TECH 646 Analysis of Research in Industry and Technology

PART III
The Sources and Collection of data:
Measurement, Measurement Scales, Questionnaires & Instruments, Sampling
Ch. 12 Measurement Scales

Lecture note based on the text book and supplemental materials:

Cooper, D.R., & Schindler, P.S., *Business Research Methods* (12th edition), McGraw-Hill/Irwin

Paul I-Hai Lin, Professor
http://www.pfw.edu/~lin
A Core Course for M.S. Technology Graduate Program
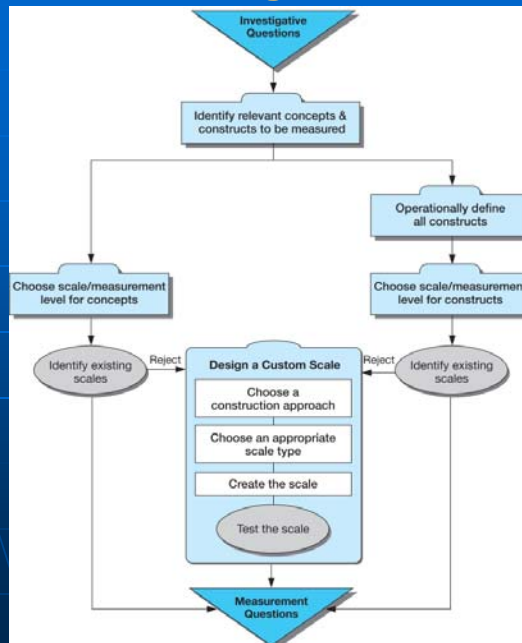Purdue University Fort Wayne

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Measurement

Learning Objectives … Understand

- The nature of attitudes and their relationship to behavior.
- The critical decisions involved in selecting an appropriate measurement scale.
- The characteristics and use of rating, ranking, sorting, and other preference scales.

The Scaling Process

Nature of Attitudes

| Cognitive | I think oatmeal is healthier than corn flakes for breakfast. |

| Affective | I hate corn flakes. |

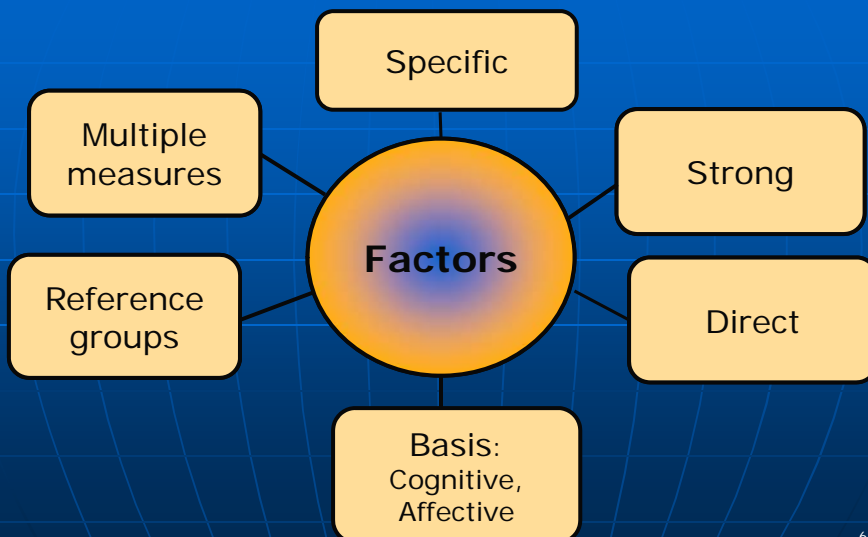| Behavioral | I intend to eat more oatmeal for breakfast. |

Nature of Attitudes

- **Attitude**
  - An attitude is a learned, stable predisposition to respond to oneself, other persons, objects, or issues in a consistently favorable or unfavorable way.
- 1. She is convinced …
  - **Cognitive**-based attitude: memories, evaluation, and beliefs about properties of the object
    - A Belief - an estimate (probability) about the truth of something
- 2. She loves working at …
  - **Affective** –based attitude: feeling, intuition, value, and emotion towards …
- **3.** She expects to stay …
  - **Behavioral** or Conative-based attitudes

Measurement Scales   5

Improving Predictability

Specific

Multiple measures

Reference groups

Factors

Strong

Direct

Basis: Cognitive, Affective

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Selecting a Measurement Scale

Research objectives

Response types

Data properties

Number of dimensions

Balanced or unbalanced

Forced or unforced choices

Number of scale points

Rater errors

Response Types

Rating scale:
• **Score, without making a direct comparison**

Ranking scale:
• **Make comparison and determine order among two or more properties**

Categorization:
• **Place into groups or categories**

Sorting:
• **Sort using established criteria**

Number of Dimensions

Unidimensional:
One attribute

Multi-dimensional:
Combined multiple attributes into one measure

Balanced or Unbalanced Scales

- **Balanced Scale** - has an equal number of categories Above and Below the Midpoint

❑Very bad
❑Bad
❑Neither good nor bad
❑Good
❑Very good

Unbalanced Scale - has an unequal number of favorable and unfavorable response choices

❑Poor
❑Fair
❑Good
❑Very good
❑Excellent

Forced or Unforced Choices

- Unforced – provides "No Opinion" choice
- Forces – requires a choice

❑ Very bad
❑ Bad
❑ Neither good nor bad
❑ Good
❑ Very good

❑ Very bad
❑ Bad
❑ Neither good nor bad
❑ Good
❑ Very good
❑ No opinion
❑ Don't know

Number of Scale Points

- 3-point scale
  - Better than average – Average – Worse than average
- 5, 7,11 point scales

❑ Very bad
❑ Bad
❑ Neither good nor bad
❑ Good
❑ Very good

❑ Very bad
❑ Somewhat bad
❑ A little bad
❑ Neither good nor bad
❑ A little good
❑ Somewhat good
❑ Very good

Rate Errors

Error of central tendency

Error of leniency

→

- **Adjust strength of descriptive adjectives**
- **Space intermediate descriptive phrases farther apart**
- **Provide smaller differences in meaning between terms near the ends of the scale**
- **Use more scale points**

Rate Errors (cont.)

Primacy Effect
Recency Effect

→

Reverse order of alternatives periodically or randomly

Rate Errors (cont.)

Halo Effects

→

Rate one trait at a time

Reveal one trait per page

Reverse anchors periodically

Simple Category Scale

Simple attitude scale
- **Dichotomous**
- **Data type: nominal**

I plan to purchase a MindWriter laptop in the 12 months.
- ❑ Yes
- ❑ No

Multiple-Choice, Single-Response Scale

- **Check list**
- **Select one or several**
- **Data type: nominal**

What newspaper do you read most often for financial news?
- ❑ East City Gazette
- ❑ West City Tribune
- ❑ Regional newspaper
- ❑ National newspaper
- ❑ Other (specify:_____)

Multiple-Choice, Multiple-Response Scale

- **Check list**
- **Data type: nominal**

What sources did you use when designing your new home? Please check all that apply.
- ❑ Online planning services
- ❑ Magazines
- ❑ Independent contractor/builder
- ❑ Designer
- ❑ Architect
- ❑ Other (specify:_____)

Likert Scale

- **Summated rating scale**
- **Data: interval**

The Internet is superior to traditional libraries for comprehensive searches.
- ❑ Strongly disagree (1)
- ❑ Disagree (2)
- ❑ Neither agree nor disagree (3)
- ❑ Agree (4)
- ❑ Strongly agree (5)

Measurement Scales

Semantic Differential (SD) Scale

- **Measures the psychological meaning of an attitude object using bipolar adjective.**
- **For studies of brand and institute image**
- **Data: interval**

Lands' End Catalog

FAST __ : __ : __ : __ : __ : __ : __ : SLOW
HIGH QUALITY __ : __ : __ : __ : __ : __ : __ : LOW QUALITY

Adapting SD Scale

Convenience of Reaching the Store from Your Location

Nearby	___:___:___:___:___:___:___:	Distant
Short time required to reach store	___:___:___:___:___:___:___:	Long time required to reach store
Difficult drive	___:___:___:___:___:___:___:	Easy Drive
Difficult to find parking place	___:___:___:___:___:___:___:	Easy to find parking place
Convenient to other stores I shop	___:___:___:___:___:___:___:	Inconvenient to other stores I shop

Products offered

Wide selection of different kinds of products	___:___:___:___:___:___:___:	Limited selection of different kinds of products
Fully stocked	___:___:___:___:___:___:___:	Understocked
Undependable products	___:___:___:___:___:___:___:	Dependable products
High quality	___:___:___:___:___:___:___:	Low quality
Numerous brands	___:___:___:___:___:___:___:	Few brands
Unknown brands	___:___:___:___:___:___:___:	Well-known brands

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SD Scale for Analyzing Industry Association Candidates

Analyze (candidate) for current position:

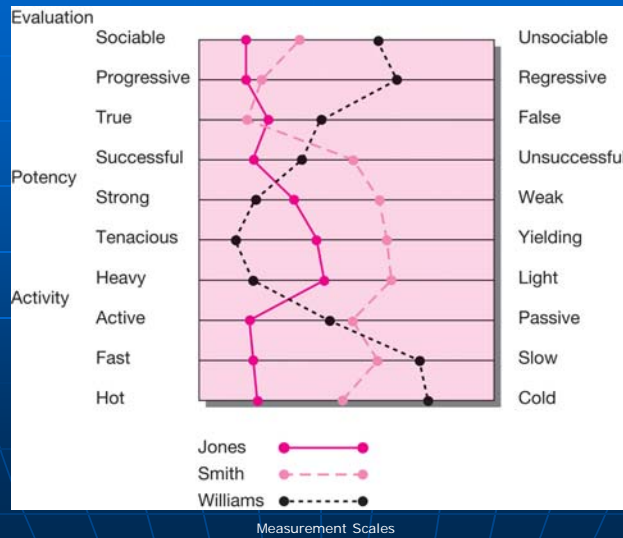|			
(E)	Sociable	(7): ___:___:___:___:___:___:___:	(1) Unsociable
(P)	Weak	(1): ___:___:___:___:___:___:___:	(7) Strong
(A)	Active	(7): ___:___:___:___:___:___:___:	(1) Passive
(E)	Progressive	(7): ___:___:___:___:___:___:___:	(1) Regressive
(P)	Yielding	(1): ___:___:___:___:___:___:___:	(7) Tenacious
(A)	Slow	(1): ___:___:___:___:___:___:___:	(7) Fast
(E)	True	(7): ___:___:___:___:___:___:___:	(1) False
(P)	Heavy	(7): ___:___:___:___:___:___:___:	(1) Light
(A)	Hot	(7): ___:___:___:___:___:___:___:	(1) Cold
(E)	Unsuccessful	(1): ___:___:___:___:___:___:___:	(7) Successful

- E – Evaluation, P – Potency, A – Activity scales are mixed

Measurement Scales

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Graphic (snake diagram) of SD Analysis - Reordered

Evaluation		
Sociable		Unsociable
Progressive		Regressive
True		False
Successful		Unsuccessful
Potency		
Strong		Weak
Tenacious		Yielding
Heavy		Light
Activity		
Active		Passive
Fast		Slow
Hot		Cold

Jones ●———●
Smith ●− − −●
Williams ●·······●

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Numerical Scale Examples

- **Have equal intervals that separate their numeric scale points**
- **Data: Ordinal or Interval**

EXTREMELY FAVORABLE	5	4	3	2	1	EXTREMELY UNFAVORABLE

Employee's cooperation in teams ___
Employee's knowledge of task ___
Employee's planning effectiveness ___

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Multiple Rating List Scales

■ **Data: interval**

"Please indicate how important or unimportant each service characteristic is":

	IMPORTANT						UNIMPORTANT
Fast, reliable repair	7	6	5	4	3	2	1
Service at my location	7	6	5	4	3	2	1
Maintenance by manufacturer	7	6	5	4	3	2	1
Knowledgeable technicians	7	6	5	4	3	2	1
Notification of upgrades	7	6	5	4	3	2	1
Service contract after warranty	7	6	5	4	3	2	1

Measurement Scales

Constant-Sum Scales

■ **Data: ratio**

"Taking all the supplier characteristics we've just discussed and now considering *cost*, what is their relative importance to you (dividing 100 units between)":

Being one of the lowest-cost suppliers	
All other aspects of supplier performance	
Sum	100

Measurement Scales

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Staple Scales

- **Similar to Semantic Differential scales**
- **Three attributes of corporate image, each attribute requires a scale with bipolar label**
- **Data: ordinal or Interval**

(Company Name)		
+5	+5	+5
+4	+4	+4
+3	+3	+3
+2	+2	+2
+1	+1	+1
Technology Leader	Exciting Products	World-Class Reputation
−1	−1	−1
−2	−2	−2
−3	−3	−3
−4	−4	−4
−5	−5	−5

Measurement Scales

Graphic Rating Scales

- **Enable measurement of finer difference**
- **Data: ordinal, interval or ratio**

"How likely are you to recommend CompleteCare to others?" (Place an X at the position along the line that best reflects your judgment.)

VERY LIKELY |————————————————| VERY UNLIKELY

|————————————|
(alternative with graphic)
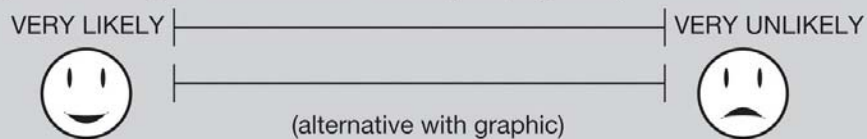
Ranking Scales

- **Paired-comparison scale**
  - Allow expressing attitudes unambiguously by choosing between two objects
- **Forced ranking scale**
  - Faster than paired comparisons and is usually easier and more motivating to the participant
- **Comparative scale**

Paired-Comparison Scale (Exhibit 12-10)

- **Data: Ordinal**

"For each pair of two-seat sports cars listed, place a check beside the one you would most prefer if you had to choose between the two."

___ BMW Z4 M Coupe   ___ Chevrolet Corvette Z06
___ Porsche Cayman S   ___ Porsche Cayman S

___ Chevrolet Corvette Z06   ___ Porsche Cayman S
___ BMW Z4 M Coupe   ___ Dodge Viper SRT10

___ Chevrolet Corvette Z06   ___ Dodge Viper SRT10
___ Dodge Viper SRT10   ___ BMW Z4 M Coupe

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Forced Ranking Scale

- Data: Ordinal

"Rank the radar detection features in your order of preference. Place the number 1 next to the most preferred, 2 by the second choice, and so forth."

___ User programming
___ Cordless capability
___ Small size
___ Long-range warning
___ Minimal false alarms

Measurement Scales

Comparative Scale

"Compared to your previous hair dryer's performance, the new one is":

SUPERIOR		ABOUT THE SAME		INFERIOR
—	—	—	—	—
1	2	3	4	5

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Sorting – Example of a Q-sort

- Solve three special problems: Item selection, Structured or unstructured choices in sorting, or Data analysis
- Involve the selection of a set of verbal statements, phrases, single words, or photos related the concept being studied

Edu-cated	Talk-ative	Lazy	Social	Shy	Ner-vous	Moti-vated	Self Confi-dent	Easy to Know
1	2	3	4	5	6	7	8	9

Example of a Q-Sort
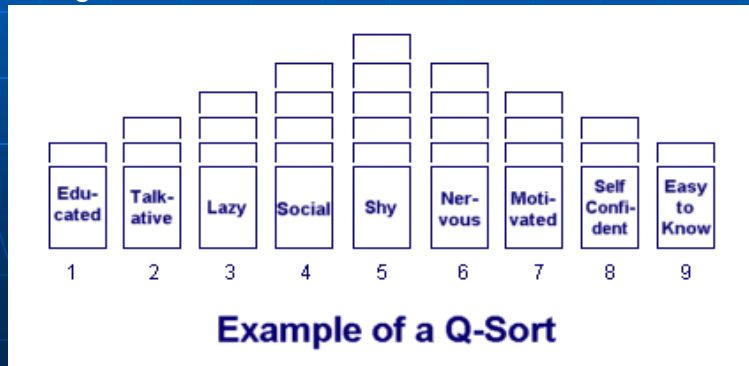
Exhibit 12-12 Alternative Scales Considered for MindWriter

Likert Scale

The problem that prompted service/repair was resolved

Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
1	2	3	4	5

Numerical Scale (MindWriter's Favorite)

To what extent are you satisfied that the problem that prompted service/repair was resolved?

Very Dissatisfied				Very Satisfied
1	2	3	4	5

Hybrid Expectation Scale

Resolution of the problem that prompted service/repair.

Met Few Expectations	Met Some Expectations	Met Most Expectations	Met All Expectations	Exceeded Expectations
1	2	3	4	5

Measurement Scales

Exhibit 12-13 Plot of MindWriter Scale Evaluation
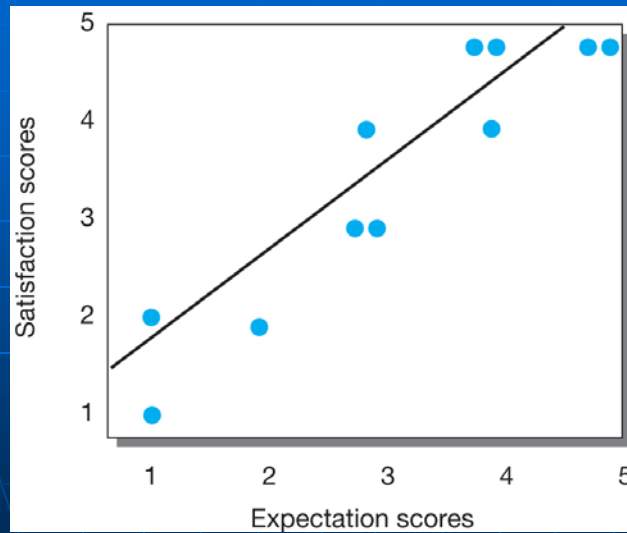
Cumulative Scales

- Total scores on cumulative scales have the same meaning.
- Given a person's total score, it is possible to estimate which items were answered positively and negatively
- A pioneering scale: Scalegram Analysis
  - For discovering highly structured attitudes and behaviors
    - Social distance
    - Organizational hierarchies
    - Evolutionary product stages

Exhibit 12-14 Ideal Sclogram Response Pattern

- Assume we are surveying opinion regarding a new Laptop computer and have developed a preference scale of four items:

1. myLaptop is good-looking.
2. I will insist on myLaptop next time because it is great-looking.
3. The appearance of myLaptop is acceptable to me.
4. I prefer the myLaptop style to other styles.

Exhibit 12-14 Ideal Scalogram Response Pattern

Item				
2	**4**	**1**	**3**	**Participant Score**
X	X	X	X	**4**
__	X	X	X	**3**
__	__	X	X	**2**
__	__	__	X	**1**
__	__	__	__	**0**

* X = agree; __ = disagree.

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Key Terms

- **Attitude**
- **Balanced rating scale**
- **Categorization**
- **Comparative scale**
- **Constant-sum scale**
- **Cumulative scale**
- **Error of central tendency**
- **Error of leniency**

- **Forced-choice rating scale**
- **Forced ranking scale**
- **Graphic rating scale**
- **Halo effect**
- **Item analysis**
- **Likert scale**
- **Multidimensional scale**

Key Terms

- **Multiple-choice, multiple-response scale**
- **Multiple-choice, single-response scale**
- **Multiple rating list**
- **Numerical scale**
- **Paired-comparison scale**

- **Q-sort**
- **Ranking scale**
- **Rating scale**
- **Scaling**
- **Scalogram analysis**
- **Semantic differential**
- **Simple category scale**

Key Terms

- **Sorting**
- **Stapel scale**
- **Summated rating scale**

- **Unbalanced rating scale**
- **Unforced-choice rating scale**
- **Unidimensional scale**

PicProfile: i.Think

Online focus groups

Candid thoughts

Moderator selection is critical

iThink:: Online Focus Groups

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PicProfile: Online Survey

Restaurant Evaluation   [Exit this survey]

1. In the last week, if you ate away from your residence or work, which of the following types of establishments did you patronize? (Check all that apply.)

	Lunch	Dinner
Buffets (Student Dining Room, Golden Corral, Chinese Buffet, etc.)	☐	☐
Chain Restaurants (Fridays, Applebee's, Cracker Barrel, etc.)	☐	☐
Fast Food Restaurants (McDonalds, Burger King, Taco Bell, etc.)	☐	☐
Local Restaurants (Seasons, Rudy's, Mi Jalapenos, Post95, etc.)	☐	☐
Pubs/Bars (Buffalo Wild Wings, O'Conner's, McMurray's, Founders, etc.)	☐	☐

2. When choosing a restaurant for food, rate the importance of each the following factors on your decision.

	1 (Low Importance)	2	3	4	5 (High-Importance)
Comfortable seating	○	○	○	○	○
Type of seating (booth vs. table vs. bar-round, etc.)	○				
Cleanliness	○				
Menu variety	○				
Quality of food	○				
Large portions	○				
Small portions	○				
Competitive price	○				
Time waiting to be seated	○				
Supporting a local establishment	○				
The use of fresh ingredients vs canned or frozen	○	○	○	○	○
Food taste	○	○	○	○	○
Vegan or Vegitarian options	○	○	○	○	○

Restaurant Evaluation   [Exit this survey]

The purpose of this survey is to learn more about student attitudes and perceptions of restaurant and entertainment venues and, in particular, of McMurray's and Paddy's Back Door Pizza. The survey will take less than 7 minutes. Your participation will help us better understand how these businesses can serve your future needs.

We appreciate your honest comments, and all information will be kept confidential.

At the end of the survey you may enter your email in a raffle to win a prize.

[Next]

>**pic**profile

SnapShot: Paired Comparison

"We now estimate that Americans with disabilities currently spent $13.2 billion in travel expenditures and that amount would at least double [to $27.2 billion] if travel businesses were more attuned to the needs of those with disabilities."

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Summary

Measurement Scales

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