Empirical Research Methods 1

Correlation and chi²

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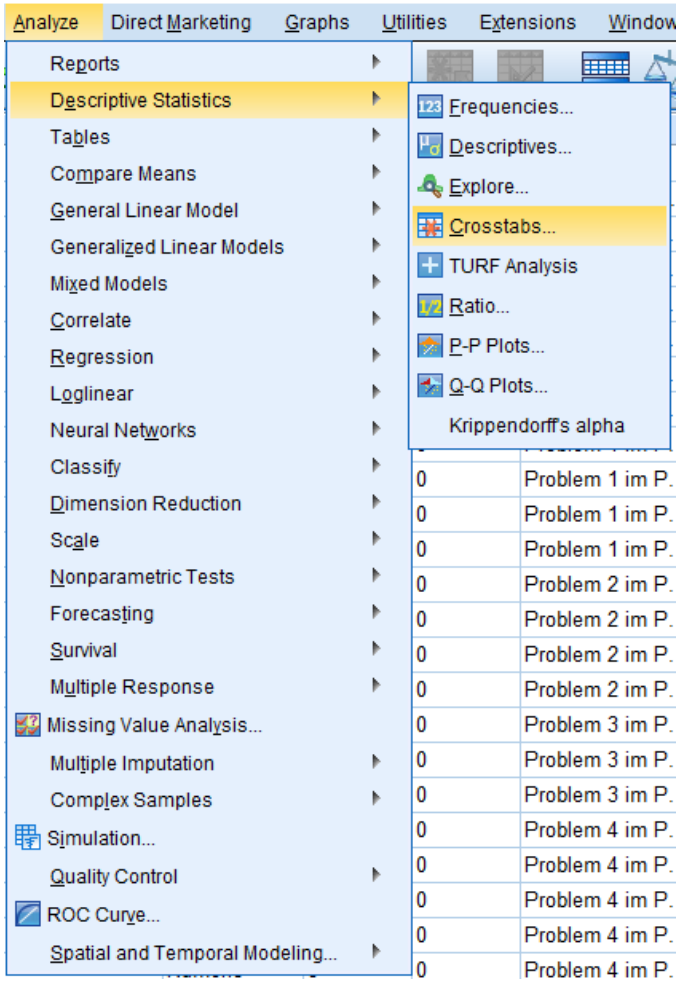
Agenda

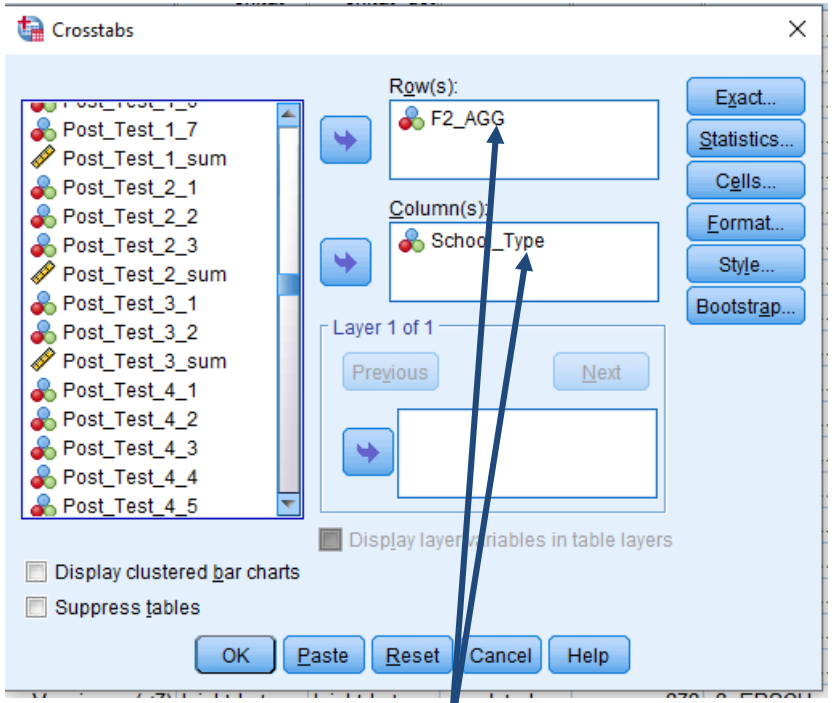
- Chi²
  - Definition
  - In SPSS
- Fisher‘s Exact Test in SPSS
- Correlations
  - Pearson correlation
  - Spearman / Kendall
  - Interpreting and reporting correlation values

chi²

- Non-parametric test, for data on nominal (or ordinal) level
- Testing a possible association between two categorical variables
- In our case: We test if a categorical variable (e.g. “School Type”) is equally distributed on our experimental groups: “Do group A and group B have the same proportion of different school types?“

chi² in SPSS

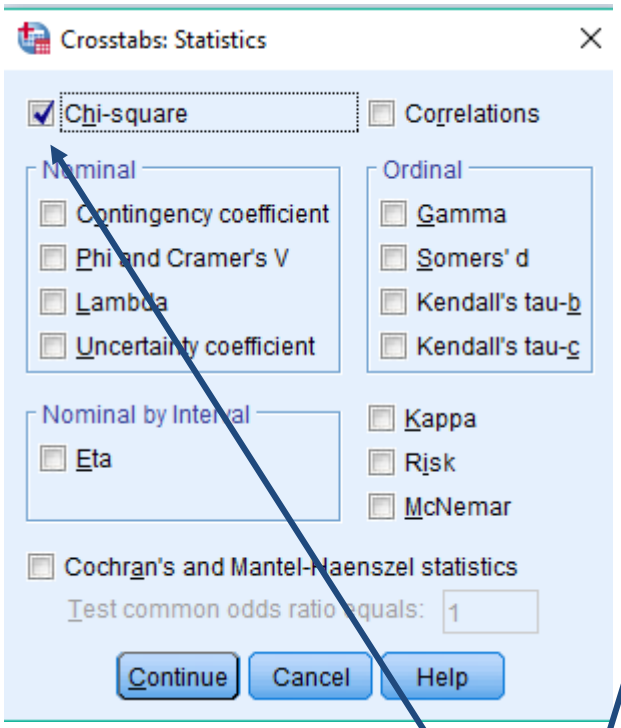


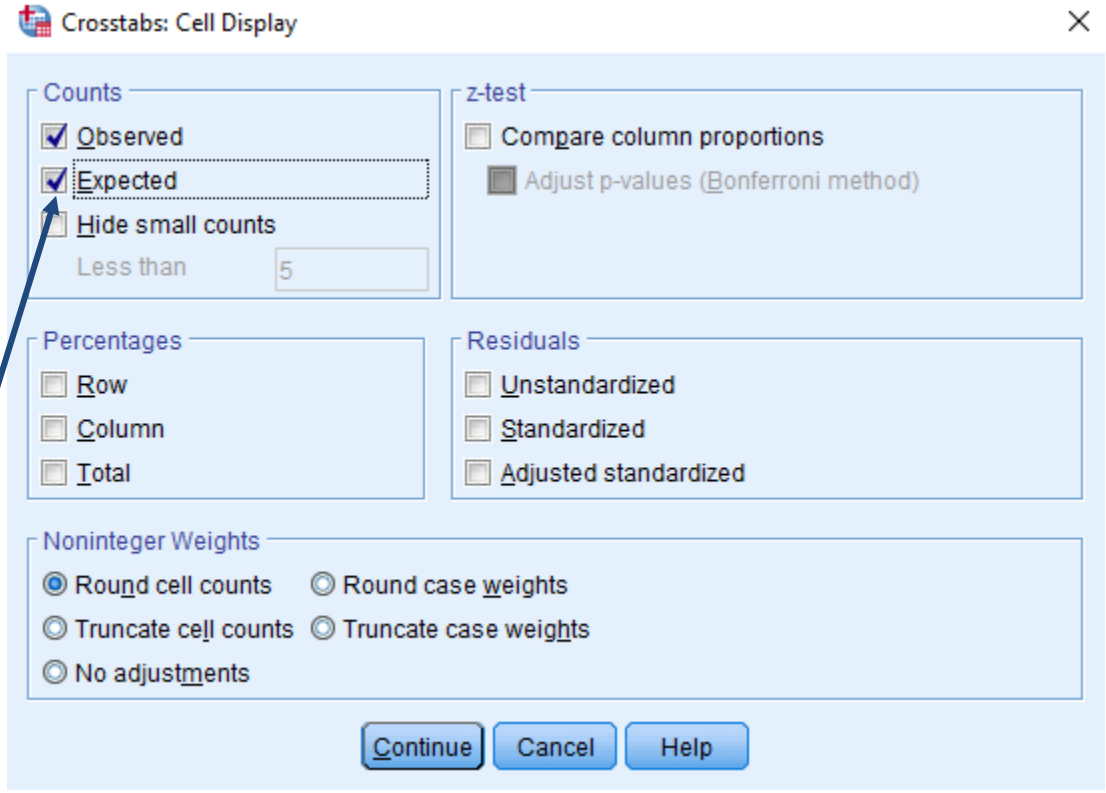


Enter your two categorical variables here

H0: F1_FAC is independent from School Type
H1: F1_FAC is not independent from School Type

chi² in SPSS





Select “chi-square” and “observed” and “expected” counts

chi² in SPSS

F2_AGG * School_Type Crosstabulation

			School_Type			
			below-average	average	above-average	Total
F2_AGG	NO AGG	Count	14	40	28	82
		Expected Count	15,2	39,5	27,3	82,0
	AGG	Count	16	38	26	80
		Expected Count	14,8	38,5	26,7	80,0
Total		Count	30	78	54	162
		Expected Count	30,0	78,0	54,0	162,0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	,234[a]	2	,890
Likelihood Ratio	,234	2	,890
Linear-by-Linear Association	,169	1	,681
N of Valid Cases	162		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 14,81.

There was no significant association between F2_AGG and School_Type:
X^2 (2) = .234, p = .890

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Fisher‘s Exact Test

- Like chi², but for small sample sizes (if the expected count of a cell is < 5)

F2_AGG * School_Type Crosstabulation

			School_Type		
			below-average	average	Total
F2_AGG	NO AGG	Count	3	15	18
		Expected Count	3,1	14,9	18,0
	AGG	Count	3	14	17
		Expected Count	2,9	14,1	17,0
Total		Count	6	29	35
		Expected Count	6,0	29,0	35,0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,006[a]	1	,939		
Continuity Correction[b]	,000	1	1,000		
Likelihood Ratio	,006	1	,939		
Fisher's Exact Test				1,000	,642
Linear-by-Linear Association	,006	1	,940		
N of Valid Cases	35				

a. 2 cells (50,0%) have expected count less than 5. The minimum expected count is 2,91.

b. Computed only for a 2x2 table

There was no significant association between F1_FAC and Gender: p = 1.000 (Fisher’s Exact Test, two-sided)

Spearman- vs. Pearson correlation

- Pearson correlation:
  - Normal distributed variables
  - Linear relationship
  - Interval scale
- Spearman / Kendall:
  - Monotonous relationship
  - Calculates with the ranks of the values
  - Ordinal scale

Spearman vs. Kendall correlation: Which to pick?

- Both are very similar
- Spearman correlation is more common
- Kendal correlation is more suitable for small samples

Interpretation

- Correlation coefficient r
  - Ranges from -1 to +1
  - -1 = perfect negative relationship (“the more X, the less Y“)
  - +1 = perfect positive relationship (“the more X, the more Y”)
  - 0 = no relationship
- If $p \leq .05$ → Correlation is significant

Reporting correlations

"There was a significant correlation of X and Y with r (964) = .14, p = .000"

df = n-2)

Correlations

		AGE OF RESPONDENT	HOURS PER DAY WATCHING TV
AGE OF RESPONDENT	Pearson Correlation	1	.139**
	Sig. (2-tailed)		.000
	N	1491	966
HOURS PER DAY WATCHING TV	Pearson Correlation	.139**	1
	Sig. (2-tailed)	.000	
	N	966	973

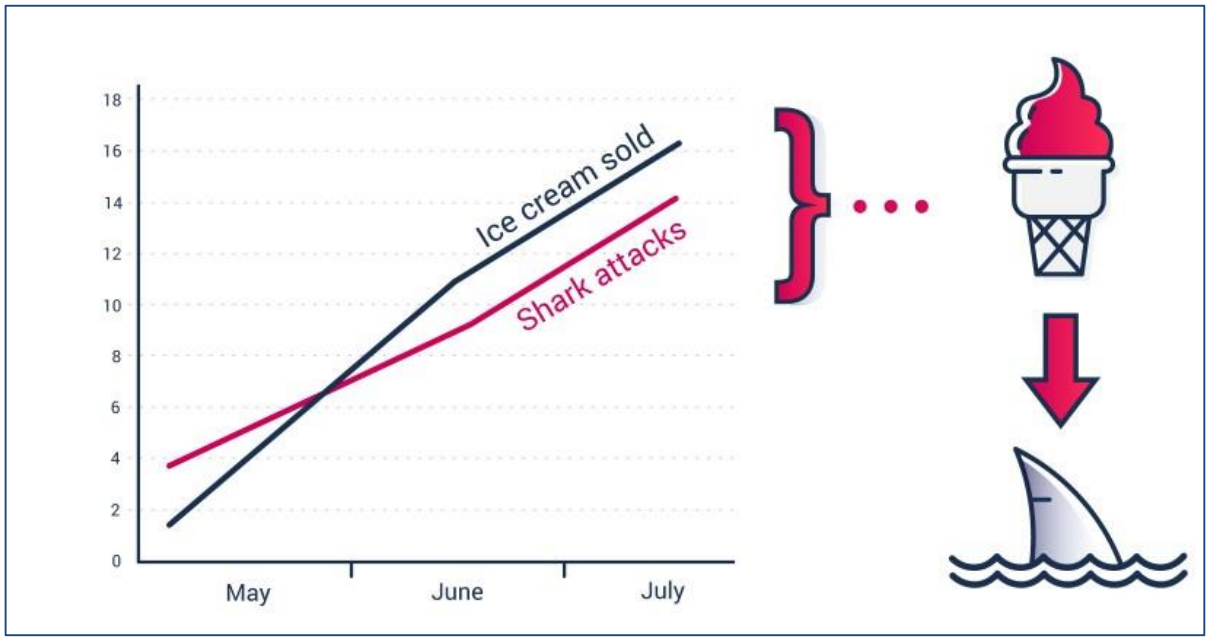
**. Correlation is significant at the 0.01 level (2-tailed).

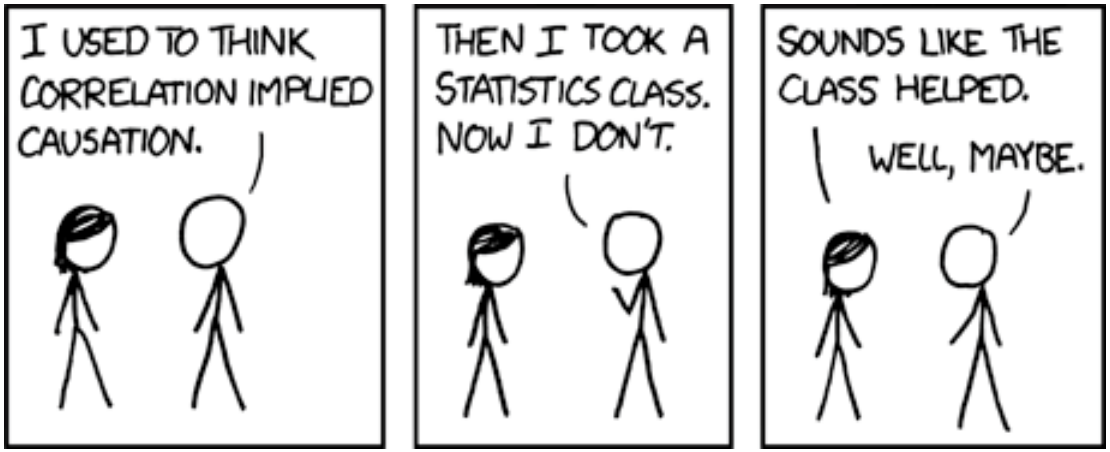
Interpretation of the correlation coefficient

- Small: .10 / -.10
- Medium: .30 / -.30
- Large: .50 / -.50

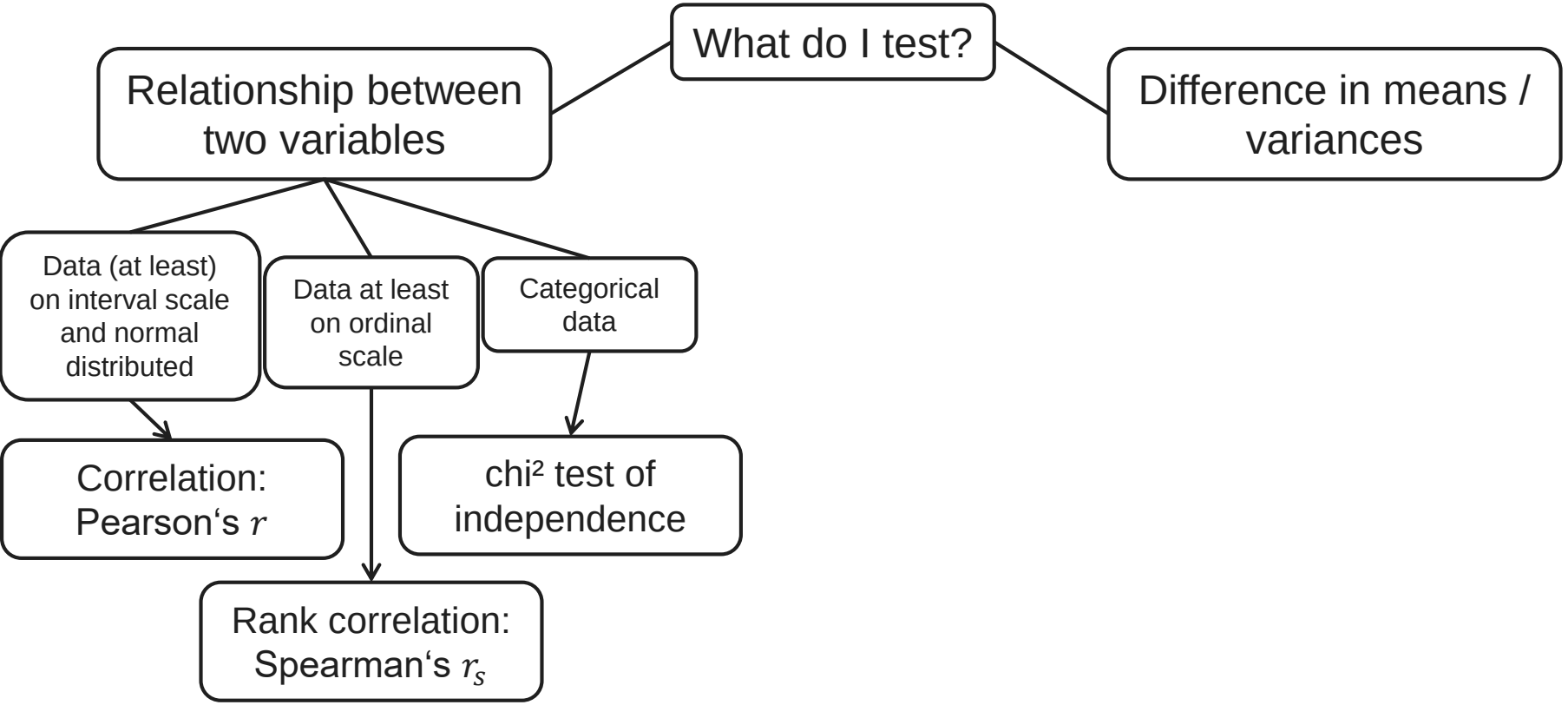
Cohen, J. (1988). Statistical power analysis for the behavioral sciences. Hillsdale: Erlbaum.

Correlation and Causation (?)





https://swflreia.com/2017/05/17/ice-cream-sales-cause-shark-attacks/#post/0
https://xkcd.com/552/


What do I test?
Relationship between two variables
Difference in means / variances
Data (at least) on interval scale and normal distributed
Data at least on ordinal scale
Categorical data
Correlation: Pearson‘s r
chi² test of independence
Rank correlation: Spearman‘s r_s

Guess the correlation

- http://guessthecorrelation.com/