Psychometrics

Computational Social Intelligence - Lecture 07

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This lecture is based on the following text (available on Moodle):

- T.R.Hinkin, “A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires”, Cornell University, 1998

Important

- You are not expected to study the article associated to this lecture (there will be no questions about at the exam);
- However, you are expected to know how to use a questionnaire and to acquire the related terminology;
- The slides provide you with all the information you need for the exam.

Outline

- Introduction
- The Example of Personality
- The Six Steps of Scale Development
- Conclusions

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Psychometrics

1. "The branch of psychology concerned with the design and use of psychological tests.
2. The application of statistical and mathematical techniques to psychological testing"

Collins English Dictionary

Psychological Constructs

"A construct is a representation of something that does not exist as an observable dimension of behavior."

T.R.Hinkin, "A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires", Cornell University, 1998.

Examples

- Personality;
- Emotions;
- Attitude;
- Intention;
- Interpersonal attraction;
- etc.

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Personality Self-Assessment

Personality

"[Latent construct that accounts] for individuals' characteristic patterns of thought, emotion, and behavior together with the psychological mechanisms - hidden or not - behind those patterns."

D. Funder, "Personality," Annual Reviews of Psychology, 52:197–221, 2001

The Big-Five

"The Big Five personality factors appear to provide a set of highly replicable dimensions that parsimoniously and comprehensively describe most phenotypic individual differences."

Saucier, Goldberg, "The Language of Personality: Lexical Perspectives on the Five-Factor Model", in "The Five-Factor Model of Personality", Wiggins (ed.), 21-50,1996

The Big-Five Traits

- Extraversion: Active, Assertive, Energetic, …
- Agreeableness: Appreciative, Forgiving, Generous, Kind, Sympathetic, Trusting, …
- Conscientiousness: Efficient, Organized, Planful, Reliable, Responsible, Thorough, …
- Neuroticism: Anxious, Self-pitying, Tense, Touchy, Unstable, Worrying, …
- Openness: Artistic, Curious, Imaginative, …

The Big-Five Inventory 10

ID	Item	SD	D	NA	A	SA
1	I am reserved					
2	I am generally trusting					
3	I am lazy					
4	I am relaxed, I handle stress well					
5	I have few artistic interests					
6	I am outgoing, sociable					
7	I tend to find faults with others					
8	I do a thorough job					
9	I get nervous easily					
10	I have an active imagination					

Rammstedt and John, “Measuring Personality in One Minute or Less: A 10-item short version of the BFI”, Journal of Research in Personality, 41(1): 203-212, 2007

The Items

- An item is a statement or a question about an observable aspect of behaviour;
- Every item is associated to a Likert Scale expected to quantify how correct the statement is;
- The items are expected to be relevant to the construct that the questionnaire aims at measuring.

Likert Scales (I)

Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
○	○	○	○	○
-2	-1	0	1	2
1	2	3	4	5

Likert Scales (II)

"Likert (1932) developed the scales to be composed of 5 equal appearing intervals with a neutral midpoint [...] Coefficient alpha reliability [...] has been shown to increase up to the use of five points, but then it levels off [...]."

T.R.Hinkin, "A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires", Cornell University, 1998.

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Scale Development

"Scale development clearly involves a bit of art as well as a lot of science."

T.R.Hinkin, "A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires", Cornell University, 1998.

1.Item Generation

"The key to successful item generation is the development of a well articulated theoretical foundation that would indicate the content domain for the new measure."

T.R.Hinkin, "A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires", Cornell University, 1998.

Two Approaches

- The items must be relevant to the construct being addressed;
- Deductive: The items are deduced from the theory underlying the construct under exam (more common and reliable);
- Inductive: The items are designed to define the construct (less common).

2.Questionnaire Administration

"The items should now be presented to a sample representative of the actual population of interest [to confirm] expectations regarding the psychometric properties of the new measure."

T.R.Hinkin, "A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires", Cornell University, 1998.

Test

- The sample should be selected according to the construct being targeted (e.g., people without children should not fill questionnaires about parenting);
- The sample should be large enough to allow statistical analysis of the results;
- The sample should be large enough to avoid individual biases.

3.Initial Item Reduction

"[…] it is recommended that factor analysis is used to further refine the new scales […] This creates a more parsimonious representation of the original set of observations […]"

T.R.Hinkin, "A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires", Cornell University, 1998.

Main Criteria

- The items that do not show sufficient variance should be removed;
- The items that do not correlate sufficiently with the others should be removed;
- Factor analysis is the approach most commonly adopted.

4.Confirmatory Factor Analysis

"[…] confirmatory factory analysis should be just that - a confirmation that the prior analyses have been conducted thoroughly and appropriately […]"

T.R.Hinkin, "A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires", Cornell University, 1998.

Main Criteria

- After the initial reduction of the items, the statistical properties of the items should be improved or, at least, confirmed;
- It is important to administer the test to a sample different from the one involved in the previous steps.

5.Convergent/Discriminant Validity

"[…] examining the extent to which the scales correlate with other measures designed to assess similar constructs (convergent validity) and to which they do not correlate with dissimilar measures (discriminant validity)."

T.R.Hinkin, "A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires", Cornell University, 1998.

Sanity Check

- The outcome of the questionnaire should be aligned with other, established questionnaires targeting the main construct;
- The outcome of the questionnaire should not correlate with the outcome of other questionnaires targeting other constructs.

6.Replication

"It would now be necessary to collect another set of data from an appropriate sample and repeat the scale-testing process with the new scales."

T.R.Hinkin, "A Brief Tutorial on the Development of Measures for Use in Survey Questionnaires", Cornell University, 1998.

Test

- The outcome of a questionnaire depends both on the test and on the people that fill it;
- Analysing the outcome of the questionnaire over multiple samples ensures that the dependence on those filling it is attenuated;
- If a questionnaire is effective, it will be adopted more likely in practice (empirical a-posteriori confirmation).

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Conclusions

- A questionnaire is the result of an empirical process driven by rigorous scientific criteria;
- The statistical properties of the questionnaire's outcomes are the main evaluation criteria;
- The effectiveness of a questionnaire in addressing professional and scientific problems makes it its adoption more or less likely.

Thank You!