

Parametric Statistics

Week 8 - Statistics Done Wrong

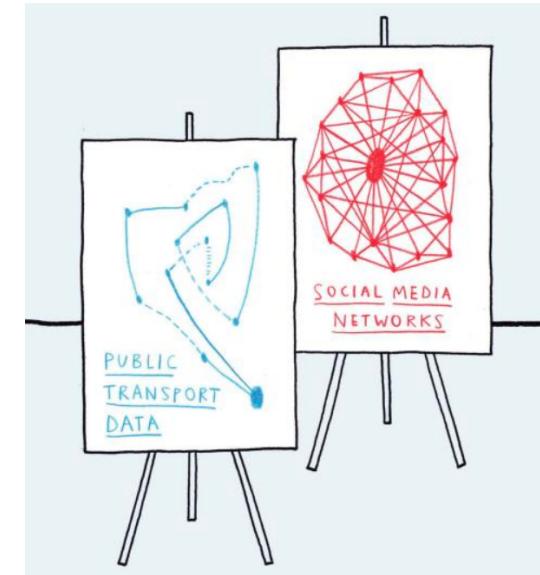
Juan Carlos Medina Serrano

Technische Universität München
Hochschule für Politik
Political Data Science

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How to Lie with Statistics

Averages, relationships, trends, graphs and statistical significance are not always what they seem

They can be used to sensationalize, inflate, confuse or misinform.

Be careful, how to use them when taking important decisions.

Especially politicians use survey data and reports to make policy decisions.

1. The Bias in the Sample

We learned about biases at the beginning of the course.

If the sample is not representative, the statistical results are wrong

Most famous case: The Literary Digest's fiasco



Well, the great battle of the ballots in the Poll of ten million voters, scattered throughout the forty-eight States of the

litan National Committee purchased THE LITERARY DIGEST?" And all types and varieties, including: "Have the Jews purchased

returned and let the people of the Nation draw their conclusions as to our accuracy. So far, we have been right in every Poll. Will we be right in the current Poll? That, as Mrs. Roosevelt said concerning the President's reelection, is in the 'lap of the gods.' "We never make any claims before election but we respectfully refer you to the opinion of one of the most quoted citizens

Roosevelt was elected! Many Republican voters in the sample.

1. The Bias in the Sample

Where do the 11 minutes come from?



Sample: Premium users which quit parship with the reason that they had found love. (In 2013...)

1. The Bias in the Sample

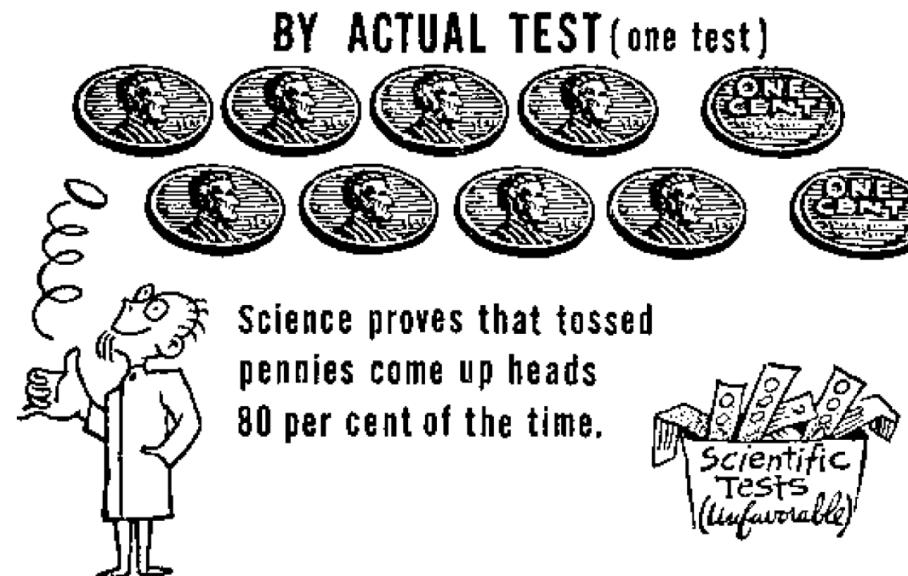
If we interview people in the U-bahn station, will it be representative of the people living in Munich?



2. The Small Sample

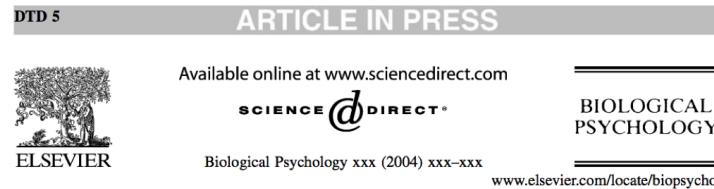
Sometimes the sample IS representative of the population, BUT it is too small to have enough statistical power.

Any effect we find is likely to have been produced by chance



2. The Small Sample

Published article on Biological Psychology



Finger length ratio (2D:4D) correlates with physical aggression in men but not in women

We tested 298 introductory psychology students (149 male and 149 female) in Canada...

Is 298 enough? And this is only Canadians... and only psychology students (are they the more normal people?)

3. The Inaccurate Average

Averages should always be taken with caution! If the distribution is not normal, the average does not tell all the important information.

6 months old babies learn to sit up on their own on average



If my baby is 8 months and not sitting on its own, is he subnormal?

Ranges tell a better picture!

3. The Inaccurate Average

Example: Kathi and Lisa do the IQ test. Kathi obtains 98 and Lisa 101. Is Lisa smarter than Kathi?

What if the IQ test had an error of ± 3

So now we know Kathi has 98 ± 3 and Lisa 101 ± 3

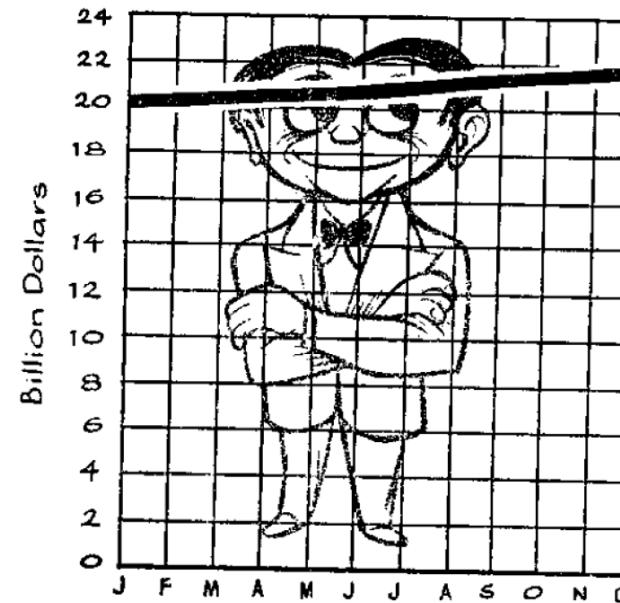
This means it is the same probability of Kathi having 95,96,97,98,99,100,101 and Lisa 98,99,100,101,102,103,104

So there is a probability that Kathi has actually a better IQ than Lisa

4. The Deceiving Graphs

There are many ways to deceive with graphs.

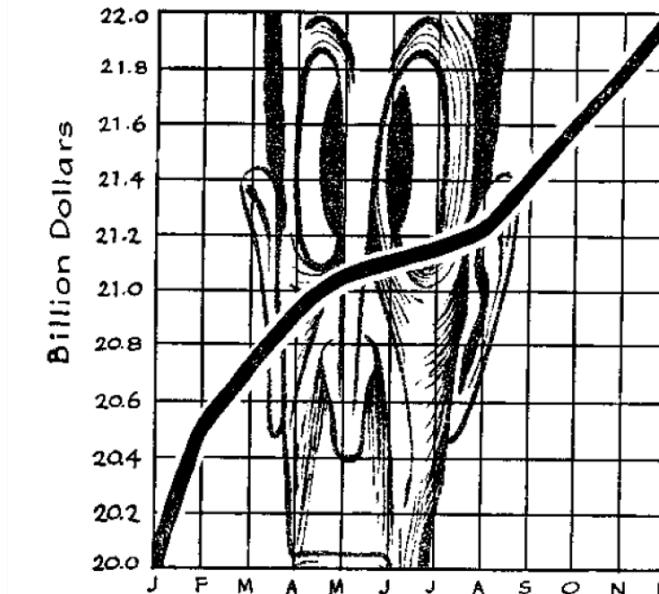
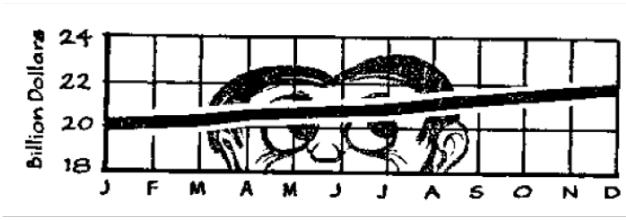
Example: National Income of country X:



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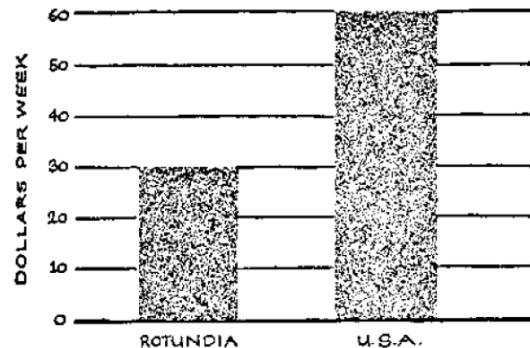
Example: National Income of country X:



4. The Deceiving Graphs

There are many ways to deceive with graphs.

Example: Average dollars per week country X vs US:



The picture deceives since it does not only double the height of the money bag, but also the width.

5. The Posthoc Fallacy

The post-hoc fallacy is when correlation is mixed with causation.

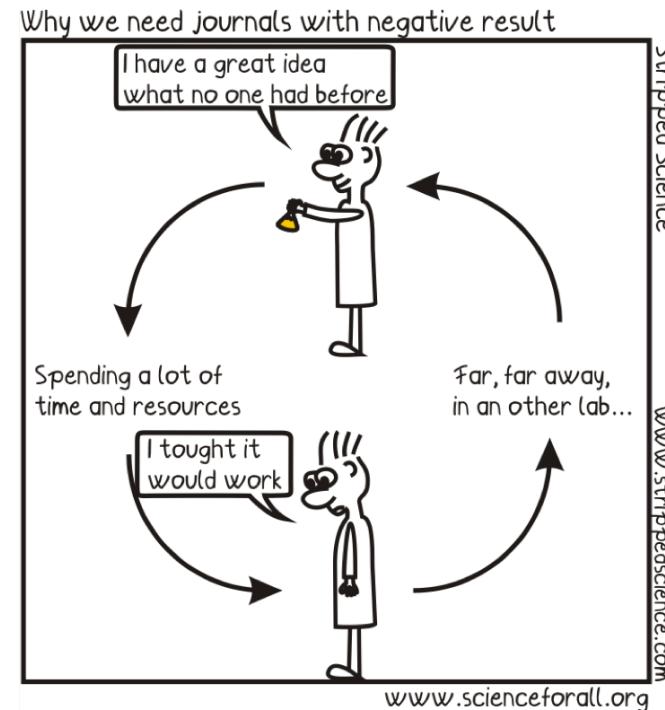
We have seen examples of this before.

Another example is not understanding that positive correlation can become a negative one:

Example: The amount of rain is correlated with great corn grows. However, if there is too much rain, the crops can be damaged!

6. The Unexciting Results Bias

Sadly, only exciting results are published in science journals! The non-exciting stay unpublished



7. The Non-normalized Assumptions

This happens when an assertion is given without taking in consideration that the counts at two point in time are not the same

Example: Automobile accidents have doubled between 1990 and 2020!

May be true, but this does not say anything, because if the number of cars are more than double in 2020, the percentage actually decreased

Loved by sensationalist news outlets!

7. The Non-normalized Assumptions



Donald J. Trump

@realDonaldTrump



Crime in Germany is up 10% plus (officials do not want to report these crimes) since migrants were accepted. Others countries are even worse. Be smart America!

72.8K 2:52 PM - Jun 19, 2018



42.1K people are talking about this



7. The Non-normalized Assumptions



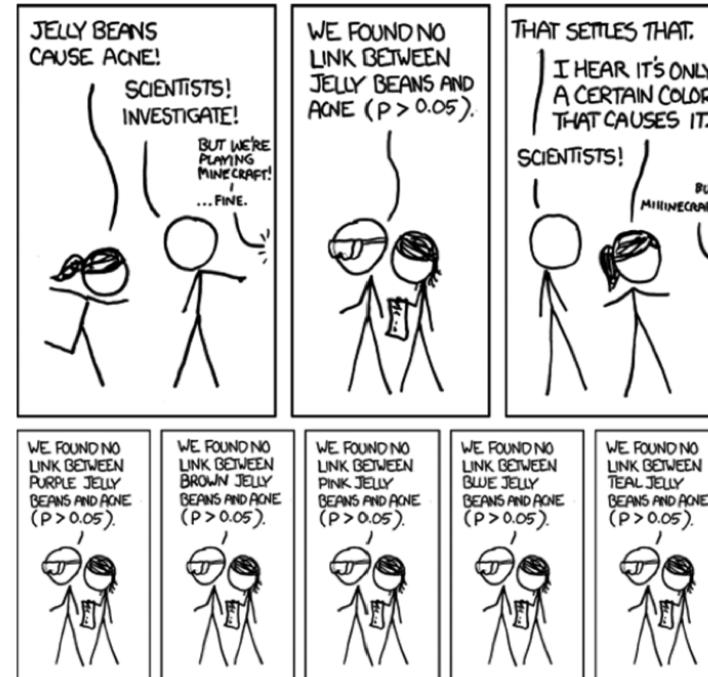
Trump claims Germany's crime rate went up by 10 percent. It went down by 10 percent.

Violent crime did increase in Germany during the initial influx of migrants, but that rate is now on the decline.

Also, migrant crimes were more likely to be reported.

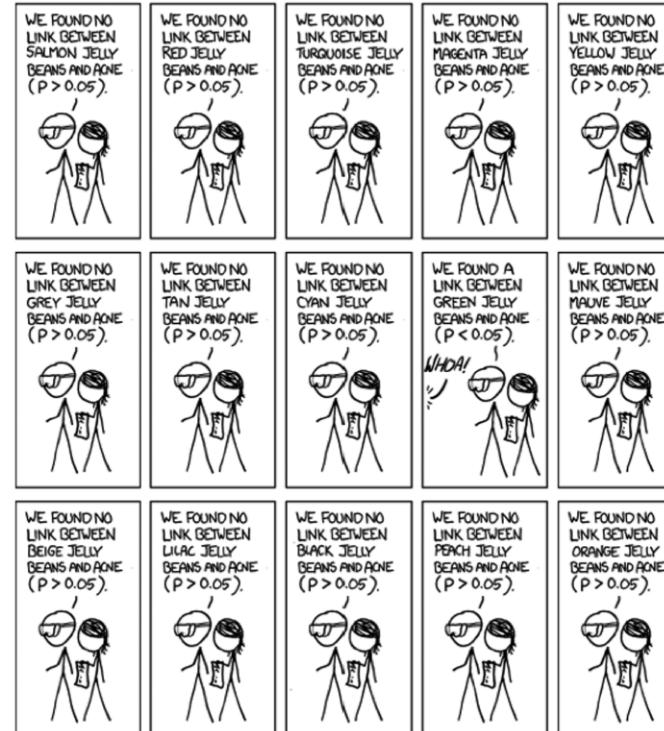
8. p-Hacking

If we perform many tests to the same data, we will find something significant by chance!



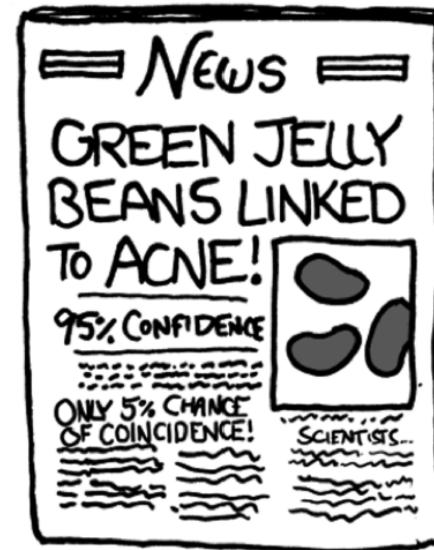
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Beware of p-values!

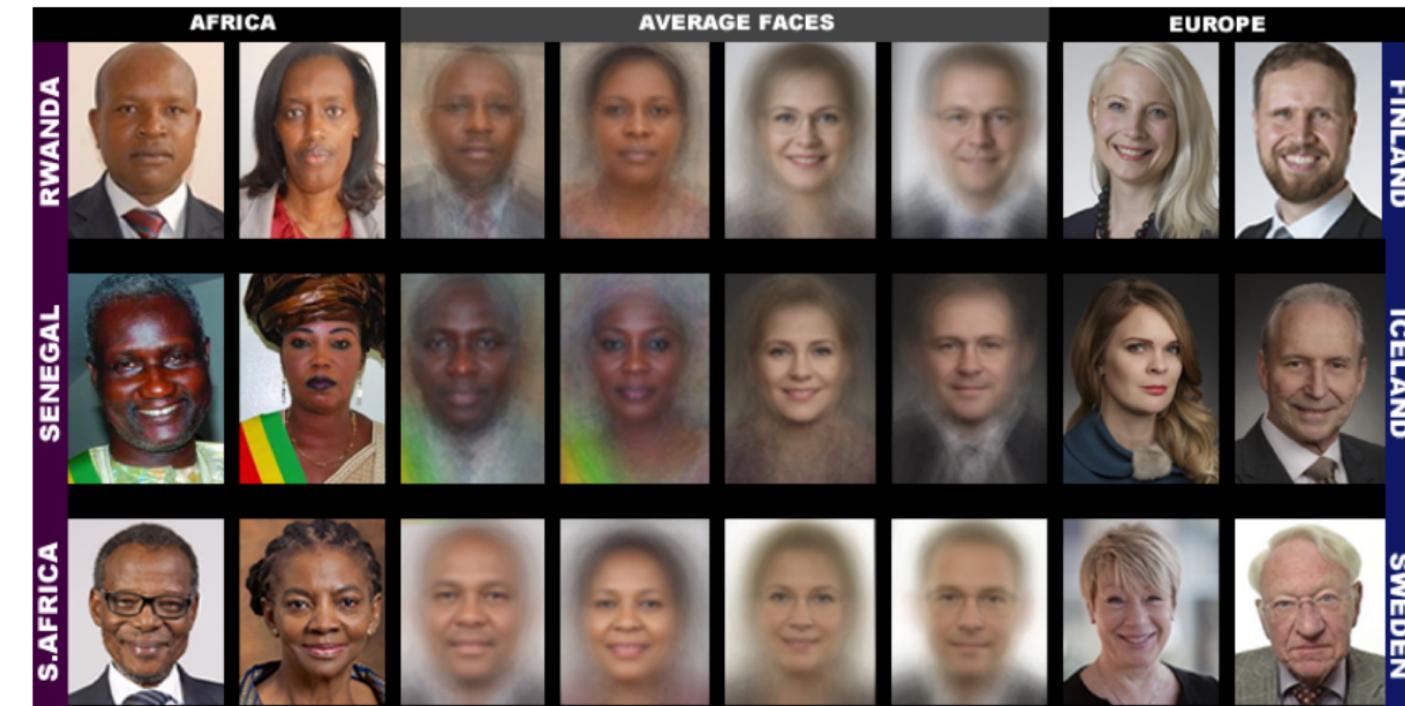
9. Forgetting Assumptions

I have insisted that assumptions are very important in statistics.

If the assumptions are not met, the results of a statistical test are not good!

10. Unfair Models

Statistical models are used to make decisions (for example in the government). If the models treat unfair different parts of the population, the usage of the models will discriminate.



Literature

If you are interested in the topic read:

- ▶ How to lie with statistics
- ▶ Statistics done wrong
- ▶ Weapons of math destruction