

# Inference and simulation

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A hypothesis test as a court trial



# Two competing claims

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# Two competing claims

1. "There is nothing going on."

Promotion and gender are **independent**, no gender discrimination, observed difference in proportions is simply due to chance. → **Null hypothesis**

2. "There is something going on."

Promotion and gender are **dependent**, there is gender discrimination, observed difference in proportions is not due to chance. → **Alternative hypothesis**

# A trial as a hypothesis test

- As a process, hypothesis testing is analogous to a court trial
- $H_0$ : Defendant is innocent
- $H_A$ : Defendant is guilty
- We then present the evidence – collect data.
- Then we judge the evidence – "Could these data plausibly have happened by chance if the null hypothesis were true?"
- If they were very unlikely to have occurred, then the evidence raises more than a reasonable doubt in our minds about the null hypothesis
- Ultimately we must make a decision. How unlikely is unlikely?



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# A trial as a hypothesis test

- If the evidence is not strong enough to reject the assumption of innocence, the jury returns with a verdict of "not guilty"
- The jury does not say that the defendant is innocent, just that there is not enough evidence to convict
- The defendant may, in fact, be innocent, but the jury has no way of being sure
- Said statistically, we fail to reject the null hypothesis
- We never declare the null hypothesis to be true, because we simply do not know whether it's true or not, therefore we never "accept the null hypothesis"
- In a trial, the burden of proof is on the prosecution.
- In a hypothesis test, the burden of proof is on the unusual claim.
- The null hypothesis is the ordinary state of affairs, so it's the alternative hypothesis that we consider unusual and for which we must gather evidence.

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