

Thesis Seminar

Operationalization and data

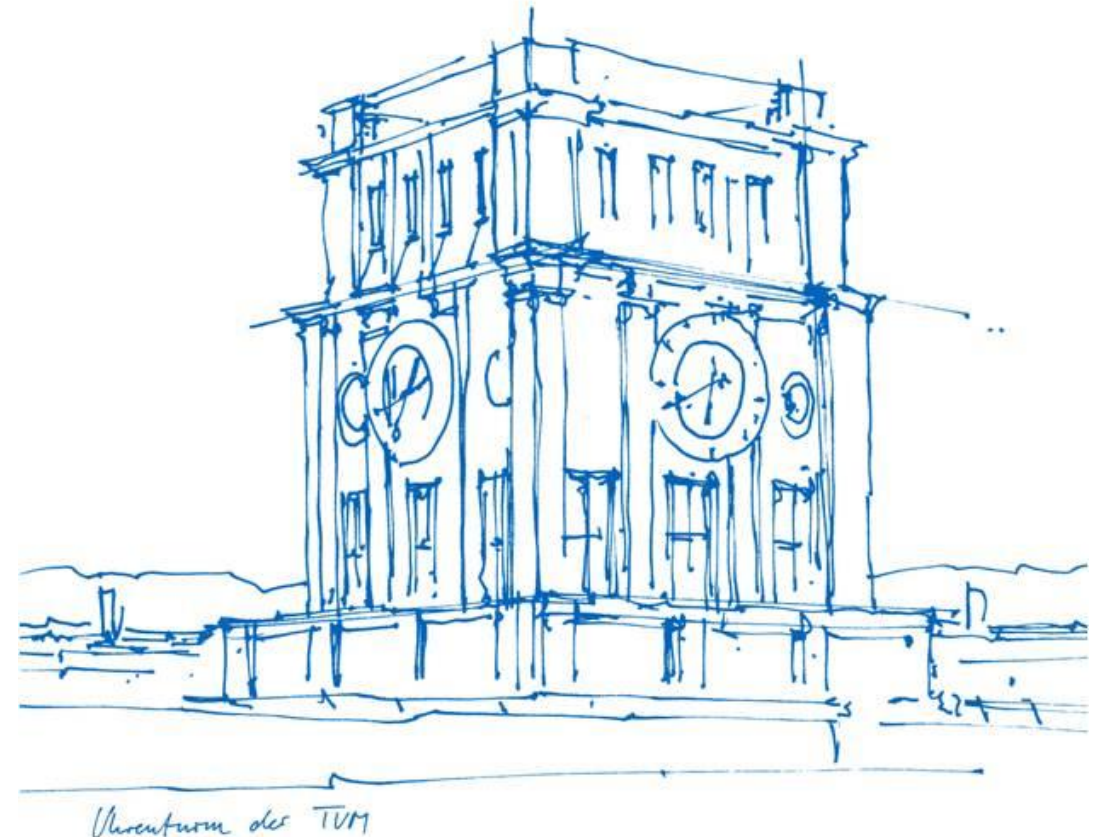
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Operationalization

...is the **process of translating your research question and hypotheses** (and the underlying theoretical constructs) into

- empirically measurable **indicators** (variables)
- empirically measurable **objects**

!!! For this translation, use standardized instruments (instructions, items, scales)!!!
(Do only adapt standardized measures if necessary and only as little as necessary!)

http://www.psychwiki.com/wiki/Main_Page

<http://www.sjdm.org/dmidi/>

<http://zis.gesis.org/>

Or look into journal articles!

Sources for scales and tests

- Zentralstelle für Psychologische Information und Dokumentation (ZPID) Universität Trier
<http://www.zpid.de/>
- Elektronisches Testarchiv
<http://www.zpid.de/index.php?wahl=products&uwahl=frei&uuwahl=userlog>
- Datenbank PSYTKOM
- Testzentrale www.testzentrale.de
- Testzentrale der Schweizer Psychologen
www.testzentrale.ch
- Das Zentrum für Testentwicklung und Diagnostik
<http://www.unifr.ch/ztd>
- European Test Publishers Group www.etpg.org
- Hans Huber AG
<http://verlag.hanshuber.com/onlinekat/testverfahren/index.php>
- Hogrefe, Verlag für Psychologie www.hogrefe.de
- Apparatzentrum des Hogrefe Verlags
www.apparatzentrum.de
- Fa. Dr. G. Schuhfried www.schuhfried.co.at
- Swets Test Services Deutschland www.harcourt.de
- Werner stangl www.standl-taller.at
- Zuma Zentrum für Umfragen Methoden und Analysen
<http://www.gesis.org/ZUMA/>

Operationalization of your hypothesized construct(s)

*How can we collect data about
unit and department leaders?*

See sampling strategy



Hypothesis: There is a difference between unit leaders and department leaders in their job satisfaction.



*How to test difference
between means?*

see Data Analysis



*How to measure
job satisfaction?*

Example of operationalization

Research question:

Is the attachment to the organization (=organisational commitment) different between public servants and employees?



Possible construct:

Organisational Commitment:
emotional (EC), normative (NC), continuance commitment (CC)



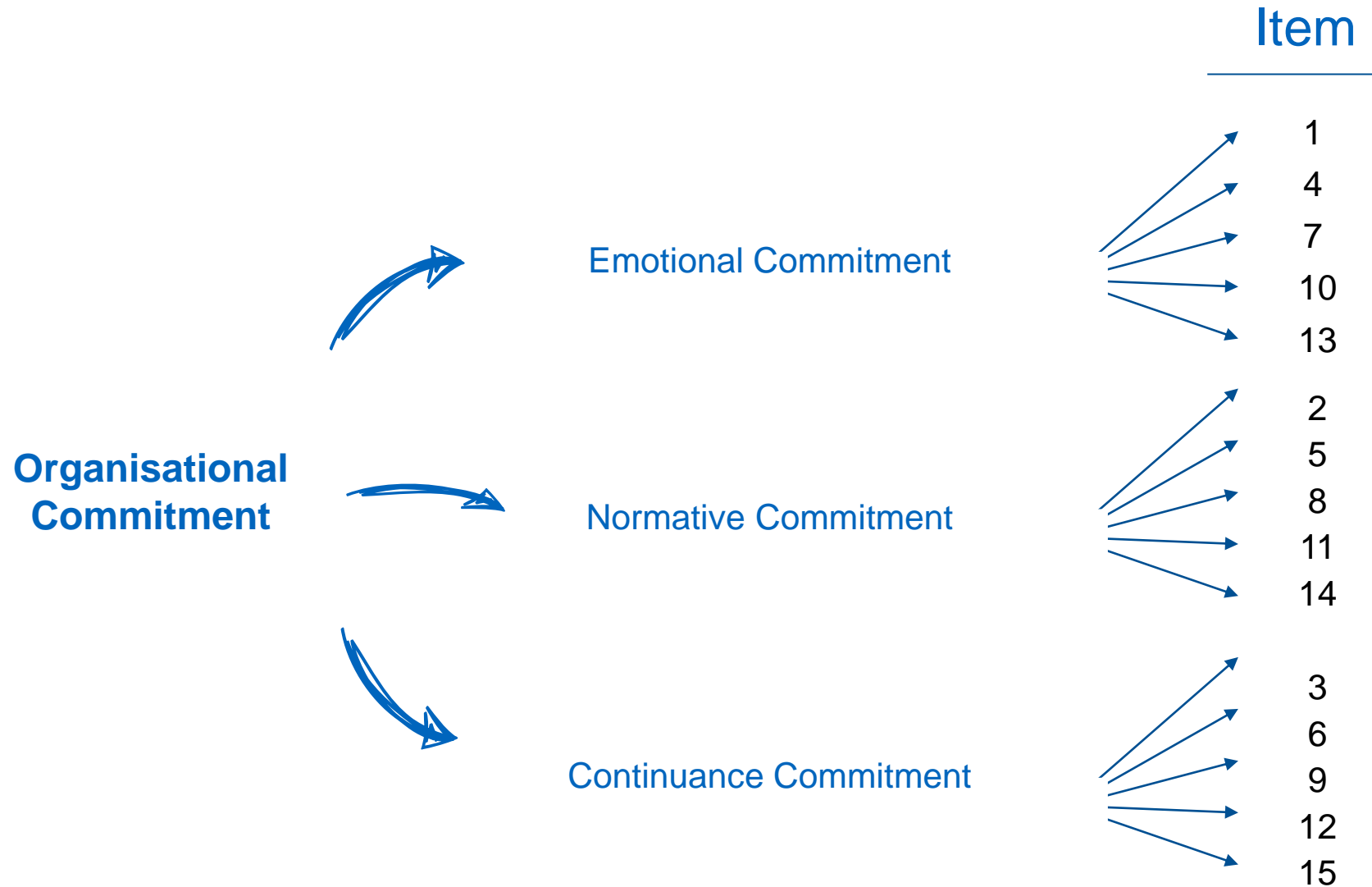
Items:

EC: I would be very happy to spend the rest of my career with this organization

NC: I think that people these days move from company to company too often.

CC: It would be very hard for me to leave my organization right now, even if I wanted to.

From construct to items



Construct definition

- 1 Literature search / derive from theory and possibly consultation of lay men or experts (qualitative study)
- 2 Collection and analysis of definitions
 - Systematization of existing definitions, inclusion of repetitive indicators for definition
- 3 Develop a working definition:
 - How do you understand this construct for your research?
 - If different definitions, models, theories are available: which ones do you use and why?
- 4 Distinguish from related constructs

Basic concepts

Dependent variable = the reaction measured in research (especially in experiments) that is supposed to be changed by the independent variable.

Independent variable = the variable that is deliberately changed in an experimental study to observe the effects on the dependent variable; independent variables (IV): characteristics attributed to other characteristics in the context of a specific issues; are "made" and manipulated in examinations.

Population = the totality of all persons or things having a certain characteristic; the entire target group of a study/survey, from which a random sample is drawn.

Representativeness = a property of random samples. It reflects the structure of the population from which the sample was taken.

Empirical = knowledge based on experience and observation.

Basic concepts

Variable = all the factors or characteristics of a concept to be examined, which are examined in an investigation.

Control Variable = Influences on the result, which are known, can be measured and thus controlled.

Interfering/disturbing variable = Influences on the result that are not known or not measured and can not be controlled

Confounding = The manifestation of the IV is exactly associated with the expression of disturbing variables.

Significance = a statement about the probability with which differences or relationships between different factors are based on chance or not.

p-value = the value that expresses the probability that the data obtained is not random. It expresses the significance of results.

Basic concepts

Operationalisation = Assignment of empirically detectable, observable or to be requested indicators to a theoretical term.

Quality criteria = Standards by which the scientific quality of research results can be measured.

Reliability = the extent to which repeated measurements of an object with a gauge provide the same values; a quality criterion of quantitative research.

Objectivity = the degree of independence of the test results from the researcher; a quality criterion of quantitative research.

Cross-sectional study = a specific design that collects data from a sample at a given time.

Longitudinal study = a specific design study where the same data collection methods are used at least at two different times.

Correlation = an arithmetic operation used to check if and how two or more variables are related. This relationship is expressed with a value, the so-called correlation coefficient.

Basic concepts

Hypotheses = substantiated assumptions, assumptions about the answer to research question. By means of scientific investigation one would like to check these hypotheses for their validity.

Data Mining = purely explorative data analysis - Renaissance of empiricism or inductivism. Methodically very sophisticated method for pattern recognition, data linking, etc. Especially widespread in medical research -> very important for the generation of hypotheses and theory systems.

Inductive = the closing of the particular (individual case) to the general. With inductive methods, facts are determined by observation and derived from theoretical considerations or theory.

Deductive = from the general to the particular (individual case) to the general. With deductive methods, facts are determined by large sample studies and derived from theoretical considerations or theories.

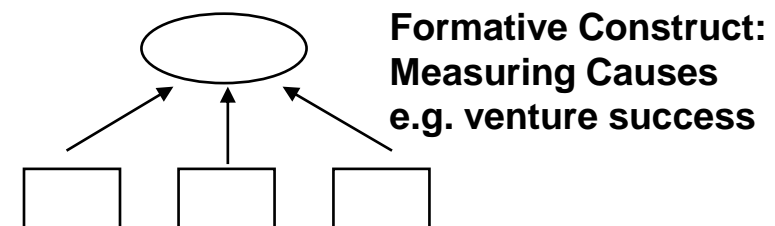
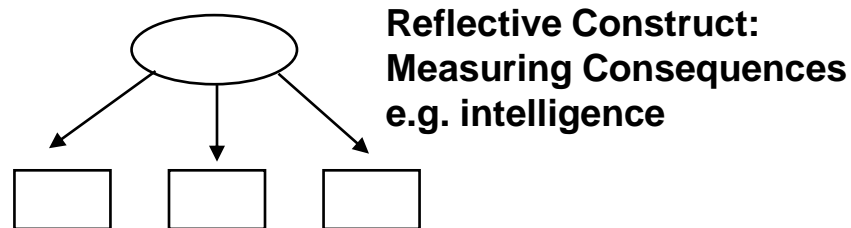
Triangulation = the simultaneous or sequential use of qualitative and quantitative approaches or the use of different survey methods to describe the same phenomenon.

Basic concepts

Constructs = Characteristics that are not accessible to direct observation (latent variables). Construct are used to describe and explain human behavior

Reflective Construct = Deferred variable - change of the variable leads to the change of ALL indicators. *Indicators are caused by the construct.*

Formative Construct = Deferred variable - changing the variable does not necessarily lead to the simultaneous change of all indicators. *Indicators cause the construct.*



Basic concepts

Discrete Variable = not further subdivided, e.g. Abitur grades

Dichotomous Variable = Feature values with only two categories, e.g. gender

Polytome Variable = Feature values with more than two categories, e.g. marital status

Continous Variable = Characteristics on a continuum, e.g. job satisfaction with Likert scale 1-7

Latent Variable = Not directly observable, e.g. intelligence

Manifest Variable = Directly observable variables, e.g. task solution, body height

Internal Validity = Changes in the DV are clearly due to the influence of the IV

External Validity = The result found in the sample can be generalized to other persons, times and situations

Variable types

Different relevance for study:

- Independent and dependent variable (IV/predictor and DV)
- Moderator, mediator, control, confounding variable

Different attribute values:

- nominal/ordinal/continuous

Empirically accessible:

- manifest/latent

Stability over time

Three types of independent variables

1. Manipulated IVs

- Experiments with randomized sample and one manipulated condition to test causality
- E.g., emotions, incentives, cognitive biases

2. Measured IVs

- Self or other assessments through questions (items)
- e.g., job satisfaction, intelligence

3. Observed/manifest IVs

- e.g., sex, birth country, salary

What are data?

- Measurement is the allocation of numbers to attributes/variables of objects
- Examples:
 - male = 1, female = 0
 - Disagree completely 1, 2, 3, 4, 5, 6, 7 Agree completely
- All measures of an object's attributes/variables are described as quantitative data

Data coding

- When coding data, attributes/variables of objects are coded into numbers.
- After allocating numbers (0/1) to attributes (male/female), it is possible to measure the values of an attribute/a variable (gender).
- Attributed values can be measured on different levels.



The measurement level determines how the data can be analyzed

Example of a codebook from Unipark

2) Do you have experience with such tasks that were used in this experiment?
(q_4535569 - Typ 111)

Variablenname	Externer Variablenname	int	Experience
v_153	v_153		
		1	Yes
		2	No
		3	Don't know

16.1 Seite: O6 = Controls - PID (PGID 2582664)

Please indicate to what extent you agree or disagree to the following statements.
(q_4535585 - Typ 311)

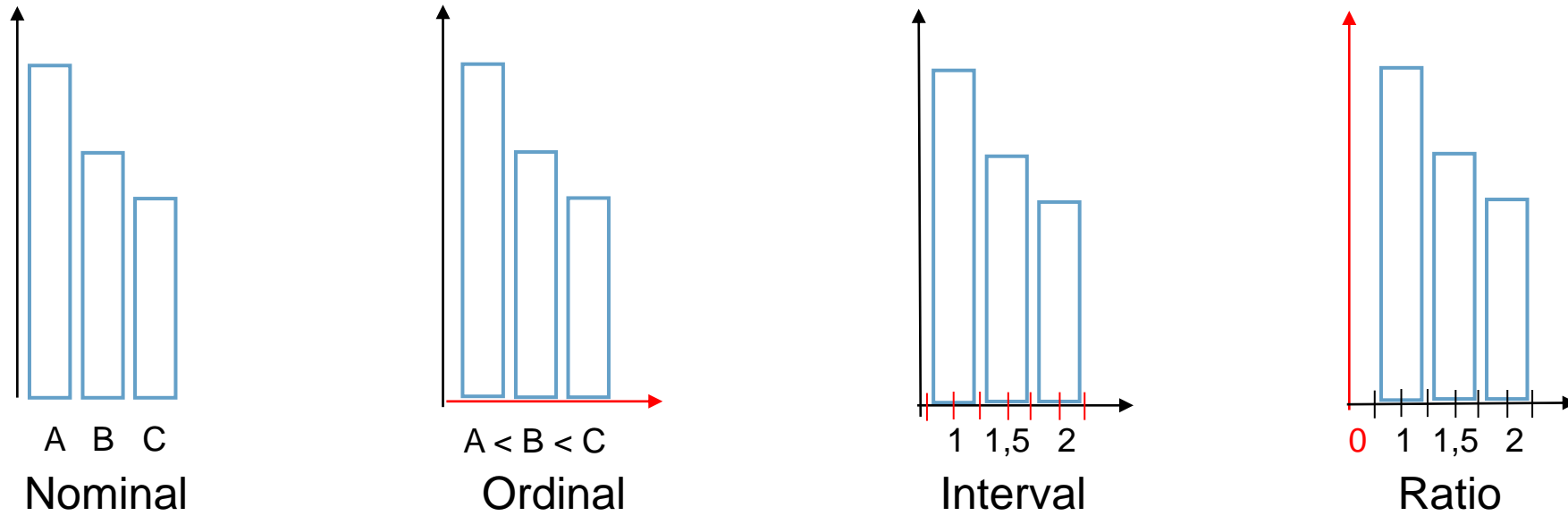
Variablenname	Externer Variablenname	int	When it comes to trusting people, I can usually rely on my gut feelings.
v_155	v_155		
		1	1 Disagree strongly
		2	2 Disagree a little
		3	3 Neither agree nor disagree
		4	4 Agree a little
		5	5 Agree strongly

Variablenname	Externer Variablenname	int	I generally don't depend on my instincts to help me make decisions.
v_156	v_156		
		1	1 Disagree strongly
		2	2 Disagree a little
		3	3 Neither agree nor disagree
		4	4 Agree a little
		5	5 Agree strongly

Which measurement levels do you know?



Measurement levels



Scale level

Low

High

Examples

Sex
yes/no

Ranking
bigger/smaller

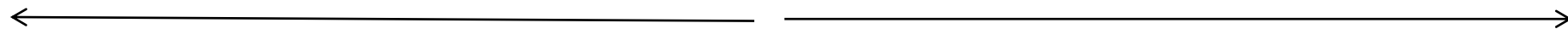
IQ
Temperature (Celsius)

Body height
Reaction time

qualitative, categorical

quantitative

non-parametric parametric



Scale Levels

	Scale types	Characteristics	Examples	
<p style="text-align: center;">Increasing applicability of analytical methods</p>	<p style="text-align: center;">Non-metric scales</p>	<p style="text-align: center;">Nominal scale</p>	<p style="text-align: center;">Classification of qualitative characteristics</p>	<p style="text-align: center;">Gender (m / w) phone numbers colors</p>
		<p style="text-align: center;">Ordinal scale</p>	<p style="text-align: center;">Rank value with ordinal numbers</p>	<p style="text-align: center;">Wind strengths brightness capacity classes</p>
	<p style="text-align: center;">Metric scales</p>	<p style="text-align: center;">Interval scale</p>	<p style="text-align: center;">Scale with equal large sections without natural zero</p>	<p style="text-align: center;">Temperature Affective commitment</p>
		<p style="text-align: center;">Ratio scale</p>	<p style="text-align: center;">Scale with equal large sections with natural zero</p>	<p style="text-align: center;">Temperature Body height income</p>

Scale transformation

Intervall/Ratioscale > Ordinal scale > Nominal scale (not vice versa!!!)

Example: company size

- Interval scale: number of employees
- Ordinal scale: Small, Medium, Large companies /
0-49 employees, 50-249 employees, or ≥ 250 employees
- Nominal scale: e.g., Is your company a small company (< 50 employees)? Yes/No

 **When collecting data, ask for specific information!**

Exercise!

<i>Example</i>	<i>Nominal</i>	<i>Ordinal</i>	<i>Interval</i>	<i>Ratio</i>
Hair color				
Ruler measurements				
Temperature				
Military ranks				
Political orientation				
Age				
Religious preferences				
Sales figures				
Time of day				
Type of living accommodation				
subject				
grades				
gender				
Prices				

Exercise!

<i>Example</i>	<i>Nominal</i>	<i>Ordinal</i>	<i>Interval</i>	<i>Ratio</i>
Hair color	x			
Ruler measurements				x
Temperature			(x) C	(x) Kel
Military ranks		x		
Political orientation	x			
Age				x
Religious preferences	x			
Sales figures				x
Time of day			x	
Type of living accommodation	x			
subject	x			
grades		x		
gender	x			
Prices				x

Criteria for good measurement instruments

(1) What is **objectivity**?

- Different observers have to come to the same results (execution, analyses, interpretation) with the same method (thermometer)

(2) What is **reliability**

- Measurement instruments are exact. Stability of Result on Repeated Measurements (The Repeatable & Objective Reliable)

(3) What is **validity**?

- Measurement instruments measure what you want to measure (Using a thermometer to measure intelligence)

(4) What is **economy**:

- Measurement efforts are in relation to the expected results in terms of
 - Time
 - Cost
 - Ease of use

Reliability

Testing **reliability** of a measurement instrument (details see statistics session):

- Retest reliability
- Paralleltest reliability
- Split-Half reliability
- Internal consistency (Cronbachs Alpha: α)

Validity is the degree to which a measurement instrument measures what it is supposed to:

- **Content validity** (content measures, what should be measured)
- **Internal validity** (exclusion of alternative explanations)
- **External validity** (are the results valid in the broader/external context? How far can the results be generalized?)
- **Criterion validity** (how well does the measure predict external, non-test criteria)
- **Convergent validity** (if different methods measure the same construct convergently and different operationalizations of the same construct lead to similar results)
- **Discriminant validity** (A construct must be different from another construct)



In the multi-trait multimethod method, we check with which agreement different methods capture the same construct (convergent validity) and how well the different constructs are differentiated by one method (discriminant validity).

Reliability and validity

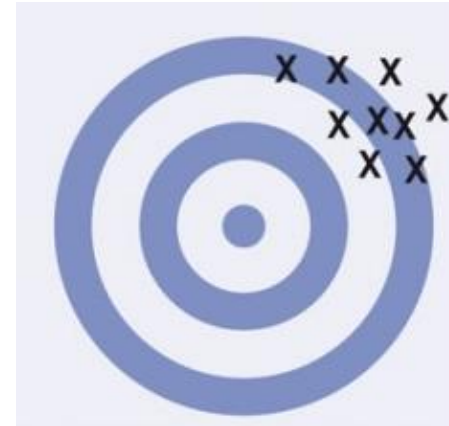
**reliability low
& validity low**

*not exact
not correct*



**reliability high
& validity low**

*exact
not correct*



**reliability low
& validity high**

*not exact
correct*



**reliability high
& validity high**

*exact
correct*

