

# Measurement

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## Different terminology

Managerial view

- Marketing managers work with abstractions
  - Concepts
    - A generalized idea about a class of objects, attributes, occurrences or processes*
  - Propositions
    - A set of concepts that are tied together as having meaningful relationships*
  - Theories
    - A set of propositions that collectively constitute a body of knowledge about phenomena*

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## Different terminology

Managerial view

- Concept
  - Customer
- Proposition
  - Brand loyalty and repeat sales are related
- Theory
  - Probability of the same brand purchase is proportionate to brand loyalty

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## Different terminology

Research view

- Marketing researchers use a specific metric no matter how general
  - Variables
    - Measurable constructs
  - Hypotheses
    - Proposed, testable conclusions
  - Models
    - Representations of real-life phenomena that have a functional relationship

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## Different terminology

Research view

### ■ Variable

Buyer who has sent the warranty card within 12 months

### ■ Hypothesis

Repetition increases the probability of the same brand purchase

### ■ Model

Three consecutive purchases increases the probability of same brand purchase by 10%

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## Operational definition

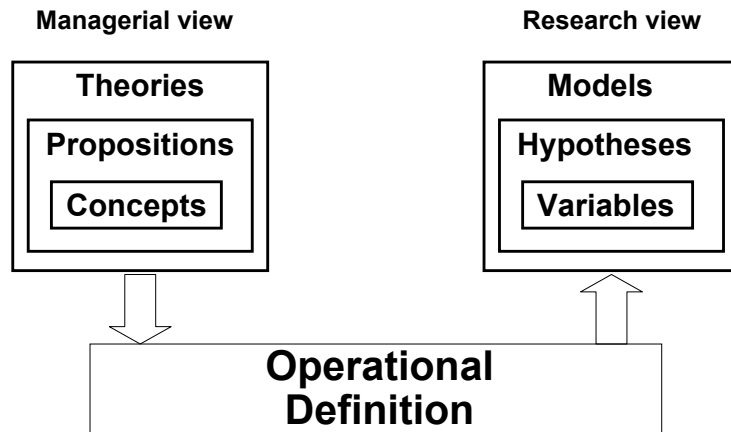
The link between management and research

- Operational definition converts abstract constructs into measurable entities by specifying what must be done to measure the concept under study

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## Operational definition

Translates conceptual to measurable



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## Operational definition

Examples

- Brand loyalty is an abstraction
- Frequency of same-brand purchases in the last six months is a measurable construct

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## Why operationalize

- Operationally defining a concept allows measurement
- What is measurement

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## Measurement

What do we measure

- How can you measure this room?
  - Think of an attribute, a characteristic

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## Measurement

What do we measure

- We may measure the amount or the intensity of attributes
  - The number of seats in the room (amount)
  - The level of illumination (intensity)

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## Measurement

What do we measure

- We may measure “objective” attributes or “subjective” attributes
  - Age of the respondent (objective)
  - Brand loyalty (subjective)

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## Measurement

Defined

- Measurement consists of rules for assigning numbers to attributes of objects that are of interest to the researcher

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## Measurement

How do we measure

- Rules that assign numbers to attributes are called scales
  - Established scales exist for many objective attributes
  - Established scales exist for some subjective attributes

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## Measurement

Scale development

- The process of establishing “rules” to measure a specific attribute is called scale development
  - Rule of thumb
    - If a suitable scale exist to measure an attribute, use it
- Scale development becomes necessary when no suitable scale exists

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## Levels of measurement

The characteristic being measured

- |          |                |
|----------|----------------|
| ■ Level  | Characteristic |
| Nominal  | Description    |
| Ordinal  | Order          |
| Interval | Distances      |
| Ratio    | Origin         |

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## Nominal scales

Labels are meaningful

- Identify the object as a label only
  - The following numbers merely represent each ball

9 2 4 1 7 3

Nominal numbers  
Identify each ball

- None is better or bigger than others because of the number on them

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## Ordinal scales

Ordering is meaningful

- The order of elements is significant

9 2 4 1 7 3  
1 2 3 4 5 6

- The ball #9 is first, the ball #2 is second, so on

Nominal 9 2 4 1 7 3 Ordinal  
1 2 3 4 5 6

- Ordinal measurements do not carry any other information. In the second row of numbers the same order holds

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## Interval scales

Distance is meaningful

- A scale that has an arbitrary "zero" point where distances between points are meaningful

Nominal 0 1 2 3 4 5 6 Interval  
9 3 6 1 4

- The distance between #3 - #6 is twice as much as the distance between #6 - #1  
#6 does not have three times the attribute as #3 (scale values of 3 and 1.)

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## Interval scales

Distance is meaningful

- In the previous scale

The ZERO point is not fixed and the interval may change

Let us look at the same placement on a different scale ...

0 1 2 3 4 5 6 7 8  
9 3 6 1 4  
0 2 4 6 8 10 12 14 16

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## Interval scales

An example

- Think of a cold winter day at 10° C and a cool spring day at 20° C. Can you say that the spring day is twice as hot as the winter day?

0	5	10	15	20	Centigrade
		W		S	
					Fahrenheit

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## Ratio scales

Magnitude is meaningful

- A scale that has a natural “zero” point where the attribute being measured does not exist. Magnitudes are meaningful

0	1	2	3	4	5	6	7	8
9	3		6	1		4		

#6 is three times farther than #3 is from #9, in other words, number six ball has three times the attribute as number three has

Because ...

The ZERO point is fixed!

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## Level of measurement

Deciding on the level

- Match the attribute to the highest level of measurement that is meaningful and practical

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## Level of measurement

Match the attribute to level

- Gender (nominal in nature)
  - Measure on nominal scale
- Income (ratio in nature)
  - Determine the need for measurement.
    - If categorizing (rich/poor) measure on nominal scale.
    - If ranking (richest, second richest, etc.) measure on ordinal scale
    - If measuring level of income, measure on ratio or at least interval scale

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## Level of measurement

Permissible operations

Level	Operation
<i>Nominal</i>	<i>Counting</i>
<i>Ordinal</i>	<i>Median</i>
<i>Interval</i>	<i>Mean, standard dev.</i>
<i>Ratio</i>	<i>All</i>

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## Reliability

Consistency in measurements

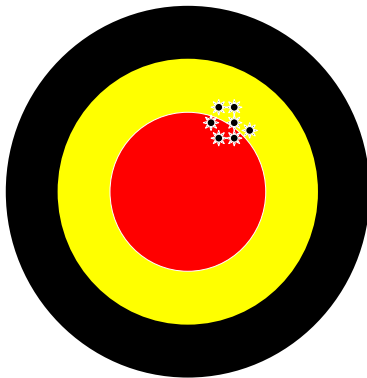
- Reliability of a measurement scale indicates the ability of the scale to produce consistently similar results under repeated trials.
  - An elastic yard-stick is not as reliable as a wooden one which may be less reliable than a steel one, etc.

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## Reliability

Consistency of performance

- Reliable

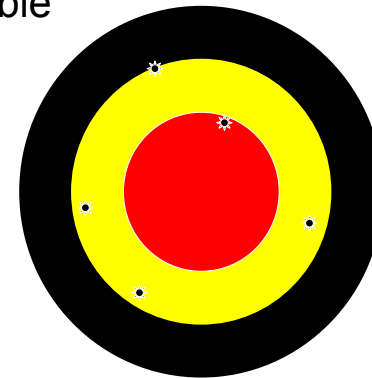


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## Reliability

Consistency of performance

- Not reliable



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## Reliability assessment

Test-retest reliability

- Consistency of measurement over time on the same group
- Repeated measurements are compared to assess reliability
- Could happen in a brief period, during the same interview
- Could occur at a later time if the respondents can be reached

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## Reliability assessment

Equivalent forms reliability

- Consistency of measurement with different wording
- An alternate wording (equivalent) is used to measure the same variable
- Real equivalency is important

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## Reliability assessment

Split-half reliability

- Split the total sample into two and take two separate measurements. If the two agree then the measurement is assumed to be reliable
- Apparent reliability may be misleading
  - Measurement 1  
3 3 3 3 3                      *Group average 3*
  - Measurement 2  
1 5 1 5 1 5                      *Group average 3*

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## Reliability assessment

How to deal with the issue

- Improve reliability
  - Redo the instrument
  - Collapse the scale
  - Remove unreliable respondents
- Always report reliability

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## Validity

The issue of accuracy

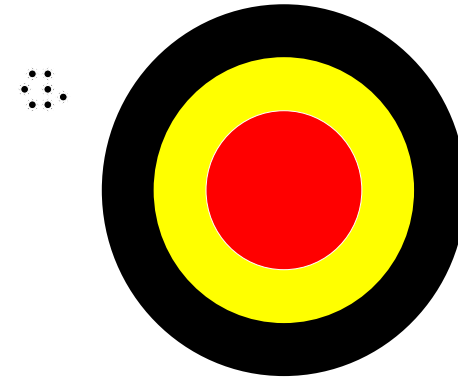
- Validity refers to the ability of the measurement method to measure what it is supposed to measure
  - True value = Measurement + Error, or
  - Measurement = True value + Error
- Perfect validity may be difficult to achieve. Error is a part of the measurement process

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## Validity

Doing the right thing

- Reliable but not valid

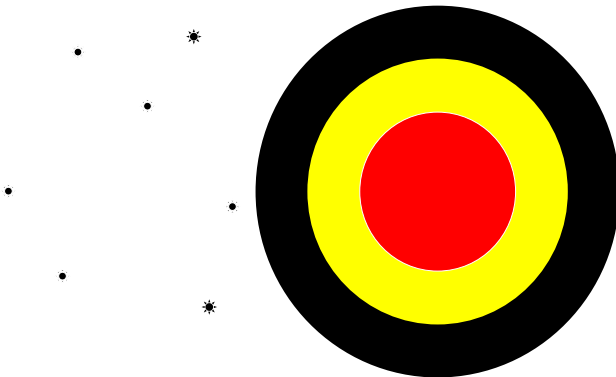


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## Validity & Reliability

Doing the right thing with consistency

- Neither valid nor reliable



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## Validity assessment

Accuracy

- Face validity
  - The instrument “appears” to measure the intended variable
  - A judgment made by the researcher

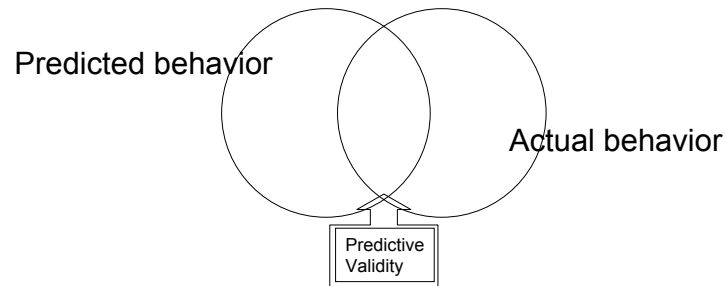
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## Validity assessment

Accuracy

### ■ Predictive validity

- How well the measurement predicts related variables



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## Validity assessment

Accuracy

### ■ Convergent validity

- Refers to two different measurement methods of the same variable yielding similar results



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## Validity assessment

Accuracy

### ■ Discriminant validity

- Dissimilar constructs should yield different measurements
- Typically based on researcher's knowledge of the differences in the constructs

### ■ Example

- Measurements of the frequency of going to movie theaters should yield different results from the frequency of watching programs on television

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## Measurement

Closing comments

- Know the construct you wish to measure
- Chose the level of measurement to suit the construct and the information needs
- Develop scales only when necessary
- Pay due attention to reliability and validity of measurements

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