**An Introduction to Statistics and Data Analysis for Psychology**

**Two questions**

* **Why** study statistics on a psychology degree?

* **What** concepts, ideas, and skills will we cover in the Research Methods modules?

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**Why are we doing this?**

Think about the following situation:

A friend tells you that they have tried a subliminal self-help audio-track. The audio-track is designed to improve memory. Relaxing music can be heard on the track, but there is also a subliminal message (which cannot be heard clearly). Your friend says that the audio-track worked for them and recommends that you try it yourself.

⏸🖉 *What objections might you have to their claim or their recommendation?*

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**Possible objections**

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Issues associated with the example

Measurement

Comparison

Study Design

Generalization

What will we be doing?

* Three examples to illustrate how to make sense of data

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**Making Sense of Data – Example 1 – Ketchup Preference**

Haller *et al.* (1999) gave a sample of 133 adults a taste test:

pure ketchup versus ketchup flavoured with a small amount of vanilla.

= person preferring vanilla ketchup, = person preferring regular ketchup

**People bottle-fed as infants People breast-fed as infants**

## **Bottle-fed:** 20 out of 30 people prefer ketchup with added vanilla

**Breast-fed:** 30 out of 103 people prefer ketchup with added vanilla

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**Making Sense of Data – Example 2 – Subliminal Audio-Tracks**

Data similar toGreenwald *et al.* (1991) – Testing subliminal self-help audio-tracks

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Type of tape | Individual change scores for self-esteem | | | | | | | | | | | | | | | | | | | | Average |
| Self esteem | 12 | 11 | 1 | 15 | 0 | 3 | 24 | 18 | 23 | 8 | –4 | 28 | 31 | 24 | 10 | 16 | 43 | 13 | 15 | 31 |  |
| Other | 30 | 9 | 23 | 25 | 13 | 19 | 31 | 14 | –1 | 37 | 16 | 25 | 19 | 6 | 4 | 15 | 11 | 0 | 28 | 16 |  |

**Making Sense of Data – Example 3 – Testosterone and Aggression**

|  |  |  |  |
| --- | --- | --- | --- |
| Prison inmate | Saliva testosterone concentration (ng/dl) | Number of days punishment per infraction | Data similar to Dabbs *et al.* (1987) – A group of prison inmates, who were serving time for non-violent crimes, were tested for their **level of testosterone**. The **severity of punishment** that they received for breaking prison rules (‘infractions’) was obtained from prison records. |
| 1 | 4 | 0 |
| 2 | 10 | 6 |
| 3 | 6 | 8 |
| 4 | 3 | 4 |
| 5 | 2 | 3 |
| 6 | 5 | 6 |
| 7 | 10 | 10 |
| 8 | 4 | 4 |
| 9 | 8 | 9 |
| 10 | 11 | 7 |
| 11 | 3 | 0 |
| 12 | 3 | 6 |
| 13 | 6 | 4 |
| 14 | 4 | 5 |
| 15 | 7 | 3 |

⏸🖉 *Complete the scatterplot to show the relationship between saliva testosterone concentration and the level of aggression (assessed by the number of days punishment per infraction).*

⏸🖉 *Your description of the pattern:*

**A brief review of the three examples**

**1.**

**2.**

**3.**

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**Six technical terms**

**Variables:** Properties of objects (people, places *etc*.) that can take on different values.

**Score:** An individualvalue for a variable.

**Population:** A complete set of scores that we might be interested in.

**Sample:** A sub-setof a population – a set of scores that we have obtained.

**Parameter:** A number that summarises the (entire set of) scores in a population.

**Statistic:** A number that summarises the scores in a sample.

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**Two types of data**

**Categorical** and **Measurement Data**

**Measurement data (quantitative data)**

* A ‘value’ or ‘score’ on a numerical scale

**Categorical data (frequency data** or **count data)**

* Scores represent categories (examine number of scores in a class or category)

**Three kinds of data statement**

**Statements about Frequencies, Differences** and **Associations**

**Frequency Statements**

We consider a single population or a single sample of scores.

For a specific variable:

How many times does a particular score occur?

Examine percentages, or average scores.

**Statements About Differences**

We examine objects, people, or measurements in different groups or categories.

Comparing the groups for a specific variable:

Are the groups different?

* If so, how different are they?

Should I trust that there is a ‘genuine’ difference?

**Statements About Associations (Relationships)**

We examine objects, events or people.

For two variables:

Are values one variable associated with the values of the other variable?

* If so, how closely?

Do values of one variable correlate with values of the other variable?

* If so, how strongly?

Should I trust that there is a ‘genuine’ association (or relationship)?

**Two types of statistical activity**

**Description** and **Inference**

**Descriptive Statistics**

Summarise samples – giving someone the main points in a simple form.

### To describe data, we will use **graphical** and **numerical (statistical) techniques**.

**Inferential Statistics**

Allow you to evaluate evidence by testing statistical hypotheses.

You can then draw conclusions about a population based on the analysis of a sample.

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**Why are we doing this?**

To be a **better psychologist**:

* Read, understand and evaluate psychological research.
* Understand human behaviour and psychological theories,
* appreciate when and how these theories can be applied.
* Conduct and report psychological research.

To be a **better citizen**:

* Evaluate statistical evidence in any domain that uses statistical methods.
* Argue from evidence in a principled and responsible manner,
* hold others to account in their use of statistical evidence.
* Contribute to society through work or other means of engaging in public life.

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###### Learning Outcomes Checklist

###### You should understand what is meant by the following:

* Variable
* Score
* Population
* Sample
* Parameter
* Statistic
* The mean
* Measurement data and categorical data
* Differences and relationships (associations)

###### Other Introductory Work for your Research Methods modules

Below, there are details of **reading** and **exercises** associated with the Introductory Video (*An Introduction to Statistics and Data Analysis for Psychology*). This is similar to what you can expect in term-time for your Research Methods modules: each week we will set you reading and exercises that consolidate and build on the material that we cover in class.

###### Introductory Reading

###### In the second half of King’s Welcome Week, you will gain access to your module textbooks. Then, please do the following reading from the textbook by David Howell that we use for your Research Methods modules:

**Howell, D.C. (2017). *Fundamental Statistics for the Behavioral Sciences* (9th edition).**

**Chapter 1: Sections 1.1 through 1.7 on pages 1-16.**

*Note:* Allow approximately one hour to do this reading. You will have (free) access to this textbook from *Welcome Week* onwards, so you can this reading in advance of your first term-time activities the following week.

Introductory Exercises

Complete these exercises by the beginning of the first week of teaching – working with someone else on the course if you like. Then mark the work yourself to obtain feedback on your work.

The exercises are taken from the textbook to David Howell. However, I have reproduced these below, so that you can do them before you have access to the textbook, if you wish:

**Howell, D.C. (2017). *Fundamental Statistics for the Behavioral Sciences* (9th edition).**

**Pages 16-17, Exercises 1.8: Questions 1.9, 1.10, 1.12, 1.13, 1.15 & 1.16**

**1.9** Give an example of a study in which we don’t care about the actual numerical value of a population average, but in which we would want to know whether the average of one population is greater than the average of a different population.

**1.10** Regarding variability,David Howell says: *“You only need one cow to find out how many legs cows have, whereas you need more to estimate their average milk production”.* How would you expect that variability would contribute to the size of the sample you would need?What would you have to do if you suspected that some varieties of cows gave relatively little milk, while other varieties gave quite a lot of milk?

**1.12** Give three examples of categorical data.

**1.13** Give three examples of measurement data.

**1.15** Give two examples of studies in which our primary interest is in looking at relationships between variables. [Try to pick psychological examples, though they can be hypothetical. Also for 1.16.]

**1.16** Give two examples of studies in which our primary interest is in looking at group differences.

**Answers to odd-numbered questions are within the textbook (by clicking the ‘Answer’ button underneath the question in the e-book version of the textbook).**

**See the final page of this handout for my answers to the even-numbered questions.**

**These are my answers to the exercises for which Howell does *not* provide an answer in the textbook:**

**Comment on question 1.9**: The second in the set of three examples from the lecture might be a good example of this. A change in self-esteem score of 12 or 28 or 43 may not mean much to us – and so we may not be very interested to learn that the average for one group was 16. But as long as we know that higher positive scores represent greater increase in self-reported self-esteem, then we will be interested to know whether one group had an average that was clearly higher than the other group.

**1.10** The greater the variability of the scores that make up the population the larger the sample needs to be to maintain accuracy or “precision” when estimating a population parameter (e.g. an average score, or the percentage of people in a category).

[This is an important point – we will do a lot of work that relates to this idea.]

**1.12** Categorical data = “Data representing counts or number of observations in each category”

My three examples:

[There are many possible answers, you can ask via email if you are unsure of your own answers.]

1. The number of men (or women) participating in a study
2. The number of people responding ‘yes’ (or ‘no’) to a question
3. The number of people in each of these categories:
   1. Those returning their questionnaire before receiving a reminder letter
   2. Those returning their questionnaire after receiving a reminder letter
   3. Those not returning their questionnaire

**1.16** My two examples:

[There are many possible answers, you can ask via email if you are unsure of your own answers.]

(1) Are there sex-differences in verbal ability? (i.e., Do men and women perform at different levels on tasks requiring verbal ability).

[This compares two “naturally occurring” groups.]

(2) Can you improve memory by teaching people a strategy to help them remember things (a ‘mnemonic strategy’). Group 1 are not taught the strategy but are given instruction in some other activity; Group 2 are taught a strategy – performance on a test of memory is measured and compared.

[This compares two groups (“conditions”) that are created for the purpose of the study.]

To contact Dr Rakow about the *Introductory Video* or something in this handout, please email **tim.rakow@kcl.ac.uk**.

Use your *King’s email account* any time that you email staff members at King’s.