



Technology Transition Workshop | Paul Chamberlain

Evaluation Framework

Introduction

- **We have looked at some of the challenges**
- **Introduced some basic probability concepts**
- **Provided an overview of first generation fingerprint probability software**

Introduction

- **In this session, we are going to take these ideas and experiences and put them together to**
 - **Show how software may be beneficial if integrated into current process**
 - **Look at some ideas for the future**

Summary of Software Demonstration

- **First, let's summarise what you have seen using the demonstration software**

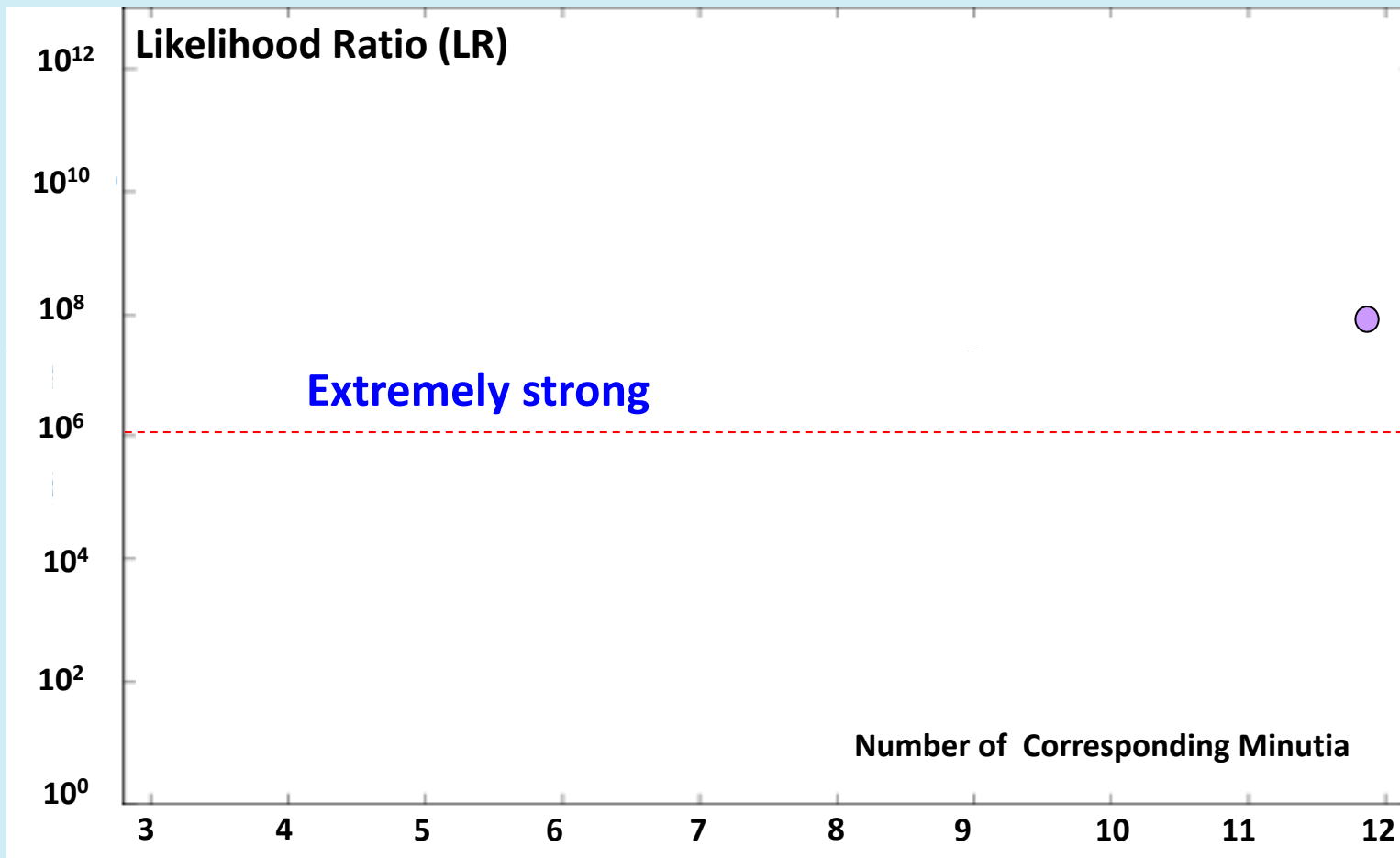
***Note:** The charts used here are indicative of trends and are do not display actual data from research.*

Summary of Software Demonstration

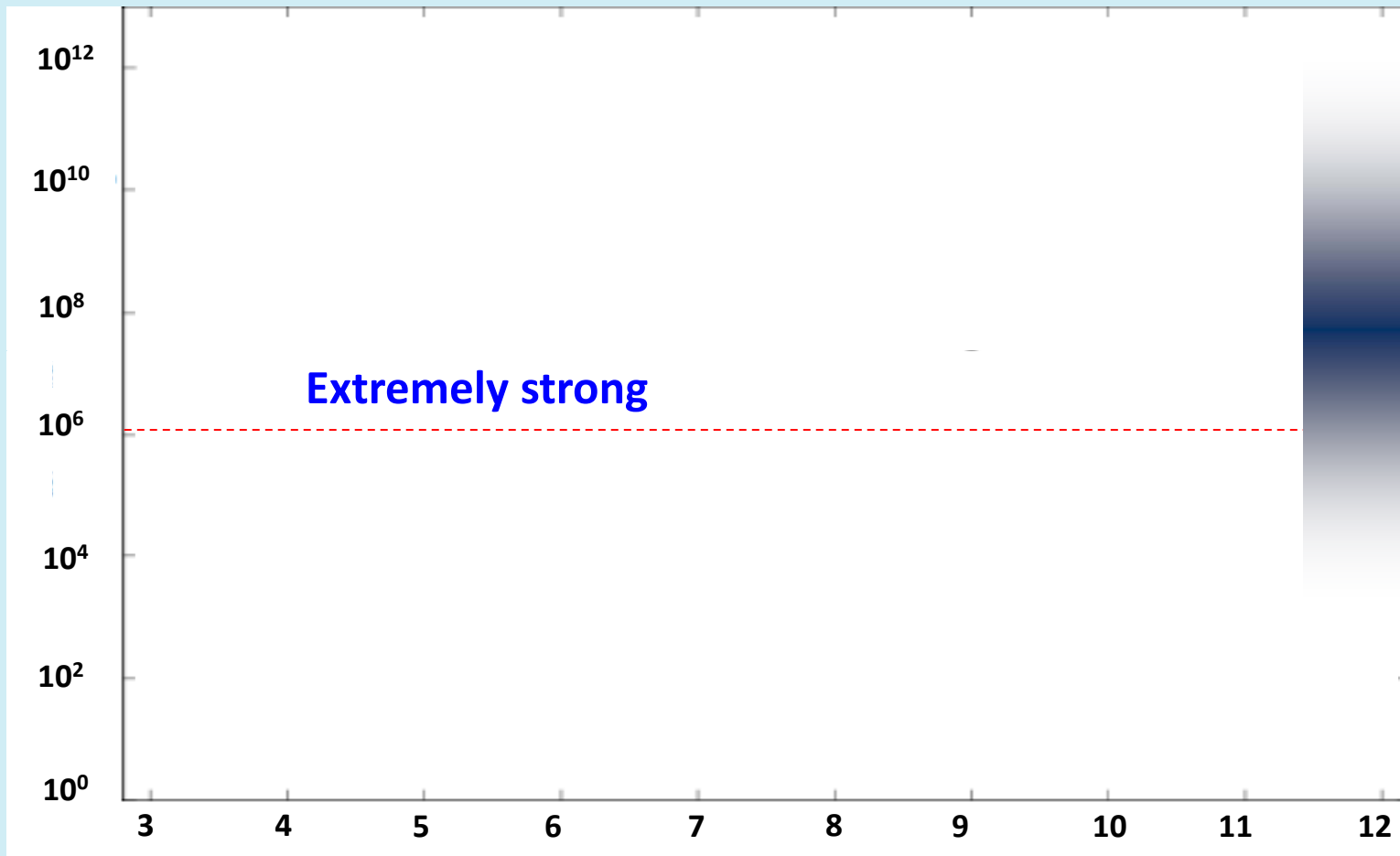
- You will recall that we presented this example of a verbal scale
- We will use this scale to summarise the output of the software

LR	
$>10^6$	Extremely strong
$10^5 - 10^6$	Very Strong
$10^3 - 10^5$	Strong
$10^2 - 10^3$	Moderate
$>1 - 10^2$	Limited

Summary of Software Demonstration



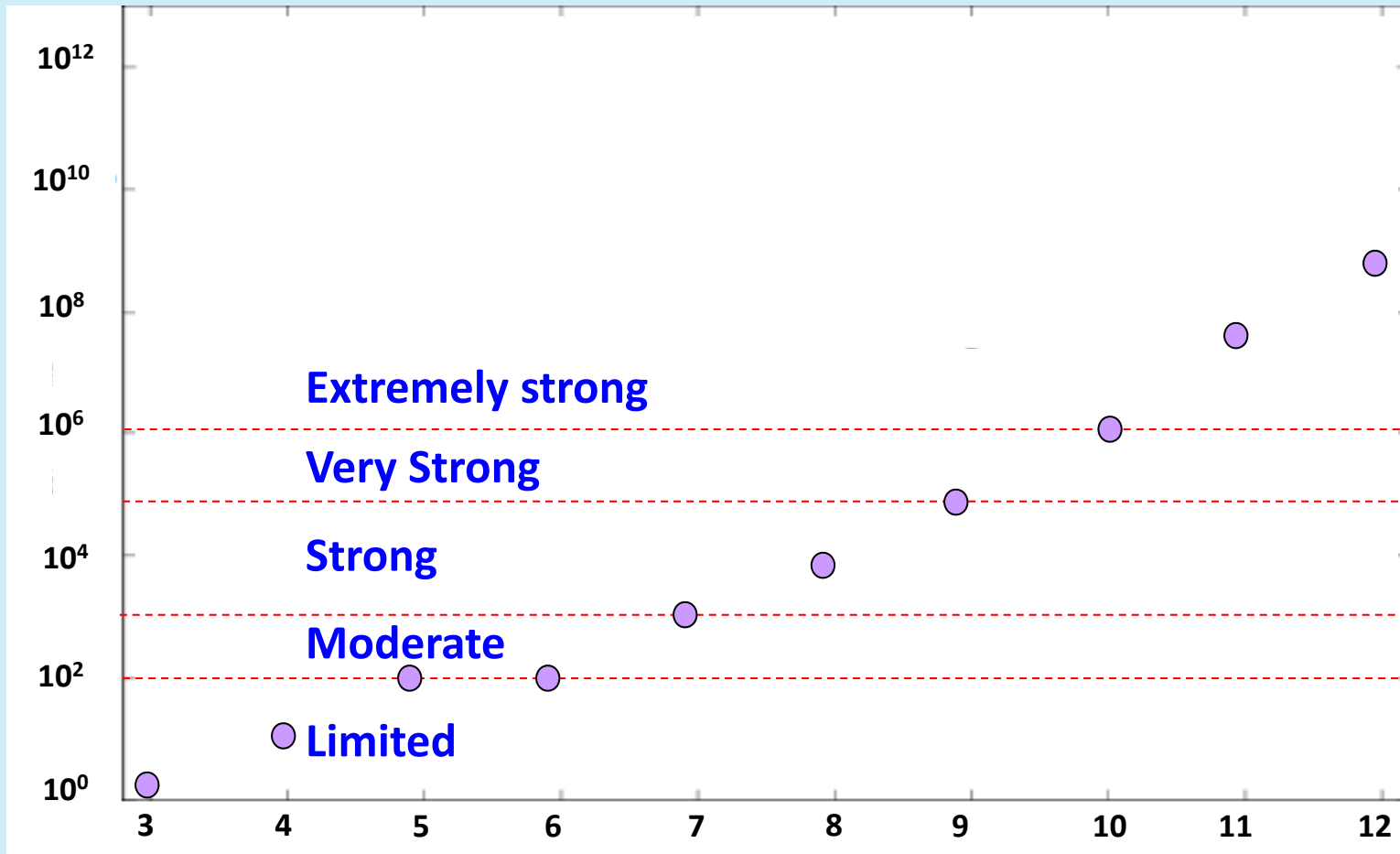
Summary of Software Demonstration



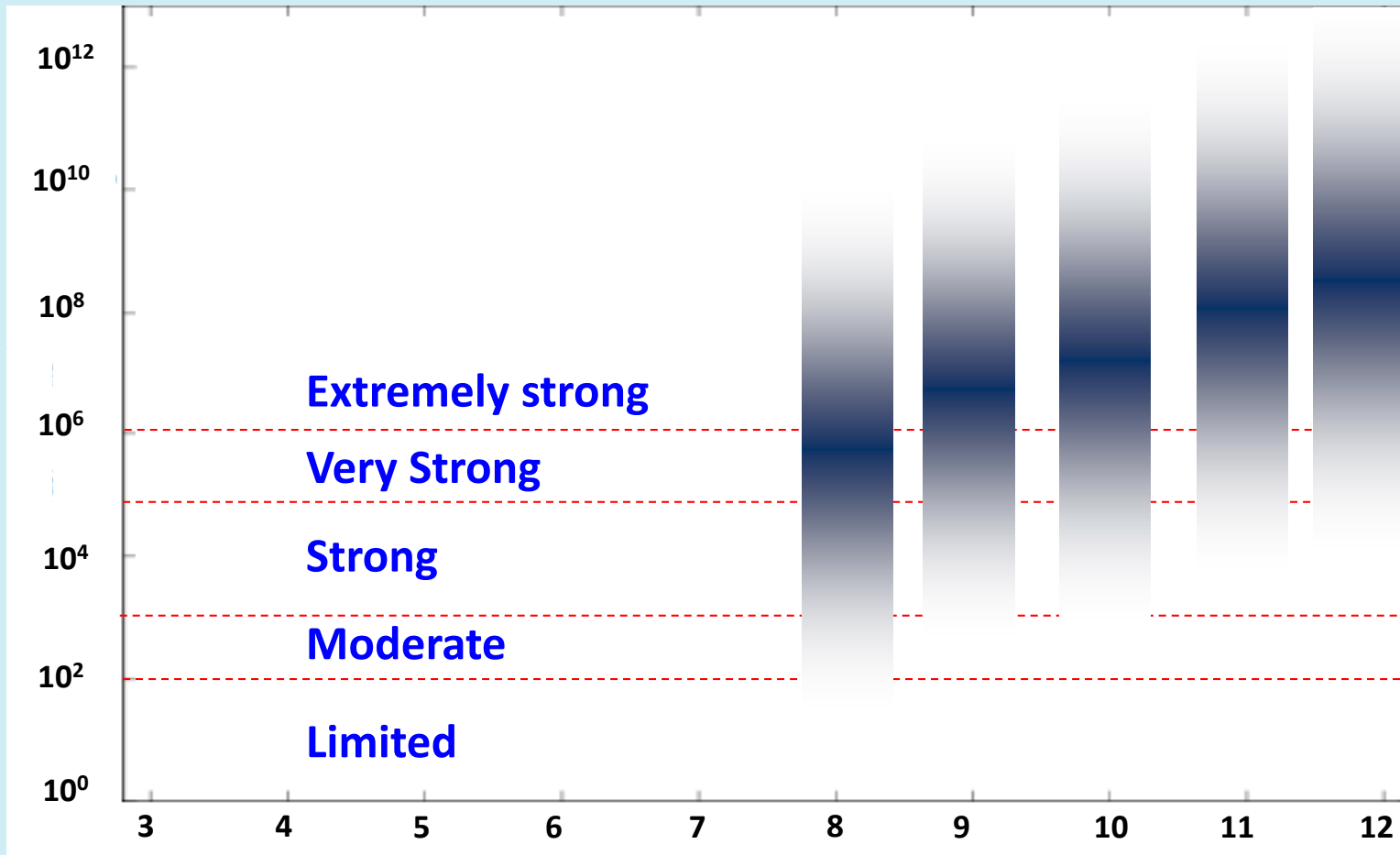
Summary of Software Demonstration

- The FSS research indicates that **for configurations of more than 12 minutiae the LR is very high**
- FSS research also indicates that the **evidential weight for a specific configuration of a certain number of minutiae can vary**

Summary of Software Demonstration



Summary of Software Demonstration



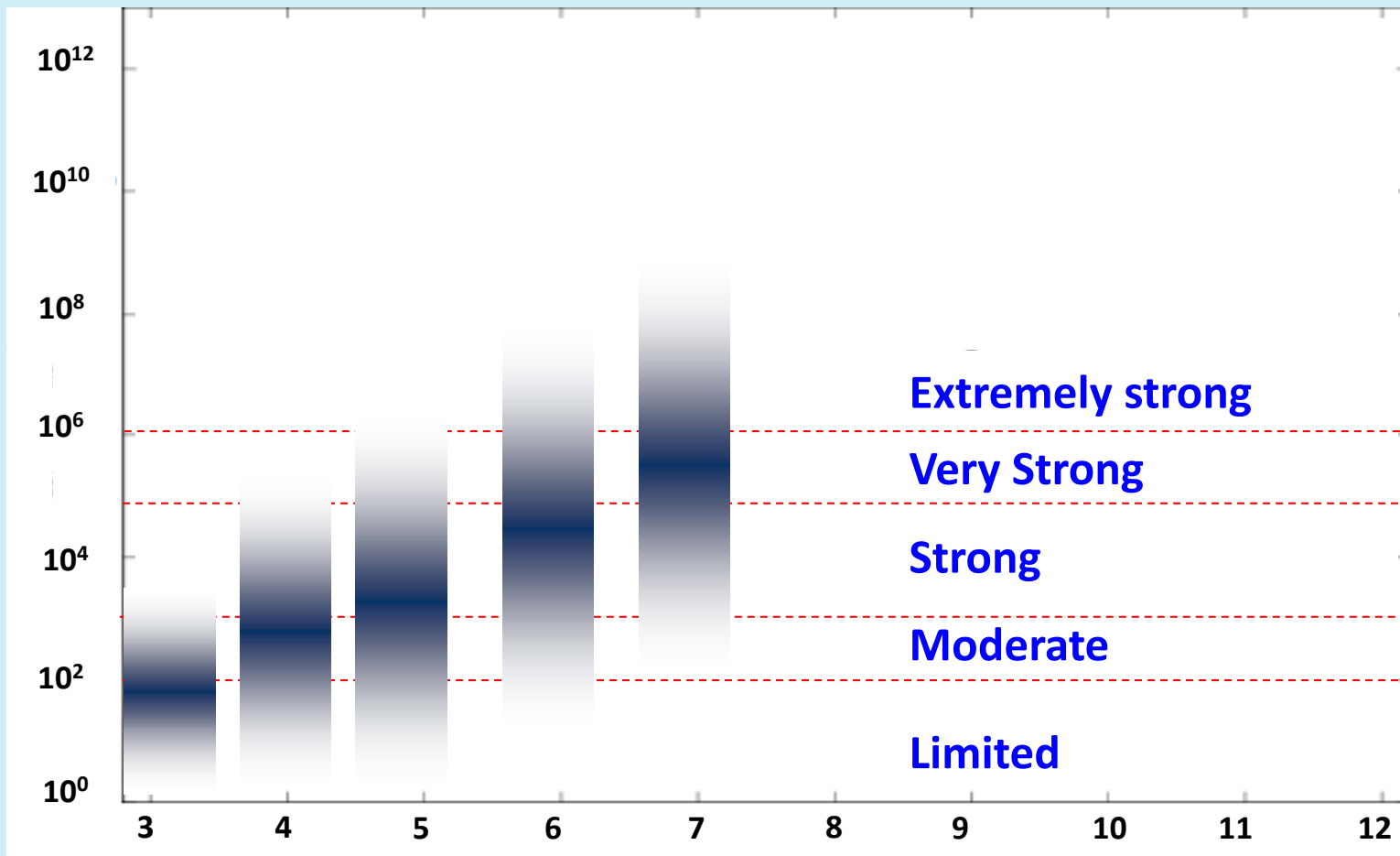
Summary of Software Demonstration

- **As we reduce the number of minutiae in the configuration from 12 to 8 we find that the LR reduces, but in the majority of cases remains extremely strong**
- **Some latents in this range do have less evidential weight than might be expected**

Summary of Software Demonstration

- Does that suggest that wrong results have been presented?
- **No**, the model is measuring minutiae configurations that form **part** of an examination
- It is possible that some evidence has been overstated where significant reliance was placed on the minutiae configuration

Summary of Software Demonstration



Summary of Software Demonstration

- As the number of minutiae in the configuration drops below 8, we find that the evidence progressively becomes less strong
- **A meaningful likelihood ratio can be generated for correspondences of as few as 3 minutiae**

Summary of Software Demonstration

- **With these low minutiae latents, it is possible that the evidence has been overstated if significant reliance was placed on the minutiae configurations**
- **This is not suggesting that evidence for latents with these low numbers of minutiae is unreliable**
- **Remember we are not providing a complete examination**

Summary of Software Demonstration

- **The range of LR generated overlaps for differing numbers of minutiae**
- **A configuration of 4 minutiae can generate the same LR as one of 7**

Impact of the software

- **How is this of any help to our current of fingerprint comparison process?**

Contributing to Scientific Validity

- **Research of this type helps validate the use of minutiae to attribute a latent to a source**
- **It begins to address those fundamental challenges to the validity of fingerprint evidence**

Supporting Individualisation

- Does it prevent individualisation?
- Remember it is not possible to support individualisation on scientific / mathematical grounds
- But...

Supporting Individualisation

- **The software is only evaluating minutiae configurations**
- **Other features are not evaluated**
- **We can therefore make the following arguments:**

Supporting Individualisation

- **Above 12 minutiae we can say that the likelihood of the latent having another source is so diminishingly small that, given the context in which the examination is undertaken, it can be dismissed**
- **This likelihood reduces still further with the evaluation of the other correspondences**

Supporting Individualisation

- **And below 12 minutiae?**
- **The LR based on minutiae may not be high**
- **Again, we will evaluate all other correspondences**

Supporting Individualisation

- **However, these other correspondences will need to add sufficient evidential weight before we can consider dismissing the potential for there to be another source**
- **As the number of corresponding minutiae drops below 12 there is, therefore, an increasing emphasis on the other features**

Supporting Individualisation

- **Ultimately, the continued acceptance of individualisation resides with **all** the stakeholders in the criminal justice system**
- **Software tools provide an opportunity to move away from the individualisation duality to reporting on a probabilistic scale**
 - **We will come back to this point**

Integrating Software Into ACE-V

- **We can identify benefits through integration into the current process**

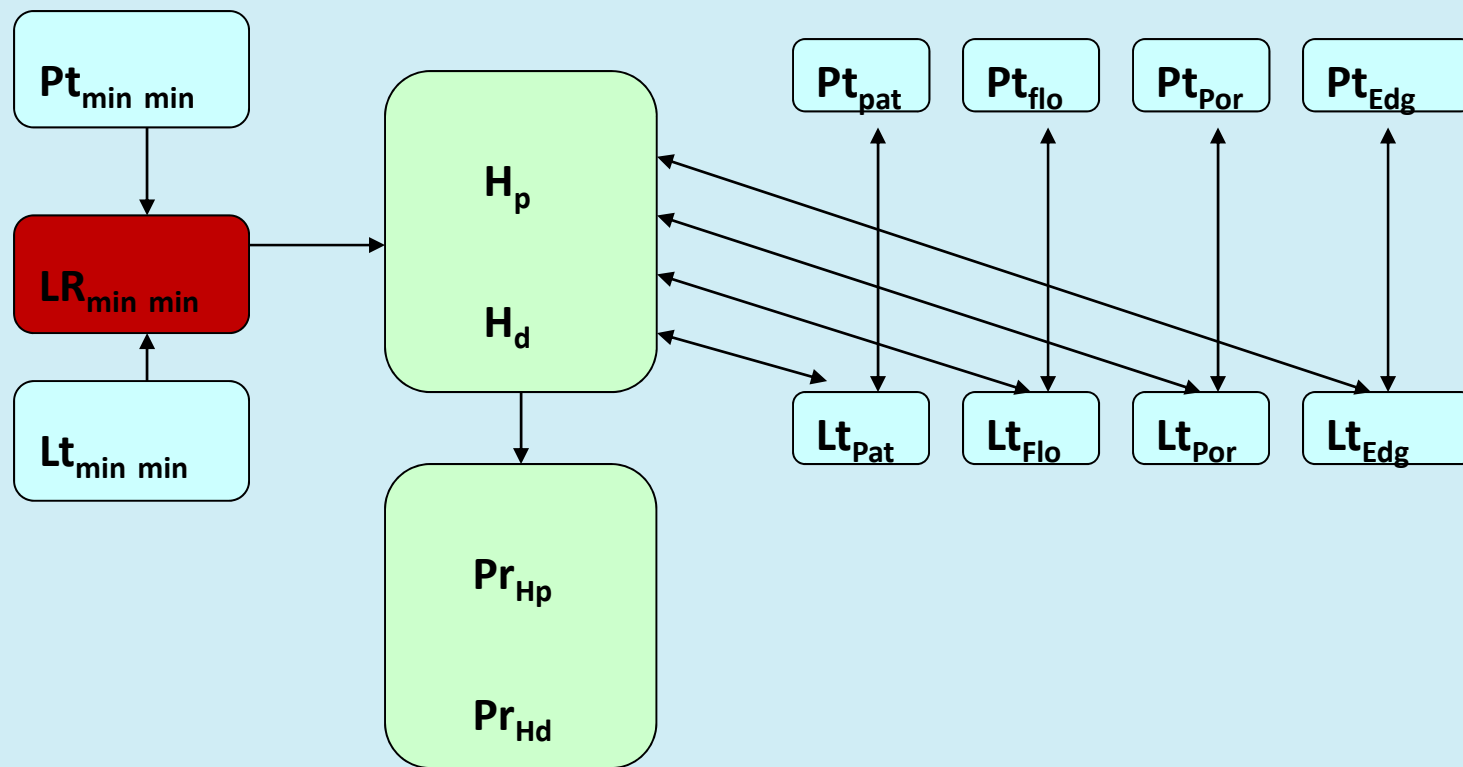
Integrating Software Into ACE-V

- **The software can be of assistance when comparing latents with low numbers of minutiae**
- **It indicates the emphasis that should be placed on features other than the minutiae**
- **“Red Flag”**

Integrating Software Into ACE-V

- **Currently we lack an effective / practical method for combining the evaluation of different feature types**
- **It is possible to construct an Evaluative Framework to combine our observations**
- **We'll not go into detail, but provide a graphical representation**

Evaluation Framework Schematic



Evaluation Framework

- **Developing a framework such as this will allow findings and observations to be combined**
- **We can use our subjective probabilities**
- **In time we can develop further models**

Evaluation Framework

- **If we develop such a framework, incorporating probability software and integrating it with ACE-V, what will we achieve?**

Evaluation Framework

- **An examination grounded on case specific data from a validated model with the decision process (evaluation) undertaken using a structured method**
- **We begin to address many of the issues that are being raised**

Probability in Court

- **How would we report this in court?**
 - **We would provide the court with the details of our framework**
 - **We would present the LR generated during our examination and the other observations we have made**

Probability in Court

- **This is within reach of all latent print examiners**
- **What about challenges to the software?**

Probability in Court

- **We can speculate when challenges would happen**
 - **When the fingerprint evidence is fundamental to a case**
 - **When the LR generation forms a substantial part of the evaluation**

Probability in Court

- **What challenges would we face?**
 - **Underlying mathematics**
 - **Size and constitution of database, etc.**
- **Any software will have substantive validation documentation**
- **Researchers and developers will address these issues**

Extending the Scope of Fingerprint Examination

- **But we can do more with such software**
- **Currently there are comparisons, identifying correspondences, where we offer no evidence or perhaps say it's “inconclusive”**

Extending the Scope

- **Fingerprint probability software can help us assign a weight of evidence to “inconclusives”**
- **Therefore we may be able to utilise**
 - **Latents currently discarded as “no value”**
 - **Latents not currently recovered**

Extending the Scope

- **We can consider a number of scenarios where to offer some evidence, however qualified, will assist a court in its deliberations**
- **We can think of scenarios where such information, though not considered evidential, could assist an inquiry**

Extending the Scope

- **Reporting such conclusions will require a significant transfer of knowledge across the criminal justice system**
- **Verbal explanation backed by a numerical presentation is the likely approach**
- **We will need to develop an appropriate terminology**

Extending the Scope

- **We can expect significant challenge, but as before we will have extensive validation and support from researchers and developers**
- **Transition from our current practice requires informed debate by all sections of the criminal justice community**

Extending the Scope

- **This is the start of the debate, and there are many questions to consider:**
 - **Will it be understood?**
 - **Can we quantify the benefits?**
 - **Is it truly beneficial to criminal justice?**

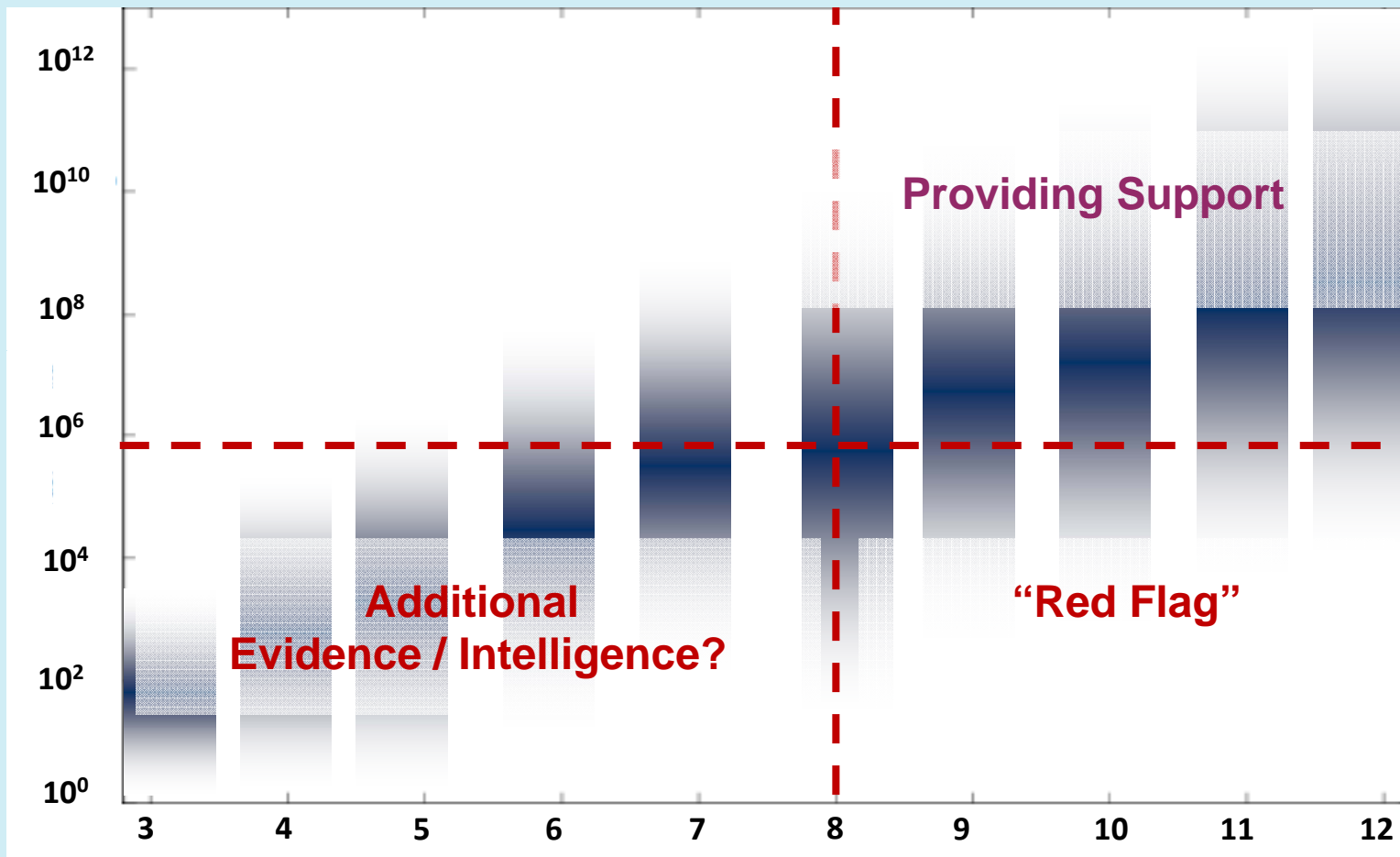
Summary

- **We have a first generation software tool that can measure the weight of evidence of minutiae configurations**
- **We have identified a way of implementing this tool through development of an Evaluation Framework**

Summary

- Integrating into current practice can bring some benefits by **supporting** our current process
- The software tool can provide us with the potential to report matches which cannot be individualised, but such a development requires support and understanding across the criminal justice community

Impact of Probability



Questions?

Contact Information

Sarah West

Mississippi Department of Public Safety

swest@mcl.state.ms.us

Paul Chamberlain

Forensic Science Service

Paul.Chamberlain@fss.pnn.police.uk