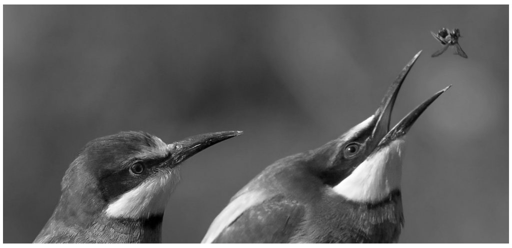
Summary & Conclusion



Lecture 10

Survey Research & Design in Psychology

James Neill, 2015

Overview

1. Survey research
2. Survey design
3. Descriptives & graphing
4. Correlation
5. Psychometric instrument development
6. Multiple linear regression
7. Power & effect sizes

Survey research

(Lecture 1)

Types of research

- **Types of research**:
  - Experimental
  - Quasi-experimental
  - Non-experimental
- Surveys are used in all types.

What is a survey?

- **What is a survey?**
  - A standardised stimulus for converting fuzzy psychological phenomenon into hard data.
- **History**
  - Survey research has developed into a popular research method since the 1920s.

Purposes of research

- **Purposes/goals of research**:
  - **Info gathering**
    - Exploratory
    - Descriptive
  - **Theory testing/building**
    - Explanatory
    - Predictive

Survey research

Survey research

Pros include:

- Ecological validity
- Cost efficiency
- Can obtain lots of data

Cons include:

- Low compliance
- Reliance on self-report

Survey design

(Lecture 2)

Survey types

Self-administered

Opposite for interview-administered surveys

- –**Pros**:
  - Cost
  - demand characteristics
  - access to representative sample
  - anonymity
- –**Cons**:
  - Non-response
  - adjustment to cultural differences, special needs

Survey questions

1. Objective vs. subjective questions
   - **1. Objective** – there is a verifiably true answer
   - **2. Subjective** – based on perspective of respondent
2. Open vs. closed
   - **1. Open** – empty space for answer
   - **2. Closed** – pre-set response format options

Level of measurement

1. Categorical/Nominal
   1. Arbitrary numerical labels
   2. Could be in any order

2. Ordinal
   1. Ordered numerical labels
   2. Intervals may not be equal

3. Interval
   1. Ordered numerical labels
   2. Equal intervals

4. Ratio
   1. Data are continuous
   2. Meaningful 0

Response formats

1. Dichotomous and Multichotomous
2. Multiple response
3. Verbal frequency scale (Never... Often)
4. Ranking (in order → Ordinal)
5. Likert scale (equal distances → Interval, typically with 3 to 9 options)
6. Graphical rating scale (e.g., line)
7. Semantic differential (opposing words)
8. Non-verbal (idiographic)

Sampling

1. Key terms
   1. (Target) population
   2. Sampling frame
   3. Sample
2. Sampling
   1. Probability
      1. Simple (random)
      2. Systematic
      3. Stratified
   2. Probability
      1. Convenience
      2. Purposive
      3. Snowball

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Descriptives & graphing
(Lecture 3)

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Steps with data

Spend '**quality time**' investigating (exploring and describing) your data

1. Get intimate (don't be afraid)
2. Check and screen the data
3. Explore, describe, and graph
4. Clearly report the data's main features

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Descriptive statistics

- **Level of measurement** and **normality** determines whether data can be treated as **parametric**
- What is the **central tendency**?
  - –Frequencies, Percentages
  - –Mode, Median, Mean
- What is the **variability**?
  - –Min, Max, Range, Quartiles
  - –Standard Deviation, Variance

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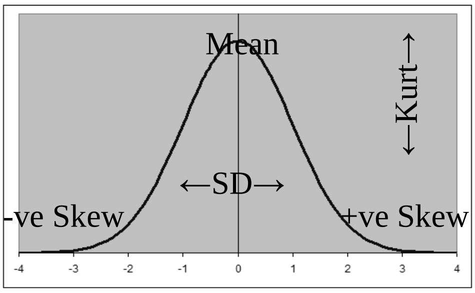
Normal distribution



Rule of thumb

Skewness and kurtosis in the range of -1 to +1 can be treated as approx. normal

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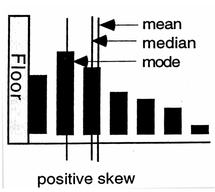
Skewness & central tendency

+vely skewed
mode < median < mean
Symmetrical (normal)
mean = median = mode
-vely skewed
mean < median < mode



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Principles of graphing

- Clear purpose
- Maximise clarity
- Minimise clutter
- Cleveland's hierarchy
  - Allow visual comparison

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Univariate graphical techniques

- Bar graph / Pie chart
- Histogram
- Stem & leaf plot
- Box plot (Box & whisker)
- Data plot / Error bar

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Correlation

(Lecture 4)

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Covariation

1. The world is made of covariations.
2. Covariations are the building blocks of more complex relationships which can be analysed through the use of:
   1. factor analysis
   2. reliability analysis
   3. multiple regression

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Purpose of correlation

1. Correlation is a standardised measure of the covariance (extent to which two phenomenon co-relate).
2. Correlation does not prove causation – may be opposite causality, bi-directional, or due to other variables.

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Types of correlation

- Nominal by nominal: Phi (Φ) / Cramer’s *V,* Chi-squared
- Ordinal by ordinal: Spearman’s rank / Kendall’s Tau *b*
- Dichotomous by interval/ratio: Point bi-serial r_{pb}
- Interval/ratio by interval/ratio: Product-moment or Pearson’s *r*

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Correlation steps

1. Choose measure of correlation and graphs based on levels of measurement.
2. Check graphs (e.g., scatterplot):
   - Linear or non-linear?
   - Outliers?
   - Homoscedasticity?
   - Range restriction?
   - Sub-samples to consider?

Correlation steps

3. Consider
   - Effect size (e.g., Φ, Cramer's *V*, *r*, r^2)
   - Direction
   - Inferential test (*p*)
4. Interpret/Discuss
   - Relate back to hypothesis
   - Size, direction, significance
   - Limitations e.g.,
     - Heterogeneity (sub-samples)
     - Range restriction
     - Causality?

Interpreting correlation

- Coefficient of determination
  - Correlation squared
  - Indicates % of shared variance

Strength	***r***	r^2
Weak:	.1 - .3	1 – 10%
Moderate:	.3 - .5	10 - 25%
Strong:	> .5	> 25%

Assumptions & limitations

1. Levels of measurement
2. Normality
3. Linearity
   1. Effects of outliers
   2. Non-linearity
4. Homoscedasticity
5. No range restriction
6. Homogenous samples
7. Correlation is not causation

Dealing with several correlations

- Correlation matrix
- Scatterplot matrix

Exploratory factor analysis
(Lecture 5)

What is factor analysis?

- Factor analysis is a family of multivariate correlational data analysis methods for summarising clusters of covariance.
- FA summarises correlations amongst items.
- The common clusters (called factors) are summary indicators of underlying fuzzy constructs.

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Assumptions

- Sample size
  - 5+ cases per variables (ideally 20+ cases per variable)
  - *N* > 200
- Bivariate & multivariate outliers
- Factorability of correlation matrix (Measures of Sampling Adequacy)
- Normality enhances the solution

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Steps / process

FAQ

1. Test assumptions
2. Select type of analysis
3. Determine no. of factors
   (Eigen Values, Scree plot, % variance explained)
4. Select items
   (check factor loadings to identify which items belong in which factor; drop items one by one; repeat)
5. Name and define factors
6. Examine correlations amongst factors
7. Analyse internal reliability
8. Compute composite scores

Lecture 6

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Types of FA

- **PAF** (Principal Axis Factoring): Best for theoretical data exploration
  - uses shared variance
- **PC** (Principal Components): Best for data reduction
  - uses all variance
- Consider trying both ways
  - Are solutions different? Why?

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Rotation

- Orthogonal (Varimax)
  - perpendicular (uncorrelated) factors
- Oblique (Oblimin)
  - angled (correlated) factors
- Consider trying both ways
  - Are solutions different? Why?

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Factor extraction

FAQ

How many factors to extract?

- Inspect EVs
  - look for > 1 or sudden drop (inspect scree plot)
- % of variance explained
  - aim for 50 to 75%
- Interpretability
  - does each factor 'make sense'?
- Theory
  - does the model fit with theory?

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Item selection

FAQ

An EFA of a good measurement instrument ideally has:

- a simple factor structure (each variable loads strongly (> +.50) on only one factor)
- each factor has at least 3 strongly loading variables (more loadings → greater reliability)
- factor loadings are high (> .6) or low (< .3) , with few intermediate values (.3 to .6).

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Psychometrics instrument development
(Lecture 6)

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What is psychometrics?

1. Science of psychological measurement
2. Goal: Validly measure individual psychosocial differences
3. Design and test psychological measures e.g., using
   1. Factor analysis
   2. Reliability and validity

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Concepts & their measurement

1. Concepts name common elements
2. Hypotheses identify relations between concepts
3. Brainstorm indicators of a concept
4. Define the concept
5. Draft measurement items
6. Pre-test and pilot test
7. Examine psychometric properties
8. Redraft/refine and re-test

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Measurement error

1. Deviation of measure from true score
2. Sources:
   1. Non-sampling (e.g., paradigm, respondent bias, researcher bias)
   2. Sampling (e.g., non-representativeness)
3. How to minimise:
   1. Well-designed measures
   2. Reduce demand effects
   3. Representative sampling
   4. Maximise response rate
   5. Ensure administrative accuracy

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Reliability

1. Consistency or reproducability
2. Types
   1. Internal consistency
   2. Test-retest reliability
3. Rule of thumb
   1. > .6 OK
   2. > .8 Very good
4. Internal consistency
   1. Split-half
   2. Odd-even
   3. Cronbach's alpha

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Validity

1. Extent to which a measure measures what it is intended to measure
2. Multifaceted
   1. Correlations with similar measures
   2. Performance in relation to other variables
   3. Predicts future

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Composite scores

Ways of creating composite (factor) scores:

1. **Unit weighting**
   1. Total of items or
   2. Average of items (recommended for lab report)
2. **Regression weighting**
   1. Each item is weighted by its importance to measuring the underlying factor (based on regression weights)

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Writing up instrument development

1. **Introduction**
   1. Review constructs & previous structures
   2. Generate research question
2. **Method**
   1. Explain measures and their development
3. **Results**
   1. Factor analysis
   2. Reliability of factors
   3. Descriptive statistics for composite scores
   4. Correlations between factors
4. **Discussion**
   1. Theory? / Measure? / Recommendations?

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Multiple linear regression

(Lectures 7 & 8)

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Linear regression

1. Best-fitting straight line for a scatterplot of two variables
2. Y = bX + a + e
   1. Predictor (X; IV)
   2. Outcome (Y; DV)
3. Least squares criterion
4. Residuals are the vertical distance between actual and predicted values

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Level of measurement and dummy coding

FAQ

1. Levels of measurement
   1. DV = Continuous
   2. IV = Continuous or dichotomous
2. Dummy coding
   1. Convert complex variable into series of dichotomous IVs

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Multiple linear regression

1. Multiple IVs to predict a single DV:

   $Y = b_1x_1 + b_2x_2 + ... + b_ix_i + a + e$

2. Overall fit: R, R^2, and Adjusted R^2
3. Coefficients
   1. Relation between each IV and the DV, adjusted for the other IVs
   2. B, β, t, p, and r_p
4. Types
   1. Standard
   2. Hierarchical
   3. Stepwise / Forward / Backward

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General steps

1. Develop model and hypotheses
2. Check assumptions
3. Choose type
4. Interpret output
5. Develop a regression equation (if needed)

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Summary: Semi-partial correlation (*sr*)

1. In MLR, *sr* is labelled "part" in the regression coefficients table SPSS output
2. sr^2 is the unique % of the DV variance explained by each IV

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Residual analysis

1. Residuals are the difference between predicted and observed Y values
2. MLR assumption is that residuals are normally distributed.
3. Examining residuals also helps assess:
   1. Normality
   2. Linearity
   3. Homoscedasticity

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Interactions

1. In MLR, IVs may interact to:
   1. Increase effect on DV
   2. Decrease effect on DV
2. Model interactions with hierarchical MLR:
   1. Step 1: Enter IVs
   2. Step 2: Enter cross-product of IVs
   3. Examine change in R^2

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Analysis of change

Analysis of changes over time can be assessed by:

1. Standard regression
   1. Calculate difference scores (Time 2 minus Time 1) and use as DV
2. Hierarchical MLR
   1. Step 1: "Partial out" baseline scores
   2. Step 2: Enter other IVs to help predict variance in changes over time.

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Writing up an MLR

1. Introduction:
   1. Purpose
   2. Describe model and hypotheses
2. Results:
   1. Univariate descriptive statistics
   2. Correlations
   3. Type of MLR and assumptions
   4. Regression coefficients
   5. Equation (if appropriate)

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Power & effect size

(Lecture 9)

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Significance testing

1. Logic – At what point do you reject H_0?
2. History – Started 1920s & became popular
3. Criticisms – Binary, dependent on *N*, ES, and critical α
4. Practical significance
   1. Is an effect noticeable?
   2. Is it valued?
   3. How does it compare with benchmarks?

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Inferential decision making

		Reality	
		H_0 False	**H_0 True**
Test	**Reject H_0**	✔ Correct rejection H_0 = Power = 1 - β	✘ Type I error = α
	Accept H_0	✘ Type II error	✔ Correct acceptance of H_0

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Statistical power

1. Power = probability of detecting a real effect as statistically significant
2. Increase by:
   – ↑ N
   – ↑ critical α
   – ↑ ES

- Power
  – >.8 "desirable"
  – ~.6 is more typical
- Can be calculated prospectively and retrospectively

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Effect size

1. Standardised size of difference or strength of relationship
2. Inferential tests should be accompanied by ESs and CIs
3. Common bivariate ESs include:
   1. Cohen's *d*
   2. Correlation *r*

- Cohen's *d* - not in SPSS – use an online effect size calculator

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Confidence interval

1. Gives ‘range of certainty’
2. Can be used for *B*, *M*, ES
3. Can be examined
   1. Statistically (upper and lower limits)
   2. Graphically (e.g., error-bar graphs)

Publication bias

1. Tendency for statistically significant studies to be published over non-significant studies
2. Indicated by gap in funnel plot → file-drawer effect
3. Counteracting biases in scientific publishing; tendency:
   – towards low-power studies which underestimate effects
   – to publish sig. effects over non-sig. effects

Academic integrity

1. Violations of academic integrity are evident and prevalent amongst those with incentives to do so:
   1. Students
   2. Researchers
   3. Commercial sponsors
2. Adopt a balanced, critical approach, striving for objectivity and academic integrity

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