Do's and don'ts in the data-analysis process and reporting of the results thereof

Focus Balkans training
Belgrade, January 31st, 2011

Ivo van der Lans
Marketing and Consumer Behaviour Group

SOCIAL SCIENCES GROUP
WAGENINGEN UR

FOCUS
FOOD CONSUMER SCIENCE IN THE BALKANS

Who am I?

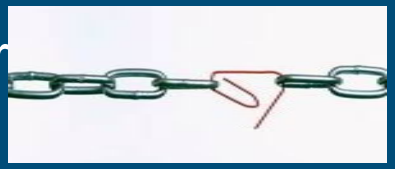
- Assistant professor
  - Teaching
    - Research Methodology in Social Sciences (BSc-, MSc-, and PhD-level, mainly quantitative)
    - Consumer Behaviour (BSc- and MSc-level)
    - MSc- and PhD-theses
  - Consultation on quantitative research methodology
  - Research interests
    - Advanced quantitative research techniques and their application in research in marketing and consumer behaviour
    - Consumer preferences for, and perception of food products
- Since 1986, … via Leiden University, Technical University Eindhoven, Ministry of Finance, Wageningen University

Who am I? … Research projects

- ISAfruit, EU-project: Pillar 1, Consumer-driven and responsive fruit supply chains
- Consumer perceptions of nutrition and health claims
- Consumer acceptance of GM pork and other pork production characteristics
- Factors underlying corpulence in China
- Consumer evaluations of (communication about) risk-management practices
- Contribution of trust in organizations contribute to consumer confidence in food safety
- Preferences of Nile-perch chain partners for different kinds of contracts
- Preferences of coop members for coop governance structures
- Preferences of pine-apple chain partners for pine-apple characteristics
- Equivalence of an instrument to measure constructs underlying people's food choices across different countries and conditions
- Link between pricing strategies and price practices
- Pegasus, EU-project: meta analysis acceptance of GM animal
- Using 'Bayesian' methods to include expert knowledge on genomes in analyses identifying optimal tomatoes from the perspective of consumer preferences
- Effect of questionnaire formats on results and conclusions

From my sneak preview of Steve's slides

- Good quality research
  - *Precision* (also called *reliability*):
    how stable are the results under replications of the study?
  - *Accuracy* (also called *validity*):
    do we measure what we want to measure?
  - Sampling versus non-sampling error



- Social sciences research
  - the objective of the research is to identify and quantify all the factors?
  - keeping all other factors constant?

Increase reliability and validity: Study design

- Many constructs escape simple, direct measurement
  - innovativeness, need for cognition, attitude, brand loyalty, trust in food safety, knowledge, satisfaction with food-related life
  - SOLUTION: use multiple items that cover different aspects of the construct
  - long tradition in multi-item scale development

Increase reliability and validity: Study design

Example: Grunert et al. (2007): Satisfaction with food-related life

One item (Disagree 1 – Agree 7)

- I am satisfied with my food-related life

Multiple items (Disagree 1 – Agree 7)

- My life in relation to food and meals is c
- With r of m
- I am g
- Food a n in
- Food a nts in my life
- When only
  disapp
- I wish my meals were a much more plea

Random error on individual statements is cancelled out

➔increases reliability

➔increases validity

Specificity of individual items is cancelled out

➔increases validity

Finer grained scale

➔increase reliability

➔increases validity

Increase reliability and validity: Study design

- Many conditions escape unique operationalization
  - nutrition and health claims, balancedness of communication about risks and benefits of novel food technologies
  - SOLUTION: operationalize each condition in multiple ways (method triangulation)
- Rossiter (2002). C-OAR-SE procedure

Increase reliability and validity: Study design

- Pretest (with few respondents from target population)
  - Check for correct understanding
  - Check for task difficulty
  - Check for respondent interest and attention
  - Test duration
- Pilot study (with small sample from target population)
  - Check for variation in answers
  - Check for quality of scales (cross-cultural research)
  - Test duration

Increase reliability and validity: Data screening

- What to do with?

  - omissions (response errors)
  - ambiguities (remember the US-president elections: what is a hole?)
  - inconsistencies
  - lack of cooperation (nonresponse errors, imputation?)
  - ineligible respondents (sampling frame error)

Increase reliability and validity: Data screening

- Rule for structure of the data file
  - make sure that all observations and all answers to the questions in the questionnaire can be retrieved from the data file

- Check, check, check for inadmissible codes, distributions, outliers, missing data and so on, for each and every variable
  - discrete scale: frequency table
  - continuous scale: descriptive statistics, Box plot
  - also/especially, in case of secondary data

Producing and reporting results

- Choose technique based on research questions and characteristics of the data
- Check assumptions
- Run the analysis
- Interpret the results
  - overall results (something is going on somewhere)
  - more detailed results (what is going on)
  - statistical significance (p-value, type-I error α)
  - practical relevance (means, percentages, R^2, partial η^2, Cramer's V, etc.)

Producing and reporting results

- Process of data analysis is far from objective: subjective choices have to be made
  - just like the process of designing the study
- The more complicated the technique
    - e.g., multiple regression analysis, factor analysis, structural equation modeling, (in-)finite mixture models, multilevel models ...
  - the more (substantiated) subjective choices need to be made
  - the more data-analysis experts differ in opinion
- Statistical computer programs do have their default options/choices, but … it is YOUR responsibility (and you'll have to defend them)

Producing and reporting results

- ‘Analysis triangulation’
  - if probably useful, run analysis with different choices
  - if probably useful, run different analyses
- Distinguish between
  - what is necessary, so that you understand what is going on?
  - what can you best present to your audience to inform/convince them of what is going on (according to you)
    - scientific integrity ! (Steve: “if I was to stand up ...”)

Guarantee for success stops at the door

- Reviewer's comments on paper including confirmatory factor analysis
  - this paper is unsuitable for the Journal of …, mainly because it is too statistical …. and does not address conceptual issues relating to health, risk and society
  - the statistics are too complex … and not sufficiently explained

Guarantee for success stops at the door

- Reviewer's comments on paper including GLM;
  - this paper is unsuitable for the Journal of …, mainly because it uses a too complex model …. and does not address the conceptual issues in model selection.
  - the statistics presented are way too complicated the journal. The authors may resubmit only if they write an introduction section to the method used.

Guarantee for success stops at the door

- Reviewer's comments on paper including GLM;
  - this paper is unsuitable for the Journal of …, mainly because it uses a too simple model …. and does not address the conceptual issues in model selection.
  - the statistics presented are a good start but the authors ignore the (lack of) robustness of their methods.

Guarantee for success stops at the door

- **Reviewer:** “This can be done using more complex forms of analysis of variance or regression analysis (which would be my preference).”
- **Editor:** “In a methodological sense, there was also some concern over your approach. I agree that the use of ANOVA in this situation appears to make less sense than a regression-based approach. So I would advise you rethinking your analysis approach in line with the reviewers' comments.
- **Authors’ reply:** “We tested our hypotheses using analysis of variance, because we measured … at the categorical level: … The analyses of variances that we carried out, give (as predicted by theory, see Cohen and Cohen 1983) exactly the same results as regression analyses that we carried out in response to your comment, with appropriate specification of dummy predictor variables for the categorical variables. … we still feel it to be more natural to present the results in terms of analyses of variance, especially because the idea of posthoc comparisons fits in better with the tradition in analysis of variance.”

Producing and reporting results (unexpected support)

- !!!!!!!!!! TRANSPARANCY !!!!!!!! ... (and practical relevance)
  - e.g., Kashy, Donnellan, Ackerman, & Russell. (2009). Reporting and Interpreting Research in PSPB: Practices, Principles, and Pragmatics. *Personality and Social Psychology Bulleting, 35* (9), 1131-1142.
    - IF 2.575, Category: Social Psychology, rank 7 out of 50.
- http://www.youtube.com/watch?v=BPyvAtQYVok

The four rules of magic in data analysis

- **Don't** hesitate to do the same trick twice (with slightly different options)
- **Always** explain how you trick works (if not common knowledge; just explain what you did, got, and conclude; don't rewrite text books, but refer to them)
- **Always** explain preprocessing steps for your trick and how you entered your data into the technique (references typically not available)
- **Don't** rule out an unfamiliar way of analyzing your data (if it helps you to answer your research questions)

Good marketing research: criteria

- Scientific method
  - Use theory and sound arguments to formulate research models, and hypotheses to guide …
    data collection, data analysis, and interpretation
- Creativity (e.g. *question funneling*, nonexistent alternatives)
- Multiple methods (sources, ways of observing, (triangulation)
  - Convergence
  - Completeness
- Healthy skepticism
  - About existing 'knowledge'
  - About assumptions implicit in the research design
  - Indication of uncertainty in results and conclusions
- Recognition of the trade-off between value and costs
- Following ethical standards