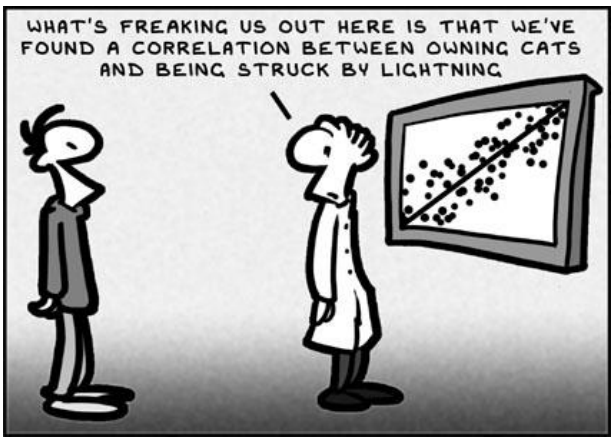
Lesson 11

Correlations



Lesson Objectives

- All students **will** define key terms and explain the difference between correlations and experiments.
- All students **should** be able to analyse scattergrams using knowledge of correlation coefficients and evaluate the use of correlations in research.
- All students **could** design a study using correlational analysis.

Key Words

- Correlation
- Co-variables
- Positive correlation
- Negative correlation
- Zero (or no) correlation
- Correlation co-efficient
- Scattergram

Extension activity:

- Have a look at the article on the following website: http://www.psychologytoday.com/blog/all-about-addiction/201003/correlation-causation-and-association-what-does-it-all-mean. This article, from the journal *Psychology Today*, highlights one of the key weaknesses in conducting correlational research. Make brief notes to add to your file.

Questions to guide your thinking ...

- What is a correlation?
- What are the types of correlation?
- Can you write hypotheses for correlations?
- Can you interpret correlation coefficients to determine the direction and strength of correlations?
- Can you interpret and plot correlations using scattergrams?
- What are the key differences between correlations and experiments?
- What are the strengths and limitations of correlations as a method of analysis?

Non-Experimental Research Methods

So far this year, we have explored experimental research methods, i.e. methods where there is at least one independent variable, one dependent variable and where the researcher typically manipulates and controls the experimental situation in some way in order to gain results. As a result of the deliberate change in one variable it is possible to infer that the independent variable has caused any observed change in the dependent variable.

However, psychologists also make good use of various **non-experimental research methods** to measure variables and look for relationships. It is **not possible to infer cause and effect relationships** between the variables under investigation, as non-experimental research methods do not involve manipulation of variables. Nevertheless, these methods can provide valuable insights into research topics and can be especially useful when experiments are not appropriate or practical.

The non-experimental methods you need to know about are

- Correlations
- Self-report techniques: Interviews and questionnaires
- Observations
- Case Studies
- Content analysis

} Year 2

Correlations

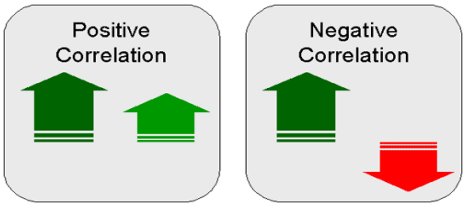
Strictly speaking, correlation is a method of analysis rather than a research method.The term 'correlation' refers to the **relationship** between two variables where **changes in one variable go along with changes in the other** (they '*co-relate*'). These variables, the things that are being measured, are known as **co-variables** (note that there is no independent variable or dependent variable in a correlation).

For example, a researcher might want investigate whether more sociable people have more friends. The co-variables would be sociability (as measured on a numerical scale) and number of friends.

Put simply, correlational analysis is a mathematical technique for investigating whether there is an association between two variables. If a relationship exist, a correlation measures the **strength** and **direction** of the relationship.

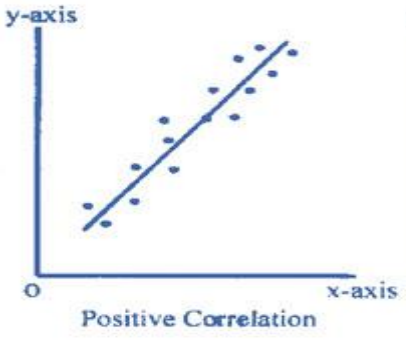
Types of correlation

A correlational analysis may reveal one of two types of correlation:

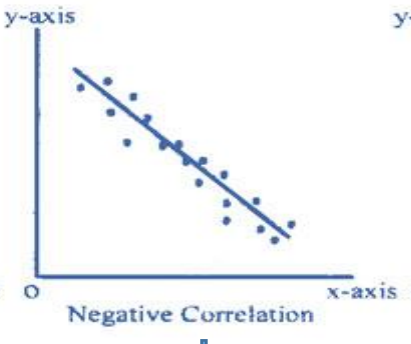


- A **positive correlation**: As one co-variable increases, so does the other.
- A **negative correlation**: As one co-variable increases, the other decreases.

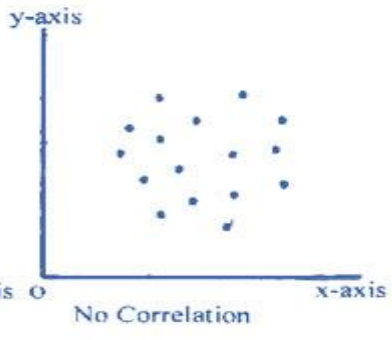
In addition, correlational analysis may show there is no correlation (or relationship) between variables. This is known as **a zero correlation**.



Example: as height increases, so does weight.

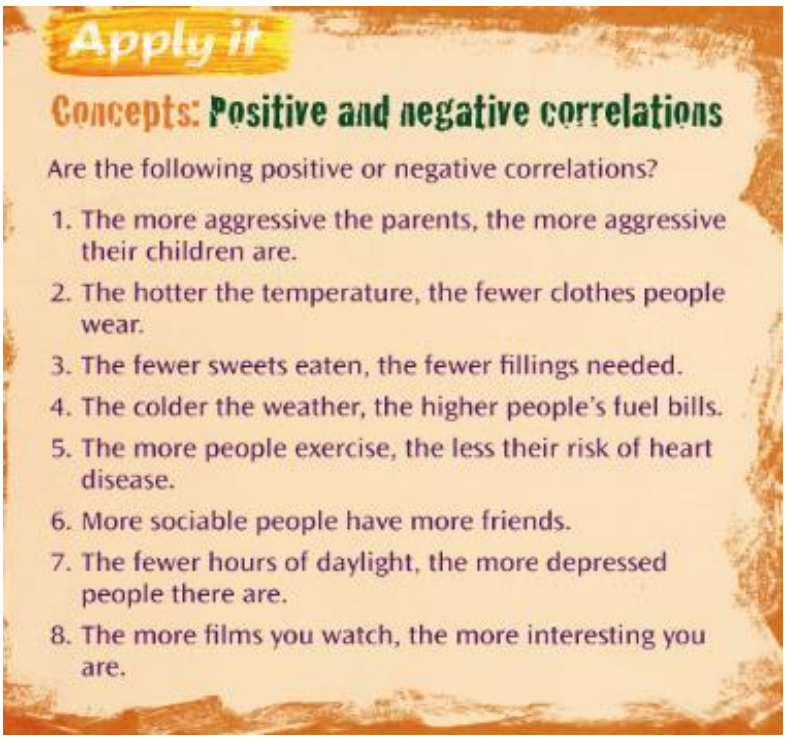


Example: the more caffeine drinks consumed, the fewer hours of sleep.



Example: there is no relationship between infant birth weight and maternal shoe size.

- **TASK 1: Complete the following 'Apply it' activity from the 'green-haired girl' book:**



Apply it

Concepts: Positive and negative correlations

Are the following positive or negative correlations?

1. The more aggressive the parents, the more aggressive their children are.
2. The hotter the temperature, the fewer clothes people wear.
3. The fewer sweets eaten, the fewer fillings needed.
4. The colder the weather, the higher people's fuel bills.
5. The more people exercise, the less their risk of heart disease.
6. More sociable people have more friends.
7. The fewer hours of daylight, the more depressed people there are.
8. The more films you watch, the more interesting you are.

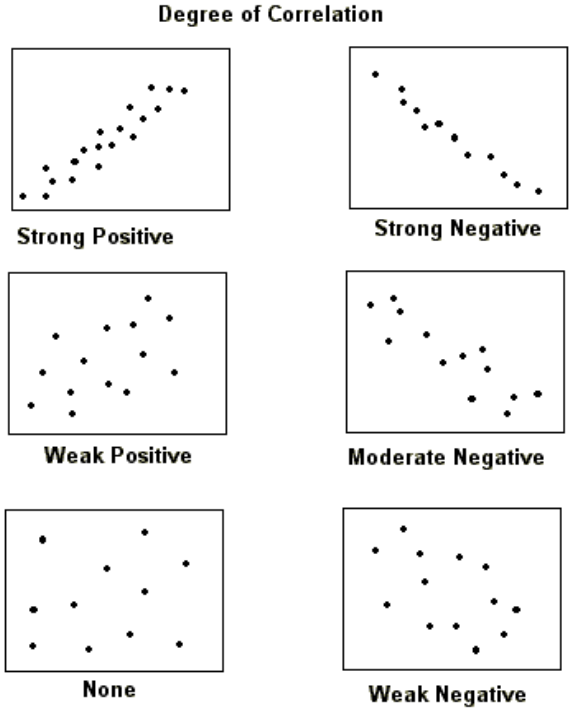
Scattergrams

Above are examples of scattergrams (sometimes called scattergraphs). These provide a graphic representation of a correlation.

Like means, medians and modes, scattergrams are a form of descriptive statistic - they *describe* the data from a study.

One co-variable forms the x-axis and the other the y-axis. Each dot on the graph is the x and y position of each co-variable.

The **closer** the points are **to a straight line**, the **stronger** the correlation.



Interpreting scattergrams

When interpreting scattergrams, **four pieces of information are needed**.

1. The **type** of correlation – positive, negative or zero correlation.
2. The **strength** of the correlation – strong, moderate, weak, etc.
3. An **explanation** of the correlation in plain English – e.g. ‘As height increases, weight increases.’
4. Any **anomalies** or a **change in direction**.

➢ **TASK 2: Answer the following question on scattergrams:**

A researcher believes that those people who are good at crosswords must have good verbal reasoning skills and sets out to see if this is true. She administers verbal reasoning tests to participants and measures their ability to do crosswords. The scores below show the results obtained:

	Score on verbal reasoning test	Score on ability to solve crossword clues
Participant 1	21	19
Participant 2	17	16
Participant 3	16	17
Participant 4	23	22
Participant 5	22	8
Participant 6	12	12
Participant 7	12	14
Participant 8	17	18
Participant 9	19	19
Participant 10	23	20

a. Draw a scattergram of the results, using a heading and clearly labeling the axes. (4 marks)

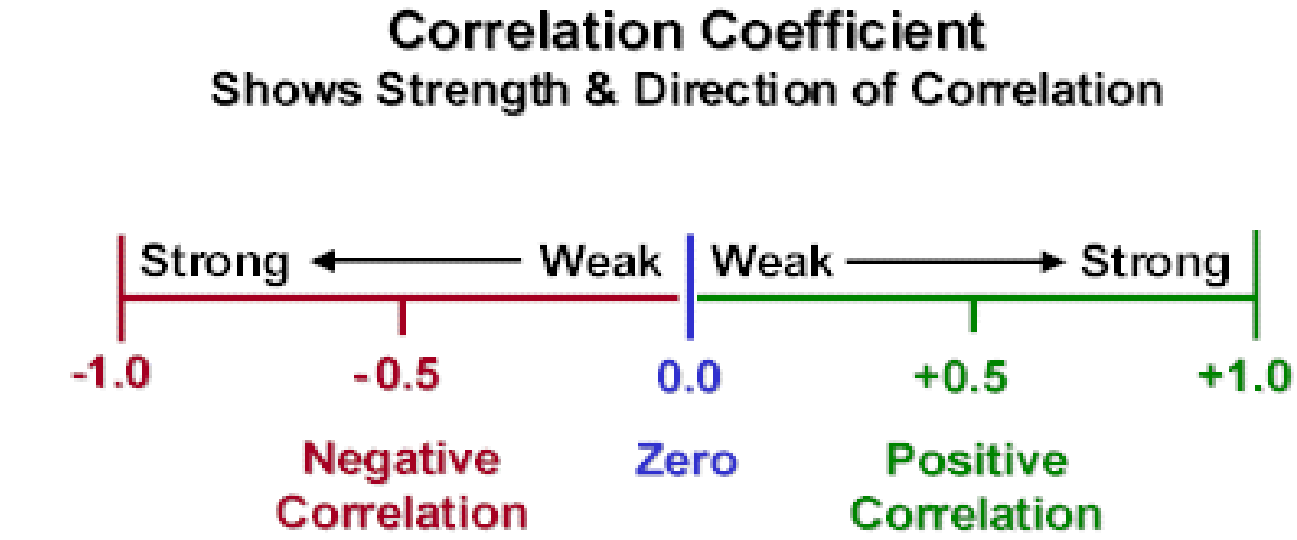
b. What conclusions can be drawn from examining the scattergram? (2 marks)

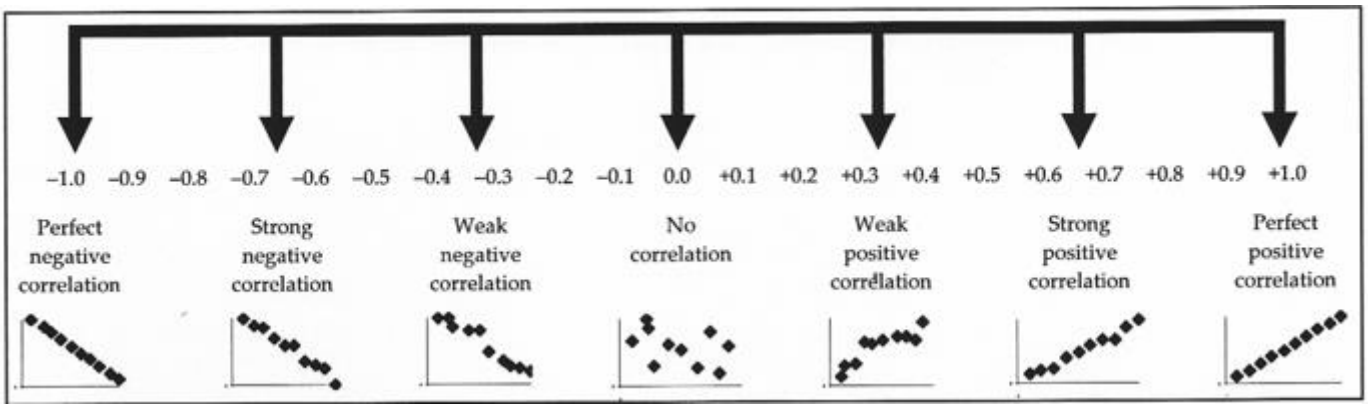
Correlation Co-efficients

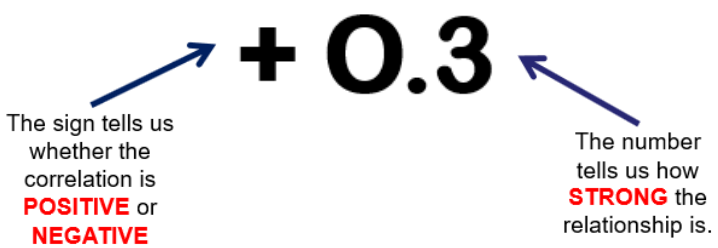
The strength and direction of a correlation can also be determined statistically, using a correlation co-efficient. You do not need to know how to calculate this for the exam, but you do need to know what a particular correlation co-efficient tells us.

Correlation co-efficients are measured on a scale from **-1 through to +1**.
-1 = a **perfect negative correlation**.
0 = no correlation.
+1 = a **perfect positive correlation**.

The **closer** the co-efficient is to **-1 or +1**, the **stronger** the relationship between the variables.

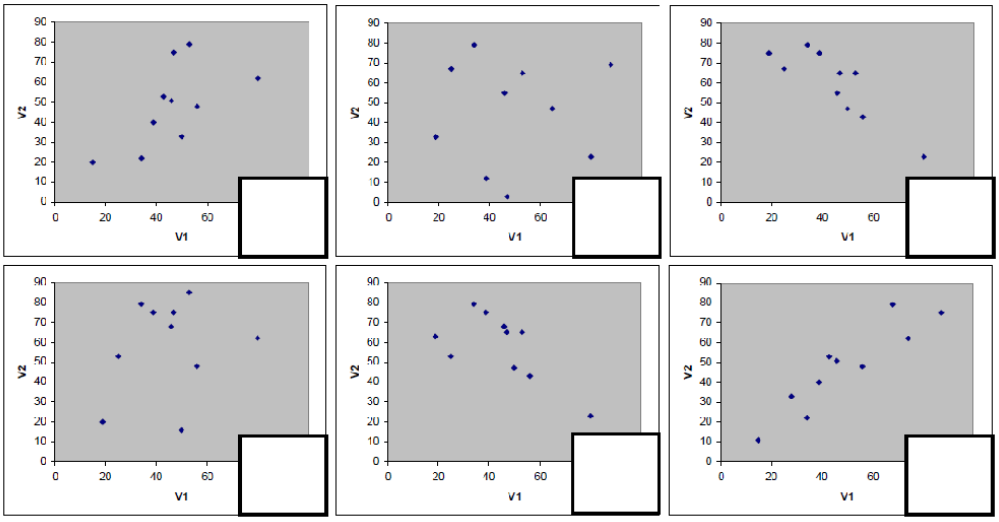






➢ **TASK 3: Match the scattergrams with the correlation co-efficients:**

+0.91 **+0.66** **-0.61** **+0.22** **-0.85** **+0.01**



Correlational hypotheses

While experimental hypotheses predict a difference between two sets of scores, correlational hypotheses predict a **relationship** or association between two variables.

Directional hypotheses for correlations state whether the relationship will be a **positive or negative correlation**.

For example:
'There will be a significant positive relationship between number of cups of coffee consumed and number of headaches.'

'There will be a significant negative correlation between temperature and sales of woolen jumpers.'

Non-directional hypotheses simply state that there will be a **correlation**.

For example:
'There will be a correlation between number of hours spent reading per week and I.Q. score.'

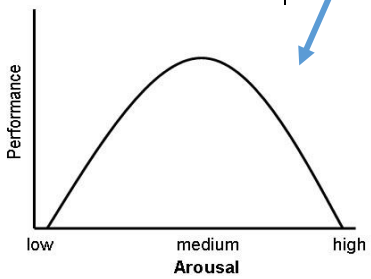
➢ **TASK 4: Write appropriately operationalised null and directional hypotheses for the following:**

a) The relationship between age and running speed over 100 metres.

b) Time taken to revise for a psychology mock exam and the score obtained.

Correlations – strengths and limitations

Strengths	Limitations
• **Relatively economical**. Unlike in a lab study, there is **no need for a controlled environment** and no manipulation is needed. When researchers make use of existing data, they are also less time-consuming than experiments. • **Can be used when it would be unethical or impractical to manipulate variables** (e.g. it would be unethical to conduct an experiment on whether smoking causes cancer). In such cases, researchers make use of existing data. • **If a correlation is significant then further investigation using an experiment may be justified**. If a correlation is not significant, then a causal relationship can be ruled out.	• **Correlation does not imply causation**. It does not tell us which co-variable may be causing the other to change. It may also be the case that another unknown, 'intervening variable' is causing the relationship between the co-variables. For example, researchers may observe a positive correlation between aggression in young children and time spent in daycare. It could be that family disturbance is the cause of children spending more time in daycare and behaving more aggressively. • **Can only measure linear relationships** (i.e. clear positive or negative correlations). It is less to detect curvilinear relationships where as one variable increases, so does the other variable, but only up to a certain point. After this point, as one variable continues to increase, the other decreases .



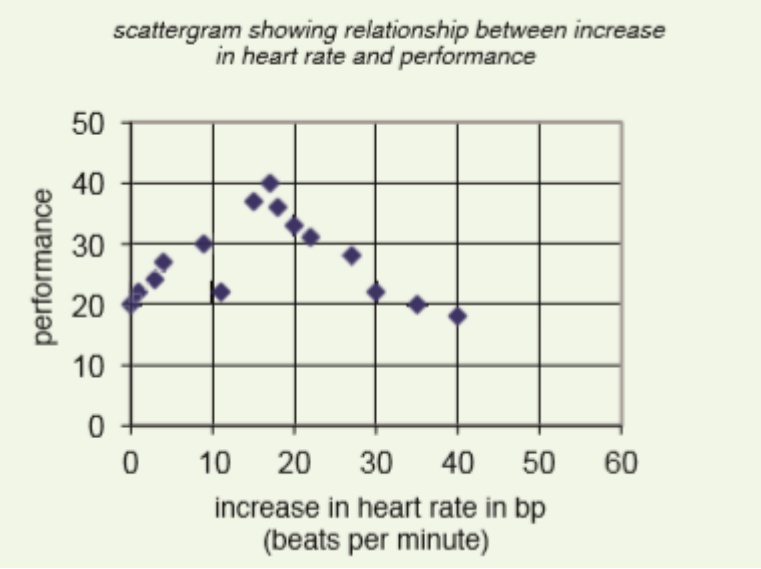
➢ **TASK 5: Answer the following exam-style question:**

Two students are in disagreement. Angie believes that only when people are very relaxed do they work well. Jasvinder argues that if you are too 'laid-back' you do not try very hard at all and therefore perform quite poorly.

In order to try to settle the argument, they decide to set up a correlational study looking at the relationship between arousal and performance. Performance is to be measured by asking participants to carry out a motor task as fast as possible in a limited amount of time. A score is awarded for the amount of accurate work done.

Arousal is to be measured by the increase in heart rate. Participants are fitted with a heart monitor and their heart rate is measured before the task begins and just as they finish it. The greater the increase in heart rate, the more aroused they are considered to be.

The scattergram on the next page shows the results obtained:



a. Describe the results shown in the scattergram. (4 marks)

b. One way of measuring correlation is to use a number known as a correlation coefficient. In this study the correlational coefficient is +0.13 which is almost a zero correlation. Why may this result be misleading? (2 marks)

c. Suggest one limitation of correlational studies.(2 marks)

d. Suggest one use of correlational data. (2 marks)