DGB03 Introduction Design Research

Set Up of Studies

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Overview

• The research variables
• The research design
• Sample versus population

Reference: Research methodology – a step-by-step guide for beginners, Ranjit Kumar, 2005
Overview

• The research variables
• The research design
• Sample versus population
The research variables: Opinions

Opinions about the iPhone:

“The best phone that was ever made!!!”

“It is the best I ever had”

“It is overvalued by Apple freaks…”

“Frustrating and annoying!”

“The Phone is perfect!”

“Incredible!!”

“Incredible!!”

“After 3 days of use, returning to the store…”

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Concepts versus variables

Concept is a mental image or perception

Subjective Impression - No uniformity of understanding - Not measurable

Variable is a property that takes on different values

Measurable but degree of precision varies
Concepts versus variables: exercise

Concept or Variable?

Rich → Rich → Income

Health → Weight → Weight

Success iPhone → Success iPhone → Sales number
Types of variable

Different variable classifications:
1. The causal relationship
2. The unit of measurement
Types of variable: the causal relationship

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>Cancer</td>
</tr>
</tbody>
</table>

**Affecting variables**
- Age
- Exercise
- # Cigarettes

**Extraneous variable**
- Age
### Types of Variable: Unit of Measurement

<table>
<thead>
<tr>
<th>Categorical</th>
<th>Continuous</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constant</strong></td>
<td></td>
</tr>
<tr>
<td>1 value</td>
<td></td>
</tr>
<tr>
<td>water</td>
<td>yes/no</td>
</tr>
<tr>
<td>tree</td>
<td>good/bad</td>
</tr>
<tr>
<td>taxi</td>
<td>rich/poor</td>
</tr>
<tr>
<td>dog</td>
<td>day/night</td>
</tr>
<tr>
<td>...</td>
<td>male/female</td>
</tr>
<tr>
<td></td>
<td>hot/cold</td>
</tr>
<tr>
<td></td>
<td>...</td>
</tr>
<tr>
<td><strong>Dichotomous</strong></td>
<td></td>
</tr>
<tr>
<td>2 values</td>
<td></td>
</tr>
<tr>
<td>political parties</td>
<td>- labor</td>
</tr>
<tr>
<td></td>
<td>- liberal</td>
</tr>
<tr>
<td></td>
<td>- democrat</td>
</tr>
<tr>
<td>income</td>
<td>- high</td>
</tr>
<tr>
<td></td>
<td>- middle</td>
</tr>
<tr>
<td></td>
<td>- low</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td><strong>Polytomous</strong></td>
<td></td>
</tr>
<tr>
<td>&gt; 2 values</td>
<td>income ($)</td>
</tr>
<tr>
<td></td>
<td>age (years)</td>
</tr>
<tr>
<td></td>
<td>weight (kg)</td>
</tr>
<tr>
<td></td>
<td>temp. (°C)</td>
</tr>
<tr>
<td></td>
<td>...</td>
</tr>
</tbody>
</table>

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Variables: measurement scales

4 types of measurement scales:
1. Nominal or classificatory scale
2. Ordinal or ranking scale
3. Interval scale
4. Ratio scale
Nominal or classificatory scales

A nominal scale enables the classification of individuals, objects or responses based on a common/shared property or characteristic.

- Political Party:
  - CDA
  - PvdA
  - VVD
  - D66
  - ChristenUnie
  - Groenlinks
  - PVV

- How do you travel to work?
  - Car
  - Bike
  - Train
  - Other

- Gender:
  - Male
  - Female
Ordinal or ranking scales

A ordinal scale enables the classification of individuals, objects or responses based on a common/shared property or characteristic and it ranks the subgroups in a certain order.

Income:
- Below average
- Average
- Above average

Income:
- < €10.000
- €10.000-20.000
- €20.000-30.000
- > €30.000

Attitude:
- Favorable
- Uncertain
- Unfavorable
Interval scales

An interval scale enables the classification of individuals, objects or responses based on a common/shared property or characteristic and it ranks the subgroups in a certain order.

It uses a unit of measurement that enables the individual responses to be placed at equally spaced intervals in relation to the spread of the variable.

Attitudinal scales (e.g.):
- 10-20 points
- 20-30 points
- 30-40 points
- 50-60 points

Temperature:
- Celsius
- Fahrenheit
Ratio scales

An interval scale enables the classification of individuals, objects or responses based on a common/shared property or characteristic and it ranks the subgroups in a certain order. It uses a unit of measurement that enables the individual responses to be placed at equally spaced intervals in relation to the spread of the variable.

The zero point of a ratio scale is fixed, which means it has a fixed starting point.

- Income: €
- Height: cm
- Age: years
- Weight: kg
- Speed: km/hr
Measurement scales

Some examples:

- Nominal Scale
- Ordinal Scale
- Interval Scale
- Ratio Scale
Overview

- The research variables
- The research design
- Sample versus population
A research design is a blueprint or detailed plan for how a research study is to be completed (Thyer, 1993):

- operationalizing variables so they can be measured,
- selecting a sample of interest to study,
- collecting data to be used as a basis for testing hypotheses,
- and analyzing the results.
The research design: purposes

The functions of a research design:

• conceptualize an operational plan to undertake various procedures and tasks to complete the study (what will you do?)

• ensure that these procedures are adequate to obtain valid, objective and accurate answers to the research questions (quality of the approach)
Research design: nature of investigation

3 classes of studies:

- Experimental
- Non-experimental
- Quasi-experimental

Controlled versus natural environment
Experimental study designs

Many types of experimental designs:

• the after-only design
• the before-and-after design
• the control-group design
• the double-control design
• the comparative design
• the “matched control” experimental design
• the placebo design
• …
After-only design

The population is being, or has been, exposed to an intervention.
What is the **impact** on the population?

```
<table>
<thead>
<tr>
<th>Study population</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before/pre observation</td>
<td>Time</td>
</tr>
<tr>
<td>Retrospective baseline</td>
<td>Present</td>
</tr>
<tr>
<td>After/post observation collect data</td>
<td></td>
</tr>
</tbody>
</table>
```
Before-and-after design

\[ \text{Change in dependent variable} = \left( \text{status of the dependent variable at the "after" observation} \right) - \left( \text{status of the dependent variable at the "before" observation} \right) \]
Control-group design

Two population groups:
• a control group
• an experimental group

Study population

Intervention

Experimental group

Study population

Study population

Control group

Study population

Study population
Comparative design

Compare the effectiveness of different treatments/interventions

Study population X
- Intervention 1 (e.g. Teaching model A)
  - Xa

Study population Y
- Intervention 2 (e.g. Teaching model B)
  - Xb

Study population Z
- Intervention 2 (e.g. Teaching model C)
  - Xc

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Between-subject vs. Within-subject design

Counterbalancing to prevent order problems

Within subject design:

The same subjects may be tested at each level of the independent variable

Subject 1 → Intervention 1 → Subject 1

Subject 1 → Intervention 2 → Subject 1

Randomize!
Between-subject design:
Different group of subjects for each level of the independent variable

Subject Group 1

\[ \approx \]

Subject Group 2

Intervention 1

Intervention 2

Subject Group 1 ≈ Subject Group 2
Overview

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Sample versus population

Study Population: *sampling units*

Select a few units

Sample

Collect information to find answer to research questions

Estimate of study population

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Sample representativeness

Study Population (N): sampling units

Select a few units

Sample size (n)

representativeness
Questions?

TARGET GROUPS LIKELY TO BE AFFECTED

ARE YOU IN FAVOUR OF MORE TREES?

WUFF!