The Future State of Handwriting Examinations: A Roadmap to Integrate the Latest Measurement Science and Statistics

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AAFS Annual Meeting
February 20, 2014
Seattle, WA

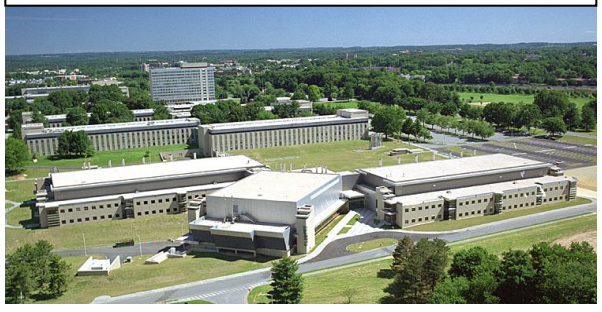
Agenda

- National Institute of Standards and Technology
- MSSFHA Planning Team & Conference
- MSSFHA Facilitated Session – Future, Barriers, Roadmap
- Recommendations

National Institute of Standards and Technology

- Advances measurement science, standards, and technology in ways that −
  - Promote U.S. innovation and industrial competitiveness
  - Enhance economic and physical security
  - Improve our quality of life
- Founded in 1901 as the National Bureau of Standards
- Within the U.S. Department of Commerce
- **Non-regulatory agency**

Gaithersburg Campus



National Institute of Standards and Technology

- **Non-regulatory status** enables an important role as a convener that facilitates collaboration between agencies of the Federal Government, industry, private organizations, and state and local governments.

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Measurement Science and Standards in Forensic Handwriting Analysis (MSSFHA) Conference & Webcast

- Held June 4-5, 2013, at NIST in Gaithersburg, MD with live webcast.

- The purpose of this conference was to enhance the current state of forensic handwriting analysis by exploring of the latest advancements in measurement science and the latest research investments in quantitative analysis capabilities.

- Archived: http://www.nist.gov/oles/handwriting.cfm

MSSFHA: Collaborative Effort

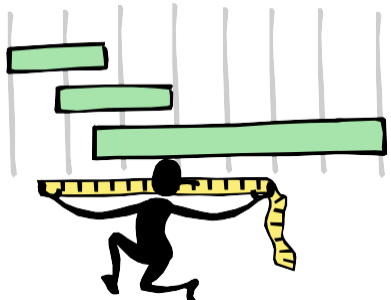
- Designed by a planning team consisting of representatives from:
  - American Academy of Forensic Sciences –Questioned Document Section,
  - American Board of Forensic Document Examiners (ABFDE),
  - American Society of Questioned Document Examiners (ASQDE),
  - Federal Bureau of Investigation (FBI) Laboratory,
  - National Institute of Justice (NIJ),
  - National Institute of Standards and Technology (NIST),
  - Scientific Working Group for Forensic Document Examination (SWGDOC).

MSSFHA: Planning Team

- Jane A. Lewis – AAFS QD Section
- Kirsten Singer – ABFDE
- John Paul Osborn – ASQDE
- Rigo Vargas – SWGDOC
- JoAnn Buscaglia – FBI Laboratory
- Heather Waltke – National Institute of Justice (NIJ)
- John Paul Jones – National Institute of Standards and
- Technology (NIST)
- Contract Support – Kristen Mehamed with SAIC

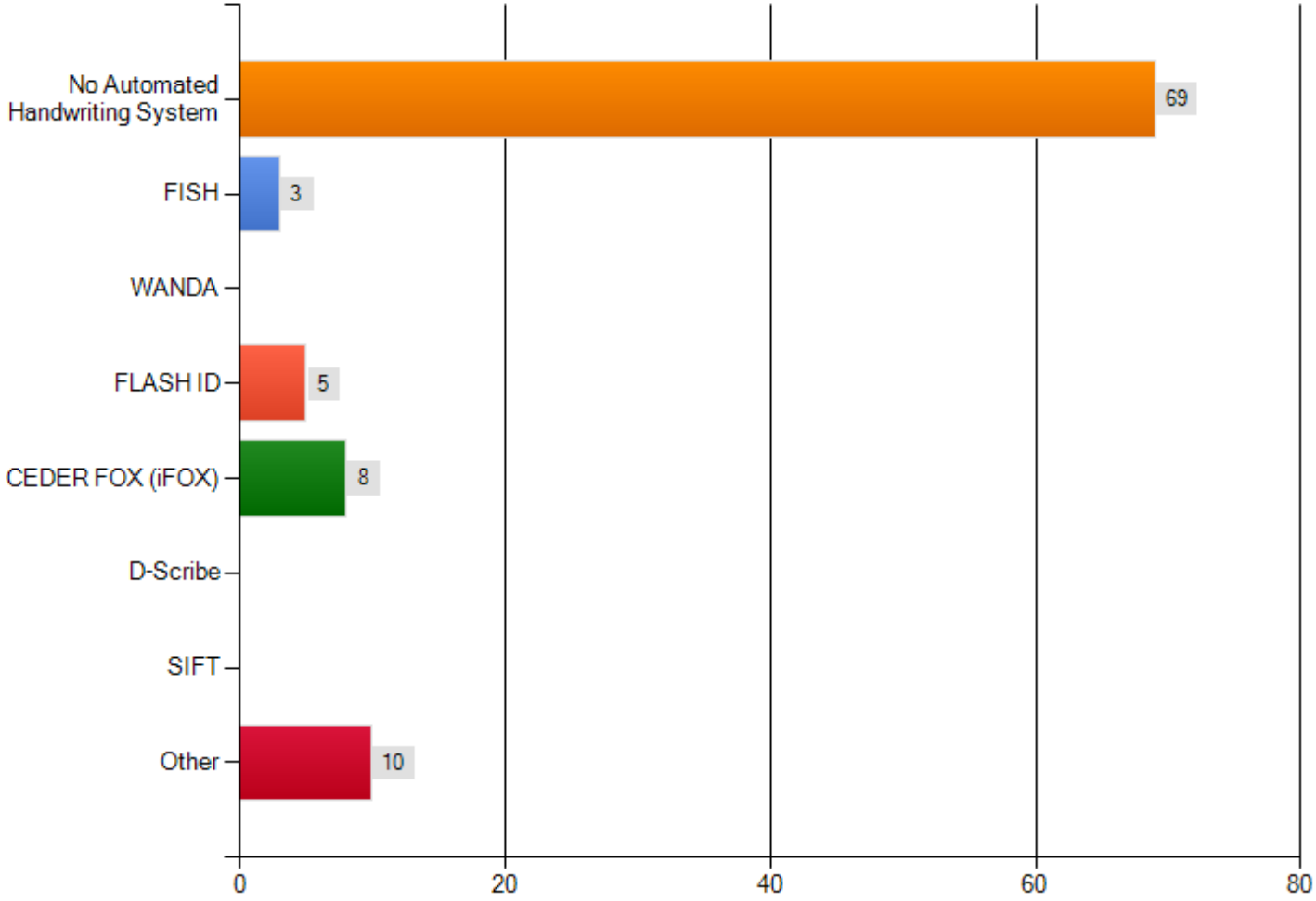
Quantitative Systems for Forensic Handwriting Analysis

- WANDA – A Measurement Tool for Forensic Document Examiners
  - *Katrin Franke, PhD – Gjovik University College*
- FLASH-ID – Forensic Language Independent Analysis System for Handwriting Identification
  - *Mark Walch – Gannon Technologies Group*
- CEDAR FOX and iFOX
  - *Sargur Srihari, PhD – SUNY Buffalo*
- D-Scribe
  - *Matthias Schulte-Austum - Siemens AG*
- SIFT – Scale Invariant Feature Transform
  - *Jeffrey Woodard, PhD – The MITRE Corporation*



Note: FISH is another quantitative system, however no presentation was delivered during the event

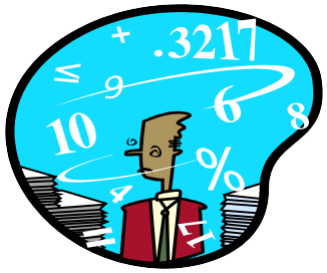
If you use an automated Handwriting system, which one (or more) do you use? (check all that apply)



95 Answered

Advances in Statistics for Handwriting Analysis #1

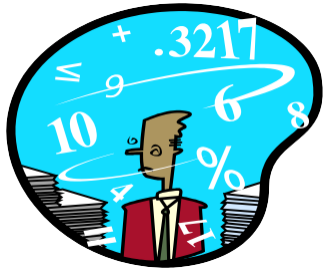
- Trends in Frequency Occurrence of Handwriting and Hand Printing Characteristics
  - *Thomas W. Vastrick - Private FDE*
- Error, Confidence and (Un)certainty – Deconstructing Authorship Opinions Using a Forced-Call Testing Protocol
  - *Brent Ostrum - Canada Border Services Agency*
- Understanding Individuality of Handwriting Using Score-Based Likelihood Ratios
  - *Christopher Saunders, PhD - South Dakota State University*
- The Development of Individual Handwriting Characteristics and the Statistical Evaluation of Different Combination Likelihoods of These Individual Characteristics
  - *Lisa Hanson - Minnesota Bureau of Criminal Apprehension*



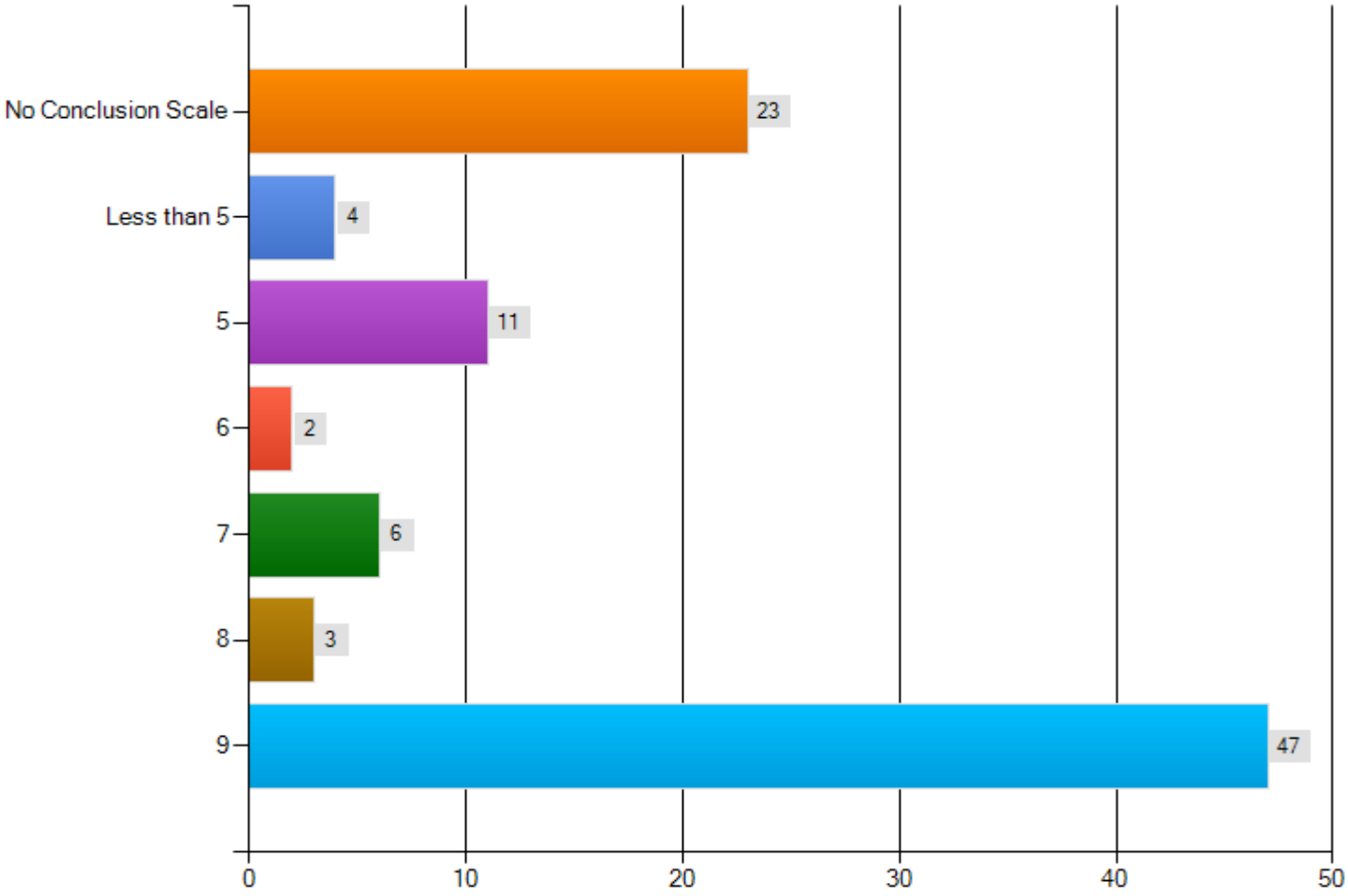
Advances in Statistics for Handwriting Analysis #2

- Handwriting Evidence Evaluation Based on the Shape of Characters: Application of Multivariate Likelihood Ratios
  - *Raymond Marquis, PhD - Institute of Forensic Science, University of Lausanne*

- Statistical Basis to Determine Probabilities of Occurrence of Handwriting Characteristics
  - *Kirsten Singer, D-ABFDE - Department of Veteran Affairs, OIG*
  - *Sargur Srihari, PhD - Buffalo*

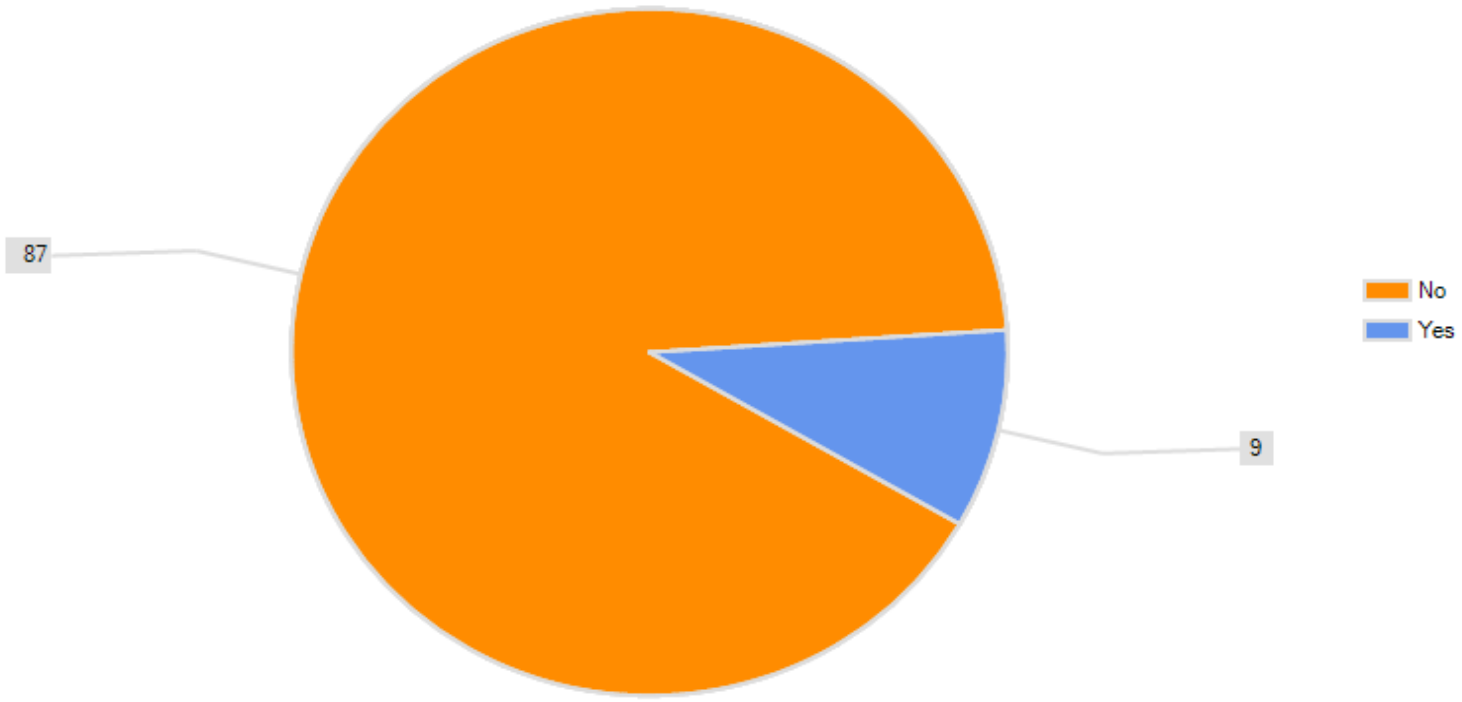


Do you use a Conclusion Scale, if so, how many different conclusions exist on that scale? (select the best single answer)



96 Answered

Do you issue statistics with your handwriting examination conclusions?



96 Answered

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Facilitated Session: The Questions

- What does the future state of handwriting analysis look like?
- What are the barriers to implementing the future state?
- What does a roadmap to achieve the future state look like?

- Facilitated By:
  - John Paul Osborn, Rigo Vargas, John Paul Jones II

Facilitated Discussion Disclaimer

- This presentation summarizes the **concluding discussion**, including conversations in the room and comments submitted online. Although not every participant agreed with every comment, **this summary gives a general sense of the discussions.**

What does the future state of handwriting analysis look like?

What does the future state of handwriting analysis look like? (1)

- The discipline will incorporate more quantitative analysis tools during the examination process to access and compare handwriting characteristics.
- FDEs will employ the use of statistical models to explain significance of conclusions based on the uniqueness of **observed** and **measured** handwriting characteristics.
- Researchers will publish more studies involving the use of quantitative analysis in peer-reviewed journals.
- More peer-review of casework and proficiency testing requirements as all forensic disciplines move toward mandatory accreditation and certification.

What does the future state of handwriting analysis look like? (2)

- Proficiency tests will better simulate actual casework.
- **NOTE:** Some FDEs believe that peer review and proficiency testing will be required by the court system.
- Previously established standards will be updated or validated as new technology is used to test long-standing practices.
- More formal use of statistics determining uncertainty and strength of similarities between writings.
- Opinion scale currently in use will change…

What does the future state of handwriting analysis look like? (3)

- As research demonstrates a better understanding of the frequency of characteristics in handwriting samples, FDEs will be able to formalize their conclusions in a more uniform, quantifiable fashion.

- **Note:** Automated comparison systems may be considered **separate** from statistical models, as automated systems can facilitate the matching of a known writer with questioned documents without necessarily generating statistics.

- **Ultimately FDE's can use statistics and automated systems to complement their current practices and to enhance the way they review cases – but neither can replace humans.**

Think about it…

- In current practice, when an FDE determines the **genuineness, simulation, or disguise** of a handwriting sample, the FDE is often mentally calculating the frequency of observations of certain strokes and specific features, studying the geometrical outlines and areas of letters, developing ratios between extenders and small letters, noting the variability of indicators…

- The FDE conclusions already involve approximate mental "**statistical observations**" but they do not include a metrical evaluation of the parameters.

- Participants believe it is quite reasonable to start **generating on paper** the calculations that FDE's usually perform mentally without any actual measuring.

What does the future state of handwriting analysis look like? (4)

- Courts will demand more statistical data with conclusions like DNA model.
- Reporting of results in the criminal justice system is changing toward degrees of confidence, and FDEs will have to deal with statistics to show this.
- **Note:** statistics may help with the attorneys and court however may not be helpful to jurors… Many FDEs will instead present conclusions with images that present a clearer picture to the jury than statistical jargon would.
- Society will move away from formalized education on handwriting which may result in more unique handwriting styles and may encourage hand-printing.

What are the barriers to implementing the future state?

What are the barriers to implementing the future state? (1)

- Statistics may be too complicated for the jury to understand and may be manipulated by attorneys to show excessive doubt.
- Many FDEs lack statistical training – makes explaining probabilities or ratios challenging.
- Field is aging and current FDEs may struggle to accept the new procedures and technologies.
- Some labs experience decreasing caseloads and staffing in QD while DNA units in the same lab are expanding.

What are the barriers to implementing the future state? (2)

- Crime scene investigators may not know the value the FDE can provide for a case.
- More cases going civil route than criminal.
- Research is expensive and FDEs have challenges connecting with top researchers – much research has been done by FDEs outside their normal casework without additional funding, often focusing on **case-specific questions**. *(changing recently)*
- Many FDE research publications are in professional journals with targeted readership or presented during discipline specific conferences.

What does a roadmap to achieve the future state look like?

What does a roadmap to achieve the future state look like? (1)

- Increased research to validate existing methods and develop new technologies.
- NIJ continues support and other agencies like NSF should invest to encourage larger projects which will result in publications in top tier peer-reviewed, general science journals.
- FDEs and statisticians collaborate more regularly to identify the statistical methods that will best help casework and testimony – test with real-world data.
- FDEs receive formal training in statistics. (Some larger labs have associations with statisticians)

What does a roadmap to achieve the future state look like? (2)

- More collaborations through peer-review of casework and proficiency testing – increases validity of conclusions.
- Collaborations with academic institutions with students writing their masters thesis on a QD topics. Allows professors to investigate larger issues and also creates the next generation of FDEs.
- Campaign to attract the next generation of FDEs.
- Reaching into academic institutions generates opportunities to collaborate with groups outside of your discipline that may be working on common challenge areas. (i.e. statistics, psychology, etc.).

What does a roadmap to achieve the future state look like? (3)

- Technology advances and validation of methods can result in new opportunities (dig**ital signatures**) and increased caseloads. This is a good thing when some labs are reporting a decrease.
- As existing technological aids are tested and validated, FDEs should incorporate them into casework with a full understanding of the value they offer.
- More training for law enforcement officials on FDE capabilities and your value proposition.
- Labs must allow FDEs to be trained on latest techniques.

What does a roadmap to achieve the future state look like? (4)

- Although modern communication is more often typed rather than handwritten, additional technological advancements could allow FDE's to analyze high-resolution electronic signatures and to conduct linguistic analysis on documents.

- FDE's must continue to review their processes and standards to support existing and forthcoming technology.

- Everyone needs datasets – need a repository…
  - To conduct reliability and reproducibility studies on FDE performance and newly developed quantitative measurement systems.

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Recommendations 1-3

1. FDEs should receive **basic statistical training** relevant to forensic handwriting analysis to help formalize the use of statistics in casework and to communicate statistical findings to the court.

1. Through SWGDOC and the American Statistical Association's ad hoc committee on forensic science, FDEs should **collaborate with statisticians** to develop better statistical models to address handwriting analysis challenges.

1. NIJ should continue its **enthusiastic support** of forensic handwriting analysis research, and other agencies should contribute to this support.

Recommendations 4-6

4. FDEs should collaborate with academic institutions and should **leverage graduate students** to conduct studies on case-specific questions.

5. Researchers should strive to publish forensic handwriting analysis studies **in top-tier, peer-reviewed journals** to invite the level of scrutiny and acceptance experienced by other scientific fields.

6. Through SWGDOC or OSAC, FDEs should develop an expanded and standardized list of **conclusions with degrees of confidence** based on scientific research.

Recommendations 7-10

7. FDEs and researchers should consider establishing an **open-source data set** with anonymous handwriting samples similar to real-world casework to use in testing and validating technological tools and statistical models.

8. NIST should consider serving as a **repository for handwriting datasets** and should make this material available to FDEs and researchers to test new technological developments.

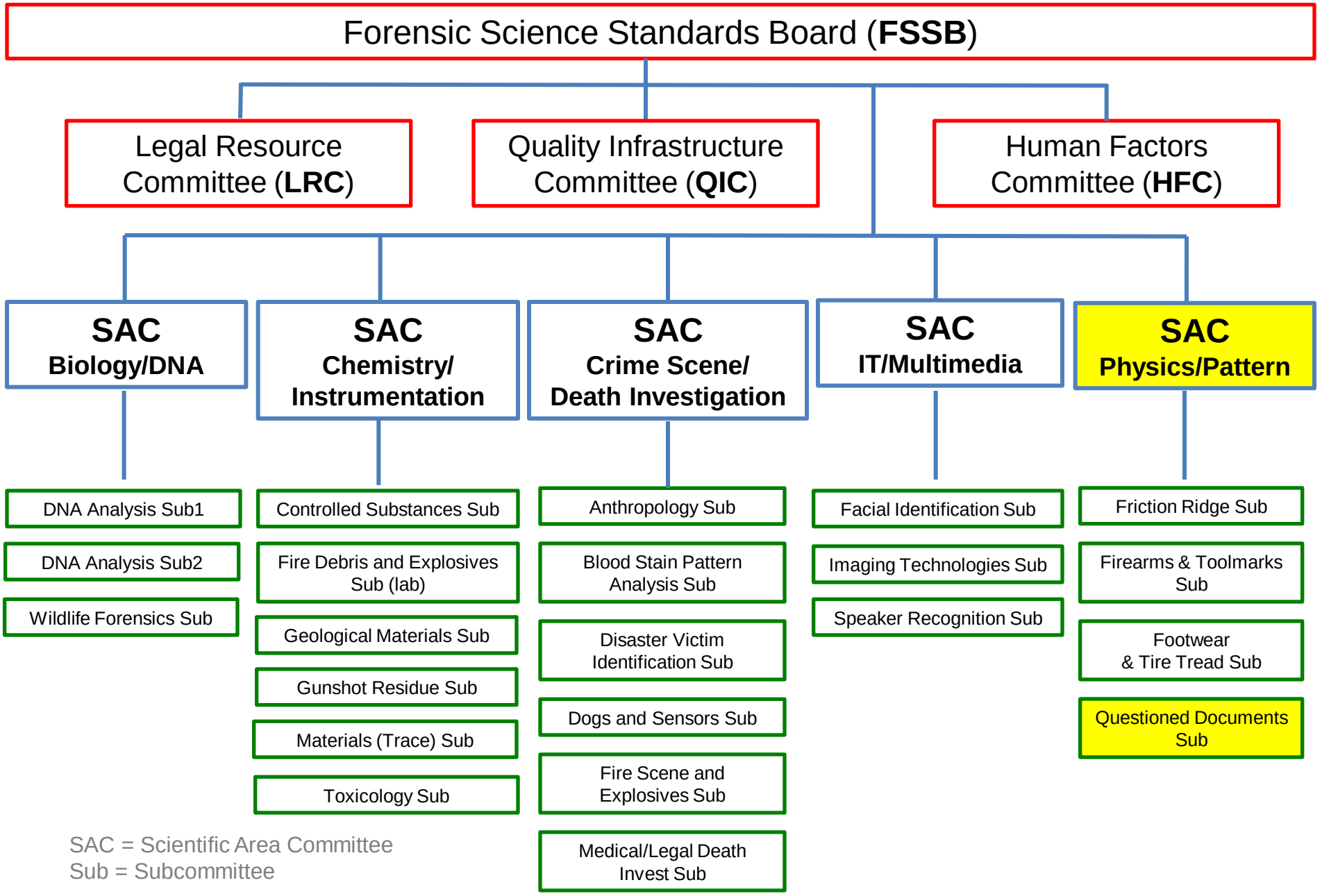
9. Through SWGDOC or OSAC, FDEs should revise and develop standards that apply to **the latest technological advances**.

10. Professional associations that represent FDEs should consider **launching campaigns to attract younger scientists** to the discipline.

Other Ideas

- SWGDOC
  - http://www.swgdoc.org
- American Statistical Association ad Hoc Forensic Committee
  - http://www.amstat.org/policy/forensicscience.cfm
- National Commission on Forensic Science (NCFS)
  - Policy issues
- Organization of Scientific Area Committees (OSAC)
  - http://www.nist.gov/forensics/osac.cfm
- National Science Foundation “Dear Colleague Letter”
  - http://www.nsf.gov/pubs/2013/nsf13120/nsf13120.jsp
- Optical Character Recognition Technology Partners

Organization of Scientific Area Committees (OSAC)



SAC = Scientific Area Committee
Sub = Subcommittee

Questions

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