Tutorial 07, Michaelmas Term

Research Methods for Political Science (PO3600)

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http://muellerstefan.net/research-methods

Session Outline

1. Calculate correlations by hand
2. Correlations in SPSS
3. Research proposal/paper

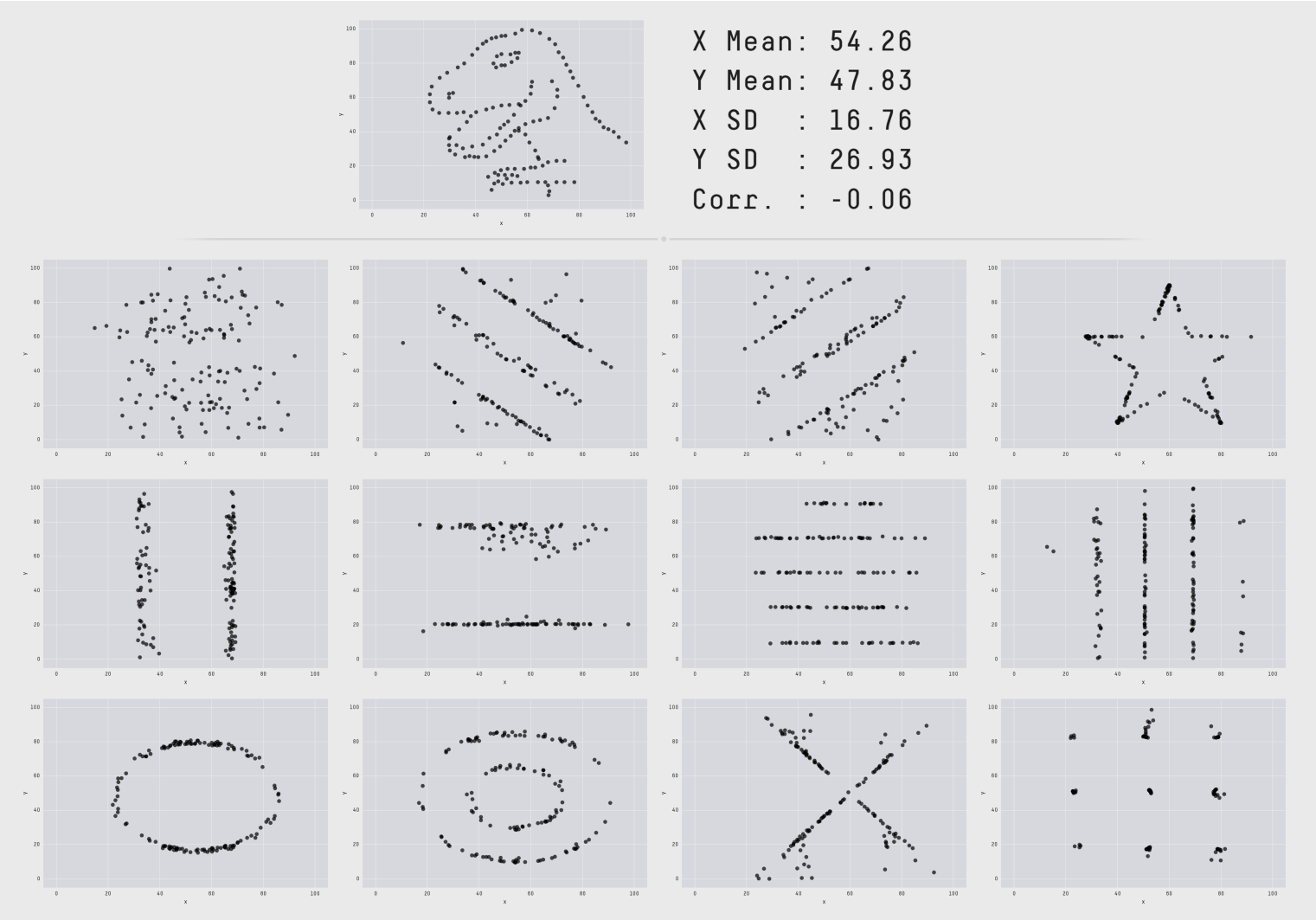
Covered so far

1. Mean, standard deviation, standard error
2. Confidence intervals
3. t-test (one-sample and two-samples)
4. SPSS: Plots, cross-tables, merging datasets, create new variable, summary statistics, methods from above

Correlation

- Before you start, always create a scatterplot!
- Correlation and covariation used to measure the association between two interval-ratio variables.

Correlation



Source: https://www.autodeskresearch.com/publications/samestats

One step back: variance and covariance

$$variance = \frac{\sum(x_i - \bar{x})^2}{N-1} = \frac{\sum(x_i - \bar{x})(x_i - \bar{x})}{N-1}$$

$$covariance = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{N-1}$$

Interpreting covariance:

- $cov(x, y) = 0$: variables not related
- $cov(x, y) > 0$: variables vary in the same direction
- $cov(x, y) < 0$: variables vary in the opposite direction

Problem of covariation? It depends on the scales.

Correlation

Solution? Divide the covariation by the standard deviations of x and y.

$$correlation = \frac{covariance}{standard\ \ deviation_x \times standard\ \ deviation_y}$$

Example: Calculate correlation by hand

x	y
1	1
2	3
4	5
5	7

Steps:

1. Calculate mean of each variable
2. Calculate standard deviations of x and y: $\sigma = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$
3. Calculate covariance: $\textit{covariance} = \frac{\sum(x_i-\bar{x})(y_i-\bar{y})}{N-1}$
4. Divide covariance by sum of standard deviations

Example: Calculate correlation

1. Calculate mean of each variable: $\bar{x} = 3$, $\bar{y} = 4$
2. Calculate standard deviations: $\sigma_x = 1.83$ and $\sigma_y = 2.58$
3. Calculate covariance: $\textit{covariance} = ((1-3) \times (1-4) + (2-3) \times (3-4) + (4-3) \times (5-4) + (5-3) \times (7-4))/(4-1) = 4.66$
4. Divide covariance by sum of standard deviations: $4.66/(1.83 \times 2.58)$

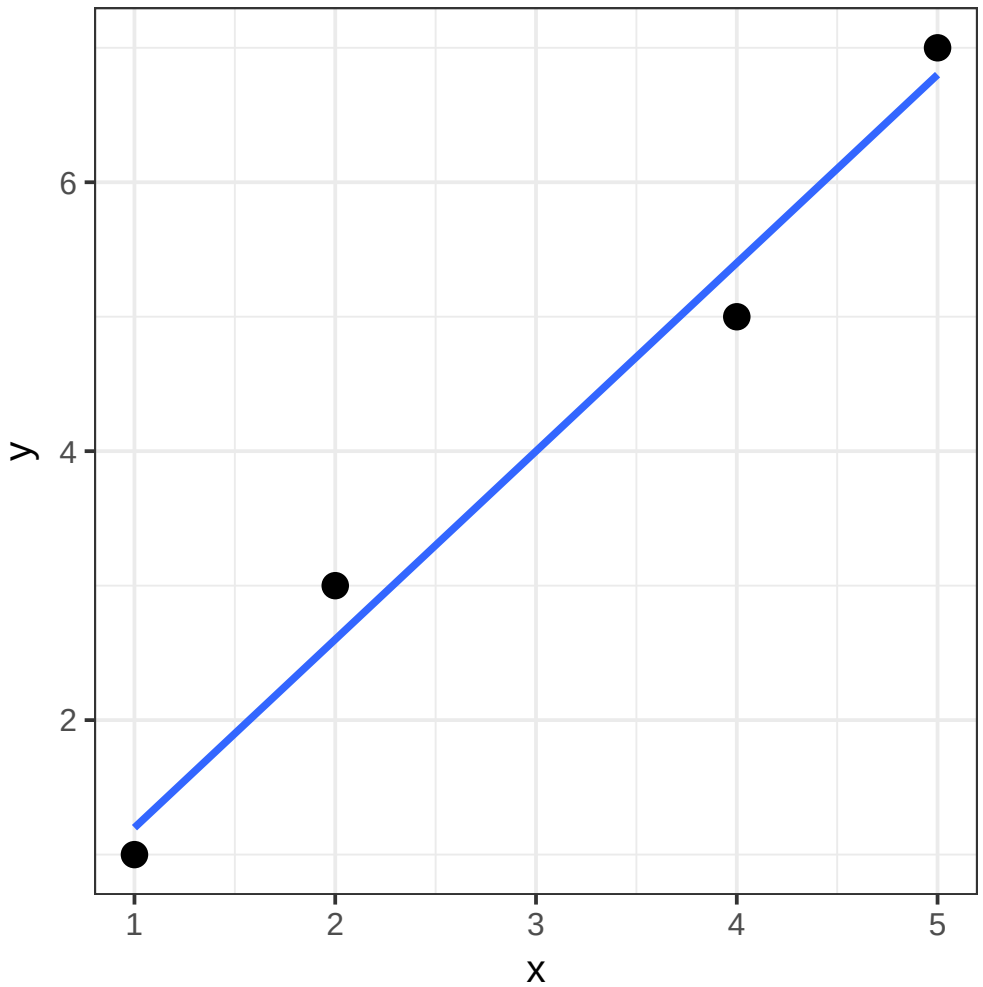
Correlation $(r) = 0.99$

Example: Reproduce analysis in SPSS

1. Insert dataset into SPSS
2. Create scatterplot of x and y
3. Estimate correlation

x	y
1	1
2	3
4	5
5	7

Example: Plot relationship



Example: SPSS output

Correlations

		x	y
x	Pearson Correlation	1	.990*
	Sig. (2-tailed)		.010
	N	4	4
y	Pearson Correlation	.990*	1
	Sig. (2-tailed)	.010	
	N	4	4

*. Correlation is significant at the 0.05 level (2-tailed).

Example: Significance of correlation

$$t_r = \frac{r\sqrt{N-2}}{\sqrt{1-r^2}}$$

$$t_r = \frac{0.98\sqrt{4-2}}{\sqrt{1-0.98^2}}$$

$$t_r = 6.96$$

Conclusion: correlation is statistically significant

Research Proposal

Team up and discuss (some of) the following aspects:

1. Research question + relevance
2. Theoretical argument + hypothesis
3. Type of data + operationalisation of variables
4. Ways of analysing your data

Research Proposal

Discuss with your neighbour:

1. What is the puzzle you address?
2. Why is the question relevant?
3. What are your key dependent and independent variables?
4. What data will you use?