The Program

What is SQP?

- A survey quality prediction system for questions used in survey research.
- A program available for free at sqp.upf.edu
- A database of questions with information about their quality.

What can I achieve with SQP?

An indication of the quality of survey questions and suggestions for improving them. The program provides reliability, validity, and quality coefficients, with confidence intervals.

What do I have to do?

- Consult the information already stored in the SQP database regarding the quality of each question.
- Introduce a new question and code its characteristics following the program instructions until you get a prediction for your own question.

For more information: sqp.upf.edu or sqp@upf.edu
How can I use the information from SQP?

1- To improve questions before data collection

Example of a suggestion of improvement:

H28 / TEST28 / social trust, careful
ESS Round 1 United Kingdom - English

Request for Answer Text:
Generally speaking, would you say that most people can be trusted, or that you can’t be too careful in dealing with people? Please tick one box.

Answer options:
* You can’t be too careful
* Most people can be trusted

<table>
<thead>
<tr>
<th>Reliability Coefficient</th>
<th>Prediction</th>
<th>Interquartile range</th>
<th>Standard error</th>
<th>MTMM Estimate</th>
<th>MTMM 95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>r</td>
<td>0.811</td>
<td>(0.766, 0.827)</td>
<td>0.113</td>
<td>0.781</td>
<td>(0.722, 0.829)</td>
</tr>
<tr>
<td>Validity Coefficient</td>
<td>v</td>
<td>0.967</td>
<td>(0.962, 0.981)</td>
<td>0.149</td>
<td>0.887</td>
</tr>
<tr>
<td>Qualitiy Coefficient</td>
<td>q</td>
<td>0.726</td>
<td>(0.608, 0.755)</td>
<td>0.103</td>
<td>0.683</td>
</tr>
</tbody>
</table>

Potential Improvement to Question Quality
View the potential for improving this question based on this quality prediction by changing individual characteristics.

<table>
<thead>
<tr>
<th>Number of categories (ncategories)</th>
<th>Average change if prediction</th>
<th>pvalue</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0.528</td>
<td>0.023</td>
</tr>
<tr>
<td>4</td>
<td>0.511</td>
<td>0.012</td>
</tr>
<tr>
<td>6</td>
<td>0.540</td>
<td>0.007</td>
</tr>
<tr>
<td>8</td>
<td>0.535</td>
<td>0.036</td>
</tr>
</tbody>
</table>

SQP suggests to increase the number of answer categories to 11. This will improve the question quality by 0.034.

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To correct for measurement errors
Example of correcting the correlations using SQP predictions:

The observed correlation between H28 and H29 is .45.
To recover the true correlation we use equation 2 (cf. next column) and compute:

\[ m = \sqrt{1 - v^2} \]

For H28: \[ m = \sqrt{1 - .907^2} = .42 \]
For H29: \[ m = \sqrt{1 - .910^2} = .41 \]

\[ \rho(f_1, f_2) = (0.45 - 0.801 \times 0.42 \times 0.41 \times 0.803) / (0.801 \times 0.907 \times 0.803 \times 0.910) = .64 \]

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Behind the program

True score model

\[ f_i = \text{satisfaction with the economy} \]

\[ t_{ij} = \text{reaction to the 11 point scale} \]

\[ y_{ij} = \text{observed response 11 point scale} \]

Definitions

Reliability = \[ r^2 = \text{strength of the relationship between } t \text{ and } y = 1 - \text{var}(e) \]

Validity = \[ \gamma^2 = \text{strength of the relationship between } t \text{ and } f = 1 - \text{var}(m) \]

Quality = \[ q^2 = r^2 \gamma^2 = \text{variance in the observed variable } y \text{ explained by } f \]

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If we have 2 concepts

\[ f_1 = \text{satisfaction with economy} \]
\[ f_2 = \text{satisfaction with the way the democracy works} \]

We can express the observed correlations as a function of the structural parameters:

\[ \text{corr}(y_{1j}, y_{2j}) = r_{1j}v_1 \rho(f_1f_2)v_2r_{2j} + r_{1j}m_1m_2r_{2j} \]  \hspace{1cm} (1)

We can also reverse the formula to compute the true correlation based on the observed correlation:

\[ \rho(f_1f_2) = \frac{[\text{corr}(y_{1j}, y_{2j}) - r_{1j}m_1m_2r_{2j}]}{(r_{1j}v_1v_2r_{2j})} \]  \hspace{1cm} (2)

In order to recover the true correlation we need estimates of the reliability and the validity coefficients.

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Estimating reliability, validity, and quality

- Model not identified for 2 concepts and one method.
- It is identified if we have more concepts (typically 3) measured, each using several methods (typically 3 too).
- This is called the MultiTrait-MultiMethod (MTMM) approach.
- Reliability and validity estimated using the True Score model.

Limits of the MTMM approach

- Necessary to repeat the same questions for the same respondents.
- Cannot repeat all questions from all questionnaires in practice.
- High cognitive burden, long questionnaires to avoid memory effects.

Solution: SQP 2.0

- Meta-analysis of more than 3,700 MTMM quality estimates explained by up to 73 questions characteristics.
- Random Forest approach used.
- Good predictions obtained: explained variance ($R^2$) for reliability of .65 and for validity of .84.

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