Biometrics in the 21st Century: A Historian's View

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Seamless Identification Network: A Historical View

• “In a few years the police departments and penal institutions of the entire world will be working under one universal system.”
  – Mary Holland (1908)
Historical Obstacles to the Seamless Identification Network

- Incompatible systems
  - Competing jurisdictions
  - Competing vendors
- Information management
- Popular resistance

Universal Fingerprinting

- Peaks c. 1925-1935
- Aimed to bring about more civil society
- Appeals to civic duty
- Appeals to self-interest
  - Kidnapping
  - Amnesia
- Involvement of J. Edgar Hoover
End of Universal Fingerprinting

• 1935-1943 – Three bills defeated
  – Mandate universal fingerprinting
  – Attach fingerprint to social security card
• Victory for civil liberties
• But creates two-tiered system
  – Criminals vs. citizens

Seamless Identification Network: Contemporary View

• Now technically achievable
• But should it be done?
• Most debate is on DNA, not fingerprints
  – Genetic exceptionalism
Diagnostic Fingerprint Research

- Francis Galton
  - “Galton’s regret”
    - dearth of arches of among Jews
- Other researchers
  - Primates
  - Epileptics
  - Prisoners
  - The mentally ill
  - Ethnic groups
  - Heredity
What Happened to Eugenic Fingerprint Research?

- Never disproved
- Declining Research Program
- Re-discovery of the gene c. 1900
- Capture of the field by law enforcement
  - Racial and behavioral overtones erased
  - Fingerprint becomes individual identifier only

Heredity of fingerprints
The DNA Database Debate

• Threshold problem
  – Sex offenders, murderers?
  – Violent offenders?
  – Convicts?
  – Arrestees, suspects?
  – Everyone?

Reasons to Worry About DNA Databases

• Roundups by government
• Mining of information by insurance companies
• Identification of a “crime gene”
• Discriminatory composition
• Familial searching
• Framing
• Error
Universal databases as anti-discrimination measures

• Sir Alec Jeffreys
• Akhil Reed Amar
• David Kaye, Michael Smith
• Lord Justice Sedley
• Howard Safir

The Popular Compromise

• Arrestee databases
  – 5 states (La., Va., Minn., Tx., Cal.)
  – More on the way (N.Y., S.C.)
  – Legislate away the privacy of “other people”
  – Precisely the same compromise we struck in the 1940s w/ fingerprints
Worst Possible Solution

My (idiosyncratic) view

- Danger lies less in genetic information than in genetic determinism
- Genetic exceptionalism is, therefore, a mistake
- Universal database does not solve the discrimination problem
- The real danger is less exploitation of medical information than routinization and “black-boxing” of technology and assumption of infallibility
  - which brings me to...
Infallibility

“We just did our job and made a mistake.”
That’s how I like to think of it--an honest mistake.”
“I’ll preach fingerprints till I die. They’re infallible. I still consider myself one of the best in the world.”
– John Massey, one of three FBI examiners who made the Mayfield misidentification
(Chicago Tribune, Oct. 17, 2004)
Fingerprint Misattributions

<table>
<thead>
<tr>
<th>Case</th>
<th>Year</th>
<th>Jurisdiction</th>
<th>Charge</th>
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<tbody>
<tr>
<td>1. Loomis</td>
<td>1920</td>
<td>PA</td>
<td>Murder</td>
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<td>2. Stewart</td>
<td>1920</td>
<td>N.J.</td>
<td>Murder</td>
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<tr>
<td>3. Stappell</td>
<td>1920</td>
<td>Cal.</td>
<td>Narcotics</td>
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<td>4. Crafted</td>
<td>1922</td>
<td>MI</td>
<td>Murder</td>
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<tr>
<td>5. &quot;Manchester Case&quot;</td>
<td>1923</td>
<td></td>
<td></td>
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<tr>
<td>6. Bockin</td>
<td>1945</td>
<td>NC</td>
<td>Murder</td>
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<tr>
<td>7. Glading</td>
<td>1946</td>
<td>NC</td>
<td>Burglary</td>
</tr>
<tr>
<td>8. &quot;Vincennes #1&quot;</td>
<td>1946</td>
<td>IL</td>
<td></td>
</tr>
<tr>
<td>9. &quot;Vincennes #2&quot;</td>
<td>1946</td>
<td>IL</td>
<td></td>
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<tr>
<td>10. Coopert</td>
<td>1941</td>
<td>AL</td>
<td></td>
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<tr>
<td>11. Lam</td>
<td>1991</td>
<td>FL</td>
<td>Rape</td>
</tr>
<tr>
<td>12. Rizz</td>
<td>1991</td>
<td>FL</td>
<td>Murder</td>
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<tr>
<td>13. Cherry</td>
<td>1991</td>
<td>FL</td>
<td>Burglary</td>
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<tr>
<td>15. Miller</td>
<td>1991</td>
<td>SC</td>
<td>Burglary (murder investigation)</td>
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<tr>
<td>17. &quot;Manchester Case&quot;</td>
<td>2000</td>
<td></td>
<td></td>
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<td>18. Ashley</td>
<td>2002</td>
<td>SC</td>
<td>Murder</td>
</tr>
<tr>
<td>19. Harkub</td>
<td>2002</td>
<td>SC</td>
<td>Murder investigation</td>
</tr>
<tr>
<td>21. Conroy</td>
<td>2004</td>
<td>MA</td>
<td>Attempted murder</td>
</tr>
<tr>
<td>22. Mayfield</td>
<td>2004</td>
<td>US</td>
<td>Terrorist bombing</td>
</tr>
</tbody>
</table>


Temporal Analysis

**Figure 1**
Exposed United States and United Kingdom Fingerprint Misattributions, 1920-2004
Madrid Bombing

The Fingerprint

Daoud record print

Ouhnane Daoud

Mayfield record print

Brandon Mayfield

Madrid latent
The Mayfield Case

- 3 FBI examiners (verification)
- 1 (highly regarded) defense examiner (defense review)
- 15 points (but Spanish can only find 8)
- “a 100% identification” (this is routine, even required)

level of competence. The record shows that over the years there have been at least a few instances in which fingerprint examiners, here and abroad, have made identifications that +566 have turned out to be erroneous. But Mr. McCarley knew of no erroneous identifications attributable to FBI examiners. Defense counsel contended that such non-knowledge does not constitute proof that there have been no FBI examiner errors. That is true, but nothing in the record suggests that the defense is true. It has been open to defense counsel to present examples of erroneous identifications attributable to FBI examiners, and no such examples have been forthcoming. I conclude, therefore, on the basis of the limited information in the record as expanded, that there is no evidence that the error rate of certified FBI fingerprint examiners is unacceptably high.

Llera Plaza II at 566

Review of capital cases

Following discovery of the misidentification, the FBI Laboratory initiated several actions, including: (1) an internal review of LPU policies and procedures, (2) a review of prior IAFIS identifications from digital prints, (3) a monthly review of prisoners scheduled for capital punishment who may have been convicted or sentenced based on an FBI fingerprint identification, and (4) corrective action with respect to the examiner involved in the Mayfield misidentification.
“Explainable dissimilarities”


“Unusual similarity of the prints”

Identify Daoud as the source of the print. These 10 features in LFP 17 formed a constellation of points that was generally consistent with the constellation of points in the known fingerprints of both Mayfield and Daoud. The unusual similarity is reflected in the relative location of the points, the orientation of the ridges coming into the points, and the number of intervening ridges between the points. Although the OIG found no systematic study of the rarity of such an event, anecdotal reports suggest that this degree of similarity between prints from two different people is an extremely unusual circumstance.
The Errors Continue
Lessons of Mayfield

- Even laboratories considered “the best” make errors
- Even verifiers make errors
- Even defense experts make errors
- Lack of appreciation for population issue
- IAFIS-aided search
- Fortuity of exposure

Critiques of Latent Print Individualization

- No measurement of accuracy
- No population statistics
- No solution to threshold problem
- Two more points
  - 50K study
  - Role of biometric community
50K X 50K “study”

- Probability of duplicate full prints existing
  = 1 in $10^{97}$
  (> # of atoms in the universe)
- Probability of duplicates masked (22%) full print = 1 in $10^{27}$

50K X 50K “study” Flaws

1. Impression compared to itself
   - Misrepresents forensic process
2. Calculation of statistics
   - Assumption of normality way out in the tails
50K X 50K “study” published, scientific critiques

1. Stoney, “extraordinarily flawed and highly misleading”
2. Champod & Evett, “insupportable”
3. Wayman “bad science”
4. Pankanti et al.
5. Kaye “disturbing”
6. Zabell

Points about 50K study

- What study design reveals about practitioners’ conceptualization of latent print individualization
  - Establishing “metaphysical uniqueness” rather than measuring ROC curve
    - fingerprint examiner’s fallacy
- Despite disclaimers, continued use in court
  - By practitioners, in hearing concerning “reliability” (i.e., accuracy)
  - To measure accuracy
  - In defiance of peer review
Courts & 50K Study

- Treated as accuracy study
  - *US v. Mitchell*
- None of the *published* criticism cited or mentioned in *any* judicial opinion
- Treated as satisfying peer review requirement
  - Severe criticisms of unpublished study in published literature = “peer review & publication” (*NH v. Sullivan*)

We turn next to the testability of the second hypothesis—that positive identification can be made from fingerprints containing sufficient quantity and quality of detail. Much of the debate in this case is marked by the word “sufficient.” For example, a

Modest support also comes from the second part of the government’s 50:50 experiment, which matched simulated latent prints (pseudolatents) against the 50,000 full-rolled prints in the sample under examination. Setting aside spurious results due to mistakes in the FBI’s database, the experiment found that each pseudolatent strongly matched one and only one full-rolled print. In other words, the experiment did not reveal any counterexample to the hypothesis that identifications can be made. Moreover, statistical

Man vs. Machine

- Assertion made that humans are better
- This is an exception to the general rule that the public *fears* turning sensitive tasks over to machines
- Cannot measure whether machines are better, without first measuring accuracy of humans
- Chess computer model: Measure accuracy of machines to measure accuracy of human to improve accuracy of machines