Introduction to *Statistics for Psychological Research*

Three questions to address in this lecture:

(1) Why are we studying statistics on a psychology degree?

(2) What concepts, ideas and skills will we cover in this module?

(3) How can I master the content of this module?

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 him/her, and recommends that you try it yourself.

II ✎ *What objections might you have to their evidence?*

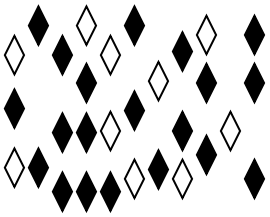
What will we be doing?

Three examples to illustrate how to make sense of data

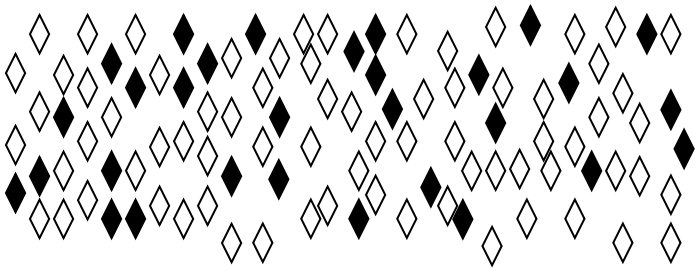
Example 1: Haller *et al*. (1999) gave a sample of 133 adults a taste test (pure ketchup versus ketchup flavoured with a small amount of vanilla).

♦ = person preferring vanilla ketchup, ◊ = person preferring pure 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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Example 2: Data similar to Greenwald, Spangenberg, Pratkanis and Eskenazi (1991). Testing subliminal self-help audiotapes.

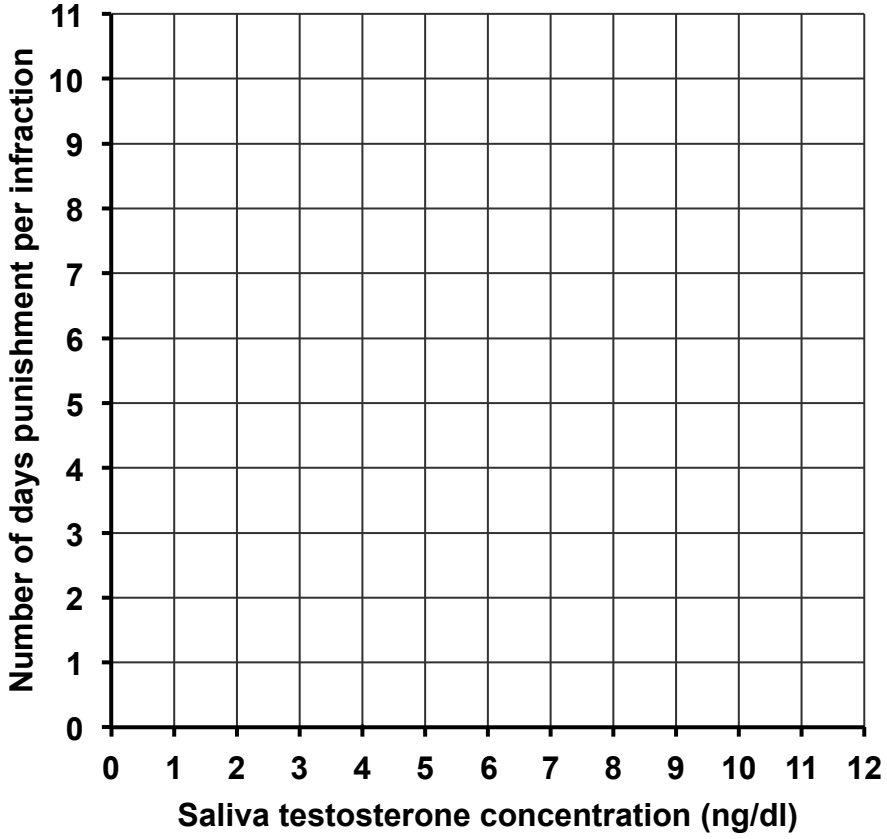
Change in self-esteem score:

Type of tape	Individual change scores																				**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	

Example 3: Data similar to Dabbs *et al.'s* (1987) study of testosterone and criminal violence: 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 also obtained from prison records.

Prison inmate	Saliva testosterone concentration (ng/dl)	Number of days punishment per infraction
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

II ✎ *Complete this scatter-plot to show the relationship between saliva testosterone concentration and the level of aggression (assessed by the number of days punishment per infraction).*



II ✎ *Your description of the pattern:*

A brief review of the three examples

1.

2.

3.

Six technical terms

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

Score: An individual value for a variable.

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

Sample: A sub-set of 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

What will we be doing?

We will look at **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) –**

The number of things in a class or category

We will look at **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 particular 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.

For a particular variable:

Are the groups different? If so, how different are they?

Do I trust that there is a "genuine" difference?

Statements about associations (relationships) –

We examine objects, events or people.

For two variables:

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

Do I trust that there is a "genuine" association (relationship)?

We will engage in **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 the evidence for a ***hypothesis***.

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

We will learn **important statistical concepts**

Four Themes or **"Big Ideas"**

Summarising

Standardisation

Sampling variability

Statistical inference

Why are we doing this?

To gain a set of **skills** and techniques for understanding numerical information

To learn a **language** to communicate what we have found out from a set of data

To **understand** and **use** statistical methods to evaluate evidence:

Describe…	**Assess** the size of differences or the strengths of relationships
Test…	**Evaluate** the strength of evidence for a theory or hypothesis
Conclude…	**Decide** whether the evidence supports a particular explanation

To be a **better psychologist**:

To be able to read, understand and evaluate psychological research.

To improve your understanding of human behaviour and psychological theories, and to gain a better appreciation of when and how these theories can be applied.

To be able to conduct your own psychological research.

To be a **better citizen**:

To be able to evaluate statistical evidence in any domain, and so to understand research and ideas from the numerous fields of science and social science that use statistical methods.

To learn to argue from evidence in a principled and responsible manner, and to be able to hold others to account in their use of statistical evidence.

To gain a set of skills which increase your employment opportunities.

How will we be doing this?

We will focus on: *Concepts and understanding rather than purely on mathematics*

We will use: *Computers to avoid taking too much time with computation*

We will learn: *Skills in data analysis, not only theory or knowledge of concepts*

How will I learn this material?

Research Methods 1 and 2 have a varied programme of study that includes:

Lectures (a 2-hour lecture each week)

Practical classes (a 75-minute class each week with the activities to be completed by the following week's class; the year-group is split into three separate groups for these classes) **[Note: More class time is set aside for these activities than in some previous years.]**

Seminars (a 75-minute session each week with preparation done in advance; the year-group is split into eight separate groups for these classes) **[Note: Held weekly for 2017/18 and 2018/19; previously, seminars were longer but held every fortnight.]**

Reading (set weekly on the lecture content, to be completed before the following week's lecture)

Weekly exercises and activities (set weekly to consolidate the lecture material, to be completed before the next lecture; answers are provided so that you can mark your own work and check your own progress)

Other questions and activities

This varies from week to week, but includes:

- Self assessments
- Tutor-marked work, which is returned marked and with written feedback from staff
- Practice assessment question to help you prepare for the coursework and end-of-module examinations

Further opportunities for collaborative working and additional contact with staff

- You can discuss your work with teaching staff after a class or lecture.
- Staff members are happy to be contacted if you wish to make an appointment to see them.
- You can email lecturers with a question, or post your question on *KEATS*.
- You are encouraged to work collaboratively with other students on the module.
- The Department's facilities are open to BSc Psychology students each day 0700-1900 in and out of term time.

If you have questions about this lecture, please email Dr Tim Rakow (**tim.rakow@kcl.ac.uk**)

Reading for the On-line Introductory Lecture

Howell, D.C. (2017). *Fundamental statistics for the behavioral sciences* (9th edition).

Chapter 1: pages 1-16

[Note: You will collect this textbook in the first two days of *King's Welcome Week*, so will have plenty of time to do this reading in advance of your first face-to-face lecture the following week.]

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)

In future lectures, look out for examples of:

Summarising (descriptive statistics)
Standardisation
Sampling variability
Statistical inference (inferential statistics)

Weekly Exercises

Complete these before the next lecture – working with someone else on the course if you like – and mark the work yourself.

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

I have reproduced these here, so that you can do them before you collect the textbook, if you wish:

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 given on page 615.

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:
(A) Those returning their questionnaire before receiving a reminder letter
(B) Those returning their questionnaire after receiving a reminder letter
(C) 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.]