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**Article Title:** Collective Intelligence in Fingerprint Analysis (free download)

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### **Article's Subject Matter:**

- Research has demonstrated that fingerprint examiners are highly accurate but not infallible. These cognitive scientists are interested in designing resilient systems to “make it harder for people to do something wrong and easier for them to do it right”. In this article, they demonstrate that pooling decisions of small groups of experts (known as the ‘wisdom of crowds’) by selecting the decision of the majority, reduced the false positive rate (8%) and false negative (12%) for 1:1 fingerprint comparisons (ground truth samples). Performance of experts was compared to novices.

### **Key Points in Article**

- ‘Wisdom of crowds’ phenomenon was investigated by Galton (1907) and recently the benefits of aggregation have been identified across many safety-critical domains such as medical diagnosis.
- Study compared performance of the individual versus groups, for fingerprint examiners and novices, using 3 different rules: ○ follow-the-majority; ○ follow-the-most-confident; and, ○ follow-the-most-senior.
- 36 examiners (Australian police) and 36 novices (psychology undergraduate students) were presented with 24 fingerprint pairs (same source) and 24 highly similar pairs (different source) which consisted of latent and fully-rolled knowns. ○ Asked to rate on 1 (sure different) to 12 (sure same) scale ○ Different source pairs generated through National Australian FIS ○ In 44 trials participants had 20 seconds to decide
  - In 4 trials participants had unlimited time (each pair examined by 3 different participants)
- Experts outperformed novices.
- For each pair of fingerprints random sampling of 3,5,7 ...35 examiners (repeated 2000 times) resulted in 2000 majority decisions for each of the 48 pairs across the 17 difference group sizes.



- Pooling independent judgements of groups of examiners using the majority rule reduced false negative rate (FPR) by 12% and false positive rate (FNR) by 8%.

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- Combined FPR and FNR into a single measure of discriminability demonstrated that all 3 rules boosted collective performance but the majority rule produced the largest improvement (confidence rule was second and the seniority rule was last).

### **Fallacies and/ or Issues**

- The test explores 1:1 comparison and not 1:10 which is more realistic for casework.
- Are the time and resourcing implications of implementing a team-based decision making approach versus the current 2 examiners performing complete ACE, fully understood for casework.
- How will the courts view such an approach? Will several examiners be required to testify or will the original examiner be sufficient (if the original examiner's opinion conflicts with the majority decision then the testimony will need to be given by someone else).

### **Recommendations**

- Canadian law enforcement could explore adopting a team-based approach to decision-making for specific high-risk fingerprint comparisons such as:
  - Conflict between original examiner and verifier (i.e. RCMP's Independent Evaluation Group)
  - Single identification AFIS search to a particular individual
  - Complex comparisons (low quality, high ambiguity, distortion, etc.) perhaps where consultation has occurred.
- Further research using ground truth samples on the impact of time-restricted decisions on accuracy should be undertaken.

