Introduction to Quantitative Questionnaire Study

Lecture series: HOW TO GET A PH.D.: METHODS AND PRACTICAL HINTS

Lecturer:

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Structure:

1) The art of asking good questions
2) How to draft and organize a questionnaire
3) Sampling process and data collection
4) Basic analysis methods

Why is this important?

• Quantitative questionnaire survey is a good tool for analyzing human behavior and attitudes
• Facilitates the collection and analysis of large sample sizes
  ➔ Enables sample segmentation for deeper understanding of the underlying phenomenon
  ➔ Produces statistically significant results which can be generalized
Why is this important?

- The design and the implementation of the study is vital!!
  - Pitfalls:
    - Poor questionnaire design → useless data
    - Poor implementation → inadequate sample size, undesirable sample distribution

What type of info can be gathered:

- Info related to human behavior or population facts
- Info related to psychological states or attitudes
- Info related to knowledge
1) The art of asking good questions:

- You must ask the right questions
- Respondents must understand the questions
- Respondents must know the answers
- Respondents must be willing to answer the questions

ABC for writing questions:

Before writing questions:
A) Think through your research questions and objectives
B) Prepare a plan for data analysis

After the preliminary set of questions:
C) Ask yourself, in relation to A) and B) if each question on your list is necessary?
   - questions should be ultimately be used in analysis to make the cut!
   → “Nice to know” - data should not be gathered!
A good question…

1) yields a truthful, accurate answer
2) asks for one answer on one dimension
3) is easy to understand
4) has mutually exclusive response options
5) produces variability in responses

Ask one question at a time

• Bad Question:
  – “During the past week, have you used SMS and mobile data services?”

• Better question:
  – “During the past week, have you used:
    a) SMS services?
    b) Mobile data services?”
Don’t bias the respondent

• Bad question:
  – “During the past week, have you shopped in luxury stores such as Pertti Palmroth?”

• Better question:
  – “During the past week, have you shopped in the following stores:
    a) Pertti Palmroth?
    b) … “

Make sure the respondent knows the answer

• Bad question:
  – “How many text messages did you send last year?”

• Corrective measures:
  – Limit the time interval to more comprehensive one
  – Provide reasonable choice categories
Is the respondent willing to answer?

- In the extreme: no responses
  - “Have you ever broken the law?”
- In general: problem with social desirability
  - Respondents will try to represent themselves in a way that reflects positively on them
  - As questions become more threatening, respondents are more likely to overstate or understate behavior, even when the best question wording is used

Social desirability

- For socially desirable behavior, it is better to ask whether respondents have ever engaged in the behavior before asking whether they currently engage in the behavior
- For socially undesirable behavior, it is better to ask about current behavior first, rather than ask about their usual or typical behavior
2) How to draft and organize a questionnaire:

- Open vs. Closed questions
  - In general, closed questions are better
    - easier for respondents, less coding, categorizing of answers
    - limits spontaneity, may lead to casual responses
- Questions involving choices
  - Dichotomous questions
    - Two choices (yes/no)
    - May limit the analysis
  - Response scales
    - Most common ones: 1-5, 1-7 (Likert scales)
      - "Strongly disagree, ..., Strongly agree"
    - "Not at all important, ..., Very important"
    - Associate greater response levels with greater numbers
  - Multiple choice questions
    - "Which appliances have you used today? TV, Radio, Mobile phone, ..."

Ordering of Questions:

Cover letter/introduction before questions!
- purpose of the questionnaire, who is conducting the study, how will the data be used, (possible) incentives to participate

1) "Warm-up" questions
   - Easy to answer, non-threatening
2) Questions related to research objectives
   - Easier ones first
     1) Questions about behavior
     2) Questions about knowledge
     3) Questions about attitudes
3) Demographic questions
   - Age, gender, education, income, address, etc.
Response rate

- Varies considerably
  - In general ~30%
  - Even 20% can be considered adequate
  - May be as high as 80%
- Ways to enhance:
  - Good cover letter
  - Good incentives
  - Follow-up
    - OBS: in case of follow-up study, non-response bias must be checked.
    - Chi-square –test for the two response groups

CONDUCT A PILOT TEST BEFORE THE ACTUAL STUDY!!!
3) Sampling process and data collection

- The objective of most questionnaire studies is to gain information related to a population
  - Population = a set of entities concerning which statistical inferences are to be drawn
  - Sample = a subject chosen from a population for investigation

Sampling process

1) Define the target population
2) Define the data collection method
3) Define the sampling frame
4) Define the Sampling method
5) Define the required sample size
6) Implementation of the study
Sample size

- Depends on the purpose of the study:
  - Market potential (500 →)
  - Product test (300 – 500)
  - Advertising research (200 – 500)
  - Attitudes, behavior (100 to thousands, depending on the population definition)

Sampling methods

- Non-probability sampling:
  - Convenience sampling
  - Judgment sampling
  - Quota sampling

- Probability sampling:
  - Random sampling
  - Systematic sampling
  - Stratified sampling

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4) Basic analysis methods

Process of the analysis:

1) Validate the responses
2) Code the responses
3) Input the data into a database
4) Check the data
5) Statistical analysis

Descriptive analysis

- Frequency distributions
  - Basic statistics:
    - Mean
    - Mode
    - Variance
    - Skewness
Comparison of groups

- t-test
  - Compares the means of two groups (e.g. men and women)

- F-test
  - Compares the variances of two groups

- A chi-square test
  - any statistical hypothesis test in which the test statistic has a chi-square distribution when the null hypothesis is true
  - Specifically, a chi-square test for independence evaluates statistically significant differences between proportions for two or more groups.

- One-way ANOVA (Analysis of Variance)
  - Used to test for differences among three or more independent groups
Example t-test for equality of means

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>You were using</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In my opinion, the system is useful</td>
<td>167</td>
<td>4.98</td>
<td>1.386</td>
</tr>
<tr>
<td>A borrowed mobile phone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your own mobile phone</td>
<td>45</td>
<td>4.90</td>
<td>1.421</td>
</tr>
<tr>
<td>Using the system was beneficial to me</td>
<td>161</td>
<td>4.11</td>
<td>1.525</td>
</tr>
<tr>
<td>A borrowed mobile phone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your own mobile phone</td>
<td>45</td>
<td>3.38</td>
<td>1.723</td>
</tr>
<tr>
<td>I am going to use a similar system also in the future</td>
<td>144</td>
<td>4.77</td>
<td>1.599</td>
</tr>
<tr>
<td>A borrowed mobile phone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your own mobile phone</td>
<td>44</td>
<td>5.05</td>
<td>1.765</td>
</tr>
<tr>
<td>Using the system was clear</td>
<td>167</td>
<td>4.00</td>
<td>1.501</td>
</tr>
<tr>
<td>A borrowed mobile phone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your own mobile phone</td>
<td>46</td>
<td>3.78</td>
<td>1.812</td>
</tr>
<tr>
<td>The system was easy to use</td>
<td>166</td>
<td>4.04</td>
<td>1.629</td>
</tr>
<tr>
<td>A borrowed mobile phone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your own mobile phone</td>
<td>49</td>
<td>5.53</td>
<td>1.815</td>
</tr>
<tr>
<td>I am satisfied with using the system</td>
<td>164</td>
<td>4.24</td>
<td>1.347</td>
</tr>
<tr>
<td>A borrowed mobile phone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your own mobile phone</td>
<td>42</td>
<td>3.81</td>
<td>1.435</td>
</tr>
</tbody>
</table>

Levene's Test for Equality of Variances

<table>
<thead>
<tr>
<th></th>
<th>Equal variances assumed</th>
<th>Equal variances not assumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>In my opinion, the system is useful</td>
<td>90.2, 3.795</td>
<td>1.617, 2.102</td>
</tr>
<tr>
<td>Using the system was beneficial to me</td>
<td>164.7, 1.717</td>
<td>2.772, 2.085</td>
</tr>
<tr>
<td>I am going to use a similar system also in the future</td>
<td>2,262, 1.276</td>
<td>2.890, 2.610</td>
</tr>
<tr>
<td>The system was easy to use</td>
<td>90.2, 3.795</td>
<td>1.617, 2.102</td>
</tr>
<tr>
<td>I am satisfied with using the system</td>
<td>6.746, 0.211</td>
<td>8.307, 0.821</td>
</tr>
</tbody>
</table>
Dependency between variables

• Correlation
  – a measure of the relation between two or more variables
  – Spearman, Pearson, Canonic, ....
  – Values between -1, ..., 1

• Regression analysis
  – Dependency between an independent and explanatory variables
  – Linear, logistic
  – Regression equation depicts the causal relationships between the variables
    • Statistical measures: R2(model fit), beta coefficients (dependency measures)
    • Possible problems: Multicollinearity, Autocorrelation

Example regression tables
Factor analysis

- Factor analysis is a statistical data reduction technique used to explain variability among observed random variables in terms of fewer unobserved random variables called factors.

- Two types:
  - Exploratory factor analysis (EFA) could be described as orderly simplification of interrelated measures. EFA, traditionally, has been used to explore the possible underlying factor structure of a set of observed variables without imposing a preconceived structure on the outcome
  - Confirmatory factor analysis (CFA) is a statistical technique used to verify the factor structure of a set of observed variables. CFA allows the researcher to test the hypothesis that a relationship between observed variables and their underlying latent constructs exists.

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olento ystävän laitteen tarjoaminen palveluista laajon ja laiteen lähiössä</td>
<td>0.469</td>
<td>0.032</td>
<td>0.130</td>
<td>0.271</td>
<td>-0.241</td>
</tr>
<tr>
<td>Käyttö vastaa käyttäjän hyövön ja taiton liityntä</td>
<td>0.832</td>
<td>0.056</td>
<td>0.257</td>
<td>0.356</td>
<td>-0.532</td>
</tr>
<tr>
<td>Käyttö luonut mielityötävän henkilöllisyyden</td>
<td>0.625</td>
<td>0.105</td>
<td>0.141</td>
<td>0.320</td>
<td>-0.402</td>
</tr>
<tr>
<td>Mobilin annosten edistäminen ja informatiivi palvelusta</td>
<td>0.601</td>
<td>0.206</td>
<td>0.070</td>
<td>0.553</td>
<td>-0.146</td>
</tr>
<tr>
<td>Terveen ja asianmukaan palvelut laajon ja laiteen lähiössä</td>
<td>0.977</td>
<td>0.926</td>
<td>0.122</td>
<td>-0.192</td>
<td>-0.082</td>
</tr>
<tr>
<td>Tietoa on ja on tietystä</td>
<td>-0.011</td>
<td>0.899</td>
<td>0.121</td>
<td>0.207</td>
<td>-0.101</td>
</tr>
<tr>
<td>Mahdollinen ja asiakas</td>
<td>0.080</td>
<td>0.794</td>
<td>0.248</td>
<td>0.556</td>
<td>-0.163</td>
</tr>
<tr>
<td>Käsi avoimia tietoa</td>
<td>0.033</td>
<td>0.772</td>
<td>0.047</td>
<td>0.364</td>
<td>-0.366</td>
</tr>
<tr>
<td>Sain ennen käyttää</td>
<td>0.214</td>
<td>0.081</td>
<td>0.945</td>
<td>0.868</td>
<td>-0.190</td>
</tr>
<tr>
<td>Sain ennen käyttää</td>
<td>0.133</td>
<td>0.096</td>
<td>0.944</td>
<td>-0.017</td>
<td>-0.142</td>
</tr>
<tr>
<td>Ongelmistaksepahaista olenevat</td>
<td>0.002</td>
<td>0.267</td>
<td>0.603</td>
<td>0.205</td>
<td>-0.259</td>
</tr>
<tr>
<td>Lähteet helpottavat olennä</td>
<td>0.278</td>
<td>0.167</td>
<td>0.059</td>
<td>0.842</td>
<td>-0.181</td>
</tr>
<tr>
<td>Oksa, että päämäärässä ja asiakastukeessa palvelusta olon hyväksi</td>
<td>0.182</td>
<td>0.203</td>
<td>0.134</td>
<td>0.221</td>
<td>-0.287</td>
</tr>
<tr>
<td>Lähteet helpottavat kunnostamista</td>
<td>0.404</td>
<td>0.156</td>
<td>0.112</td>
<td>0.803</td>
<td>-0.182</td>
</tr>
<tr>
<td>Laitteen asuun saa hyvää tietoa</td>
<td>0.341</td>
<td>0.194</td>
<td>0.171</td>
<td>0.802</td>
<td>-0.327</td>
</tr>
<tr>
<td>Käyttöliittymä on selkeä ja helppohoidon</td>
<td>0.182</td>
<td>0.229</td>
<td>0.166</td>
<td>0.299</td>
<td>-0.856</td>
</tr>
<tr>
<td>Palveluvahvistossa olkaa manual aloilla</td>
<td>0.474</td>
<td>0.019</td>
<td>0.298</td>
<td>0.315</td>
<td>-0.773</td>
</tr>
<tr>
<td>Käytöllistaksepahaista olenevat</td>
<td>0.496</td>
<td>0.274</td>
<td>0.207</td>
<td>0.132</td>
<td>-0.754</td>
</tr>
<tr>
<td>Palveluset on mahtavaa kännykkä</td>
<td>0.669</td>
<td>0.108</td>
<td>0.300</td>
<td>0.468</td>
<td>-0.698</td>
</tr>
</tbody>
</table>
Recap: Steps in conducting a quantitative questionnaire study

- Decide what information is needed
- Design the questions carefully
- Pilot test the questionnaire
- Plan the implementation carefully
  - Population, sample size
- Choose the relevant analysis SW and statistics
- Report your findings and submit to journals!

References: