IPRES Tutorial 11: Statistical Testing and Correlations

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10 May 2019

Agenda

1.) Check-in and Recap: Exercise from last week

2.) Excel-exercise (Exercise 11)

3.) Statistical significance and Correlations/Pearson's R

4.) Wrap-up and Questions

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Check-in (also Google doc)

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Recap

Last week's exercise

$$95\%\, CI = sample\, mean - (1.96 \times \frac{SD}{\sqrt{n}})$$

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Where we are

Part 2:

- Prerequisites of quantitative research: Experiments and comparative case studies (**Tutorial 7**)
- Descriptive Statistics I: LoM and data hands-on (**Tutorials 8**)
- Descriptive Statistics II: Spreads (**Tutorial 9**)
- Sampling and Confidence Intervals (**Tutorial 10**)
- Inferential Statistics: Foundations of statistical testing (**Tutorial 11**)
- Limits of numbers and ethics/exam prep. (**Tutorial 12**)

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Information

- Excel-clinic:

Tuesday, 14.05. (next week)

13.30 - 14.45

- Rooms NL: **REC CK.03** & **CK.07**
- Rooms EN: **REC JK.3.85** & **D0.01**

- Only for Excel-stuff, not computer problems or assignment questions

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Statistical testing

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- What do you need?
  - H_0: There is no difference between two samples/groups
  - H_A: There is a difference (and it's not by chance)

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Statistical testing

- Popper: We are trying to *disprove* H_0
  - Example:
    - H_0: Dutch women are on average as tall as British women ($\boldsymbol{\mu}_D = \boldsymbol{\mu}_B$)

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- 2 Ways of testing: Confidence Intervals and Test Statistics

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Statistical testing

- Test statistics: z-and t-tests
  - t-tests: if we don't know SD_{pop} and do not have a normal distribution
  - Also: t-tests ~ z-tests with large observation numbers

$$t = \frac{\bar{x} - \mu}{SD/\sqrt{n}}$$

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α / r	0,25	0,2	0,15	0,1	0,05	0,025	0,01	0,005	0,0005
1	1,000	1,376	1,963	3,078	6,314	12,706	31,821	63,656	636,578
2	0,816	1,061	1,386	1,886	2,920	4,303	6,965	9,925	31,600
3	0,765	0,978	1,250	1,638	2,353	3,182	4,541	5,841	12,924
4	0,741	0,941	1,190	1,533	2,132	2,776	3,747	4,604	8,610
5	0,727	0,920	1,156	1,476	2,015	2,571	3,365	4,032	6,869
6	0,718	0,906	1,134	1,440	1,943	2,447	3,143	3,707	5,959
7	0,711	0,896	1,119	1,415	1,895	2,365	2,998	3,499	5,408
8	0,706	0,889	1,108	1,397	1,860	2,306	2,896	3,355	5,041
9	0,703	0,883	1,100	1,383	1,833	2,262	2,821	3,250	4,781
10	0,700	0,879	1,093	1,372	1,812	2,228	2,764	3,169	4,587
11	0,697	0,876	1,088	1,363	1,796	2,201	2,718	3,106	4,437
12	0,695	0,873	1,083	1,356	1,782	2,179	2,681	3,055	4,318
13	0,694	0,870	1,079	1,350	1,771	2,160	2,650	3,012	4,221
14	0,692	0,868	1,076	1,345	1,761	2,145	2,624	2,977	4,140
15	0,691	0,866	1,074	1,341	1,753	2,131	2,602	2,947	4,073
16	0,690	0,865	1,071	1,337	1,746	2,120	2,583	2,921	4,015
17	0,689	0,863	1,069	1,333	1,740	2,110	2,567	2,898	3,965
18	0,688	0,862	1,067	1,330	1,734	2,101	2,552	2,878	3,922
19	0,688	0,861	1,066	1,328	1,729	2,093	2,539	2,861	3,883
20	0,687	0,860	1,064	1,325	1,725	2,086	2,528	2,845	3,850
21	0,686	0,859	1,063	1,323	1,721	2,080	2,518	2,831	3,819
22	0,686	0,858	1,061	1,321	1,717	2,074	2,508	2,819	3,792
23	0,685	0,858	1,060	1,319	1,714	2,069	2,500	2,807	3,768
24	0,685	0,857	1,059	1,318	1,711	2,064	2,492	2,797	3,745
25	0,684	0,856	1,058	1,316	1,708	2,060	2,485	2,787	3,725
26	0,684	0,856	1,058	1,315	1,706	2,056	2,479	2,779	3,707
27	0,684	0,855	1,057	1,314	1,703	2,052	2,473	2,771	3,689
28	0,683	0,855	1,056	1,313	1,701	2,048	2,467	2,763	3,674
29	0,683	0,854	1,055	1,311	1,699	2,045	2,462	2,756	3,660
30	0,683	0,854	1,055	1,310	1,697	2,042	2,457	2,750	3,646
40	0,681	0,851	1,050	1,303	1,684	2,021	2,423	2,704	3,551
60	0,679	0,848	1,045	1,296	1,671	2,000	2,390	2,660	3,460
120	0,677	0,845	1,041	1,289	1,658	1,980	2,358	2,617	3,373
∞	0,674	0,842	1,036	1,282	1,645	1,960	2,326	2,576	3,290

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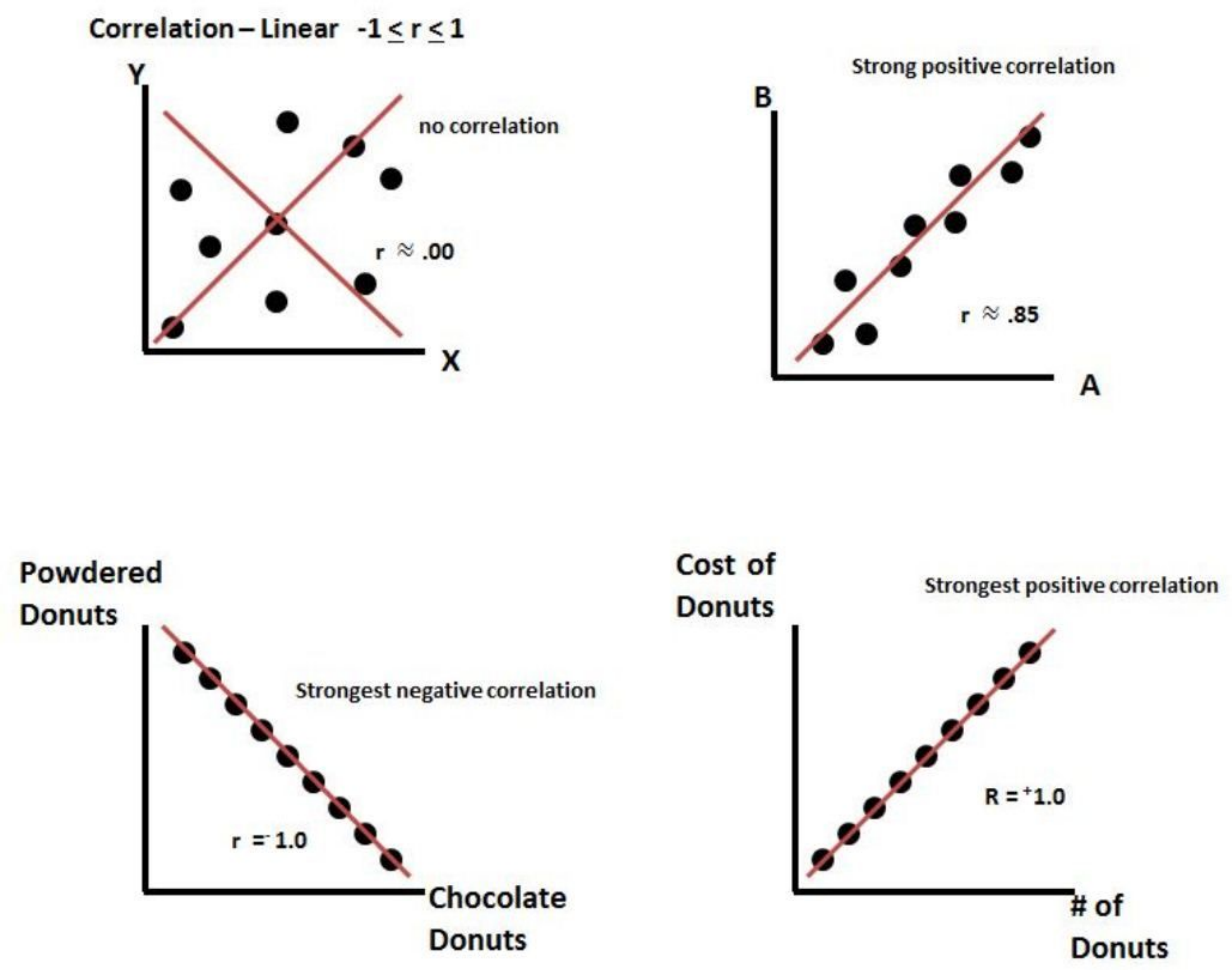
More than one variable: Correlations

- Pearson's R gives us an idea of the *linear* correlation between two variables:
  - **-1**: perfectly negative correlation
  - **1**: perfectly positive correlation
  - **0**: no *linear* correlation



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More than one variable: Correlations

- After calculating Pearson's R (measure of linear correlation):
  - Using R to establish t-value (to check for significance):
    - i.e.: is our sample deviating from the population in a systematic way?
    - or: can H_0 be rejected?

Formula for t-test w. R:

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Then: check whether t-score exceeds boundaries (H_0 rejected) or not (H_0 not rejected)

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Image t-table: https://upload.wikimedia.org/wikipedia/commons/b/bd/Tabla_t.png

Correlation pictures:

https://www.google.nl/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=2ahUKEwjospzvq47iAhVIKuwKHX5XAO4QjRx6BAgBEAU&url=https%3A%2F%2Fcommons.wikimedia.org%2Fwiki%2FFile%3ALinear_Correlation_Examples.JPG&psig=AOvVaw3HgEvfe-tmuG9HzWRtho-c&ust=1557487672813491

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