Likelihood Ratio

The LR assigns a numerical value in favor or against one proposition over another:

$$LR = \frac{\Pr(E|H_p, I)}{\Pr(E|H_d, I)},$$

where H_p typically aligns with the prosecution case, H_d is a reasonable alternative consistent with the defense case, and I is the relevant background information.

Setting Propositions

- The value for the LR will depend on the propositions chosen: different sets of propositions will lead to different LRs.
- Choosing the appropriate pair of propositions can therefore be just as important as the DNA analysis itself.

Hierarchy of Propositions

Evett & Cook (1998) established the following hierarchy of propositions:

Level	Scale	Example
III	Offense	H_p : The suspect raped the complainant.
		H_d : Some other person raped the complainant.
II	Activity	H_p : The suspect had intercourse with the complainant.
		H_d : Some other person had intercourse with the complainant.
Ι	Source	H_p : The semen came from the suspect.
		H_d : The semen came from an unknown person.
0	Sub-source	H_p : The DNA in the sample came from the suspect.
		H_d : The DNA in the sample came from an unknown person.

Hierarchy of Propositions



- A forensic scientist can provide information in relation to propositions which are intermediate to the ultimate issue.
- The higher the level of propositions, the more information is needed on the framework of circumstances.
- Since different levels rely on different assumptions to consider, strength of the evidence estimates will change significantly at each level.

Setting Propositions

Some useful principles for setting hypotheses:

- Propositions should address the issue of interest;
- Propositions should be based on relevant case information;
- Propositions should not include irrelevant details;
- Propositions should be (close to) MECE.

MECE Definition

Mutually exclusive

(i.e. non-overlapping)



(i.e. covers all outcomes)

- The prosecution hypothesis (H_p) is usually known, or more or less straightforward to set.
- However, the defense are usually under no requirement to offer a proposition, and often they do not.
- If a defense stance is not available, a sensible proposition can be chosen.

What if multiple alternative hypotheses are relevant?

- Report the 'most relevant' LR (and provide the rest in the appendix);
- Provide all considered propositions and corresponding LRs;
- Report only the lowest LR to provide a lower bound for the LR.

What about the number of contributors?

This is an important component of mixture interpretation. Most approaches assume that the NoC is known.

- Underestimating the NoC is usually conservative (minor contributors may be incorrectly excluded).
- Overestimating the NoC may not be conservative (non-contributors may not be excluded).
- For major contributors the NoC has little effect on the LR.

What about relatives?

The LR can accommodate for this, which we will see in the next section.

What if the DNA got there by some other means? This indicates a different level of propositions. The discussion will likely move to transfer and contamination.

Propositions are formed based on information available at that time. If this information changes, or the defense want any other propositions considered, it may be necessary to update or add LR calculations.