to that individual.’”<sup>37</sup> The *Glynn* court may have been influenced by a report of a committee of the National Academy of Sciences.<sup>38</sup> This NAS committee was formed to assess the feasibility of creating a computer-searchable national database “that would house images of firings of all newly manufactured and imported firearms . . . as an aid to criminal

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<sup>31</sup> *Id.* at 355.

<sup>32</sup> 578 F. Supp. 2d 567 (S.D.N.Y. 2008).

<sup>33</sup> *Id.* at 574.

<sup>34</sup> *Id.* at 575. GIANNELLI ET AL., *supra* note 1, § 14.06[b], at 776, suggests that *Monteiro* used the same standard. However, the only use of the phrase is in a citation to a case involving bite-mark evidence as one illustration of the type of testimony that would fall short of the “100 percent sure” assertions that the court excluded in favor of “reasonable ballistic certainty.” *Monteiro*, 407 F. Supp. 2d at 372.

<sup>35</sup> U.S. Attorney for the Southern District of New York, Press Release, Bloods Gang Member Sentenced to Life in Prison for Ordering a Drug-related Murder in 2000, Jan. 28, 2009, available at <https://www.justice.gov/archive/usao/nys/pressreleases/January09/glynnsentencingpr.pdf>.

<sup>36</sup> *Id.* at 570 (footnote omitted).

<sup>37</sup> *Id.* at 571 (footnote omitted). Thus, the court found that the AFTE “standard defining when an examiner should declare a match—namely, ‘sufficient agreement’—is inherently vague.” *Id.* at 572.

<sup>38</sup> *Id.* (citing the report).

investigations.”<sup>39</sup> Although the committee was concerned with digital imaging and pattern-recognition technology, it began with an inquiry into the logic of traditional firearm-mark analysis.<sup>40</sup> It reported that “[t]he validity of the fundamental assumptions of uniqueness and reproducibility of firearms-related toolmarks has not yet been fully demonstrated”<sup>41</sup> Moreover, the committee approved of opinions that “refused to accept ‘exclusion of all other firearms’ arguments”<sup>42</sup> and disapproved of the practice of “overreach[ing] to make extreme probability statements.”<sup>43</sup>

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<sup>39</sup> NAT’L RESEARCH COUNCIL COMM. TO ASSESS THE FEASIBILITY, ACCURACY, AND TECHNICAL CAPABILITY OF A NATIONAL BALLISTICS DATABASE, BALLISTIC IMAGING 1 (Daniel L. Cork et al., eds. 2008) [hereinafter cited as 2008 Report]. The committee concluded that such a database would not be advisable, but recommended enhancements to the existing National Integrated Ballistic Information Network (NIBIN). *Id.* at 5-6.

<sup>40</sup> *Id.* at 3 (“Underlying the specific tasks with which the committee was charged is the question of whether firearms-related toolmarks are unique: that is, whether a particular set of toolmarks can be shown to come from one weapon to the exclusion of all others. Very early in its work, the committee found that this question cannot now be definitively answered.”).

<sup>41</sup> *Id.* at 5, 81.

<sup>42</sup> *Id.* at 84.

<sup>43</sup> *Id.* The AFTE disagreed. It maintained, as it always has, that examiners can and do achieve practical scientific certainty. AFTE Committee for the Advancement of the Science of Firearm & Toolmark Identification, The Response of the Association of Firearm and Tool Mark Examiners to the National Academy of Sciences 2008 Report Assessing the Feasibility, Accuracy, and Technical Capability of a National Ballistics Database, 40 AFTE J. 234, 242 (2008), available at <https://afte.org/uploads/documents/position-nas-2008.pdf>. The AFTE’s definition of “practical certainty” for “a scientific conclusion” is surprisingly weak. It means only that “an examiner . . . believes the conclusion to be true and accurate; . . . has rational grounds for [the belief]; and “acknowledges that, in the abstract, it is not possible to achieve absolute certainty for results flowing from a scientific theory or technique.”); *cf.* John E. Murdock et al., *The Development and Application of Random Match Probabilities to Firearm and Toolmark Identification*, 62 J. FORENSIC SCI. 619, 625 (2017) (“Absolute certainty opinions may have been adopted in the past, but this type of position has been retired for some time and no longer represents the consensus thinking of the firearm and toolmark community. . . . [O]ur everyday lives are predicated upon practical certainty. There is a practical certainty that our car will start in the morning (assuming it is in good mechanical condition), or that our (normally obedient) dog will come when called.”).



## IV. Heightened Scrutiny Following the 2009 NAS Report

Soon after the 2008 NAS report, a larger NAS Committee on Identifying the Needs of the Forensic Sciences Community observed that “[m]uch forensic evidence—including, for example, bite marks and firearm and toolmark identifications—is introduced in criminal trials without any meaningful scientific validation . . . .”<sup>44</sup> The committee reiterated some of the statements from the 2008 report,<sup>45</sup> emphasized the need for valid estimates of the uncertainties in forensic-science identification methods generally,<sup>46</sup> and pointed to a way to express the probative value of the associations without drawing a source conclusion.<sup>47</sup>

Neither the 2008 nor the 2009 NAS report made recommendations on admissibility of evidence, for that was not part of their charge.<sup>48</sup> Practitioners and prosecutors proposed that this meant that the reports should or could not be taken as undermining the admissibility of traditional firearm-mark or other highly judgmental pattern-matching identifications.<sup>49</sup> However,

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<sup>44</sup> NAT'L RESEARCH COUNCIL COMM. ON STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES, STRENGTHENING FORENSIC SCIENCE IN THE UNITED STATES: A PATH FORWARD 107-08 (2009) (footnotes omitted).

<sup>45</sup> *Id.* at 154.

<sup>46</sup> *Id.* at 184.

<sup>47</sup> The committee remarked that “[p]ublications such as Evett et al., Aitken and Taroni, and Evett provide the essential building blocks for the proper assessment and communication of forensic findings.” *Id.* at 186 (notes omitted; these references advocate strength-of-evidence statements rather than source conclusions).

<sup>48</sup> Indeed, the 2008 committee cautioned that “*the proposal for this study explicitly precluded the committee from assessing the admissibility of forensic firearms evidence in court, either generally or in specific regard to testimony on ballistic imaging comparisons.*” 2008 Report, *supra* note 38, at 20 (emphasis in original). In the next breath, the committee added that “We note, however, that high-subjectivity branches of forensic science are now confronting growing skepticism with regard to discernible uniqueness as a result of a number of legal and scientific studies.” *Id.*

<sup>49</sup> *E.g.*, AFTE Comm., *supra* note 42; Government’s Opposition to Defendant’s Motion to Exclude Expert Testimony Concerning Latent Fingerprint Evidence at 3, United States of America v. Titus Faison, No. 2008-CF2-16636 (D.C. Super. Ct. Feb. 19, 2010), as quoted in Harry T. Edwards, *The National Academy*

the committees' reviews of the literature clearly lent credence to the questions about the routine admission of categorical source attributions based on firearm-marks.<sup>50</sup> In five prominent published opinions, courts cited the NAS reports and the opinions in Part III to limit such testimony. First, the district court in *United States v. Taylor*<sup>51</sup> deemed the AFTE theory of sufficiency "circular."<sup>52</sup> It reiterated the assessment of the 2009 NAS committee that "a

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*of Sciences Report on Forensic Sciences: What It Means for the Bench and Bar*, 51 JURIMETRICS J. 1 (2010) (describing this argument as "utterly absurd").

<sup>50</sup> For example, in describing the scientific basis of "forensic science fields like firearms examination," the 2008 report quoted with approval an article by two forensic scientists stating that "[f]orensic individualization sciences that lack actual data, which is most of them, . . . simply . . . assume the conclusion of a miniscule probability of a coincidental match . . ." 2008 REPORT, *supra* note, at 54. Apparently recognizing the threat of such assessments, AFTE complained that the committees' literature reviews were shallow. In response to the 2008 report, it wrote that "the committee lacked the expertise and information necessary for the in-depth study that would be required to offer substantive statements with regard to these fundamental issues of firearm and toolmark identification." AFTE Comm., *supra* note 42, at 243. Likewise, it wrote that "the [2009] NAS committee in effect chose to ignore extensive research supporting the scientific underpinnings of the identification of firearm and toolmark evidence." AFTE, *The Response of the Association of Firearms and Tool Mark Examiners to the February 2009 National Academy of Science Report "Strengthening Forensic Science in the United States: A Path Forward,"* 41 AFTE J. 204, 206 (2009). According to AFTE, "years of empirical research . . . conclusively show that sufficient individuality is often present on tool (firearm tools or non-firearm tools) working surfaces to permit a trained examiner to conclude that a toolmark was made by a certain tool and that there is no credible possibility that it was made by any other tool working surface." AFTE Comm., *supra* note 42, at 242. After all, "[t]he principles and techniques utilized in forensic firearms identification have been *used internationally* for nearly a century *by the relevant forensic science community* to both identify and exclude specific firearms as the source of fired bullets and cartridge cases." *Id.* at 234 (emphasis added). Prosecutors too sought to blunt the implications of the skeptical statements about the limited validation of the premises of the traditional theory of bullet-mark identification with an affidavit from the chairman of the NAS committee that wrote the 2008 report. Affidavit of John E. Rolph, *United States v. Edwards*, No. F-516-01, Super. Ct., D.C., May 23, 2008. Yet, the affidavit merely collects excerpts from the report itself and ends with one that could be read as supporting admissibility under certain conditions. For another affidavit from a committee member contending that NAS "has questioned the validity of these fundamental assumptions of uniqueness and reproducibility," see Declaration of Alicia Carriquiry In Support of Motion in Limine to Exclude Firearms Examiner's Opinion, *People v. Knight*, No. LA067366, Super. Ct., Los Angeles County, at 2. Apr. 2012. The use of affidavits of one or two committee members to give their personal views on what the words that the committee as a whole agreed upon is ill-advised. It resembles asking individual members of Congress to provide their *post hoc* thoughts on what a committee report on legislation (or the statute itself) really meant.

<sup>51</sup> 663 F. Supp. 2d 1170 (D.N.M. 2009).

<sup>52</sup> *Id.* at 1177.

fundamental problem with toolmark and firearms analysis is the lack of a precisely defined process. . . . AFTE has adopted a theory of identification, but it does not provide a specific protocol.”<sup>53</sup> To cope with the absence of controlling standards for making source attributions, the court held that the expert “will not be permitted to testify that his methodology allows him to reach this conclusion as a matter of scientific certainty [or] that there is a match to the exclusion, either practical or absolute, of all other guns.”<sup>54</sup> Instead, “[h]e 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.”<sup>55</sup>

Second, *United States v. Willock*<sup>56</sup> provides the most extensive judicial analysis of firearms testimony to date. It observes that “toolmark analysis guidance provided by the AFTE lacks specificity because it allows an examiner to identify a match based on ‘sufficient agreement,’ which the AFTE defines using the undefined terms ‘exceeds the best agreement’ and ‘consistent with.’”<sup>57</sup> Based on “reading . . . the many published studies, journal articles, and cases,” Magistrate Judge Paul Grimm characterized “the AFTE theory . . . that once ‘sufficient agreement’ [establishes] a practical impossibility” as “astonishing.”<sup>58</sup> The district court ordered “[t]hat [the expert] not be allowed to opine that it is a ‘practical impossibility’ for any other

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<sup>53</sup> *Id.* at 1178.

<sup>54</sup> *Id.* at 1180.

<sup>55</sup> *Id.*

<sup>56</sup> 696 F. Supp. 2d 536 (D. Md. 2010).

<sup>57</sup> *Id.* at 566 (describing the reasoning of the 2009 NAS report).

<sup>58</sup> *Id.* at 572.

firearm to have fired the cartridges [and that he] only be permitted to state his opinions and bases without any characterization as to degree of certainty.”<sup>59</sup>

Third, in *Commonwealth v. Pytou Heang*,<sup>60</sup> the Massachusetts Supreme Judicial Court enumerated difficulties with the AFTE theory of sufficiency and practical impossibility. It settled on “reasonable degree of ballistic certainty” as an acceptable indication of the limits of an opinion, and cautioned that “[p]hrases that could give the jury an impression of greater certainty, such as ‘practical impossibility’ and ‘absolute certainty’ should be avoided.”<sup>61</sup> Likewise, it ruled that “‘reasonable degree of scientific certainty’ is unacceptable because it suggests that forensic ballistics is a science, where it is clearly as much an art as a science.”<sup>62</sup>

Fourth, the district court in *United States v. Ashburn*,<sup>63</sup> while declining to go as far as *Green* and *Glynn* in circumscribing source opinions, relied on the 2009 NAS Report and the criticisms of the AFTE sufficiency theory in the opinions discussed above to preclude “this expert witness from testifying that he is ‘certain’ or ‘100%’ sure [or] that a match he identified is to ‘the exclusion of all other firearms in the world,’ or that there is a ‘practical impossibility’ that any other gun could have fired the recovered materials.”<sup>64</sup> It limited the expert “to stating that his

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<sup>59</sup> *Id.* at 548.

<sup>60</sup> 942 N.E.2d 927 (Mass. 2011),

<sup>61</sup> *Id.* at 946 (footnote omitted).

<sup>62</sup> *Id.*; *cf.* *United States v. Cazares*, 788 F.3d 956, 989 (9th Cir. 2015) (distinguishing between “scientific certainty” and “a reasonable degree of certainty in the ballistics field,” and holding that the latter expression “is the proper expert characterization of toolmark identification”; the court did not consider whether a report of “practical impossibility” would be admissible).

<sup>63</sup> 88 F. Supp. 3d 239 (E.D.N.Y. 2015),

<sup>64</sup> *Id.* at 249.



conclusions were reached to a ‘reasonable degree of ballistics certainty’ or a ‘reasonable degree of certainty in the ballistics field.’”<sup>65</sup>

Finally, in *Gardner v. United States*,<sup>66</sup> the District of Columbia Court of Appeals, without mentioning *Willock*, wrote that it was error to admit an examiner’s “unqualified opinion.”<sup>67</sup> The court cited “questions about pattern matching generally, and bullet pattern matching specifically, [that] surfaced in the scientific community.”<sup>68</sup> Although the opinion condemned “absolute or 100% certainty,” it did not specify the qualifications an examiner would have to place on source attributions, and it did not discuss the AFTE theory of sufficiency for “practical impossibility.”<sup>69</sup>

To be clear, the cases collected here are exceptions to the normal, uncritical acceptance of firearm-mark testimony. And during this same period, other courts, in less detailed opinions, imposed no limitations on source attributions.<sup>70</sup> In all, the modern opinions on firearms source attribution uniformly hold that the similarities in the features can be presented (just as the earliest opinions on the subject did), and all but one allow an expert to provide some opinion on the source hypothesis. But what kind of an opinion that should be is being probed with increasing frequency. Although the still small number of critical cases are all over the map on how such

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<sup>65</sup> *Id.*

<sup>66</sup> 140 A.3d 1172 (D.C. 2016).

<sup>67</sup> *Id.* at 1184.

<sup>68</sup> *Id.* at 1183.

<sup>69</sup> *Id.*

<sup>70</sup> *E.g.*, *United States v. Casey*, 928 F.Supp.2d 397, 399-400 (D. Puerto Rico 2013) (although “defendant challenges [the] conclusion that [the examiner] is 100% certain . . . [the court] remains faithful to the long-standing tradition of allowing the unfettered testimony of qualified ballistics experts”); *United States v. Natson*, 469 F.Supp.2d 1253, 1261–62 (M.D. Ga. 2007) (permitting forensic ballistics expert to offer an opinion of a match “to a 100% degree of certainty”); *State v. Davidson*, 509 S.W.3d 156, 205 (Tenn. 2017) (“It’s like a fingerprint”).

opinions can or should be presented, this developing line of authority does seem to reflect a growing judicial sense of unease about the AFTE theory of personal sufficiency and practical impossibility, and no firm support for the theory is apparent in legal commentary. To the contrary, legal commentators tend to criticize the modern opinions for not excluding all conclusions based on current methods for comparisons<sup>71</sup> or for allowing “extremely misleading” phrases for a degree of certitude in a source attribution.<sup>72</sup>

## V. The 2016 PCAST Report

A third report from scientists outside of the firearms and toolmarks community generated even more consternation within that community and among law enforcement officials.<sup>73</sup> Late in 2016, the President’s Council of Advisors on Science and Technology (PCAST) released a report

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<sup>71</sup> *E.g.*, 4 DAVID L. FAIGMAN ET AL., MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY § 34 (2016-2017 ed.). This treatise refers to “cases like *Green*, *Glynn*, and *Willock*” as “partial and somewhat unsatisfying” and “a mere band-aid, requiring experts to slightly soften the language in which they express their conclusions, but not requiring any more significant modifications, nor any concrete empirical evidence regarding error rates, nor objective metrics to guide comparisons.” *Id.* § 34:5. KAYE ET AL., *supra* note 6, describes the *Monteiro* line of cases as allowing “the expert [to] give a looser opinion intended to connote that even if there is some chance of a matching weapon somewhere in the world, the bullet very likely passed through the barrel of the gun in the case at bar” and observes that “[w]hether even this weaker statement of local individualization satisfies *Daubert* and *Kumho Tire* is open to serious question . . . .” *Id.* § 15.2.4, at 685.

<sup>72</sup> GIANNELLI ET AL., *supra* note 1, § 14.06[d], at 780; *cf.* KAYE ET AL., *supra* note 6, § 15.2.4, at 685 (“to a reasonable degree of scientific certainty’ adds nothing meaningful to the opinion”); *id.* § 15.5 (Cum. Supp. 2016) (“Unless the source probability is demonstrably very close to one, so that a source attribution is defensible, nonnumerical expressions of source probability do not seem promising.”).

<sup>73</sup> For discussion of early reactions of the forensic-science establishment, see David H. Kaye, *The National District Attorneys Association’s Slam: PCAST “Usurps the Constitutional Role of the Courts,”* FORENSIC SCI., STAT. & L., Sept. 5, 2016, David H. Kaye, *The PCAST Report and Argumentum Ad Hominem*, FORENSIC SCI., STAT. & L., Sept. 24, 2016, <http://for-sci-law.blogspot.com/2016/09/the-pcast-report-and-argumentum-ad.html>; Adam B. Shniderman, *Prosecutors Respond to Calls for Forensic Science Reform: More Sharks in Dirty Water*, 126 YALE L.J. FORUM 348 (2017).

on “ensuring scientific validity of feature-comparison methods.”<sup>74</sup> Like the two NAS reports, the PCAST report questions the AFTE theory of unstructured firearm-mark identification to a practical certainty. Indeed, it dismisses it as “clearly not a scientific theory,” but rather “a claim that examiners applying a subjective approach can accurately individualize the origin of a toolmark” based on a “stated method” that “is circular.”<sup>75</sup>

#### A. Validity of Traditional Firearm-mark Analysis

The report finds that, whatever the theory behind firearm-mark analysis may be, the AFTE procedure has yet to be validated. Finding 6 is blunt:

PCAST finds that firearms analysis currently falls short of the criteria for foundational validity, because there is only a single appropriately designed study

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<sup>74</sup> Executive Office of the President, PCAST, Report to the President on Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods, Sept. 2016 [hereinafter 2016 PCAST Report].

<sup>75</sup> *Id.* at 60. In a reply to PSAC, the Firearms and Toolmark Subcommittee of the Organization of Scientific Area Committees for Forensic Science argued that the notion of sufficiency as the criterion for individualization is not circular because

The sufficient agreement threshold is exhibited when the amount of agreement is greater than best known non-matches established by the community and conveyed to each examiner through a lengthy and extensive training program. That is, it is not an arbitrary point. In fact, by definition, no non-matches can ever have more similarity than the sufficient agreement point.

Organization of Scientific Area Committees (OSAC), Firearms and Toolmarks Subcommittee, Response to the President’s Council of Advisors on Science and Technology (PCAST) Call for Additional References Regarding its Report “Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods,” Dec. 14, 2016, at 9, available at [https://www.theiai.org/president/20161214\\_FATM\\_Response\\_to\\_PCAST.pdf](https://www.theiai.org/president/20161214_FATM_Response_to_PCAST.pdf). *Accord*, AFTE, Response to PCAST Report on Forensic Science, Oct. 31, 2016, <https://afte.org/uploads/documents/AFTE-PCAST-Response.pdf>. The idea is that examiners draw on a kind of internal database—an overall sense of the similarity of some set of the most closely matching pairs of items from different sources that they encountered when they were trained or in exercises since then. They compare their memory of the similarities in different-source specimens to the observed similarities in the current case. If the current pair is outside the remembered range for non-mates, they believe that it is logically impossible for the current pair to have originated from the same source (“by definition,” that cannot occur). It seems doubtful that most courts would agree that this articulation provides the “specificity” required to avoid the kind of “circularity” or “inherent vagueness” that troubled the courts in *Taylor*, *Willock*, and *Glynn*.

to measure validity and estimate reliability. The scientific criteria for foundational validity require more than one such study, to demonstrate reproducibility.<sup>76</sup>

This damning conclusion follows from the specific criteria that PCAST adopted for establishing what it called “foundational validity.”<sup>77</sup> Finding (1) of the report explains that

To establish foundational validity for a forensic feature-comparison method, the following elements are required: (a) a reproducible and consistent procedure for (i) identifying features in evidence samples; (ii) comparing the features in two samples; and (iii) determining, based on the similarity between the features in two sets of features, whether the samples should be declared to be likely to come from the same source (“matching rule”); and (b) empirical estimates, from appropriately designed studies from multiple groups, that establish (i) the method’s false positive rate—that is, the probability it declares a proposed identification between samples that actually come from different sources and (ii) the method’s sensitivity—that is, the probability it declares a proposed identification between samples that actually come from the same source.<sup>78</sup>

Among other things, the “scientific validation studies should . . . be conducted so that the examinees have no information about the correct answer.”<sup>79</sup> Furthermore, for source conclusions that are not the product of a standardized, step-by-by procedure that involves “little or no judgment,”<sup>80</sup> PCAST insists on one (and apparently only one) approach to establishing foundational validity—“the method must be evaluated as if it were a ‘black box’ in the

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<sup>76</sup> 2016 PCAST Report, *supra* note 74, at 112; *see also id.* at 111 (“The scientific criteria for foundational validity require appropriately designed studies by *more than one group* to ensure reproducibility. Because there has been only a single appropriately designed study, the current evidence falls short of the scientific criteria for foundational validity.”). The response from the OSAC subcommittee, *supra* note 75, at 2-5, maintains that other types of studies supply ample proof of validity. In an addendum to the 2016 report, PCAST reiterated that the designs of most of the other studies are too flawed to permit them be relied on to establish validity. PCAST, An Addendum to the PCAST Report on Forensic Science in Criminal Courts, Jan. 6, 2017, at 7

[https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast\\_forensics\\_addendum\\_finalv2.pdf](https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_forensics_addendum_finalv2.pdf) (these studies “do not provide useful information about the actual reliability of firearms analysis”). It conceded that two additional studies, although still flawed, merited some consideration. *Id.*

<sup>77</sup> “Foundational validity” is not a standard phrase in metrology and statistics. “Validity” as PCAST defined it is discussed in KAYE ET AL., *supra* note 6, § 15.7.5(c) (Cum. Supp. 2017).

<sup>78</sup> 2016 PCAST Report, *supra* note 74, at 65.

<sup>79</sup> *Id.* at 66.

<sup>80</sup> *Id.* at 5 n.3.

examiner’s head”<sup>81</sup> via “black-box studies that measure how often many examiners reach accurate conclusions across many feature-comparison problems involving samples representative of the intended use.”<sup>82</sup>

By applying the *no-information-about-the-correct-answer* criterion, PCAST narrowed the number of “appropriately designed studies” to one unpublished experiment.<sup>83</sup> The “Ames Laboratory study”<sup>84</sup> was funded by the Department of Defense and reported in 2014. The 218 examiners who elected to participate “made . . . 15 comparisons of 3 knowns to 1 questioned cartridge case. For all participants, five of the sets were from known same-source firearms [known to the researchers but not the firearms examiners], and ten of the sets were from known different-source firearms.”<sup>85</sup> Ignoring “inconclusive” comparisons, the performance of the examiners is shown in Table 1.

| Table 1. Associations of Cartridge Cases to Handguns<br>in the Ames Laboratory Performance Study (Baldwin 2014). |      |      |      |
|------------------------------------------------------------------------------------------------------------------|------|------|------|
|                                                                                                                  | ~S   | +S   |      |
| -E                                                                                                               | 1421 | 4    | 1425 |
| +E                                                                                                               | 22   | 1075 | 1097 |

<sup>81</sup> *Id.* at 5.

<sup>82</sup> *Id.* at 66. For both objective and subjective methods, “[t]he studies must (a) demonstrate that the method is repeatable and reproducible and (b) provide valid estimates of the method’s accuracy (that is, how often the method reaches an incorrect conclusion) that indicate the method is appropriate to the intended application.” *Id.* at 5. “Repeatable” and “reproducible” are terms of art in metrology. “Repeatability describes the agreement within sets of measurements . . . where the same person uses the same equipment in the same way under the same conditions (including place and, as far as possible, time). Reproducibility . . . describes the agreement within a set of measurements . . . where different people, equipment, methods or conditions are involved.” Mike Goldsmith, Nat’l Physical Laboratory, UK, Good Practice Guide No. 118, A Beginner’s Guide to Measurement (2010), available at <http://www.npl.co.uk/publications/a-beginners-guide-to-measurement>.

<sup>83</sup> David P. Baldwin et al., A Study of False-positive and False-negative Error Rates in Cartridge Case Comparisons, Ames Laboratory, USDOE, Technical Report #IS-5207 (2014), at <https://afte.org/uploads/documents/swggun-false-postive-false-negative-usdoe.pdf>.

<sup>84</sup> 2016 PCAST Report, *supra* note 74, at 110. The Ames Laboratory is a Department of Energy national laboratory associated with Iowa State University. *Id.* at 11.

<sup>85</sup> Baldwin et al., *supra* note 83, at 10.



|                                                                                                                                                                                                                                                                                                                     |      |      |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|--|
|                                                                                                                                                                                                                                                                                                                     | 1443 | 1079 |  |
| -E is a negative finding (the examiner decided there was no association).<br>+E is a positive finding (the examiner decided there was an association).<br>~S indicates that the cartridges came from bullets fired by a different gun.<br>+S indicates that the cartridges came from bullets fired by the same gun. |      |      |  |

The observed false-positive rate is  $22/1443 = 1.52\%$ .<sup>86</sup> Taken at face value, these results are encouraging. On average, examiners displayed high levels of accuracy, both for cartridge cases from the same gun (better than 99% specificity) and from different guns (better than 98% sensitivity). Firearms examiners are not reaching all these correct conclusions by chance. In addition, these figures apply to the classifications made by single examiners in isolation (assuming that all the participants completed the exercises by themselves). Having a second, independent examination and then reconciling any differences in the outcomes before reporting an association or exclusion should reduce the rates of error.

Even so, an examination of further details of the Ames study supports PCAST’s doubts about relying on this one study to conclude that a wide cross-section of examiners can achieve high accuracy rates. To begin with, researchers enrolled 284 volunteer examiners in the study by sending out emails and announcements in newsletters.<sup>87</sup> Using volunteers often biases the results of an experiment.<sup>88</sup> Second, one-third of the volunteers did not submit answers,<sup>89</sup> so nonresponse bias is a further concern. Third, the volunteers who completed the tasks were told that that they were being tested to “benefit society by providing a better statistical evaluation of this common and important forensic discipline that will strengthen the legal system in its understanding of the

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<sup>86</sup> The 95% confidence interval is 0.96% to 2.30%. Conversely, the observed true-positive rate is 98.48%. The 95% confidence interval is 97.7% to 99.04%.

<sup>87</sup> *Id.* at 8.

<sup>88</sup> *E.g.*, P. F. Pinsky et al., *Evidence of a Healthy Volunteer Effect in the Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial*, 165 AM. J. EPIDEMIOLOGY 874 (2007).

<sup>89</sup> Baldwin et al., *supra* note 83, at 9.

value of firearms comparisons.”<sup>90</sup> Finally, only type of firearm and ammunition was used,<sup>91</sup> and only impressions on cartridge cases were considered.

As this example suggests, a robust set of studies—with different selection methods and conditions—is required to establish validity across an entire domain.<sup>92</sup> But there are studies with other firearms that indicate that examiners can discern the matching item out of a set when they know that the set contains a cartridge case or bullet fired by the test gun. The 2016 report dismisses these as of no value in establishing validity because source attribution in this “closed set” situation does not lend itself to meaningful estimates of error rates and is much easier than making source attributions when the examiner does not know whether a bullet in the test set came from the gun.<sup>93</sup> The very small error rates reported from such studies grossly exaggerate accuracy, but they lend some support to the claim that the expertise demonstrated in the Ames study extends beyond the limited circumstances of that study.

Consequently, despite PCAST’s concerted effort to supply definitive criteria for judicial findings of the requisite degree of scientific validity to admit the conclusions of subjective interpretations of perceived features,<sup>94</sup> courts could continue to find that a sufficient scientific

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<sup>90</sup> *Id.* at 25. On the one hand, they may have been motivated to perform exceptionally well because they wanted to show that their work is valuable. On the other hand, they may have been less motivated by the knowledge that it was just an experiment rather than a part of a criminal investigation and that no individual’s mistakes would be revealed to laboratory management.

<sup>91</sup> The experimenters selected the inexpensive Ruger SR9 semiautomatic 9-mm Luger centerfire pistol. *Id.* at 5 & 9. All the guns were new. The ammunition came from two lots made by one manufacturer. *Id.* at 9.

<sup>92</sup> *Cf.* HANS ZEISEL & DAVID H. KAYE, *EMPIRICAL METHODS IN LAW AND LITIGATION* ch. 5 (1997).

<sup>93</sup> Once an examiner picks the one true match, all the declarations of nonmatches are automatically correct. Experiments with other “set-to-set” designs have less internal dependencies but still fail to meet PCAST’s no-information criterion.

<sup>94</sup> *See, e.g.*, 2016 PCAST Report, *supra* note 74, at 4 (“[L]egal standards and scientific standards intersect. Judges’ decisions about the admissibility of scientific evidence rest solely on *legal* standards . . . . But, these decisions require making determinations about scientific validity. It is the proper province of the scientific community to provide guidance concerning scientific standards for scientific validity, and it is on those scientific standards that PCAST focuses here.”); *id.* at 4-5 (“Foundational validity . . . is the

foundation for bullet-mark evidence exists even though the PCAST scientists did not. The report convincingly contends that “[n]othing—not training, personal experience nor professional practices—can substitute for adequate empirical demonstration of accuracy.”<sup>95</sup> Nonetheless, there is still room to debate the threshold for an “adequate empirical demonstration.”<sup>96</sup>

## B. Error-rates for Firearm-mark Analysis

Apparently recognizing that its criteria for an adequate empirical foundation might be disputed, the PCAST report hedges its bet. The report acknowledges that “[w]hether firearms analysis should be deemed admissible based on current evidence is a decision that belongs to the courts,”<sup>97</sup> but urges that any courts that reject its pronouncements on scientific validity admit source attributions only when accompanied by quantitative estimates of the false-positive error rate as inferred from rigorous performance studies.<sup>98</sup>

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*scientific* concept we mean to correspond to the *legal* requirement, in Rule 702(c), of “reliable principles and methods.”).

<sup>95</sup> *Id.* at 46 (italicized in original).

<sup>96</sup> Finding 6 concludes: “If firearms analysis is allowed in court, the scientific criteria for validity as applied should be understood to require clearly reporting the error rates seen in appropriately designed black-box studies (estimated at 1 in 66, with a 95 percent confidence limit of 1 in 46, in the one such study to date).” In the Addendum PCAST continued to insist that “[f]rom a scientific standpoint, scientific validity should require at least two properly designed studies to ensure reproducibility,” Addendum, *supra* note 77, at 7. But it conceded that there was some useful information in two other studies. It wrote that “[t]he issue for judges is whether one properly designed study, together with ancillary evidence from the two imperfect studies, adequately satisfies the legal criteria for scientific validity.” *Id.* Firearms examiners maintain that many other studies noted but deemed inappropriate in the 2016 report comprise important evidence. OSAC Subcommittee response, *supra* note 75.

<sup>97</sup> 2016 PCAST Report, *supra* note 74, at 112.

<sup>98</sup> *Id.* at 112. The meaning of 95 percent confidence is subtle (and the description in the 2016 report is incorrect. David H. Kaye, *PCAST’s Sampling Errors (Part I)*, FORENSIC SCI., STAT. & L., Oct. 24, 2016, <http://for-sci-law.blogspot.com/2016/10/pcasts-sampling-errors.html>). As indicated *supra* note 85, another way to report the same estimate of a false declaration of a match when the materials tested did not come from the same gun is that this interval goes from the 0.96% to 2.30%. For notes on some of the difficulties with PCAST’s approach to estimating false-positive probabilities as measures of probative value in a particular case, see David H. Kaye, *PCAST’s Sampling Errors (Part II: Getting More Technical)*, FORENSIC SCI., STAT. & L., Dec. 11, 2016, <http://for-sci-law.blogspot.com/2016/12/pcasts-sampling-errors-part-ii-getting.html>; David H. Kaye, *PCAST and the Ames Bullet Cartridge Study: Will*

But applying such numbers to individual examiners and particular cases is more challenging than the report recognizes. It is one thing to show that, as a group, some set of examiners can reach correct conclusions (in comparisons that they do not regard as inconclusive). It is another to accurately estimate the probability of an error for a given examiner in a particular comparison.<sup>99</sup> Indeed, the 2016 report notes that “20 of the 22 false positives were made by just 5 of the 218 examiners — strongly suggesting that the false positive rate is highly heterogeneous across the examiners”;<sup>100</sup> however, the report does not discuss the implications of this heterogeneity for testimony about “the error rates” that it wants “clearly presented.”<sup>101</sup> It calls for “rigorous proficiency testing” of the examiner and disclosure of those test results.<sup>102</sup> There is a substantial argument for admitting both performance-test-based estimates of error

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*the Real Error Rates Please Stand Up?*, FORENSIC SCI., STAT. & L., Nov. 1, 2016, <http://for-sci-law.blogspot.com/2016/11/pcast-and-ames-study-will-real-error.html>.

<sup>99</sup> This caveat does not mean that an average error rate in a study is irrelevant, or that only examiner-specific “proficiency tests” on casework-like samples of the same level of difficulty (in which examiner judgments also are analyzed as the output of a black-box system) are relevant. It is sensible to rely on average figures when nothing better is at hand (and to consider them in conjunction with an individual-specific error-rate even when one is available). *See generally* Dominique Fourdrinier & Martin T. Wells, *On Improved Loss Estimation for Shrinkage Estimators*, 27 STAT. SCI. 61 (2012); Hermanus H. Lemmer, *Shrinkage Estimators*, in *ENCYCLOPEDIA OF STATISTICAL SCIENCE* (Samuel Kotz & Campbell B. Read eds., 2d ed. 2006).

<sup>100</sup> 2016 PCAST Report, *supra* note 74, at 112.

<sup>101</sup> Baldwin et al. cautioned that

[F]or the pool of participants used in this study the fraction of false positives was approximately 1%. The study was specifically designed to allow us to measure not simply a single number from a large number of comparisons, but also to provide statistical insight into the distribution and variability in false-positive error rates. The . . . overall fraction is not necessarily representative of a rate for each examiner in the pool. Instead, . . . the rate is a highly heterogeneous mixture of a few examiners with higher rates and most examiners with much lower error rates. This finding does not mean that 1% of the time each examiner will make a false-positive error. Nor does it mean that 1% of the time laboratories or agencies would report false positives, since this study did not include standard or existing quality assurance procedures, such as peer review or blind reanalysis.

Baldwin et al., *supra* note 83, at 18.

<sup>102</sup> 2016 PCAST Report, *supra* note 74, at 111.

rates, but the report does not develop the idea.<sup>103</sup> PCAST’s discussion of a false-positive rate from a study designed to show whether examiners as a group are generally capable of reaching correct results (without verification) should not be taken as a final word on how to estimate error rates for courtroom use.<sup>104</sup>

## VI. The Future

It seems unlikely that the PCAST report will result in the widespread judicial rejection of largely subjective comparisons.<sup>105</sup> But the recommendations and conclusions of yet a third body of accomplished scientists should intensify judicial reservations about testimony that the “chance of error [is] so remote as to be a ‘practical impossibility.’”<sup>106</sup> If the report has this effect, the issue of how to present the evidence becomes more critical. As previously noted, phrases like “reasonable ballistic certainty” and “more likely than not” are not the solution.<sup>107</sup> Three more

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<sup>103</sup> See *supra* note 99.

<sup>104</sup> Verification by a second examiner also is relevant to presenting or using an error rate. As previously noted, if the errors occur independently across examiners (as might be the case if the verification is truly blind), then the relevant false-positive error rate from the Ames study drops to  $(1.52\%)^2 = 0.0231\%$ .

<sup>105</sup> There are no published opinions on whether the analysis in the report warrants exclusion of firearm-mark evidence. In *United States v. Chester*, No. 13 CR 00774, 2017 WL 3394746 (N.D. Ill. Oct. 7, 2016), the district court thought (oddly) that the report merely “provides foundational scientific background and recommendations for further study [and] does not dispute the accuracy or acceptance of firearm toolmark analysis within the courts.” *Id.* at 1-2. In addition, the court wrote that the error rates in the Ames study and one of the other ones discussed in the report were “sufficiently low.” *Id.* at 2.

<sup>106</sup> 2016 Report, *supra* note 74, at 145 (recommending that courts should never permit scientifically indefensible claims such as: “zero,” “vanishingly small,” “essentially zero,” “negligible,” “minimal,” or “microscopic” error rates; “100 percent certainty” or proof “to a reasonable degree of scientific certainty;” identification “to the exclusion of all other sources;” or a chance of error so remote as to be a “practical impossibility.”).

“Practical impossibility” and “practical certainty” are signature phrases for firearms examiners. See *supra* notes 12 & 43; see also AFTE, *supra* note 75, at 1 (“examiners employing standard, validated procedures will rarely, if ever, commit false identifications or false eliminations.”) (emphasis added).

<sup>107</sup> See *supra* notes 71-72 & accompanying text; KAYE ET AL., *supra* note 6, § 15.2.5:

Allowing testimony to “a reasonable degree of ballistic (or some such) certainty,” however, is a fig leaf that does not provide decent modesty. The witness often is



promising approaches are worth noting. If operating within the current paradigm of experience- and-training-based holistic conclusions, experts should not claim to be applying distinctly *scientific* methods for interpreting measurements or observations.<sup>108</sup> To follow the AFTE logic, they could explain that they have been trained in comparing the variations in the marks left by a gun, and that the marks seem to diverge from the normal range that they recall—but that they have no quantitative knowledge of the variation that normally exists when bullets are fired from the same gun as opposed to different guns.<sup>109</sup> And, any conclusion that the excess variation means that marks on the questioned item came from the known gun should be accompanied by meaningful error probabilities.

This kind of presentation corresponds to the “black box” perspective on the process. The examiner is treated no differently than a mysterious computer program that classifies questioned items into two categories—same gun, or different guns. The marks are the input or stimulus; a 1 (same gun) or 0 (different gun) is the output or response.<sup>110</sup> For the purpose of trusting the categorical conclusion, *how* the examiner performs the classification is not crucial.<sup>111</sup> The

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presented as a scientist, applying a scientific method and using scientific terms. The phrase “to a reasonable degree of scientific certainty” adds nothing meaningful to the opinion of such a witness, and extirpating the phrase does not go far toward closing the distance between a firm opinion and a well-warranted one.

<sup>108</sup> See Kaye, *supra* note 20.

<sup>109</sup> As such, they should not use the phrases like “individual marks.” Cf. KAYE ET AL., *supra* note 6, § 15.7.1(c) (“The demand that the forensic science community perpetuate the time-honored but intellectually unsatisfying theory of individual versus class characteristics is unfortunate.”). “Class characteristics” are acquired via a manufacturing or other process that is known to be uniform enough to produce many items with that characteristic. Other characteristics are acquired via a more variable process that produces fewer items with the same characteristic, but no law of nature dictates that an “individual characteristic” exists in one and only one item.

<sup>110</sup> I am putting to the side a refusal to reach a clear conclusion by declaring that the evidence is inconclusive.

<sup>111</sup> That a classification procedure is based on a valid theory lends credence to the results, and it affects how extensively the process needs to be tested, but the theory is not a substitute for empirical testing of the procedure or its components.

“operating characteristics” of the examiner as a source detector,<sup>112</sup> if adequately studied, are sufficient. Broadly speaking, this is the PCAST perspective on validation and presentation of traditional testimony.

However, it is not necessary for the examiner to be an inscrutable detector that registers either a same-gun signal or its absence as a 1 or a 0. Many forensic scientists and statisticians favor a second mode of presentation in which the examiner describes (1) how often the perceived degree of agreement between the questioned specimen and those from the test firings would be seen if all the specimens came from the same gun and (2) how often such similarity would be seen if the questioned specimens came from a different gun.<sup>113</sup> The extent to which (1) exceeds (2) indicates how much the evidence supports the same-source conclusion as opposed to the different-source conclusion.<sup>114</sup> Describing the strength of the evidence in this manner—without any categorical conclusion from the expert’s mind—is an attractive alternative to conventional testimony.<sup>115</sup> A firearms analyst should be able to articulate the “likelihoods”—the rough probabilities of the marks given each hypothesis about the source and the basis for these judgments about the evidence. Assessing the likelihoods is the expertise that lay jurors lack and that is supposed to come with training and experience in the field. But jurors can decide which

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<sup>112</sup> For discussion of operating characteristics of a statistical classification procedure, see, for example, THOMAS D. WICKENS, *ELEMENTARY SIGNAL DETECTION THEORY* (2002); NAT’L RESEARCH COUNCIL, COMM. ON EVALUATION OF SOUND SPECTROGRAMS, ON THE THEORY AND PRACTICE OF VOICE IDENTIFICATION 27–30 (1979).

<sup>113</sup> See, e.g., BERNARD ROBERTSON ET AL., *INTERPRETING EVIDENCE: EVALUATING FORENSIC SCIENCE IN THE COURTROOM* (2d ed. 2016); European Network of Forensic Science Institutes, *ENFSI Guideline for the Formulation of Evaluative Reports in Forensic Science* (2015); Ian W. Evett et al., *Finding the Way Forward for Forensic Science in the US—A Commentary on the PCAST Report*, 278 *Forensic Sci. Int’l* 16 (2017); Geoffrey Stewart Morrison et al., *A Comment on the PCAST Report: Skip the “Match”/“Non-match” Stage*, 272 *Forensic Sci. Int’l* e7 (2017) (letter); *supra* note 47.

<sup>114</sup> E.g., KAYE ET AL., *supra* note 6, § 14.2; David H. Kaye, Review-essay, *Digging into the Foundations of Evidence Law*, 116 *MICH. L. REV.* 915 (2017).

<sup>115</sup> Of course, proof that examiners’ judgments of the weight of evidence are reasonably accurate is necessary. E.g., Kaye, *supra* note 20.

likelihood ratios are large enough to warrant a source attribution as well as firearms experts can.<sup>116</sup> When experts take over that task, they end up presenting radically different conclusions for marks that are just shy of their implicit and unarticulated cutoff for source attribution than for marks that are barely over their threshold.<sup>117</sup>

The preceding two approaches are still predominantly subjective. In the longer term, we can and should expect expert testimony to be informed by statistical data about the frequency of types of marks on bullets or cartridge cases as determined from reference databases.<sup>118</sup> Three-dimensional imaging methods allow automated feature extraction.<sup>119</sup> With data on the distributions of similarity scores in items from the same gun and items from different ones, statistical models can generate quantitative likelihood ratios.<sup>120</sup> Such systems are statistically reliable (the same inputs generate the same outputs), and they can be validated empirically by investigating their performance on different data sets. Progress in these endeavors will enable firearms examiners to speak more fittingly of the “The Science Behind Firearm and Tool Mark Examination.”<sup>121</sup>

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<sup>116</sup> Cf. David H. Kaye, *Likelihoodism, Bayesianism, and a Pair of Shoes*, 53 JURIMETRICS J. 1 (2012) (footwear-mark testimony).

<sup>117</sup> E.g., ROBERTSON ET AL., *supra* note 113; Morrison et al., *supra* note 113.

<sup>118</sup> In 2016, the National Institute of Standards and Technology established such a database. NIST Ballistics Toolmark Database, Dec. 20, 2017, <https://www.nist.gov/programs-projects/nist-ballistics-toolmark-database>.

<sup>119</sup> E.g., Daniel Ott et al., *Identifying Persistent and Characteristic Features in Firearm Tool Marks on Cartridge Cases*, 5 SURFACE TOPOGRAPHY: METROLOGY & PROPERTIES (2017), <http://iopscience.iop.org/article/10.1088/2051-672X/aa864a>.

<sup>120</sup> E.g., Fabiano Riva & Christophe Champod, *Automatic Comparison and Evaluation of Impressions Left by a Firearm on Fired Cartridge Cases*, 59 J. FORENSIC SCI. 1556 (2014).

<sup>121</sup> Nancy Ritter, *The Science Behind Firearm and Tool Mark Examination*, Oct. 2014, <https://nij.gov/journals/274/Pages/firearm-toolmark-examination.aspx>.

## Exec Sec Package on ULTR and Testimony Monitoring

---

**From:** "Antell, Kira M. (OLP)" <(b) (6)>  
**To:** "Terwilliger, Zachary (ODAG)" <(b) (6)>  
**Cc:** "Hunt, Ted (ODAG)" <(b) (6)>, "Bolitho, Zachary (ODAG)" <(b) (6)>, "Hur, Robert (ODAG)" <(b) (6)>, "Crytzer, Katherine (OLP)" <(b) (6)>, "Champoux, Mark (OLP)" <(b) (6)>  
**Date:** Wed, 10 Jan 2018 17:21:30 -0500  
**Attachments:** Package on ULTR and Testimony Monitoring\_DISTRIBUTED TO ES 01102018\_SIGNED.pdf (1.31 MB)

---

Good afternoon,

On December 28, OLP submitted an advance copy of the package on the Uniform Language for Testimony and Reports (ULTR) and testimony monitoring framework for a general ODAG review prior to submission into exec sec. Per our discussion this morning, this afternoon we submitted the complete package into exec sec (WF 3961079)

I have attached an electronic PDF file of that package here

This file contains

1. Action memo for decision
2. Draft public facing statement from the DAG to components on the ULTR and testimony monitoring (this document has been socialized with components).
3. OLP summary providing background, process information, and component positions
4. Component cleared Latent Print ULTR
5. Component cleared testimony monitoring framework

OLP is happy to provide a briefing if that would be helpful. If you have any questions, please do not hesitate to call or email.

Thanks very much,  
Kira

Kira Antell  
Senior Counsel  
Office of Legal Policy  
U.S. Department of Justice  
950 Pennsylvania Avenue, NW  
Washington, DC 20530

(b) (6)  
(b) (6)

## Package for Final Review

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**From:** "Antell, Kira M. (OLP)" <(b) (6)>  
**To:** "Hunt, Ted (ODAG)" <(b) (6)>  
**Date:** Wed, 27 Dec 2017 08:25:19 -0500  
**Attachment** OLP Summary Latent ULTR and TM 12272017 FOR THUNT REVIEW.doc (91.92 kB); Compare 12162017 to 12272017.pdf (182.53 kB); Latent Print ULTR\_12272017.docx (36.57 kB); Department TM Framework\_122721017.docx (23.74 kB)

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Hi Ted,

You asked for a chance to see everything before we submitted it to ODAG. Attached is

1. OLP summary
2. Redline of OLP summary against the last version you saw
3. Cleared Latent Print ULTR
4. Cleared TM framework

Once you've reviewed, I'll submit the clean summary and the two cleared documents to Zach(k). I'll explain that this is an advance copy of a package that will be submitted through exec sec after an initial ODAG review and that OLP is happy to meet to brief the DAG next week if that would be helpful.

Kira Antell  
Senior Counsel  
Office of Legal Policy  
U.S. Department of Justice  
950 Pennsylvania Avenue, NW  
Washington, DC 20530

(b) (6)  
(b) (6)



## RE: Comments on OLP Packet

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**From:** "Antell, Kira M. (OLP)" <(b) (6)>  
**To:** "Hunt, Ted (ODAG)" <(b) (6)>  
**Date:** Thu, 28 Dec 2017 09:52:11 -0500  
**Attachment:** Ted Change to Final pdf (217 kB)

---

Hi Ted,

Attached is a redline comparing your version to the final – edits that I did not accept are highlighted.

Thank ,  
K

---

**From:** Antell, Kira M. (OLP)  
**Sent:** Wednesday, December 27, 2017 3:54 PM  
**To:** Hunt, Ted (ODAG) <(b) (6)>  
**Subject:** RE: Comments on OLP Packet

Hi Ted,

I am going through your OLP summary edits now and while you're right that many are non-substantive, given that this has been reviewed and cleared by my AAG, I'm not in a position to be able to take many of them at this late point. I am making the ones that seem important for clarification but not making the stylistic ones. In the future, we can address this by getting your input earlier in the process before it is adopted by OLP. You'll recall that you declined to review this document previously. I'll send you a redline FYSA before I submit anything.

Thanks,  
K

---

**From:** Hunt, Ted (ODAG)  
**Sent:** Wednesday, December 27, 2017 3:43 PM  
**To:** Antell, Kira M. (OLP) <(b) (6)>  
**Subject:** Comments on OLP Packet

Kira,

- 1) The OLP summary – I know this is an OLP document, but I went ahead and made some non-substantive edit suggestions to the LP and TM summaries.
- 2) LP ULTR – very minor grammatical changes.
- 3) TM policy – very minor grammatical changes. I did add one word after requirement #3. Take a look. I don't think the sentence makes much sense without adding the word, "document."

Let me know if you have any questions.

Thx. Ted

Ted R. Hunt  
Senior Advisor to the Attorney General on Forensic Science  
Office of the Deputy Attorney General  
United States Department of Justice  
950 Pennsylvania Ave. NW  
C 20530

(b) (6)  
(U) (U)

# Package on ULTR and Testimony Monitoring

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**From:** "Antell, Kira M. (OLP)" <(b) (6)>  
**To:** "Terwilliger, Zachary (ODAG)" <(b) (6)>  
**Cc:** "Hunt, Ted (ODAG)" <(b) (6)>, "Bolitho, Zachary (ODAG)" <(b) (6)>, "Thiemann, Robyn (OLP)" <(b) (6)>, "Crytzer, Katherine (OLP)" <(b) (6)>, "Hur, Robert (ODAG)" <(b) (6)>  
**Date:** Thu, 28 Dec 2017 11:50:27 -0500  
**Attachments:** Package on ULTR and Testimony Monitoring\_DISTRIBUTED 12282017.pdf (220.28 kB)

---

Good morning Zach,

Per our discussion last week, attached is an electronic copy of the package on the Uniform Language for Testimony and Reports (ULTR) and testimony monitoring.

This file contains:

- 1 OLP summary providing background, process information, and component positions
2. Component cleared Latent Print ULTR
- 3 Component cleared testimony monitoring policy

In early January, we plan to submit these documents through Exec Sec for approval, accompanied by an action memo and public facing declaration. OLP is available next week (Wednesday-Friday) and would be delighted to provide a briefing prior to Exec Sec submission to ensure these documents reflect leadership positions. If you have any questions, please do not hesitate to call or email.

Thanks very much,  
Kira

Kira Antell  
Senior Counsel  
Office of Legal Policy  
U.S. Department of Justice  
950 Pennsylvania Avenue, NW  
Washington, DC 20530  
(b) (6)  
(b) (6)

## Federal PCAST Decisions

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**From:** "Antell, Kira M. (OLP)" <(b) (6)>  
**To:** "Hunt, Ted (ODAG)" <(b) (6)>  
**Date:** Mon, 26 Feb 2018 11:39:56 -0500  
**Attachment** United State v Ca au pdf (76.36 kB); United State v North pdf (87.4 kB); United State v Bond pdf (88.54 kB)

---

Hi Ted,

Attached

K

Kira Antell  
Senior Counsel  
Office of Legal Policy  
U.S. Department of Justice  
950 Pennsylvania Avenue, NW  
Washington, DC 20530

(b) (6)  
(b) (6)

2017 WL 6729619

Only the Westlaw citation is currently available.

United States District Court,  
D. Colorado.

UNITED STATES of America, Plaintiff,

v.

9. Ambrose CASAUS, Defendant.

Criminal Case No. 14-cr-00136-CMA-09

|  
Signed 12/29/2017

#### Attorneys and Law Firms

[James R. Boma](#), U.S. Attorney's Office, Denver, CO, for Plaintiff.

[Lisa Monet Wayne](#), [Lisa M. Wayne](#), Law Office of, [Adam Michael Tucker](#), Adam Tucker, P.C., The Law Office of, [Richard James Banta](#), Richard J. Banta, PC, Denver, CO, for Defendant.

#### Opinion

### ORDER TO DENYING DEFENDANT'S MOTION TO EXCLUDE LATENT FINGERPRINT IDENTIFICATION EVIDENCE

[CHRISTINE M. ARGUELLO](#), United States District Judge

\*1 This matter is before the Court on Defendant Casaus's Motion to Exclude Latent Fingerprint Identification Evidence (Doc. # 517). Essentially, Defendant Casaus asks this Court to find that the fingerprint methodology used by the FBI, commonly known as the ACE-V method, is per se unreliable and therefore inadmissible. Keeping in line with the majority of courts to have addressed this issue, the Court denies the motion.

#### I. LAW

[Fed. R. Evid. 702](#) imposes on a district court a gatekeeper obligation to “ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable.” [Daubert v. Merrell Dow Pharms., Inc.](#), 509 U.S. 579, 589 (1993). “Rule 702, both before and after [Daubert](#),

was intended to relax traditional barriers to admission of expert opinion testimony.” [Cook v. Rockwell Int'l Corp.](#), 580 F. Supp. 2d 1071, 1082 83 (D. Colo. 2006).

[Rule 702](#) provides that a witness who is qualified as an expert by “knowledge, skill, experience, training, or education” may testify if:

- (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;
- (b) the testimony is based on sufficient facts or data;
- (c) the testimony is the product of reliable principles and methods; and
- (d) the expert has reliably applied the principles and methods to the facts of the case.

[Fed. R. Evid. 702](#). The proponent of a challenged expert must demonstrate by a preponderance of the evidence that the testimony and opinion is admissible. [United States v. Nacchio](#), 555 F.3d 1234, 1241 (10th Cir. 2009).

In determining whether expert testimony is admissible, the Court generally employs a three-step process. First, it must first determine whether the expert is qualified “by knowledge, skill, experience, training, or education” to render an opinion. *Id.* at 124. Second, if the expert is sufficiently qualified, the Court must determine whether the proposed testimony is sufficiently “relevant to the task at hand,” such that it “logically advances a material aspect of the case.” [Norris v. Baxter Healthcare Corp.](#), 397 F.3d 878, 884, 884 n.2 (10th Cir. 2005). “Doubts about whether an expert's testimony will be useful should generally be resolved in favor of admissibility unless there are strong factors such as time or surprise favoring exclusions. The jury is intelligent enough to ignore what is unhelpful in its deliberations.” [Robinson v. Mo. Pac. R.R. Co.](#), 16 F.3d 1083, 1090 (10th Cir. 1994) (quotation omitted).

Third, the Court examines whether the expert's opinion “has ‘a reliable basis in the knowledge and experience of his [or her] discipline.’ ” *Id.* (quoting [Daubert](#), 509 U.S. at 592). Guided by these principles, this Court has “broad discretion” to evaluate whether an expert is helpful, qualified, and reliable under [F.R.E. 702](#). [United States v. Velarde](#), 214 F.3d 1204, 1208-09 (10th Cir. 2000).



## II. ANALYSIS

\*2 Defendant Casaus does not dispute the Government's fingerprint expert's qualifications, nor does he argue that the fingerprint evidence is irrelevant. Instead, he focuses only on the general reliability of fingerprint examinations using the ACE-V method.

To support his contentions that the ACE-V method is per se unreliable, Defendant Casaus relies heavily on a 2016 report created by President Obama's **Council of Advisors on Science and Technology**, wherein the Council criticized latent fingerprint examinations. This Court, however, is bound by established Tenth Circuit precedent concluding otherwise that fingerprint comparison is a reliable method of identifying persons and one that courts have consistently upheld against a *Daubert* challenge. *United States v. Avitia-Guillen*, 680 F.3d 1253, 1260 (10th Cir. 2012); *United States v. Baines*, 573 F.3d 979, 990 91 (10th Cir. 2009) (noting “[f]ingerprint identification has been used extensively by law enforcement agencies all over the world for almost a century,” has an “impressively low” error rate, and has achieved “overwhelming acceptance” by experts in the field); *United States v. Gutierrez-Castro*, 805 F. Supp. 2d 1218, 1231 (D.N.M. 2011) (finding that the ACE-V fingerprint method is sufficiently reliable to be admissible); see also *United States v. Crisp*, 324 F.3d 261 (4th Cir. 2003) (concluding fingerprint identification satisfied *Daubert*); *United States v. Hernandez*, 299 F.3d 984 (8th Cir. 2002) (same); *United States v. Havvard*, 260 F.3d 597, 601 (7th Cir. 2001) (same).

Although the Court understands that further research and intellectual scrutiny into the reliability of fingerprint

evidence would be “all to the good,” *Baines*, 573 F.3d at 992, the Court agrees with the conclusion of the Tenth Circuit that “to postpone present in-court utilization of this ‘bedrock forensic identifier’ pending such research would be to make the best the enemy of the good.” *Id.* Indeed, “*Daubert* ... demands only that the proponent of the evidence show that the expert's conclusion has been arrived at in a scientifically sound and methodologically reliable fashion.” *Ruiz-Troche v. Pepsi Cola of Puerto Rico Bottling Co.*, 161 F.3d 77, 85 (1st Cir. 1998). After considering the arguments set forth in the Government's Response, the Court finds that the Government has met this burden.

Moreover, Defendant Casaus does not point out any specific pitfalls or concerns with respect to the fingerprint examination conducted in this case and, as mentioned, provides no argument or authority to support that the Government's expert is somehow unqualified to have conducted her examination. See *Avitia-Guillen*, 680 F.3d at 1260 (“Defendant ... pointed to nothing in the record indicating [the expert] deviated from normal, reliable fingerprint comparison methods.”).

## III. CONCLUSION

For the foregoing reasons, the Court denies Defendant Casaus's Motion to Exclude Latent Fingerprint Identification Evidence. (Doc. # 517.)

### All Citations

Slip Copy, 2017 WL 6729619

### Footnotes

- 1 The Court notes that the Defendant did not request a hearing on this issue. The Court nonetheless finds that a hearing, which is not required, is not necessary in this case. *Burlington N. & Santa Fe Ry. Co. v. Grant*, 505 F.3d 1013, 1031 (10th Cir. 2007) (“Generally, the district court performs this function at a *Daubert* hearing, although such a hearing is not specifically required.”).



2017 WL 5508138

Only the Westlaw citation is currently available.

United States District Court,  
N.D. Georgia, Atlanta Division.

UNITED STATES of America,

v.

Jeff NORTH, Defendant.

1:16-cr-309-WSD

|

Signed 11/17/2017

**Attorneys and Law Firms**

Ryan Huschka, U.S. Attorney's Office, Atlanta, GA, for  
United States of America.

James Wesley Bryant, Federal Defender Program Inc.,  
Atlanta, GA, for Defendant.

**Opinion**

**OPINION AND ORDER**

WILLIAM S. DUFFEY, JR., UNITED STATES  
DISTRICT JUDGE

\*1 This matter is before the Court on Defendant Jeff North's ("Defendant") Motion to File Out of Time ("Motion to File") [94] and Motion to Preclude Gun-Shot Residue Analysis Opinion Evidence (the "Daubert Motion") [94.1].

**I. BACKGROUND**

On May 26, 2016, a grand jury in the Northern District of Georgia returned a three-count indictment [13] charging Defendant with Carjacking in violation of 18 U.S.C. § 2119(1) (Count 1); Discharging a Firearm During a Federal Crime of Violence in violation of 18 U.S.C. §§ 924(c)(1)(A)(i), (ii), and (iii) (Count 2); and Possession of a Firearm by a Convicted Felon in violation of 18 U.S.C. §§ 922(g)(1) and 9224(e) (Count 3). The Indictment alleges that, on or about March 23, 2015, Defendant shot Johnny Dansby and stole his vehicle.

On March 23, 2015, swabs from Defendant's hands were submitted to the Georgia Bureau of Investigation, Division of Forensic Sciences for a gunshot residue

("GSR") analysis. The sealed samples were later analyzed by Microanalyst Alexander Covin. Mr. Covin completed an official report detailing the method of analysis, results, and conclusions. ([97.1]). Mr. Covin's primary trainer and Manager and Acting Director of the Trace Evidence Section, Michael McCarriagher, independently reviewed the evidence, report, and all associated documentation. (Id.).

The GSR report was provided to Defendant at his arraignment hearing on September 9, 2016. The report states that the samples taken from Defendant's hands were tested for the presence of particles characteristic of GSR. It details the test method used ("scanning electron microscopy/energy dispersive x-ray spectroscopy") and summarizes the results (the examination "revealed three particles characteristic of GSR"). It also summarized the analysts' opinion that the examination of the samples:

revealed the presence of particles characteristic of [GSR]. This supports the possibility that the individual discharged a firearm, was in close proximity to a firearm upon discharge, or came into contact with an item whose surface bears GSR.

([97.1]).

On September 20, 2017, the Court ordered [69] that this case be placed on the Court's December 5, 2017 trial calendar. The Court further ordered that the parties file, by October 16, 2017, motions *in limine* and motions to exclude evidence or testimony.

On October 20, 2017, the Government officially noticed Mr. McCarriagher and Mr. Covin as experts who would testify in the area of gunshot residue and provided copies of their CVs. The Government also provided backup notes, data, and other information. (See [97.4]).

On November 13, 2017, Defendant filed his Motion to File, [94] in which he moved for leave to file the Daubert Motion beyond the October 16, 2017, deadline. The Defendant attached his Daubert Motion [94.1] to the Motion to File. In his Daubert Motion, Defendant argues that the Government's disclosures related to the GSR analysis fail to comply with Rule 16 of the Federal Rules of Criminal Procedure. He also seeks discovery and a hearing regarding the admissibility of Mr.

McCarriagher's testimony under [Rule 702 of the Federal Rules of Evidence](#).

\*2 By docket entry on November 13, 2017, the Court ordered that the Government respond to the Motion to File by noon on November 16, 2017.

On November 16, 2017, the Government responded to the Daubert Motion. (See [97]).

On November 17, 2017, Defendant filed his Reply [100].

## II. DISCUSSION

The Daubert Motion is currently before the Court. Defendant seeks a hearing on the admissibility of Mr. McCarriagher's testimony regarding the presence of gunshot residue on Defendant on the grounds that the Government's expert is not qualified to offer his opinion and the opinions are otherwise inadmissible under [Federal Rule of Evidence 702](#). Defendant also requests discovery on the tests used, including “a summary as required by [Rule 16 of the Federal Rules of Criminal Procedure](#).”

### A. Legal Standard

[Rule 16\(a\)\(1\)\(G\) of the Federal Rules of Criminal Procedure](#) “imposes specific disclosure requirements on the government with regards to expert witnesses that the government plans to utilize at trial.” [United States v. Holland](#), 223 Fed.Appx. 891, 893 (11th Cir. 2007). The rule provides, in pertinent part, that, “[a]t the defendant's request, the government must give to the defendant a written summary of any [expert] testimony that the government intends to use.” *Id.* The “summary” provided by the government must include the expert witness's “opinions, the bases and reasons for those opinions, and the witness's qualifications.” *Id.* The commentary to the Rule further provides that the government's summary “should cover not only written and oral reports, tests, reports, and investigations, but any information that might be recognized as a legitimate basis for an opinion....” *Id.*, Advisory Comm. Notes, 1993 Amendment.

Expert opinion testimony is governed by [Rule 702 of the Federal Rules of Evidence](#) and [Daubert v. Merrell Dow Pharmaceuticals, Inc.](#), 509 U.S. 579 (1993). Under [Rule 702](#), expert testimony is admissible if: (1) the expert is qualified to testify regarding the subject matter of

his testimony; (2) the methodology that the expert used to reach his conclusions is sufficiently reliable; and (3) the expert's testimony will assist the trier of fact in understanding the evidence or in determining a fact at issue. [United States v. Scott](#), 403 Fed.Appx. 392, 397 (11th Cir. 2010) (citing [United States v. Frazier](#), 387 F.3d 1244, 1260 (11th Cir. 2004)) (en banc); Fed. R. Evid. 702. The Government has the burden to meet each of the admissibility requirements. See [Scott](#), 403 Fed.Appx. at 397-98.

The second prong requires the district court to make a preliminary determination on whether the expert's methodology is reliable. [Scott](#), 403 Fed.Appx. at 397. In [Daubert](#), the Supreme Court provided a non-exclusive list of factors for the district court to consider:

- (1) whether the expert's theory can be and has been tested;
- (2) whether the theory has been subjected to peer review and publication;
- (3) the known or potential rate of error of the particular scientific technique;
- and (4) whether the technique is generally accepted in the scientific community.

[Frazier](#), 387 F.3d at 1262. These factors are only general guidelines, and the trial judge has “considerable leeway in deciding in a particular case how to go about determining whether particular expert testimony is reliable.” [Kumho Tire Co., Ltd. v. Carmichael](#), 526 U.S. 137, 152 (1999).

\*3 A court may conduct a hearing on a [Daubert](#) motion, but one is not automatically granted. See [Corwin v. Walt Disney Co.](#), 475 F.3d 1239, 1252 n.10 (11th Cir. 2007) (“although they are often helpful, [[Daubert](#)] hearings are not prerequisite to such determinations under the Federal Rules or established law”); [Cook ex rel. Estate of Tessier v. Sheriff of Monroe County](#), 402 F.3d 1092, 1113 (11th Cir. 2005) (noting that trial court was under no obligation to hold a [Daubert](#) hearing, although such hearings may be helpful in complicated cases involving multiple experts).

### B. The Government's Disclosures Comply With [Rule 16](#)

The pretrial disclosure provided by the Government includes a clear summary of the method of analysis, results, and opinions. The GSR report was provided

to Defendant at his arraignment hearing on September 9, 2016. It discloses that the evidence analyzed was a “[s]ealed GSR collection kit identified as containing samples from the hands of Jeff North.” ( [97.1] ). The report concluded that “three particles characteristic of GSR” were revealed on the sample, supporting the analyst's opinion that “the individual discharged a firearm, was in close proximity to a firearm upon discharge, or came into contact with an item whose surface bears GSR.” (*Id.*). It further states that the “method of analysis” used to arrive at this conclusion was by “scanning electron microscopy/energy dispersive x-ray spectroscopy (SEM/EDS) and analyzed for elemental composition and particle morphology.” (*Id.*). The report notes that the “evidence, report and all associated documentation have been reviewed by primary trainer, Michael McCarriagher.” (*Id.*). The Government also provided copies of Mr. McCarriagher's and Mr. Covin's CVs. (See [97.2-3] ). Finally, the Government supplied thirty additional pages of notes and underlying data. (See [97.4]).

The Government met its pretrial disclosure obligations under Rule 16. United States v. Campbell, No. 1:04-CV-0424-RWS, 2006 WL 346446, at \*1 (N.D. Ga. Feb. 13, 2006) (“Rule 16 does not mandate a comprehensive recitation of every nuance and detail that will make up an expert's testimony, or which may be drawn out on cross-examination.”).

### C. Expert Discovery and a Daubert Hearing Are Unnecessary

Defendant requests discovery and a hearing on the admissibility of expert opinions related to the GSR report. A hearing is not required every time a party raises a Daubert objection. See Corwin v. Walt Disney Co., 475 F.3d 1239, 1252 n.10 (11th Cir. 2007); Cook ex rel. Estate of Tessier v. Sheriff of Monroe County, 402 F.3d 1092, 1113 (11th Cir. 2005).

Here, the Government has proffered sufficient information to allow this Court to qualify Mr. McCarriagher in his area of expertise. It set forth how it plans to present Mr. McCarriagher's qualifications, training, experience, and the methodology employed in conducting his analysis and reaching his conclusions. (See [97] at 7-8). The Court is satisfied that Mr. McCarriagher has the requisite experience and training to offer opinions

on the presence of GSR. “Over the course of [Mr.] McCarriagher's ten-plus years as a forensic scientist, he has conducted more than 1,200 GSR analyses and he has testified in court and been qualified as a GSR expert approximately eighty times.” ( [97] at 7).

Applying the Daubert criteria, the Court finds that Mr. McCarriagher's opinion is reliable. Defendant does not cite any authorities or other information that the GSR analysis is unreliable, non-scientific, or that it does not have broad acceptance in the forensic community. Defendant mentions “[t]hree reports issued in 2008, 2009, and 2016 ... have called into question the reliability of many forensic ‘sciences’ previously admitted without much doubt.” ( [100] at 2-3). Defendant does not demonstrate that these reports cast cognizable doubt on the reliability of Mr. McCarriagher's method.<sup>2</sup> Defendant also does not rebut other cases submitted by the Government in which courts have admitted expert testimony regarding GSR testing similar to that which it intends to be offered at this trial in this case. See, e.g., United States v. Flowers, 235 Fed.Appx. 965, 967 (4th Cir. 2007); United States v. Eldridge, 2013 WL 6096520, at \*7-8 (W.D.N.Y. Nov. 20, 2013).

\*4 To the extent that Defendant seeks to attack the credibility and accuracy of the results of the GSR analysis, these matters can be the subject of “vigorous cross examination, presentation of contrary evidence, and careful instructions on the burden of proof.” Daubert, 509 U.S. at 596.<sup>3</sup>

### III. CONCLUSION

For the foregoing reasons,

**IT IS HEREBY ORDERED** that Defendant's Motion to File Out of Time [94] is **DENIED AS MOOT**.

**IT IS FURTHER ORDERED** that the Defendant's Motion to Preclude Gun-Shot Residue Analysis Opinion Evidence [94.1] is **DENIED**.

**SO ORDERED** this 17th day of November, 2017.

### All Citations

Slip Copy, 2017 WL 5508138

Footnotes

- 1 Defendant's Daubert Motion addresses testimony from Mr. Covin at trial. The Government "intends to call [Mr.] McCarriagher to testify in the Government's case in chief" and currently does not expect to call Mr. Covin. This Order will address Defendant's objections to Mr. Covin as if they were to Mr. McCarriagher.
- 2 See, e.g., President's **Council of Advisors on Science** and Technology, Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods 104 (September 2016) (questioning reliability of examiners' "attempt to determine whether ammunition is or is not associated with a specific firearm based on toolmarks produced by guns on the ammunition"—not primer residue analysis).
- 3 Defendant has failed to justify the expense and delay caused by pretrial discovery, especially given that Defendant was aware of the GSR report for over a year.

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End of Document

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2017 WL 4511061

Only the Westlaw citation is currently available.

United States District Court,  
N.D. Illinois, Eastern Division.

UNITED STATES of America

v.

Myshawn BONDS

No. 15 CR 573-2

|

Signed 10/10/2017

#### Attorneys and Law Firms

AUSA, [Jordan Melissa Palmore](#), United States Attorney's Office, Chicago, IL, Pretrial Services, for United States of America.

#### Opinion

### OPINION AND ORDER

[SARA L. ELLIS](#), United States District Judge

\*1 Defendant Myshawn Bonds is charged with two counts of bank robbery in violation of [18 U.S.C. § 2113\(a\)](#). The government alleges that on August 25, 2015, Bonds robbed a Chase Bank in Joliet, Illinois of \$4,682, and that on September 11, 2015, he robbed a BMO Harris Bank in Carpentersville, Illinois of \$2,247. In preparation for trial, Bonds has filed a motion seeking to exclude the government's expert testimony regarding fingerprint analysis pursuant to [Federal Rule of Evidence 702](#), contending the method used is not sufficiently reliable foundationally or as applied to his case. Because the Court finds the government's proposed fingerprint expert testimony meets [Rule 702](#)'s requirements, with Bonds' concerns going to weight and not admissibility, the Court denies Bonds' motion.

### BACKGROUND

The government has disclosed to the defense that, at trial, it intends to present the testimony of FBI forensic examiner Kira Glass as an expert in the field of latent fingerprint analysis. The government's expert disclosures indicate that Glass will testify concerning fingerprint

analysis in general, including the development of latent fingerprints and how such latent fingerprints can be used for identification when compared with an individual's known prints. She specifically will testify about the ACE-V (analysis, comparison, evaluation, and verification) method of fingerprint identification. The ACE-V method "is the standard method for determining whether two fingerprints are from the same person." [United States v. Herrera](#), 704 F.3d 480, 484 (7th Cir. 2013). The method involves the following: (1) analysis of the unknown latent print to assess the quality and quantity of detail present; (2) comparison of the latent print to known prints to determine details that correspond; (3) evaluation of the two prints to determine if there is sufficient detail in agreement for an identification or in disagreement to exclude the known print; and (4) verification by another qualified examiner, repeating the observations between the latent and known print and coming to the same conclusion, although the second examiner may be aware of the first examiner's conclusion. *Id.* (citing National Research Council of the National Academy of Sciences, *Strengthening Forensic Science in the United States: A Path Forward* 137 38 (2009)).

Using the ACE-V method, Glass examined demand notes presented during both the Joliet and Carpentersville bank robberies. She is expected to testify that four latent prints recovered from the Joliet demand note and two latent prints recovered from the Carpentersville demand note match the known print standard for Bonds.

### LEGAL STANDARD

The admissibility of expert opinion testimony is governed by [Federal Rule of Evidence 702](#) and [Daubert v. Merrell Dow Pharmaceuticals, Inc.](#), 509 U.S. 579, 113 S. Ct. 2786, 125 L.Ed. 2d 469 (1993). See [Bielskis v. Louisville Ladder, Inc.](#), 663 F.3d 887, 893 (7th Cir. 2011). [Rule 702](#) provides that a witness qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of opinion or otherwise provided that "(a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert has reliably applied the principles and methods to the facts of the case." [Fed. R. Evid. 702](#). To admit expert



testimony under this rule, the Court must determine that (1) the witness is qualified, (2) the expert's methodology is reliable, and (3) the testimony will assist the trier of fact to understand the evidence or to determine a fact in issue. *Myers v. Ill. Cent. R.R. Co.*, 629 F.3d 639, 644 (7th Cir. 2010). The Rule 702 inquiry "is a flexible one," however. *Daubert*, 509 U.S. at 594. "Determinations on admissibility should not supplant the adversarial process; 'shaky' expert testimony may be admissible, assailable by its opponents through cross-examination." *Gayton v. McCoy*, 593 F.3d 610, 616 (7th Cir. 2010). The proponent of the testimony bears the burden of proving that the proffered testimony meets these requirements, and the Seventh Circuit grants the district court "wide latitude in performing its gate-keeping function." *Bielskis*, 663 F.3d at 894.

## ANALYSIS

### I. Reliability of ACE-V Method

\*2 Bonds first argues that the ACE-V method should be excluded because it is not a proven, foundationally valid scientific method. Initially, the Court notes that fingerprint evidence need not be a proven *scientific* method to qualify for admissibility as expert evidence. While *Daubert* initially was framed as applying only to scientific evidence, it applies more broadly to all "testimony based on 'technical' and 'other specialized' knowledge," with *Daubert's* reliability factors applying flexibly depending on the specific issues presented by the testimony under consideration. *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 141, 119 S. Ct. 1167, 143 L.Ed. 2d 238 (1999); see also *id.* at 150 ("[T]he factors identified in *Daubert* may or may not be pertinent in assessing reliability, depending on the nature of the issue, the expert's particular expertise, and the subject of his testimony."). Thus, although fingerprint "matching depends on 'subjective judgments by the examiner;" as long as the "evidence [is] created or validated by expert methods and presented by an expert witness that is shown to be reliable," it is admissible under Rule 702. *Herrera*, 704 F.3d at 486-87.

Setting that initial argument aside, Bonds argues that ACE-V is not a reproducible and consistent means of determining whether two prints have a common source and that ACE-V's false positive rate is too high to justify reliance on it in a criminal trial. Bonds focuses

on a recent 2016 report issued by the President's Council of Advisors on Science and Technology (the "**PCAST** Report"), which studied latent fingerprint analysis as well as other identification procedures. See President's Council of Advisors on Science and Technology, *Forensic Science in Criminal Courts: Ensuring Validity of Feature-Comparison Methods* (Sept. 20, 2016), attached as Ex. 4 to Bonds' Motion. The **PCAST** Report reviewed two black-box studies of latent fingerprint examinations, which were specifically designed to evaluate validity and reliability. An FBI study published in 2011 reported a false positive rate (the rate at which the method erroneously called a match between a known and latent print) of 1 in 306, while a 2014 Miami-Dade Police Department Forensic Services Bureau study had a false positive rate of 1 in 18. Bonds also raises concerns about the subjective nature of fingerprint analysis, citing to various other reports questioning the assumptions on which ACE-V is based and calling for the implementation of additional safeguards in the field.

Bonds' first argument concerning matching of prints has been rejected by the Seventh Circuit, which noted that the "methodology requires recognizing and categorizing scores of distinctive features in the prints, and it is the distinctiveness of these features, rather than the ACE-V method itself, that enables expert fingerprint examiners to match fingerprints with a high degree of confidence." *Herrera*, 704 F.3d at 485. The *Herrera* court acknowledged that latent fingerprint matching is less reliable and rigorous than DNA evidence, but it found fingerprint matching "admissible evidence, in general" despite the fact that "the matching process is judgmental rather than scientifically rigorous." *Id.* at 486-87. Although the **PCAST** Report focuses on scientific validity, the Court agrees with *Herrera's* broader reading of Rule 702's reliability requirement.

More importantly, the **PCAST** Report found that "latent fingerprint analysis is a foundationally valid subjective methodology albeit with a false positive rate that is substantial and is likely to be higher than expected by many jurors based on longstanding claims about the infallibility of fingerprint analysis." **PCAST** Report at 9. Although the **PCAST** Report suggested that accurate information about limitations on the reliability of the evidence be provided, this information concerning false positive rates, in addition to the other concerns raised in the **PCAST** Report and by Bonds in his motion, goes to

the weight of the fingerprint evidence, not its admissibility. See *Stollings v. Ryobi Techs., Inc.*, 725 F.3d 753, 766 (7th Cir. 2013) (“An expert may provide expert testimony based on a valid and properly applied methodology and still offer a conclusion that is subject to doubt. It is the role of the jury to weigh these sources of doubt.”); *Metavante Corp. v. Emigrant Sav. Bank*, 619 F.3d 748, 762 (7th Cir. 2010) (criticisms of the quality of an expert’s opinion go to the appropriate weight to be accorded to the evidence and not to its admissibility). Bonds will have adequate opportunity to explore these issues on cross-examination.

## II. Reliability of ACE-V as Applied by Glass in this Case

\*3 Bonds also argues that the Court should exclude the government’s proposed fingerprint testimony because the government cannot demonstrate that Glass reliably applied ACE-V in examining the fingerprints in this case. Again, Bonds relies on the **PCAST** Report, which noted that in finding whether latent fingerprint analysis has been reliably applied, the Court should consider whether (1) “the examiner has undergone regular and rigorous proficiency testing,” (2) “the latent print(s) are of the quality and completeness represented in the foundational validity studies,” and (3) “measures [have been] taken to mitigate bias during casework.” **PCAST** Report at 101. Bonds complains that the government has not provided any information related to these factors.

The government responds that it has met its burden to demonstrate that the proffered fingerprint evidence in this case is reliable, and that Bonds’ request that the government comply with **PCAST**’s advisory recommendations goes beyond what is required to meet **Rule 702**. The Court is satisfied that the government has sufficiently established that Glass reliably applied the ACE-V method to this case, with Bonds able to raise concerns about her application of the ACE-V method to the prints at issue on cross-examination. But, while the Court agrees with the government that the **PCAST** Report presents only advisory recommendations concerning validity as applied, given that the Court does not have before it the entirety of the government’s disclosures to Bonds, Bonds and the government should confer prior to trial to determine whether the government has any additional information concerning Glass’ fingerprint examinations that should be disclosed to Bonds prior to Glass’ testimony. See *United States v. Saunders*, 826 F.3d 363, 369 70 (7th Cir. 2016) (finding that government’s failure to disclose the number of points that matched in

fingerprint comparison prior to expert’s testimony may have hindered “a defendant’s ability to prepare an attack on the validity of the identification”); *United States v. Robinson*, 44 F. Supp. 2d 1345, 1346 (N.D. Ga. 1997) (government’s failure to properly disclose the location of each point of comparison used by government’s fingerprint expert left defendant’s expert unable to review the basis of the opinion). To the extent Bonds determines that Glass did not comply with the recommended **PCAST** procedures, Bonds can raise these concerns on cross-examination.

Therefore, the Court denies Bonds’ motion to exclude the government’s fingerprint testimony at trial, finding instead that the issues Bonds raises go to the weight to be accorded to the fingerprint evidence and not to its admissibility.

## III. Limitations on Fingerprint Evidence Testimony

Alternatively, Bonds requests that if the Court does allow Glass to testify, the Court (1) prevent Glass from testifying to a match between the latent print and the suspect print, instead limiting her to describing similarities and differences between the prints; and (2) require Glass to acknowledge that the level of certainty of a purported match is limited by the most conservative reported false positive rate in an appropriately designed empirical study thus far (*i.e.*, the 1 in 18 false positive rate from the 2014 Miami-Dade study). The Court declines to limit Glass’ testimony as Bonds requests. Instead, Bonds can raise these issues with Glass on cross-examination and highlight them during his closing argument.

In a similar vein, the government asks the Court to preclude Bonds from raising any questions concerning the *Mayfield* case or any other unrelated case involving flawed fingerprint analysis while cross-examining Glass. The government argues that such cross-examination on collateral matters would distract and confuse the jury. Specifically, the government is concerned that Bonds will seek to cross-examine Glass about the FBI’s misidentification of Brandon Mayfield as an individual connected to train bombings in Madrid in 2004. The FBI identified fingerprints found on a bag of detonators in a van used by the bombers as Mayfield’s, leading to his arrest, but two weeks later, the Spanish police informed the FBI that it had identified another individual as the source of the fingerprints, causing the FBI to withdraw its identification of Mayfield. Subsequently, the U.S.

Department of Justice's Office of the Inspector General conducted a review of the case, issuing a report that detailed various problems with the use of ACE-V in the case. Bonds references the *Mayfield* case extensively in arguing that the ACE-V method is not reliable. He argues that discussion of the *Mayfield* case is a critical part of any cross-examination to demonstrate to the jury that misidentifications happen and have happened before.

\*4 The government, relying on *United States v. Rivas*, in which the Seventh Circuit found it did not violate the defendant's confrontation rights or constitute an abuse of discretion to preclude the defense from inquiring specifically about the *Mayfield* case, argues that the Court should similarly limit questioning because Glass was in no way involved in *Mayfield*. See 831 F.3d 931, 935 (7th Cir. 2016). The Court agrees that questioning Glass about a case in which she was not involved would distract from the issues before the jury, has little if any relevance, and would not be appropriate here. *Id.* The Court does not find Bonds' argument persuasive that questioning about the *Mayfield* case would ensure that the jury understands that

fingerprint misidentifications happen, where the Court is not precluding Bonds from raising general questions on that issue. As discussed above and as the government acknowledges, the Court's ruling does not prevent Bonds from questioning Glass about the reliability of the ACE-V methodology generally but only is intended to keep the testimony from devolving into a side trial concerning cases in which Glass had no involvement.

## CONCLUSION

For the foregoing reasons, the Court denies Bonds' motion to preclude expert testimony regarding fingerprint analysis [153]. The Court grants the government's request to preclude Bonds from discussing the *Mayfield* case and other unrelated cases involving flawed fingerprint analysis during Glass' cross-examination.

## All Citations

Slip Copy, 2017 WL 4511061

## KBI Next Week

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** "Antell, Kira M. (OLP)" <(b) (6)>  
**Date:** Tue, 12 Sep 2017 11:19:47 -0400  
**Attachment:** KBI Speech DRAFT doc (40 72 kB)

---

Kira,

First draft of KBI speech for next week is attached. Please take a look when you get a chance.

Thx. Ted

Ted R. Hunt  
Senior Advisor on Forensic Science  
Office of the Deputy Attorney General  
United States Department of Justice  
950 Pennsylvania Ave, NW  
Washington, D.C. 20530

(b) (6)  
(U) (0)

# KBI Speech-DRAFT\_KMA

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**From:** "Antell, Kira M. (OLP)" <(b) (6)>  
**To:** "Hunt, Ted (ODAG)" <(b) (6)>  
**Date:** Wed, 13 Sep 2017 12:25:29 -0400  
**Attachment:** KBI Speech DRAFT KMA doc (43 52 kB)

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See what you th  
PCAST section (b) (5)

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## RE: KBI Speech-DRAFT\_KMA

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** "Antell, Kira M. (OLP)" <(b) (6)>  
**Date:** Wed, 13 Sep 2017 12:44:29 -0400

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Great. Thanks very much!

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**From:** Antell, Kira M (OLP)  
**Sent:** Wednesday, September 13, 2017 12:25 PM  
**To:** Hunt, Ted (ODAG) (b) (6)  
**Subject:** KBI Speech-DRAFT\_KMA

Duplicative Material see bates stamp 20220314-09361

## DRAFT Remarks

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** "Crowell, James (ODAG)" <(b) (6)>, "Hur, Robert (ODAG)" <(b) (6)>  
**Date:** Fri, 15 Sep 2017 11:22:58 -0400  
**Attachment** DRAFT Remark KBI KS AG Meeting Sept 20 doc (46 27 kB)

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Jim/Rob:

Attached above are draft remarks that I've prepared for a talk I'm giving next week (Wednesday) to the Kansas Bureau of Investigation and the Kansas Attorney General's Office at the KBI's new lab in Topeka, KS.

These remarks have already been reviewed by OLP. Note that they contain a couple references to the PCAST Report, and that these are ODAG's first public comments on that Report.

Please let me know if you have any questions or comments.

Thanks,

Ted

Ted R. Hunt  
Senior Advisor to the Attorney General on Forensic Science  
Office of the Deputy Attorney General  
United States Department of Justice  
950 Pennsylvania Ave, NW  
Washington D.C. 20530

(b) (6)  
(b) (6)

## FRC Talkers-Additions

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**From:** "Hunt, Ted (ODAG)" <(b) (6)>  
**To:** "Antell, Kira M. (OLP)" <(b) (6)>  
**Date:** Wed, 11 Apr 2018 12:49:48 -0400  
**Attachment** Hunt' Addition FRC Meeting Talker doc (15 96 kB)

---

Kira,

Attached are relevant excerpts from the Committee Note to FRE 702, with my comments below each.

Ted

Ted R. Hunt  
Senior Advisor to the Attorney General on Forensic Science  
Office of the Deputy Attorney General  
United States Department of Justice  
950 Pennsylvania Ave. NW  
Washington, DC 20530

(b) (6)  
(b) (6)

(Excerpts from FRE 702 Advisory Committee Notes and my Comments)

Notes of Advisory Committee on Proposed Rules

*Ruiz-Troche v. Pepsi Cola*, 161 F.3d 77, 85 (1st Cir. 1998) (“**Daubert neither requires nor empowers trial courts to determine which of several competing scientific theories has the best provenance.**”).”

Hunt’s Comment: (b) (5)



“*GAP Report—Proposed Amendment to Rule 702.* The Committee made the following changes to the published draft of the proposed amendment to Evidence Rule 702:

1. The word “reliable” was deleted from Subpart (1) of the proposed amendment, in order to avoid an overlap with Evidence Rule 703, and to clarify that an expert opinion need not be excluded simply because it is based on hypothetical facts. The Committee Note was amended to accord with this textual change.

2. The Committee Note was amended throughout to include pertinent references to the Supreme Court’s decision in *Kumho Tire Co. v. Carmichael*, which was rendered after the proposed amendment was released for public comment. Other citations were updated as well.

3. The Committee Note was revised to emphasize that the amendment is not intended to limit the right to jury trial, *nor to permit a challenge to the testimony of every expert, nor to preclude the testimony of experience-based experts, nor to prohibit testimony based on competing methodologies within a field of expertise.*

4. Language was added to the Committee Note to clarify that no single factor is necessarily dispositive of the reliability inquiry mandated by Evidence Rule 702.”



Hunt's Comment: (b) (5)

[REDACTED]

*“Nothing in this amendment is intended to suggest that experience alone—or experience in conjunction with other knowledge, skill, training or education—may not provide a sufficient foundation for expert testimony. To the contrary, the text of Rule 702 expressly contemplates that an expert may be qualified based on experience. In certain fields, experience is the predominant, if not sole, basis for a great deal of reliable expert testimony. See, e.g., United States v. Jones, 107 F.3d 1147 (6th Cir. 1997) (no abuse of discretion in admitting the testimony of a handwriting examiner who had years of practical experience and extensive training, and who explained his methodology in detail); Tassin v. Sears Roebuck, 946 F.Supp. 1241, 1248 (M.D.La. 1996) (design engineer's testimony can be admissible when the expert's opinions “are based on facts, a reasonable investigation, and traditional technical/mechanical expertise, and he provides a reasonable link between the information and procedures he uses and the conclusions he reaches”). See also Kumho Tire Co. v. Carmichael, 119 S.Ct. 1167, 1178 (1999) (stating that “no one denies that an expert might draw a conclusion from a set of observations based on extensive and specialized experience.”).”*

Hunt's Comment: (b) (5)

[REDACTED]