A Field Analysis of Laboratory Case Processing: Latent Print Comparison and Examiner Conclusions

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Introduction

National Academy of Sciences Report, 2009

President’s Council of Advisors on Science and Technology Report, 2016

“Resolving latent conflict: What happens when latent print examiners enter the cage?” Rairden et al., 2018
Study Rationale

Describe the casework completed by latent comparison examiners in a large laboratory over the course of one calendar year.

Describe the prevalence of examiner conclusions during that year.

Explore whether examiner conclusions vary according to casework variables such as latent print source, offense type, or AFIS software.

Explore the extent to which there are examiner differences in examiner conclusions and case processing.
Houston Forensic Science Center

- Local government corporation
- Accredited by ANAB
- Study parameters:
  - 2018 calendar year
  - 17 latent print examiners
  - 5 to 36 years of work experience
Latent Print Evidence
LPC Procedures

- Sufficiency Determination
  - No Value
  - Not AFIS Quality
  - AFIS Quality
    - No Association
    - PAA
    - Reverse Hit

  - Confirmation Analysis
Laboratory Casework & Examiner Conclusions

- 2,975 cases and 3,239 requests for analysis
  - 69.1% burglary/theft
  - 16.3% robbery
  - 4.4% homicide
  - 10.1% other

- AFIS searches
  - 65.0% county
  - 16.9% state
  - 18.1% federal

- 20,494+ prints examined in 2018
- 9,177 AFIS-quality prints
- 11,812 AFIS entries
- 9,136 prints without association
- 2,600 potential associations
- 353 not AFIS-quality prints
- 10,964 prints of no value
- 22.2% of AFIS entries resulted in potential association
- 12.7% of all examined prints resulted in potential association
Variability within Examiner Conclusions

- **Offense Type**
  - Examiners were 1.3 times more likely to conclude a print was sufficient to enter into AFIS in cases involving a person offense
    - 25.0% vs. 19.6%

- **AFIS Software**
  - County and Federal AFIS ≈5 times more likely to result in potential association

- **Print Source**
Variability According to Print Source

- Fingerprint: 75.2% (22.7% PAA, 27.4% Reverse Hit, 4% No Association)
- Palm print: 71.1% (4.3% PAA, 27.4% Reverse Hit, 4% No Association)
- Joint print: 95.7% (4.3% PAA, 0% Reverse Hit, 96% No Association)
- Unspecified impression: 95.3% (4.7% PAA, 0% Reverse Hit, 95% No Association)
**Individual Differences**

<table>
<thead>
<tr>
<th>Examiner</th>
<th>Months Employed</th>
<th>Requests</th>
<th>Requests/ Month</th>
<th>Prints/cards Examined</th>
<th>Prints/ Month</th>
<th>% AFIS Qual.</th>
<th>% Not AQ</th>
<th>% NLoV</th>
<th>% PAA</th>
<th>% Reverse Hit</th>
<th>% No Hit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.7</td>
<td>118</td>
<td>25.1</td>
<td>747</td>
<td>158.9</td>
<td>37.8%</td>
<td>0.1%</td>
<td>62.1%</td>
<td>22.4%</td>
<td>0.7%</td>
<td>76.9%</td>
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<tr>
<td>B</td>
<td>12</td>
<td>155</td>
<td>12.9</td>
<td>1,201</td>
<td>100.1</td>
<td><strong>56.5%</strong></td>
<td>0.3%</td>
<td>43.1%</td>
<td>17.8%</td>
<td>2.3%</td>
<td>79.9%</td>
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<tr>
<td>C</td>
<td>12</td>
<td>336</td>
<td>28.0</td>
<td>1,862</td>
<td>155.2</td>
<td>45.0%</td>
<td>3.3%</td>
<td>51.8%</td>
<td>27.1%</td>
<td>0.0%</td>
<td>72.9%</td>
</tr>
<tr>
<td>D</td>
<td>12</td>
<td>220</td>
<td>18.3</td>
<td>1,209</td>
<td>100.8</td>
<td>48.5%</td>
<td>1.3%</td>
<td>50.2%</td>
<td>17.3%</td>
<td>2.2%</td>
<td>80.5%</td>
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<tr>
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<td>172</td>
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<td>1,121</td>
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<td>0.2%</td>
<td>55.2%</td>
<td>13.3%</td>
<td>2.8%</td>
<td>83.9%</td>
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<tr>
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<td>254</td>
<td>23.1</td>
<td>1,411</td>
<td>128.3</td>
<td>40.7%</td>
<td>1.5%</td>
<td>57.8%</td>
<td>25.4%</td>
<td>2.5%</td>
<td>72.2%</td>
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<tr>
<td>G</td>
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<td>146</td>
<td>12.2</td>
<td>794</td>
<td>66.2</td>
<td>44.3%</td>
<td>1.0%</td>
<td>54.7%</td>
<td>16.8%</td>
<td>4.2%</td>
<td>79.1%</td>
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<tr>
<td>H</td>
<td>12</td>
<td>206</td>
<td>17.2</td>
<td>1,197</td>
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<td>40.7%</td>
<td>2.7%</td>
<td>56.6%</td>
<td>15.2%</td>
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<td>84.2%</td>
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<td>I</td>
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<td>550</td>
<td>45.8</td>
<td>3,222</td>
<td>268.5</td>
<td>38.6%</td>
<td>0.2%</td>
<td>61.1%</td>
<td>24.5%</td>
<td>1.7%</td>
<td>73.8%</td>
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<tr>
<td>J</td>
<td>7</td>
<td>149</td>
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<td><strong>35.8%</strong></td>
<td>0.1%</td>
<td>64.1%</td>
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<td>86.0%</td>
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<td>1,134</td>
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<td>52.3%</td>
<td>0.4%</td>
<td>47.4%</td>
<td>23.0%</td>
<td>1.4%</td>
<td>75.6%</td>
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<td>L</td>
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<td>293</td>
<td>24.4</td>
<td>2,248</td>
<td>187.3</td>
<td>46.6%</td>
<td>5.4%</td>
<td>48.0%</td>
<td>18.9%</td>
<td>0.4%</td>
<td>80.7%</td>
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<tr>
<td>M</td>
<td>11.3</td>
<td>217</td>
<td>19.2</td>
<td>1,576</td>
<td>139.5</td>
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<td>2.0%</td>
<td>47.7%</td>
<td>20.4%</td>
<td>0.5%</td>
<td>79.1%</td>
</tr>
<tr>
<td>N</td>
<td>12</td>
<td>178</td>
<td>14.8</td>
<td>1,221</td>
<td>101.8</td>
<td>49.8%</td>
<td>1.7%</td>
<td>48.5%</td>
<td>22.8%</td>
<td>1.5%</td>
<td>75.8%</td>
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</tbody>
</table>

**Total**

<table>
<thead>
<tr>
<th></th>
<th>M = 11</th>
<th>M = 20.6</th>
<th>M = 141.5</th>
<th>AFIS Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>% PAA</td>
<td>44.8%</td>
<td>1.7%</td>
<td>53.5%</td>
<td>20.7%</td>
</tr>
<tr>
<td>% Reverse Hit</td>
<td>2.0%</td>
<td>1.5%</td>
<td>1.7%</td>
<td>1.5%</td>
</tr>
<tr>
<td>% No Hit</td>
<td>77.8%</td>
<td>98.3%</td>
<td>46.5%</td>
<td>79.2%</td>
</tr>
</tbody>
</table>

Note. Three examiners were excluded because they only completed independent casework for a single month during the data collection period.
## Comparison with Previous HFSC Casework

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>◦ 2,535 cases</td>
<td>◦ 2,975 cases</td>
</tr>
<tr>
<td>◦ 12 examiners</td>
<td>◦ 17 examiners</td>
</tr>
<tr>
<td>◦ ∼45% of prints deemed of sufficient quality for AFIS entry</td>
<td>◦ ∼45% of prints deemed of sufficient quality for AFIS entry</td>
</tr>
<tr>
<td></td>
<td>◦ Implementation of PAAs</td>
</tr>
</tbody>
</table>
Examiner Differences

- Examiners varied in their sufficiency determinations (36% to 57% AFIS-quality) and ultimate conclusions (13% to 27% PAAs)

- Differences in case assignment

- Differences in decision-making tendencies/threshold
  - Examination is subjective
  - Previous research suggests a lack of consensus in sufficiency thresholds (Ulery et al., 2011)
Future Directions

◦ Further research on AFIS databases
  ◦ Differences in AFIS algorithms and included prints
  ◦ Interactions between examiners and AFIS databases

◦ Analysis of workflow and case outcomes across multiple laboratories
  ◦ Results only reflect work of one laboratory over one year

◦ Use of quality metrics to explain variability in case outcomes (Gardner et al., 2021)
  ◦ Quality metrics were significantly associated with sufficiency determinations, examiner conclusions, and examiner accuracy in a blind quality control program
  ◦ *Good* prints more than twice as likely to result in correct conclusions as *Ugly* prints
Increasing Laboratory Transparency

- ≈50% of examined prints are determined to be of some value, and ≈13% of all examined prints result in potential associations, with variability relating to examiner differences, case details, print source, and AFIS database.
Thanks!

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President’s Council of Advisors on Science and Technology. Forensic science in criminal courts: ensuring scientific validity of feature-comparison methods. Washington, DC: President’s Council of Advisors on Science and Technology, 2016.
