Measurement, Scaling and Questionnaire Design

Week 05

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Measurement means assigning **numbers** or **other symbols** to **characteristics** of objects according to certain pre-specified rules.

- **One-to-one** correspondence between the numbers and the characteristics being measured.
- The **rules** for assigning numbers should be standardized and applied uniformly.
- Rules **must not change** over objects or time.

**Scaling** involves creating a continuum upon which measured objects are located.
Primary Scales of Measurement

- **Nominal**
  - Classification

- **Ordinal**
  - Classification
  - Order

- **Interval**
  - Classification
  - Order
  - Distance

- **Ratio**
  - Classification
  - Order
  - Distance
  - Natural Origin
## Primary Scales of Measurement

<table>
<thead>
<tr>
<th>Brand</th>
<th>Production Type</th>
<th>Sales Rank</th>
<th>Performance Rating</th>
<th>Warranty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer</td>
<td>Import</td>
<td>2</td>
<td>8</td>
<td>1 Year</td>
</tr>
<tr>
<td>Axio</td>
<td>Local</td>
<td>3</td>
<td>7.5</td>
<td>1 Year</td>
</tr>
<tr>
<td>Byon</td>
<td>Local</td>
<td>5</td>
<td>8</td>
<td>2 Years</td>
</tr>
<tr>
<td>Dell</td>
<td>Import</td>
<td>6</td>
<td>8.5</td>
<td>2 Years</td>
</tr>
<tr>
<td>ECS</td>
<td>Import</td>
<td>4</td>
<td>6</td>
<td>5 Years</td>
</tr>
<tr>
<td>Toshiba</td>
<td>Import</td>
<td>1</td>
<td>9</td>
<td>3 Years</td>
</tr>
</tbody>
</table>
Comparative scales involve the direct comparison of stimulus objects. Comparative scale data must be interpreted in relative terms and have only ordinal or rank order properties.

In noncomparative scales, each object is scaled independently of the others in the stimulus set. The resulting data are generally assumed to be interval or ratio scaled.
A Classification of Scaling Techniques

Scaling Techniques

Comparative Scales
- Paired Comparison
- Rank Order
- Constant Sum
- Q-Sort

Noncomparative Scales
- Continuous Rating Scales
- Itemized Rating Scales
  - Likert
  - Semantic Differential
  - Stapel
**Instructions:** We are going to present you with ten pairs of shampoo brands. For each pair, please indicate which one of the two brands of shampoo you would prefer for personal use.

**Recording Form:**

<table>
<thead>
<tr>
<th></th>
<th>Emeron</th>
<th>Sunsilk</th>
<th>Clear</th>
<th>Head &amp; Shoulders</th>
<th>Natur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emeron</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Sunsilk</td>
<td>1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Clear</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Head &amp; Shoulders</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Natur</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Number of Times Preferred&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

<sup>a</sup>A 1 in a particular box means that the brand in that column was preferred over the brand in the corresponding row.

<sup>b</sup>With n brands, \([n(n - 1)/2]\) paired comparisons are required.
**Instructions:** Rank the various brands of toothpaste in order of preference (1 for the most preferred to 10 for the least preferred)

<table>
<thead>
<tr>
<th>Brand</th>
<th>Rank Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Crest</td>
<td>__________</td>
</tr>
<tr>
<td>2. Colgate</td>
<td>__________</td>
</tr>
<tr>
<td>3. Aim</td>
<td>__________</td>
</tr>
<tr>
<td>4. Gleem</td>
<td>__________</td>
</tr>
<tr>
<td>5. Sensodyne</td>
<td>__________</td>
</tr>
<tr>
<td>6. Ultra Brite</td>
<td>__________</td>
</tr>
<tr>
<td>7. Close Up</td>
<td>__________</td>
</tr>
<tr>
<td>8. Pepsodent</td>
<td>__________</td>
</tr>
<tr>
<td>9. Plus White</td>
<td>__________</td>
</tr>
<tr>
<td>10. Stripe</td>
<td>__________</td>
</tr>
</tbody>
</table>
## Constant Sum Scale

### Form

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mildness</td>
<td>8</td>
</tr>
<tr>
<td>2. Lather</td>
<td>2</td>
</tr>
<tr>
<td>3. Shrinkage</td>
<td>3</td>
</tr>
<tr>
<td>4. Price</td>
<td>53</td>
</tr>
<tr>
<td>5. Fragrance</td>
<td>9</td>
</tr>
<tr>
<td>6. Packaging</td>
<td>7</td>
</tr>
<tr>
<td>7. Moisturizing</td>
<td>5</td>
</tr>
<tr>
<td>8. Cleaning Power</td>
<td>13</td>
</tr>
</tbody>
</table>

**Sum** 100
Respondents rate the objects by placing a mark at the appropriate position on a line that runs from one extreme of the criterion variable to the other. The form of the continuous scale may vary considerably.

How would you rate Sears as a department store?
Version 1
Probably the worst - - - - - - - - - I - - - - - - - - - - - - - - - - - - - Probably the best

Version 2
Probably the worst - - - - - - - - - I - - - - - - - - - - - - - - - - - - - Probably the best
0 10 20 30 40 50 60 70 80 90 100

Version 3
Very bad Neither good nor bad Very good
Probably the worst - - - - - - - - - I - - - - - - - - - - - - - - - - - - - Probably the best
0 10 20 30 40 50 60 70 80 90 100
The **Likert scale** requires the respondents to indicate a degree of agreement or disagreement with each of a series of statements about the stimulus objects.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sears sells high quality merchandise.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. Sears has poor in-store service.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. I like to shop at Sears.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

- The analysis can be conducted on an item-by-item basis (profile analysis), or a total (summated) score can be calculated.
- When arriving at a total score, the categories assigned to the negative statements by the respondents should be scored by reversing the scale.
The semantic differential is a seven-point rating scale with end points associated with bipolar labels that have semantic meaning.

SEARS IS:

Powerful --:--:--:--:--:--:--: Weak

Unreliable --:--:--:--:--:--:--: Reliable

Modern --:--:--:--:--:--:--: Old-fashioned

- The negative adjective or phrase sometimes appears at the left side of the scale and sometimes at the right.
- This controls the tendency of some respondents, particularly those with very positive or very negative attitudes, to mark the right- or left-hand sides without reading the labels.
- Individual items on a semantic differential scale may be scored on either a -3 to +3 or a 1 to 7 scale.
The Stapel scale is a unipolar rating scale with ten categories numbered from -5 to +5, without a neutral point (zero). This scale is usually presented vertically.

The data obtained by using a Stapel scale can be analyzed in the same way as semantic differential data.
Scale Evaluation

Reliability
- Test/Retest
- Alternative Forms
- Internal Consistency

Validity
- Content
- Criterion
- Construct

Generalizability
The true score model provides a framework for understanding the accuracy of measurement.

\[ X_O = X_T + X_S + X_R \]

where

- \( X_O \) = the observed score or measurement
- \( X_T \) = the true score of the characteristic
- \( X_S \) = systematic error
- \( X_R \) = random error

- If a measure is perfectly valid, it is also perfectly reliable. In this case \( X_O = X_T \), \( X_R = 0 \), and \( X_S = 0 \).

- If a measure is unreliable, it cannot be perfectly valid, since at a minimum \( X_O = X_T + X_R \). Furthermore, systematic error may also be present, i.e., \( X_S \neq 0 \). Thus, unreliability implies invalidity.

- If a measure is perfectly reliable, it may or may not be perfectly valid, because systematic error may still be present \( (X_O = X_T + X_S) \).

- Reliability is a necessary, but not sufficient, condition for validity.
Definition:
A formalized set of questions for obtaining information from respondents.

Questionnaire Objectives

- It must **translate** the information needed into a set of specific questions that the respondents can and will answer.

- A questionnaire must uplift, motivate, and **encourage** the respondent to become involved in the interview, to cooperate, and to complete the interview.

- A questionnaire should **minimize response error**.
Questionnaire Design Checklist

Step 1. Specify The Information Needed
Step 2. Type of Interviewing Method
Step 3. Individual Question Content
Step 4. Overcome Inability and Unwillingness to Answer
Step 5. Choose Question Structure
Step 6. Choose Question Wording
Step 7. Determine the Order of Questions
Step 8. Form and Layout
Step 9. Reproduce the Questionnaire
Step 10. Pretest
Step 1. Specify the Information Needed

1. Ensure that the information obtained fully addresses all the components of the problem. Review components of the problem and the approach, particularly the research questions, hypotheses, and specification of information needed.

2. Prepare a set of dummy tables.

3. Have a clear idea of the target population.

Step 2. Type of Interviewing Method

1. Review the type of interviewing method determined based on considerations discussed in Chapter 6.
Step 3. Individual Question Content

1. Is the question necessary?

2. Are several questions needed instead of one to obtain the required information in an unambiguous manner?

3. Do not use double-barreled questions.
Step 4. Overcoming Inability and Unwillingness to Answer

1. Is the respondent informed?

2. If respondents are not likely to be informed, filter questions that measure familiarity, product use, and past experience should be asked before questions about the topics themselves.

3. Can the respondent remember?

4. Avoid errors of omission, telescoping, and creation.

5. Questions which do not provide the respondent with cues can underestimate the actual occurrence of an event.

6. Can the respondent articulate?
Step 4. Overcoming Inability and Unwillingness to Answer

7. Minimize the effort required of the respondents.
8. Is the context in which the questions are asked appropriate?
9. Make the request for information seem legitimate.
10. If the information is sensitive:
    a. Place sensitive topics at the end of the questionnaire.
    b. Preface the question with a statement that the behavior of interest is common.
    c. Ask the question using the third-person technique.
    d. Hide the question in a group of other questions which respondents are willing to answer.
    e. Provide response categories rather than asking for specific figures.
Step 5. Choosing Question Structure

1. Open-ended questions are useful in exploratory research and as opening questions.
2. Use structured questions whenever possible.
3. In multiple-choice questions, the response alternatives should include the set of all possible choices and should be mutually exclusive.
4. In a dichotomous question, if a substantial proportion of the respondents can be expected to be neutral, include a neutral alternative.
5. If the response alternatives are numerous, consider using more than one question to reduce the information processing demands on the respondents.
<table>
<thead>
<tr>
<th>Step 6. Choosing Question Wording</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Define the issue in terms of who, what, when, where, why, and way (the six Ws).</td>
</tr>
<tr>
<td>2. Use ordinary words. Words should match the vocabulary level of the respondents.</td>
</tr>
<tr>
<td>3. Avoid ambiguous words: usually, normally, frequently, often, regularly, occasionally, sometimes, etc.</td>
</tr>
<tr>
<td>4. Avoid leading questions that clue the respondent to what the answer should be.</td>
</tr>
<tr>
<td>5. Avoid implicit alternatives that are not explicitly expressed in the options.</td>
</tr>
<tr>
<td>6. Avoid implicit assumptions.</td>
</tr>
<tr>
<td>7. Respondent should not have to make generalizations or compute estimates.</td>
</tr>
<tr>
<td>8. Use positive and negative statements.</td>
</tr>
</tbody>
</table>
Step 7. Determine the Order of Questions

1. The opening questions should be interesting, simple, and non-threatening.

2. Qualifying questions should serve as the opening questions.

3. Basic information should be obtained first, followed by classification, and, finally, identification information.

4. Difficult, sensitive, or complex questions should be placed late in the sequence.

5. General questions should precede the specific questions.

6. Questions should be asked in a logical order.

7. Branching questions should be designed carefully to cover all possible contingencies.

8. The question being branched should be placed as close as possible to the question causing the branching, and (2) the branching questions should be ordered so that the respondents cannot anticipate what additional information will be required.
Questionnaire Design Checklist

Step 8. Form and Layout

1. Divide a questionnaire into several parts.

2. Questions in each part should be numbered.

3. The questionnaire should be pre-coded.

4. The questionnaires themselves should be numbered serially.
Questionnaire Design Checklist

Step 9. Reproduction of the Questionnaire

1. The questionnaire should have a professional appearance.
2. Booklet format should be used for long questionnaires.
3. Each question should be reproduced on a single page (or double-page spread).
4. Vertical response columns should be used.
5. The tendency to crowd questions to make the questionnaire look shorter should be avoided.
6. Directions or instructions for individual questions should be placed as close to the questions as possible.
Step 10. Pretesting

1. Pretesting should be done always.

2. All aspects of the questionnaire should be tested, including question content, wording, sequence, form and layout, question difficulty, and instructions.

3. The respondents in the pretest should be similar to those who will be included in the actual survey.

4. Begin the pretest by using personal interviews.

5. Pretest should also be conducted by mail or telephone if those methods are to be used in the actual survey.

6. A variety of interviewers should be used for pretests.

7. The pretest sample size is small, varying from 15 to 30 respondents for the initial testing.

8. Use protocol analysis and debriefing to identify problems.

9. After each significant revision of the questionnaire, another pretest should be conducted, using a different sample of respondents.

10. The responses obtained from the pretest should be coded and analyzed.
THANK YOU

GRACIAS

ARIGATO

SHUKURIA

BOLZÎN

MERCİ

BIYAN

SHUKRIA

DANKSCHÉEN

TASHAKKUR ĀTU

YÂQHANYELAY

SUKSAMA

EKHMÉT

MAAKe

MAHRÉBÁNI

PALDIÉS

BOUZÉN

MÉRCSI

GAZÎMASHTÎ

EFCHARISTÔ

ASâLÚ

KHÂRÝMA

EHLÈSALÔGHÎNA