

Module 4 Wrap Up: Hypothesis Testing

Applied Epistemology: A Framework for how we know things scientifically

Agenda:

- Working through examples of hypothesis testing
 - Binomial Example
 - χ^2 Goodness of fit tests

Your pipeline for hypothesis testing in statistics

Step 1

Formulate your **null hypothesis**

- Null hypothesis is **only hypothesis that is tested**
- Falsification: want to reject your null



Step 2

Identify appropriate **test statistic**

- Assumptions of your test



Step 3

Quantify the results of your test

- **P value** or comparison to **critical values**
- How *unusual* is your data?



Step 4

Conclude: reject or fail to reject

- based on alpha value
- if appropriate, confidence interval of the parameter

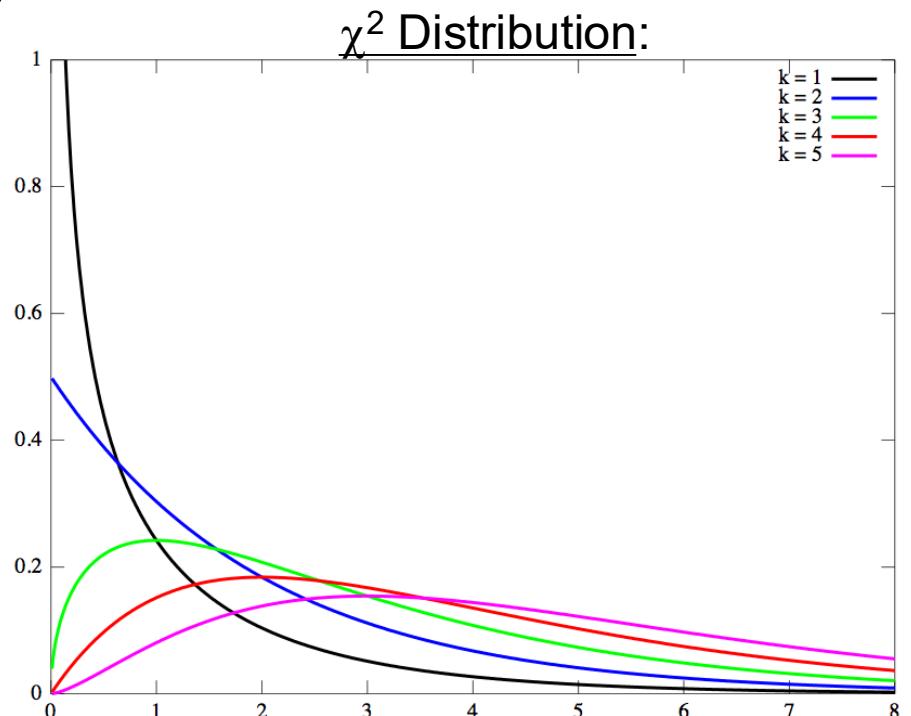
χ^2 Goodness of fit test:

- Compares observed **counts** to those predicted by a discrete probability distribution - examples: uniform Distribution (approximately), Poisson Distribution
- Non-parametric (it does not require a normal probability distribution)

Assumptions:

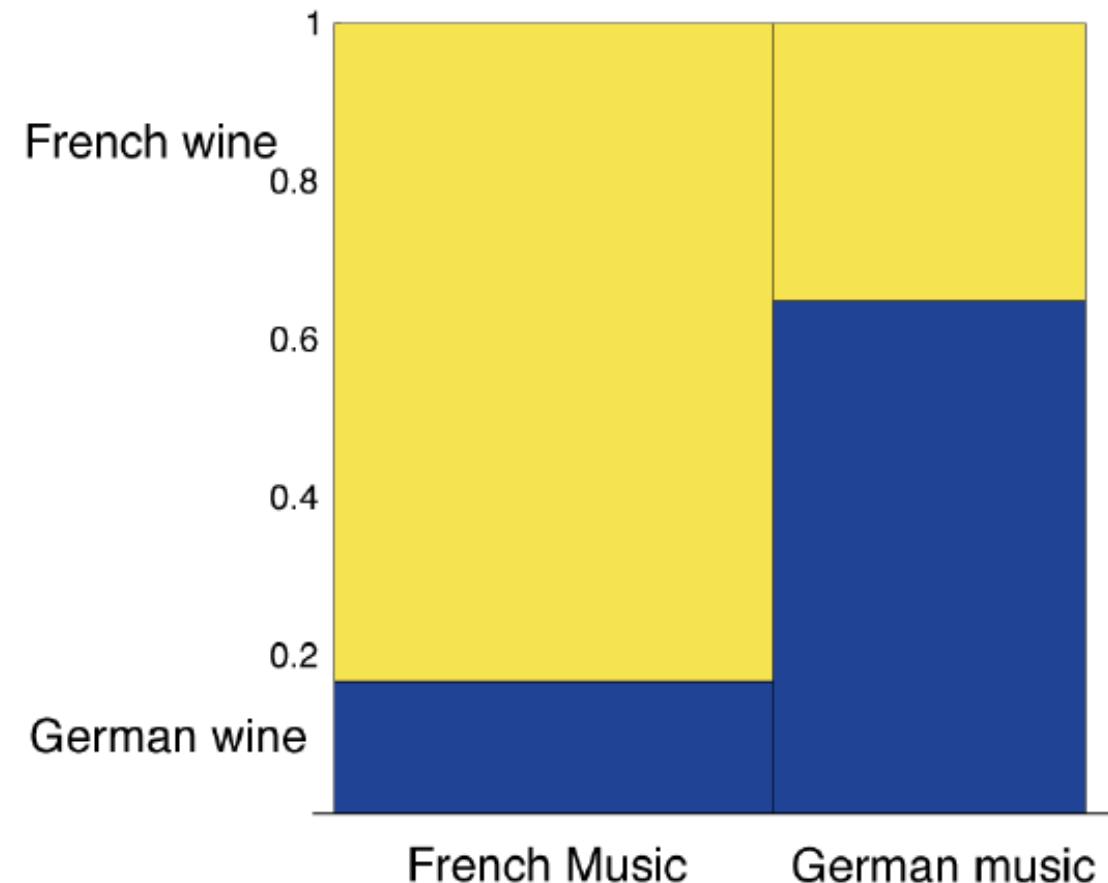
- **Expected** counts should ≥ 5 in $\geq 80\%$ categories
- No category should have an **EXPECTED** value of < 1

$$\chi^2_{df} = \sum_i \frac{(Observed_i - Expected_i)^2}{Expected_i}$$



Example: Does the nationality of background music effect the nationality of wine that is bought?

<u>Observed</u>	French Music	German Music	Row Totals
Bottles of French Wine	40	12	52
Bottles of German Wine	8	22	30
Column Totals	48	34	82



χ^2 Contingency Test -> similar but not exactly as the same χ^2 Goodness of fit test. You can think of it as a subset of χ^2 Goodness of fit tests with some calculation differences. Basis of test is Multiplication rule with the assumption of independence. Degrees of freedom are calculated differently!