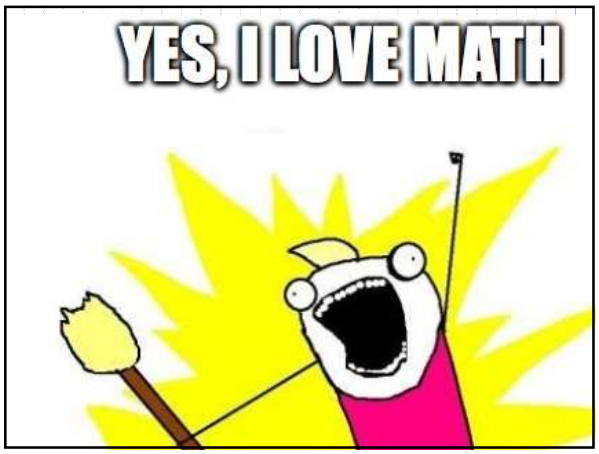


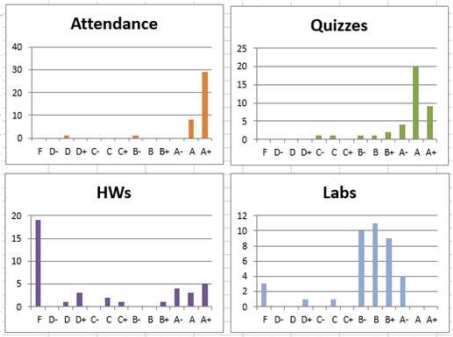
Admin Review Cbi-square PREs Choices Summary

SOC497/L: SOCIOLOGY RESEARCH METHODS

Proportional Reduction in Error & Measures of Association

Ellis Godard

Grade Distributions to Date (Sp25)

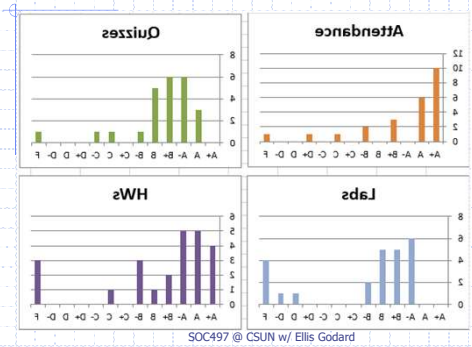


Admin Review Cbi-square PREs Choices Summary

Outline

- Review
  - Univariate, Bivariate Tests, Relationships
- Chi-square Issues
- What "PRE" means
- PRE Choices – esp Gamma & Lambda
- Demo and Lab

Grade Distributions to Date (Fa24)



Admin Review Cbi-square PREs Choices Summary

With whom did you take 424?

1. Berger 0%
2. Bogumil 10%
3. Campbell 18%
4. Davidson 0%
5. Fuller 0%
6. Godard 59%
7. Johnson 0%
8. Mavvadat 8%
9. Someone else 5%

Testing Your Research Project

- **You each need a bivariate research hypothesis** you'll test w/ data from our survey
- **You each need at *least* 2 survey questions,** to measure your DV and IV (extra credit for 2nd DV or IV, a CV, an index, etc. – but penalty for unused Qs)
- **Need to figure out which test to use,** given the measurements you've chosen and the respondent data that we collect
  - For HW6, HW9, & presentation (& paper?)
  - To *inform* your choice of the measurements
  - This lecture is another part of that review…

Relationships

- Definition = distribution of DV varies by IV
  - I.e. conditional distributions differ
- Could look at different DVs:
  - e.g. accounting for attitudes about abortion
- Could look at different IVs:
  - What accounts for partyid best (polyviews, educ, relig, or income)?

Operations Constrain Analysis

- **Level of Measurements**
  - Can the values be *out of* order?
    - If no, then it's Nominal.
    - If yes, can you *meaningfully* subtract the values from each other?
      - If No, then it's Ordinal.
        - If the values have labels, the answer is probably No.
        - If the values are labeled with ranges, it's definitely No.
      - If Yes (values can be out of order AND subtracted), it's Interval.
- **Univariate Analysis**
  - Shape (bell? Skew? Unimodal? Bimodal? Etc…)
  - Central tendency (mean, median, mode)
  - Dispersion (standard deviation, range/IQR, variation ratio)

Four Basic Statistical Tests

- ***Also* depend on LOM, *BUT* all also follow common pattern:**
  - All compare a sample measurement to a "null hypothesized" number
  - All standardize that difference based on some sort of standard error
    - Estimate of how much the sample stat (e.g. mean) differs across all possible samples
  - All ask for chance of getting a difference larger than the one observed
    - A probability (e.g. "right-hand tail") – the "pvalue" – what we usually want to be <.05
  - All follow the same 5 steps, and result in a p-value
- **Four main tests in Sociology:**
  - "T-test" for 1 interval and 1 categorical variable
  - ANOVA ("F test") for several categories & 1 interval
  - Regression ("r" correlation) for several interval variables
  - "Chi-square" for 2 categorical (ordinal or nominal) variables

Next

Last time

1. A relationship exists when…

A. The DV changes among values of the IV 93%

B. The IV changes among values of the DV 5%

C. The CV changes among values of the DV 2%

D. The IV changes among values of the CV 0%

E. The DV changes among values of the CV 0%

2. Which is NOT one of the three things you should do in any crosstab?

A. Compare % across — 20%

B. Compare % up/down — 15%

C. Look for modal %s — 0%

D. Look for main diagonal — 56%

E. Look for chi-square's p-value — 10%

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Problems w/ Chi-square

- Varies w/ size of sample & of crosstab
  - Sometimes use alternative chi-square-*based* measurements
- Only significance, *not* strength (NOT)
  - Can eyeball (compare across, modal %s)
  - Or can use other stats: PREs/MOAs

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Reminder: Crosstabs & x^2

Here, **females are more than twice as likely to say they can't still remain friends (22% vs. 9%);**

males are more likely to say they can, and modal percentages fall along the "main diagonal";

& the difference is statistically significant (p<.05).

If they cross the line, can you still remain friends? * What is your gender? Crosstabulation

			What is your gender? Male	What is your gender? Female	Total
If they cross the line, can you still remain friends?	Yes	Count	71	167	238
		% within What is your gender?	91.0%	78.0%	81.5%
	No	Count	7	47	54
		% within What is your gender?	9.0%	22.0%	18.5%
Total		Count	78	214	292
		% within What is your gender?	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.398[b]	1	.011		
Continuity Correction[a]	5.565	1	.018		
Likelihood Ratio	7.196	1	.007		
Fisher's Exact Test				.011	.007
Linear-by-Linear Association	6.376	1	.012		
N of Valid Cases	292				

Chi-square-based measures

- x^2, varies with df of (r-1)*(c-1): $\sum \frac{(f_o - f_e)^2}{f_e}$
- x^2 also varies with sample size, so Phi = $\sqrt{\frac{\chi^2}{n}}$
  - Pearson's contingency coefficient C = $\sqrt{\frac{\chi^2}{\chi^2 + n}}$
- *And*, it varies w/ table size, so Cramer's V = $\sqrt{\frac{\frac{\chi^2}{n}}{\min(r, c) - 1}}$

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3. Chi-square tests…

A. Association — 88%

B. Dependence — 10%

C. Prowess — 0%

D. Robustness — 0%

E. Strength — 2%

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Chi-square = only part of picture

- All questions ask: Is there a relationship?
  - Compare Column%s across; Modal %s; Chi-square's p
- But three key questions for crosstabs
  - Dependent relationship? (chi-square)
  - Size/Strength? (% comparisons, plus PREs)
  - Direction? (% comparisons, or gamma…)
- Three key questions for intervals, too (corr/reg)
  - Strength? – weak or strong?
  - Form? – linear? Curvilinear?
  - Direction? – positive? negative?
    - Remember valence!!

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Proportional Reduction in Error (PRE)

- By what percentage do we reduce our error in predicting values of the *dependent* variable by knowing values of the *independent* variable?
- Imagine that I want to guess which students hadn't finished an exam.
  - By how much is my guesswork improved if I know how early or late you submit homework?
  - If I know you're usually early, I might guess that you're already done with the exam.

PRE Formula

- All PREs follow same basic formula

$$(E1 - E2) / E1$$

where E1 is the errors made (in predicting values of the dependent variable) when nothing is known about the independent,

and E2 is the number of errors when the value of the dependent variable is known

Illustration of the Idea

- Univariate guess
  - If I know 60% of you are Catholic, but not who is or isn't…
  - Then, for each of you, every time, I would guess you're Catholic
  - That's most likely each time… *but* I'd be *wrong* 40% of the time.
- Bivariate guess
  - If Latinos/Latinos in the class are more likely to be Catholic…
  - Then, I'd make *fewer* errors men predicting whether or not you're Catholic, if I knew your race/ethnicity.
  - For every Latino/Latina, I'd guess "yes"; for others, "no".
  - I'd still be wrong some % of the time, but less often.
  - The difference is the *proportional reduction in error.*

All PREs have a p value

- Most have a distribution that matters; others are involved in a test statistic
- All p's are interpreted basically the same:
  - The null = that there's no relationship – e.g. the statistic, such as gamma, is zero in the population
  - P = probability we'd be wrong *if* we rejected the null
  - ~= risk in saying the statistic is what SPSS says it is
  - We want that risk to be lower than 5% (.05) so we can reject the null & find support for our claim
    - Remember: p never *is* zero, though might be close
    - If SPSS says .000, it's <.001; if it says .00000, it's <.00001

Distinguishing PREs

- Proportional Reduction in Error measures
- Not same as strength, or significance
- Not *necessarily* a "**measure of association**"… but some overlap
  - Not all MOAs have a PRE interpretation
  - Some other statistics (r^2) *do* have a PRE interpretation but aren't technically MOAs
  - I'll focus on stats that are *both* PREs *and* MOAs

4. A p value is the probability of being wrong if we…

A. Reject the null 95%

B. Accept the null 5%

C. Reject the alternative 0%

D. Accept the alternative 0%

E. Give up 0%

Nominal Variables: Lambda

- Based on ability to guess values on one of the variables
  - PRE achieved through knowledge of values on the other variable
  - Represents reduction in errors as a proportion of the errors that would have been made on the basis of the overall distribution.
- Example: if we make 600 fewer errors predicting employment status, for a sample of 900, when we know the gender, lambda = 600/900 = .67
  - Measures the statistical association between gender and employment status. It indicates a strong relationship.
- Rough guideline: above 0.5 is strong? below is weak?
- Always positive; can't be negative

C vs. D vs. "ties"

Note: these are NOT crossstabs!!

- Concordant pair:

	John	Mary
Educ	Higher	Lower
Pay	Higher	Lower

- Discordant pair:

	John	Mary
Educ	Higher	Lower
Pay	Lower	Higher

- Tied pairs:

	J	M
Educ	H	H
Pay	?	?

	J	M
Educ	?	?
Pay	L	L

Ordinal variables: Gamma

- = PRE (guess values on one variable w/ values of another) ***BUT*** considers order of values
  - So cannot use with nominals – i.e. if *either* is nominal
- Example: Religiosity and political conservatism.
  - If we know there is a strong relation between the two & they're each ordinal (v. strong, strong, neutral, weak, v. weak), then
  - Knowing that someone is very strong in political conservatism would lead us to guess they're very strong in religiosity.
- Guesses that a higher value on one variable connects w/ higher value on the other, for every possible pair of cases
- Allows us to guess direction as well as magnitude ("strength") of an association

Interpreting Gamma 1: Direction

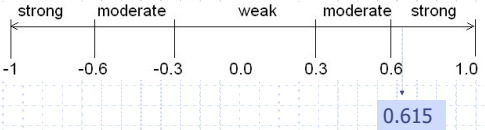
- If gamma > 0, relationship is positive
  - predict that a higher value on one probably *does* mean a higher value on the other
- If gamma < 0, relationship is negative
  - predict that a higher value on one probably means a *lower* value on the other
- In above example:
  - 0.615 -> positive relationship

The Idea Behind "Gamma" (γ)

- Compares *most* pairs of cases in the sample
- **Focuses on those *concordant* w/ relationship**
  - (those that show that higher values on one variable are associated with higher values on the other one)
- **and those *discordant* w/ a relationship**
  - (the reverse of or at *discord* with a positive relationship – a higher value on one variable but lower on the other)
- Gamma = (C – D) / (C + D)
  - the difference, as a fraction of the combination

Interpreting Gamma 2: Strength

- Weak relationship if 0 to .3 (or 0 to -.3)
- Moderate if 0.3 to .6 (or -.3 to -.6)
- Strong if 0.6 to 1 (or -.6 to –1)



Disadvantage of Gamma

- Does not take into account tied pairs
  - Therefore overstates strength – it might suggest a perfect positive association (+1) with only one concordant pair:
    (C-D)/(C+D) = (1-0)/(1+0) = 1
  - **Somer's D** takes ties into account
    = (C-D) / (all tied pairs)
- Assumes that a higher value is "more"…

What's the variable's *valence*?

- Gamma assumes a higher *value* means a higher value *label*
  - *E.g. 1= low ses, 2=middle, 3= high ses*
- If your variable is the reverse, you'll need to *either* recode the variable to reverse the values *or* interpret gamma upside-down (positive as negative, etc)

Goodman & Kruskall's tau b

- Like gamma, tau b is asymmetrical
  - Infers a "direction' to the relationship
  - Chi^2 is symmetrical – doesn't distinguish between DV & IV (tho column percents *do*)
  - (plain) tau also symmetrical – could use for 2 nominals?
  - Could use tau b for 2 ordinals?
- Like Lambda, not absolute; relative only
  - below .5ish weaker; above .5ish is stronger

5 key PRE Measures, esp 2…

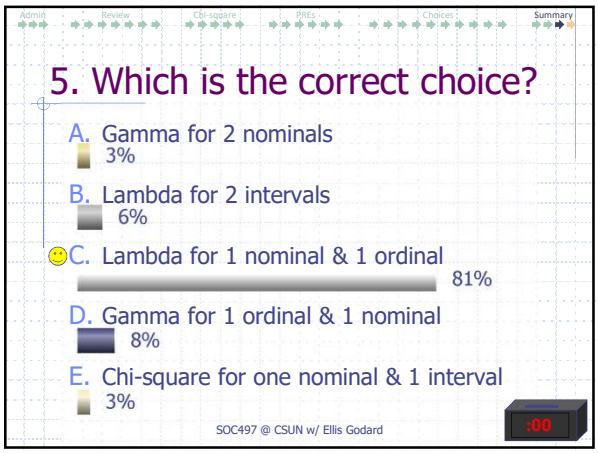
- **Gamma** *(8.5, p.223) –*
  (Concordant–Discordant) / (Concordant+Discordant)
- Somer's D
  (concordant – discordant) / all ties
- Goodman & Kruskall's tau b *(8.4, p.224)*
  - *based on row marginals*
- G&K's tau c
  - *based on column marginals*
- **Lambda**
  - *nominal only, based on modal category*
  - *Must use if either variable is nominal*

Measures to use…

- Chi-square always, to establish dependence
- Lambda if *either* variable is nominal *and* has more than 2 categories
  - Also interpret the p-value – can you reject the null (that the lambda is simply 0)?
- Gamma if **each** variable is either ordinal or dichotomous
  - Also interpret the p-value – can you reject the null (that the gamma is simply 0)?

SPSS (time/interest permitting)

- Demo: Crosstab w Abortion
  - Two possible explanations: sex & polviews
  - Don't forget:
    - get cell count, column %, chi-square, & gamma or lambda
    - use *Pearson chi-square*, and get Asymp Sig (= p value)
  - Summary table @ board
- Lab: is the US in Decline?
  - Now you try. ☺
  - Handout and data are on the web
  - Use USDECLINE as the IV (makes more sense!)


Admin
Review
Chi-square
PREs
Choices
Summary
5. Which is the correct choice?
A. Gamma for 2 nominals
3%
B. Lambda for 2 intervals
6%
C. Lambda for 1 nominal & 1 ordinal
81%
D. Gamma for 1 ordinal & 1 nominal
8%
E. Chi-square for one nominal & 1 interval
3%
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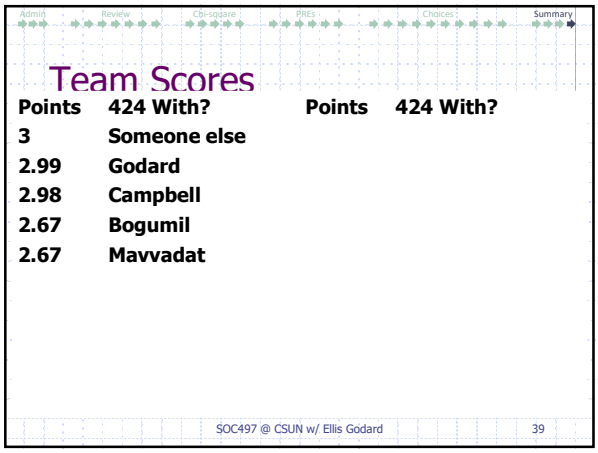
:00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Review
Chi-square
PREs
Choices
Summary
Team Scores
Points 424 With? Points 424 With?
3 Someone else
2.99 Godard
2.98 Campbell
2.67 Bogumil
2.67 Mavvadat
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