Summary & Conclusion

Image source: http://commons.wikimedia.org/wiki/File:Pair_of_merops_apiaster_feeding_cropped.jpg

Lecture 10

Survey Research & Design in Psychology

James Neill, 2017

Overview

1. Module 1: Survey research and design
    1. Survey research
    2. Survey design
2. Module 2: Univariate and bivariate
    1. Descriptives & graphing
    2. Correlation
3. Module 3: Psychometrics
    1. Exploratory factor analysis
    2. Psychometric instrument development
4. Module 4: Multiple linear regression
    1. MLR I
    2. MLR II
5. Module 5: Power & summary
    1. Power & effect sizes
    2. Summary and conclusion

Survey research

(Lecture 1)

Types of research

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

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 social science research method since the 1920s.

Purposes of research

- **Purposes/goals of research**:
    - **Information 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

7

Survey design

(Lecture 2)

8

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

9

Survey questions

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

10

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)
6. Graphical rating scale (e.g., line)
7. Semantic differential (opposing words)
8. Non-verbal (idiographic)

11

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

12

Sampling

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

Non-sampling biases

1. Acquiescence
2. Order effects
3. Fatigue effects
4. Demand characteristics
5. Hawthorne effect
6. Self-serving bias
7. Social desirability

Descriptives & graphing

(Lecture 3)

Getting to know data

- Play with the data
- Don't be afraid – you can't break data
- Check and screen the data
- Explore the data
- Get intimate with data
- Describe the main features
- Test hypotheses

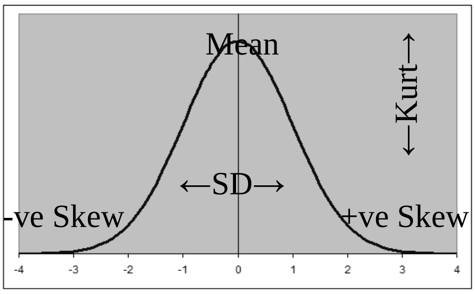
Summary: LOM & statistics

- If a normal distribution can be assumed, use parametric statistics (more powerful)
- If not, use non-parametric statistics (less power, but less sensitive to violations of assumptions)

Descriptive statistics

- What is the **central tendency**?
  - Frequencies, Percentages (Non-para)
  - Mode, Median, Mean (Para)
- What is the **variability**?
  - Min, Max, Range, Quartiles (Non-para)
  - Standard Deviation, Variance (Para)

Normal distribution



Rule of thumb

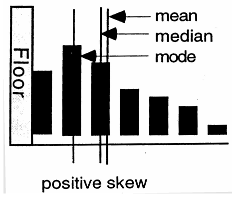
Skewness and kurtosis in the range of -1 to +1 can be treated as approx. normal

Skewness & central tendency

+vely skewed
mode < median < mean

Symmetrical (normal)
mean = median = mode

-vely skewed
mean < median < mode



Principles of graphing

- Clear purpose
- Maximise clarity
- Minimise clutter
- Allow visual comparison

Univariate graphs

- Bar graph
- Pie chart

} Non-parametric
i.e., nominal or ordinal

- Histogram
- Stem & leaf plot
- Data plot / Error bar
- Box plot

} Parametric
i.e., normally distributed interval or ratio

Correlation
(Lecture 4)

Covariation

1. The world is made of covariations.
2. Covariations are the building blocks of more complex multivariate relationships.
3. Correlation is a standardised measure of the covariance (extent to which two phenomenon co-relate).
4. Correlation does not prove causation - may be opposite causality, bi-directional, or due to other variables.

Purpose of correlation

The underlying purpose of correlation is to help address the question:

What is the

- **relationship** or
- **association** or
- **shared variance** or
- **co-relation**

between **two variables**?

25

What is correlation?

1. Standardised covariance
2. Ranges between -1 and +1, with more extreme values indicating stronger relationships
3. Correlation does not prove causation – may be opposite causality, bi-directional, or due to other variables.

26

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*

27

Correlation steps

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

28

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?

29

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%

30

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

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 into a smaller number of underlying fuzzy constructs (called factors).

Steps / process

1. Test assumptions
2. Select extraction method and rotation
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

Assumptions

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

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

Rotation

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

37

Factor extraction

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?

38

Item selection

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 multiple loading variables (more loadings → greater reliability)
- target factor loadings are high (> .6) and cross-loadings are low (< .3), with few intermediate values (.3 to .6).

39

Psychometrics instrument development
(Lecture 6)

40

Psychometrics

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

41

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

42

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

43

Reliability

1. Consistency or reproducibility
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

44

Validity

1. Extent to which a measure measures what it is intended to measure
2. Multifaceted
    1. Compare with theory and expert opinion
    2. Correlations with similar and dissimilar measures
    3. Predicts future

45

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)

46

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?

47

Multiple linear regression

(Lectures 7 & 8)

48

General steps

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

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

MLR assumptions

1. Level of measurement
2. Sample size
3. Normality
4. Linearity
5. Homoscedasticity
6. Collinearity
7. Multivariate outliers
8. Residuals should be normally distributed

Level of measurement and dummy coding

1. Levels of measurement
   1. DV = Continuous (Likert or ratio + normal)
   2. IV = Continuous or dichotomous
2. Dummy coding
   1. Convert complex variable into series of dichotomous IVs

General steps

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

Multiple linear regression

1. Multiple IVs to predict a single DV:

   $Y = b_1x_1 + b_2x_2 + \ldots + b_ix_i + a + e$
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 s*r2*
4. Types
   1. Standard
   2. Hierarchical
   3. Stepwise / Forward / Backward

Summary: Semi-partial correlation (*sr*)

1. In MLR, *sr* is labelled "part" in the regression coefficients table SPSS output
2. Square these values to obtain sr^2, the unique % of DV variance explained by each IV
3. Discuss the extent to which the explained variance in the DV is due to unique or shared contributions of the IVs

55

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. Linearity
   2. Homoscedasticity

56

Interactions

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

57

Analysis of change

Analysis of changes over time can be assessed by:

1. Standard regression
   1. Calculate difference scores (Post-score minus Pre-score) and use as a 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.

58

Writing up an MLR

1. Introduction
   1. Establish purpose
   2. Describe model and hypotheses
2. Results
   1. Univariate descriptive statistics
   2. Correlations
   3. Type of MLR and assumptions
   4. Regression coefficients
3. Discussion
   1. Summarise and interpret, with limitations
   2. Implications and recommendations

59

Power & effect size

(Lecture 9)

60

Significance testing

1. Logic – At what point do you reject H_0?
2. History – Started in 1920s & became very popular through 2nd half of 20th century
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?

61

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

62

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

63

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

64

Confidence interval

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

65

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:
   - low-power studies tend to underestimate real effects
   - bias towards publish sig. effects over non-sig. effects

66

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

Unit outcomes

Learning outcomes

1. Design and conduct survey-based research in psychology;
2. Use SPSS to conduct and interpret data analysis using correlation-based statistics, including reliability, factor analysis and multiple regression analysis;
3. Communicate in writing the results of survey-based psychological research

Graduate attributes

1. Display initiative and drive, and use organisation skills to plan and manage workload
2. Employ up-to-date and relevant knowledge and skills
3. Take pride in professional and personal integrity
4. Use creativity, critical thinking, analysis and research skills to solve theoretical and real-world problems

Feedback

- What worked well?
- What could be improved?
- Direct feedback (e.g., email, discussion forum)
- Interface Student Experience Questionnaire (ISEQ).

Open Office Impress

- This presentation was made using Open Office Impress.
- Free and open source software.
- http://www.openoffice.org/product/impress.html