Critical thinking and the justice system

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Learning objectives

By the end of today:

- Understand common tools used in the courtroom
- Understand and apply basic ideas from probability theory

Evidence in the courtroom

Evidence in the courtroom

- Fingerprinting
- DNA evidence
- Eye witness testimony
- Video and audio
- Witness testimony
- Other physical evidence

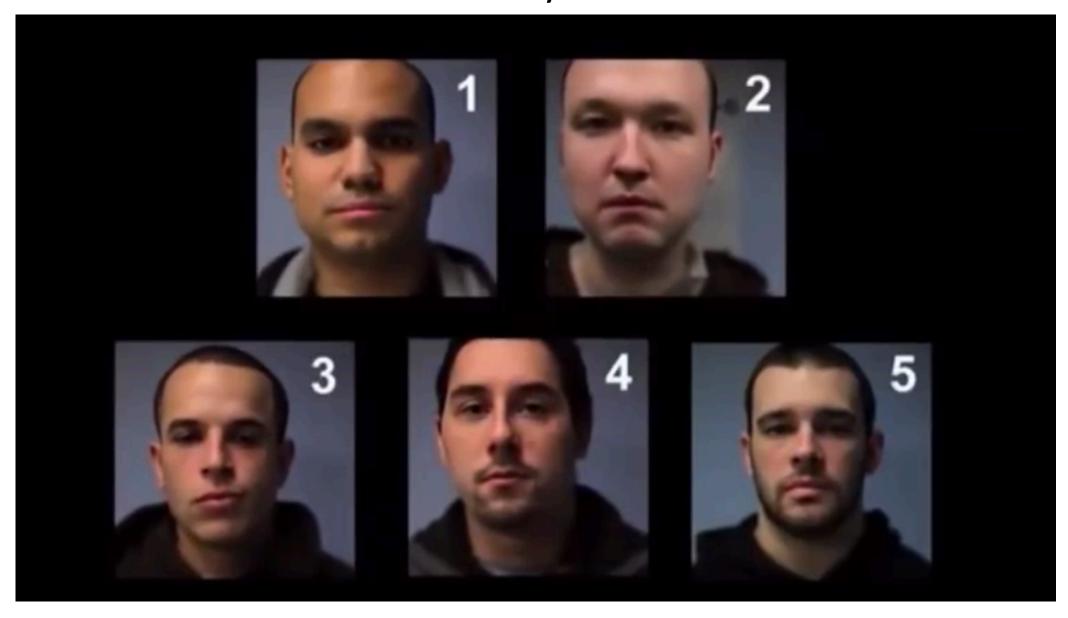
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What do you remember from the scene?

- How many people were involved in the crime (including the victim)?
- What were the robbers wearing?
- What language were they speaking?
- What else do you remember?

Who committed the robbery?



Which of these statements are false?

- The woman's coat is red
- The man dropped his camera
- The camera is silver
- The victim was wearing a backpack

Conclusions

• Eye witness testimony is not always reliable. A number of factors may affect one's memory.

DNA evidence

- DNA evidence can be mishandled like any other piece of evidence
- Often will get no match, or only close matches
- It depends on what data you are comparing the DNA evidence against



DNA evidence

- Suppose you get DNA from a hair found at the scene of the crime and find six usable places in the genome to test. The chance that any given person is a genetic match at those six places is pretty small, say 1 in 5 million.
- If someone matches at those six places, are they likely the perpetrator?



A similar example to the DNA case

- Sally Clark, a British woman, was accused of killing her two children who died at 11 and 8 weeks of age
- Sudden infant death syndrome occurs in about 1/8543 or 0.011% of children

- Sally Clark, a British woman, was accused of killing her two children who died at 11 and 8 weeks of age
- Sudden infant death syndrome occurs in about 1/8543 or 0.011% of children
- In the court case, an "expert witness" argued that the chance of two cases of SIDS in one family was then (1/8543)*(1/8543) = 1 in 73 million
- Prosecutor argued that the chance Sally Clark was innocent was 1 in 73 million

We want to know is Sally Clark innocent or guilty?

Two main problems with argument

- Assumption of independence and probability of two cases of SIDS
- Further, the calculation is not a measure of guilt or innocence

Calculating the probability of SIDS

- The number 1 in 73 million turns out to be too high
 - Does not account for fact that boys are more likely to die of SIDS
 - Does not account for fact that those with one SIDS case are more likely to have another

• It turns out a better estimate is something like 1 in 1,000,000

Interpretation of calculations in incorrect

• 1 in 1,000,000 is the probability of deaths given she is not guilty, it is not the probability she is guilty given two deaths

 We want to know what is the probability she is guilty given two deaths

 We need to "condition" our calculations on whether or not she is guilty

To the white-board

Conclusions

- Need to be critical of how reliable various pieces of evidence are
- More lines of evidence is better than a single source

- Need to be careful with interpretations of statistics, even from "experts"
 - This is particularly true with big and small numbers

Homework for next week

Work on Breast cancer problem