JURIES & THEIR UNDERSTANDING OF EXPERT EVIDENCE

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There is a critical need in most fields of forensic science to raise the standards for reporting and testifying about the results of investigations.
“...In my opinion, the correspondence between the footwear mark at the crime scene and the shoe of the accused is 4.5 times more likely to occur when the prosecutions version of the crime is correct than when the defense’s version of the crime is correct.”

European Network of Forensic Science Institutes
MATCH: Some concordance, some similarity, but no expression of specificity intended; generally similar but true for a large percentage of the population.
# Association of Forensic Science Providers

Likelihood Ratio   | Verbal Translation (support)
-------------------|----------------------------------
>1-10              | Weak or limited                  
10-100             | Moderate                         
100-1,000          | Moderately strong                
1,000-10,000       | Strong                           
10,000-1,000,000   | Very strong                      
>1,000,000         | Extremely strong                 

**Table:** Likelihood Ratios and Verbal Translations

- **Likelihood Ratio:** The ratio used to compare the probability of an event occurring under two different conditions.
- **Verbal Translation:** A descriptive term used to interpret the likelihood ratio.
"I'm confused about the meaning of the weather bureau's language when they deal with the chance of rain", writes a baffled Bob Liddelow, of Avalon. "On Friday they predicted the 'chance of any rain' was '95 per cent'. Does that mean that all of us have a 95 per cent probability that will will get rained on at some time during the day, but for an unspecified length of time? That at all places it will rain for 95 per cent of the day? That at any time of the day there is a 95 per cent probability that it will be raining, so that at any one time 95 per cent of us will be getting wet?"
What does “There is a 30% chance of rain tomorrow” convey?

a. It will rain tomorrow for 30% of the time
b. It will rain tomorrow in 30% of the region
c. It will rain on 30% of the days like tomorrow

Gigerenzer, Hertwig, Van Den Brock, Fasolo, & Katsikopoulous, 2005
UNDERSTANDING PROBABILITIES

Percent with correct answer ‘\textbf{c – Days}’

Gigerenzer, Hertwig, Van Den Brock, Fasolo, & Katsikopoulous, 2005

World Map By Frank Bennett [Public domain], via Wikimedia Commons
Opinions should be expressed in simple, precise and unambiguous terms.
One hundred times more likely
10,000 times more likely
1 million times more likely
<table>
<thead>
<tr>
<th>Strong Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Strong Support</td>
</tr>
</tbody>
</table>
How many times?
More likely to be guilty or not guilty?
How many times?
Present expert evidence
More likely to be guilty or not guilty?
How many times?

Case facts
Prior belief
Belief change
Posterior belief
difference
<table>
<thead>
<tr>
<th>Likelihood Ratio</th>
<th>Verbal Translation (support)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-100</td>
<td>Weak or limited</td>
</tr>
<tr>
<td>100-1,000 [450]</td>
<td>Moderately strong</td>
</tr>
<tr>
<td>1,000-10,000</td>
<td>Strong</td>
</tr>
<tr>
<td>10,000-1,000,000 [4,050,000]</td>
<td>Very strong</td>
</tr>
<tr>
<td>&gt;1,000,000</td>
<td>Extremely strong</td>
</tr>
</tbody>
</table>

**EXPERIMENT 1.**
EXPERIMENT 1 – VERBAL EXPRESSIONS.

Likelihood Ratio

- Weak or limited: 0.75
- Moderately Strong: 1.18
- Very Strong: 1.33

Martire, Kemp, Watkins, Sayle & Newell, 2013
EXPERIMENT 1.

DAMNED by feint PRAISE

Weak or limited support

61%

39%

is that the BEST you can do?
EXPERIMENT 3.

- Present expert evidence
  - In favour of hypothesis 2 (the two fingerprints originated from different people).
  - In favour of hypothesis 1 (the two fingerprints originated from the same people).
  - Neutral (No support for either hypothesis).

<table>
<thead>
<tr>
<th>Value of likelihood ratio</th>
<th>Corresponding verbal equivalent for Hypothesis 1 (two fingerprints originated from the same person)</th>
<th>Corresponding verbal equivalent for Hypothesis 1 (two fingerprints originated from the same person)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10 times more likely</td>
<td>Offers Weak to limited support</td>
<td>Offers Weak to limited support</td>
</tr>
<tr>
<td>10-100 times more likely</td>
<td>Offers Moderate support</td>
<td>Offers Moderate support</td>
</tr>
<tr>
<td>100-1,000 times more likely</td>
<td>Offers Moderately strong support</td>
<td>Offers Strong support</td>
</tr>
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<td>&gt; 1,000,000 times more likely</td>
<td></td>
<td></td>
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</tbody>
</table>

Martire, Kemp, Sayle & Newell, 2014
EXPERIMENT 4.

Present Expression

Best substitute?

What is the best substitute for “weak support”?

WEAK 55%

MODERATE 65%

MODERATELY STRONG 75%

STRONG 90%

VERY STRONG 95%

EXTREMELY STRONG 95%

50% support for A compared to B

100%
5. A verbal scale based on the notion of the likelihood ratio is the most appropriate basis for communication of evaluative expert opinion to the court.
But what about just using the numbers?
“Numerical likelihood ratios are the preferred form of communication of evaluative expert opinions, especially where there is data to assign a likelihood ratio through numerical methods”

CEH Berger (2013)
Personal Communication
What is the likelihood that the defendant was the source of the DNA from the crime scene?

- "1 in 1600 WILL share" with 71.5% chance
- "99.9375% WILL NOT share" with 91.2% chance
Probabilistic evidence is challenging

Presentation format does matter

Evidence does not always mean the same thing to everyone

Consultation and collaboration is required
THANK you comments

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