Data Handling and Analysis in Psychology

Welcome to this comprehensive guide on data handling and analysis for AQA A-Level Psychology. This presentation covers the essential statistical concepts and techniques required for understanding psychological research, from distinguishing between different types of data to performing basic statistical tests. Each section includes practice questions to test your knowledge and prepare you for examinations.

by Stephen Renwick

Quantitative and Qualitative Data

In psychological research, we distinguish between two fundamental types of data:

Quantitative Data

Numerical information that can be measured and expressed in numerical terms. Examples include reaction times, test scores, or rating scale responses.

Qualitative Data

Non-numerical information that describes qualities or characteristics. Examples include interview responses, observations of behaviour, or written accounts of experiences.

The distinction between these data types influences the collection techniques employed by researchers. Quantitative techniques typically involve structured methods like experiments or surveys with closed questions, while qualitative techniques include interviews, focus groups, and observation.

Question 1 (4 marks): Explain two differences between quantitative and qualitative data collection techniques in psychological research.

Primary and Secondary Data

Psychologists work with two sources of data:

Primary Data

Information collected firsthand by the researcher specifically for their study. Examples include:

- Experimental results
- Survey responses
- Interview transcripts
- Direct observations

Secondary Data

Pre-existing information collected by others for different purposes. Examples include:

- Published research papers
- Government statistics
- Clinical records
- Historical documents

Meta-analysis is a statistical technique that combines the results of multiple scientific studies addressing the same question, creating a more powerful and reliable conclusion than any single study can provide.

Question 2 (3 marks): Outline one advantage and one limitation of using secondary data in psychological research.

Question 3 (4 marks): Explain how meta-analysis contributes to the development of psychological knowledge.

Measures of Central Tendency

Mean

The arithmetic average of all values in a data set.

Calculation: Sum of all values ÷ Number of values

Example: For the data set {2, 4, 6, 8, 10}, the mean is (2+4+6+8+10) ÷ 5 = 30 ÷ 5 = 6

Median

The middle value when all data points are arranged in order.

Calculation: Arrange values in ascending order and find the middle value.

Example: For {2, 4, 6, 8, 10}, the median is 6 (the middle value)

Mode

The most frequently occurring value in a data set.

Calculation: Identify which value appears most often.

Example: For {2, 4, 4, 6, 8, 10}, the mode is 4 (appears twice)

Question 4 (6 marks): For the data set {3, 7, 7, 8, 9, 12, 15}, calculate the mean, median, and mode. (2 marks each)

Question 5 (4 marks): Explain one situation in psychological research where the median would be more appropriate than the mean as a measure of central tendency.

Measures of Dispersion

While measures of central tendency tell us about the typical value in a data set, measures of dispersion tell us about how spread out the data is:

Range

The difference between the highest and lowest values in a data set.

Calculation: Highest value - Lowest value

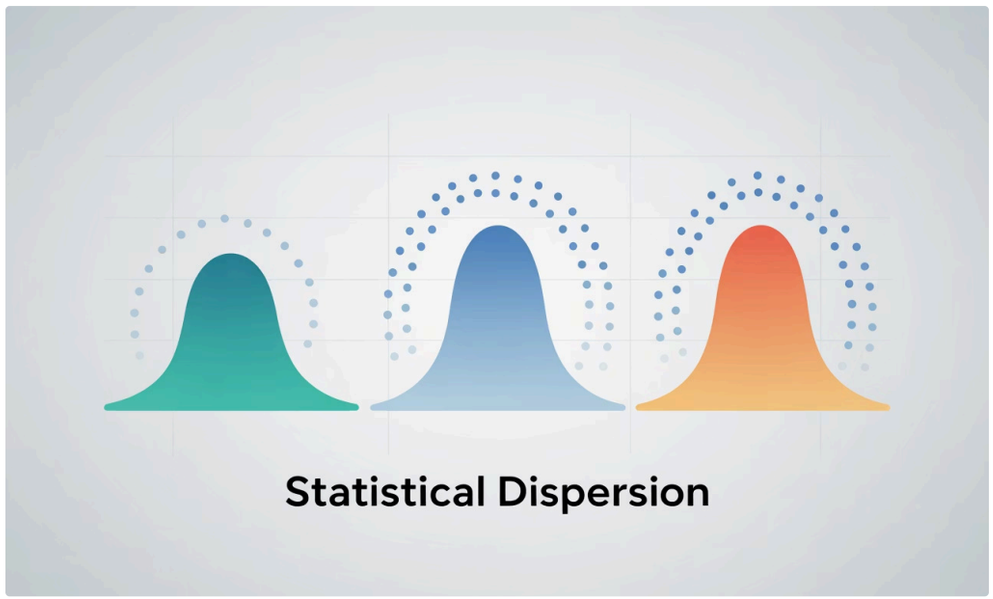
Example: For the data set {2, 4, 6, 8, 10}, the range is 10 - 2 = 8

Standard Deviation

A measure of how spread out values are from the mean.

Calculation steps:

1. Find the mean
2. Subtract the mean from each value and square the result
3. Find the mean of these squared differences
4. Take the square root of this mean

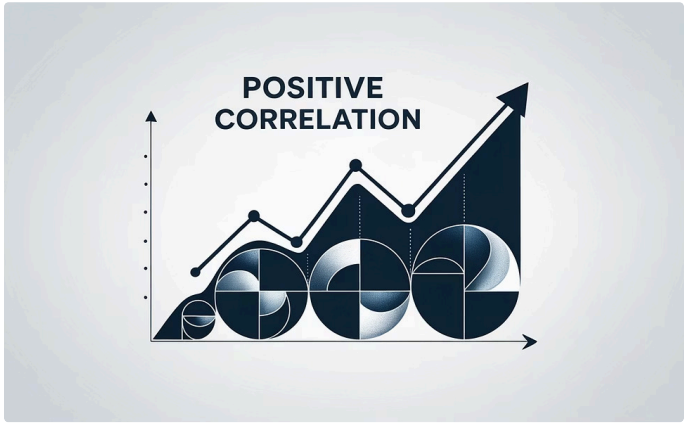


A small standard deviation indicates that data points tend to be close to the mean, while a large standard deviation indicates that data points are spread out over a wider range of values.

Question 6 (2 marks): Calculate the range for the data set {15, 18, 22, 25, 30, 32}.

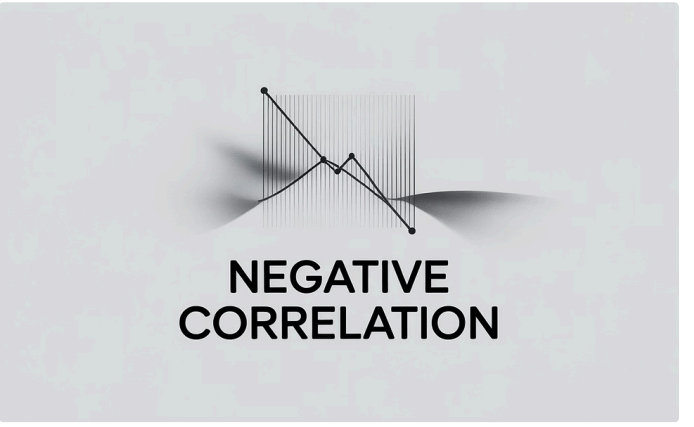
Question 7 (4 marks): Explain why standard deviation is generally considered a more informative measure of dispersion than range in psychological research.

Correlation



Positive Correlation

As one variable increases, the other variable also increases. Example: The relationship between study time and exam performance.



Negative Correlation

As one variable increases, the other variable decreases. Example: The relationship between stress levels and immune system functioning.

Zero Correlation

No consistent relationship between the two variables. Example: The relationship between eye colour and intelligence.

Correlation coefficients range from -1 (perfect negative correlation) through 0 (no correlation) to +1 (perfect positive correlation). It's crucial to remember that correlation does not imply causation; two variables may be related without one causing changes in the other.

Question 8 (6 marks): A psychologist found a positive correlation between social media use and anxiety levels in teenagers. Explain what this correlation means and discuss two possible interpretations of this relationship.

Presentation of Quantitative Data

Effective data presentation is crucial for communicating research findings. Psychologists use various methods to display quantitative data:

Tables

Organized arrangements of data in rows and columns, useful for presenting exact values and multiple variables.

Bar Charts

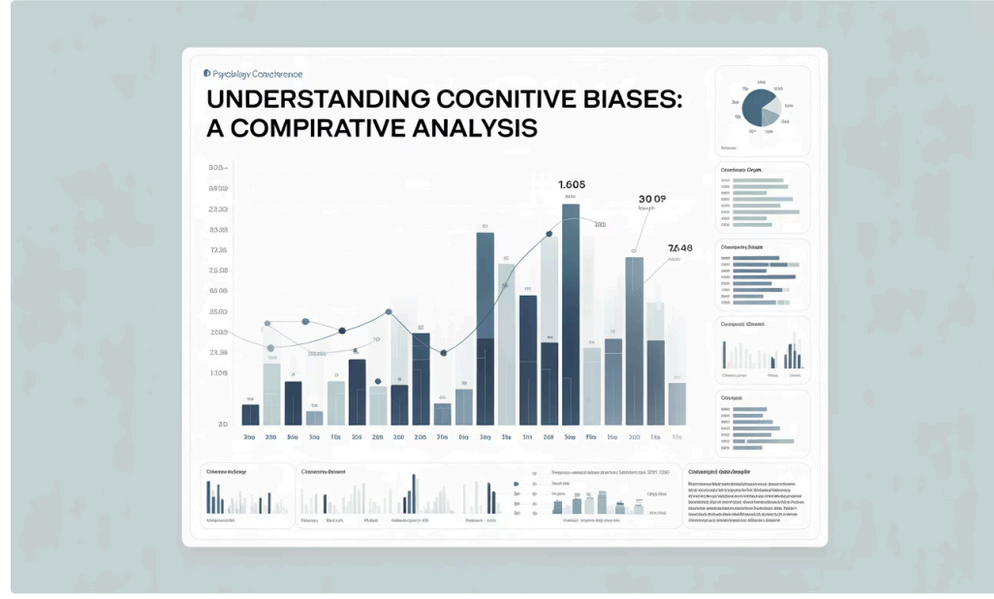
Rectangular bars with heights proportional to the values they represent, ideal for comparing discrete categories.

Scattergrams

Plots showing the values of two variables as points on a graph, used to visualize correlations.

Line Graphs

Points connected by lines, effective for showing changes over time or trends.



The choice of display method depends on the type of data and the message you want to convey. For instance, scattergrams are particularly useful for showing relationships between variables, while bar charts excel at comparing values across different categories.

Question 9 (4 marks): Explain which type of data display would be most appropriate for showing the relationship between hours of sleep and reaction time, and justify your answer.

Distributions

Normal Distribution

Characteristics:

- Bell-shaped, symmetrical curve
- Mean, median, and mode are all equal
- Most values cluster around the central point
- Approximately 68% of values fall within one standard deviation of the mean
- Approximately 95% of values fall within two standard deviations

Examples in psychology: IQ scores, reaction times in large samples, heights in a population

Skewed Distributions

Positively Skewed (right-skewed):

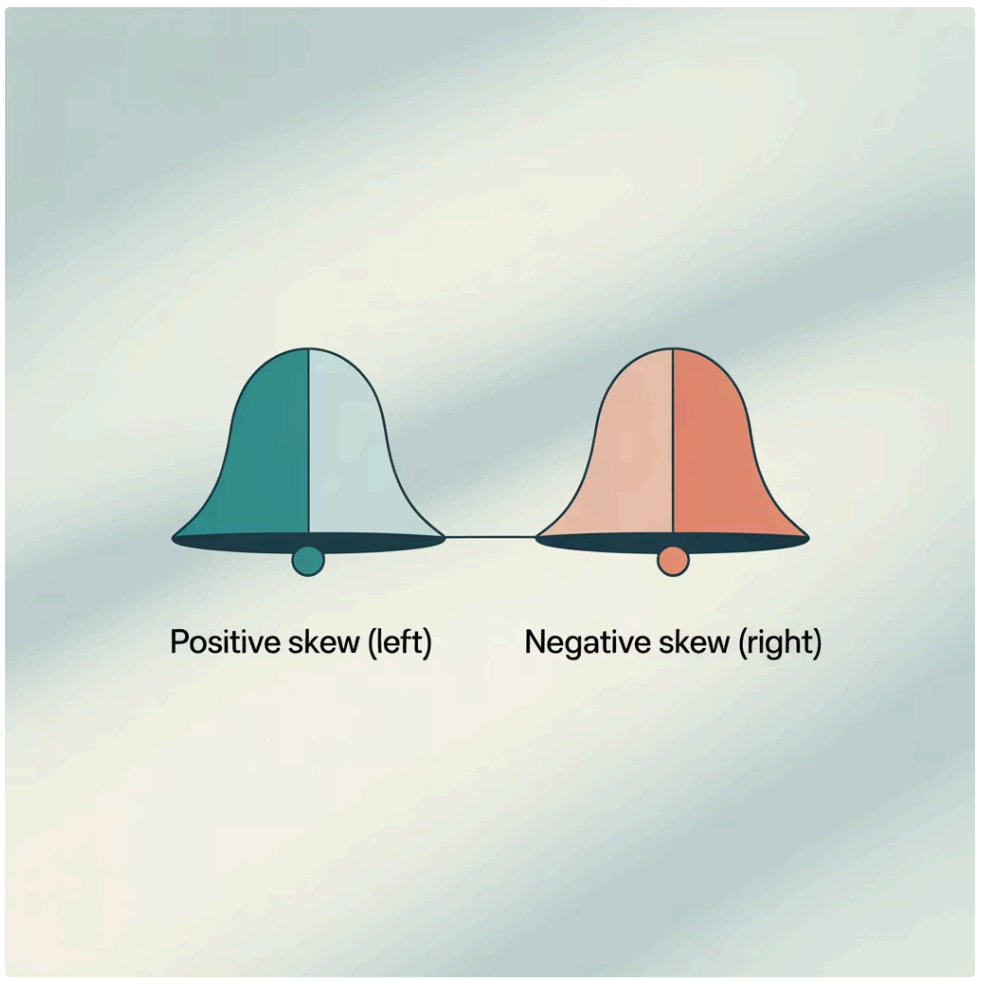
- Tail extends toward higher values
- Mode < Median < Mean

Examples: Reaction times, wealth distribution

Negatively Skewed (left-skewed):

- Tail extends toward lower values
- Mean < Median < Mode

Examples: Exam scores in easy tests, age at death



Question 10 (5 marks): Explain why reaction times in a psychological experiment typically show a positively skewed distribution rather than a normal distribution.

Introduction to Statistical Testing

Statistical tests help psychologists determine whether their results occurred by chance or represent genuine effects. The sign test is one of the simplest non-parametric tests used in psychology.

When to Use the Sign Test:

- When comparing two related conditions or matched pairs
- When data is at nominal or ordinal level
- When you're interested only in the direction of difference, not magnitude
- When sample sizes are small
- When assumptions for parametric tests are not met

Calculating the Sign Test:

1. For each pair of observations, note whether condition B is greater than (+), less than (-), or equal to (0) condition A
2. Discard any pairs with no difference (0)
3. Count the number of less frequent signs (either + or -)
4. Compare this value to the critical value in the sign test table for your sample size and significance level
5. If your calculated value is less than or equal to the critical value, the result is significant

Question 11 (6 marks): A psychologist tested whether a mindfulness intervention reduced anxiety levels in 10 participants. The number of participants showing reduced anxiety was 9, with 1 showing no change. Calculate the sign test and state whether this result is significant at $p < 0.05$.

Practice Questions and Next Steps

Review Key Concepts

Ensure you understand the distinction between different types of data, measures of central tendency and dispersion, and when to use various statistical tests.

Practice Calculations

Regularly practice calculating means, medians, modes, ranges, and standard deviations with different data sets. Also practice the sign test with various scenarios.

Apply to Research Methods

Connect statistical concepts to research design and methodology. Understand how data analysis informs conclusions in psychological research.

Question 12 (8 marks): A researcher conducted an experiment to investigate the effect of background music on memory recall. Ten participants completed a memory task in silence and then with background music. Explain how you would analyse the results using descriptive statistics and an appropriate statistical test. Justify your choices.

Remember that understanding data handling and analysis is fundamental to evaluating psychological research critically. These skills will serve you well throughout your A-Level Psychology course and beyond.