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Module Title: Introduction to Statistics

Session Title: Thinking statistically

**Topic title: Measurement and graphical
representations of data**



Learning Outcomes

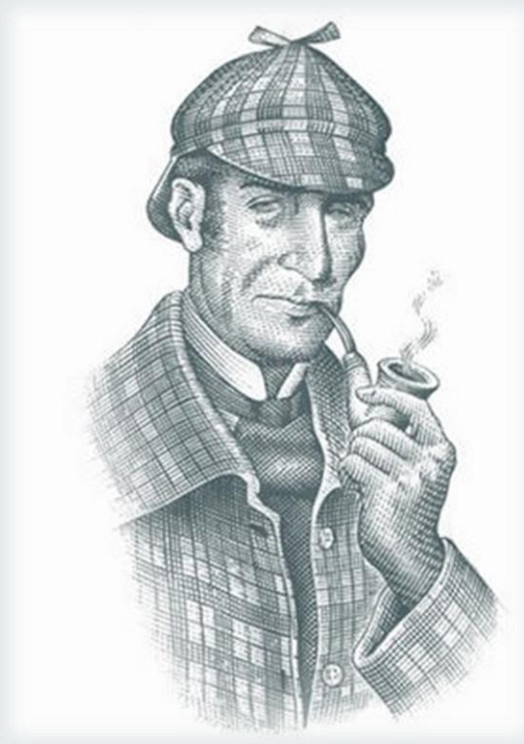
- To understand why statistics works
 - To understand when to use statistics
 - To understand the overall goal of using statistics
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- The course does not require prior knowledge in statistics
 - Invariably students will be at different levels depending on previous exposure to statistics
 - We will take it step by step and we will work together, helping each other with the ideas and the methods



A First Note on Statistics

Statistics is a valuable tool in modern research and is used extensively. It helps us unravel the mystery.

Sherlock Holmes quoting Winwood read:



"A famous statistician once stated that **while the individual man is an insoluble puzzle**, in the aggregate he becomes a mathematical certainty. You can, for example, **never foretell what any one man will do**. But you can, with precision, **say what an average man will do**. Individuals vary, percentages remain constant. So says the statistician. "



Introduction to Statistics

In this course we will see and understand why both parts of the quote, you have just heard, are true:

“you can **never foretell what a specific person will do**
but you **can, with precision, say what people on average will do**”

- **why** can we actually do so?
(do statistics really work?)
- **when** does it make sense to use statistics?
(we don't always use it)
- **how** do we apply statistics?
(you can learn to do so, give it a chance)



Introduction to Statistics: Why it Works?

Imagine that we have a bowl and we pour in the same amounts of pink, yellow and white candies.



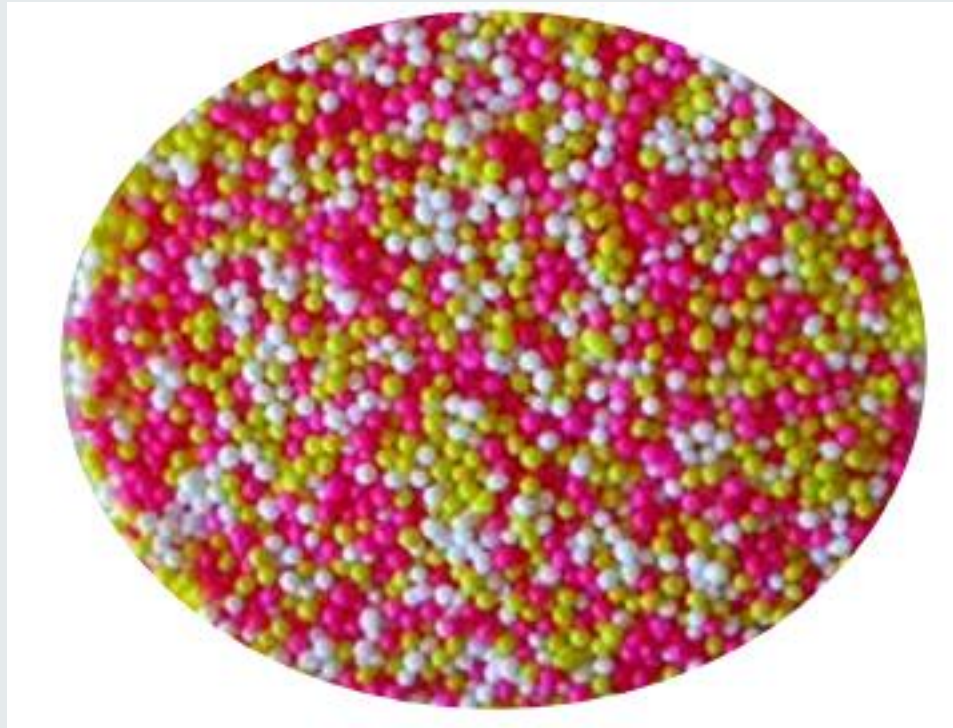
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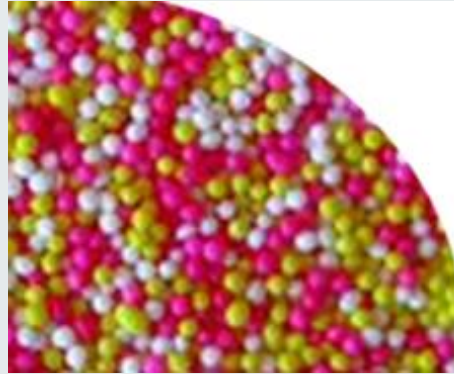


Introduction to Statistics: Why it Works?

Assume that we did not know the proportions of each colour and we can only see a random part of the bowl.



?



?



?

Can we tell, if we only saw part of the bowl, that there are equal proportions from each colour?

Actually, we could even count how many of each colour there are in a random sample of the bowl, and based on that estimate how many there are in the entire bowl.



Introduction to Statistics: When to Use?

That is how statistics works. We study a representative sample and find out (**infer**) what happens in the entire population.

So when do we use statistics?

When we want to study a characteristic and we can only access a sample of the population, not every one on the planet.

But that is not all: what kind of characteristics?



Introduction to Statistics: When to Use?

Example: we want to study how fast a runner's heart beats after 10 minutes of running.

Heart rate *variable*

170

150 *values*

195

The values “vary”, not everyone has the same rate.

A characteristic that varies (a variable) is a characteristic that we study using statistics.



<https://depositphotos.com/10476109/stock-illustration-sketch-of-female-marathon-runner.html>



Introduction to Statistics: When to Use?

Observing that the heartbeats vary is one thing, but why do the heart rates vary? To understand that, we add variables:

Heart rate	Age	BMI
170	22	22
150	21	35
195	32	18

In statistics the objective is to understand why things vary:

“to explain the variability” “to reduce uncertainty”

In this course we will learn ways to account for this variability.



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Introduction to Statistics: What is the Goal?

Statistics is the science whose objective is to understand why things are not the same for everyone:

Why don't we all have the same weight? Why don't we live the same amount of days? Why don't we all feel equally happy?

Statistics helps us unravel the mystery of variability.

We study a sample and use probability theory to have an educated guess about the **population** based on our **sample**.

While our target is to understand the **population**, we work on the **sample**. We need to get to know our data first.



Reference List

For more details of the concepts covered in Session 1, see Chapters 1- 3 of the book:

Agresti, A. and Finlay, B. (2009). Statistical Methods for the Social Sciences (4th Edition), Prentice Hall Inc. Chapters 1-3.

For more details on SPSS implementation see:

Field (2005) Discovering Statistics using SPSS 2nd Edition, Sage, London.

The SPSS Environment, Chapter 2.

For more details on measurement issues see:

Streiner & Norman (2003) Health Measurement Scales: A Practical Guide to Their Development and Use. Oxford University Press.





Thank you

Please contact [your module leader](#) or [the course lecturer of your programme](#), or visit the module's [forum](#) for any questions you may have.

If you have comments on the materials (spotted typos or missing points) please contact Dr Vitoratou:

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