Measurement and Scaling

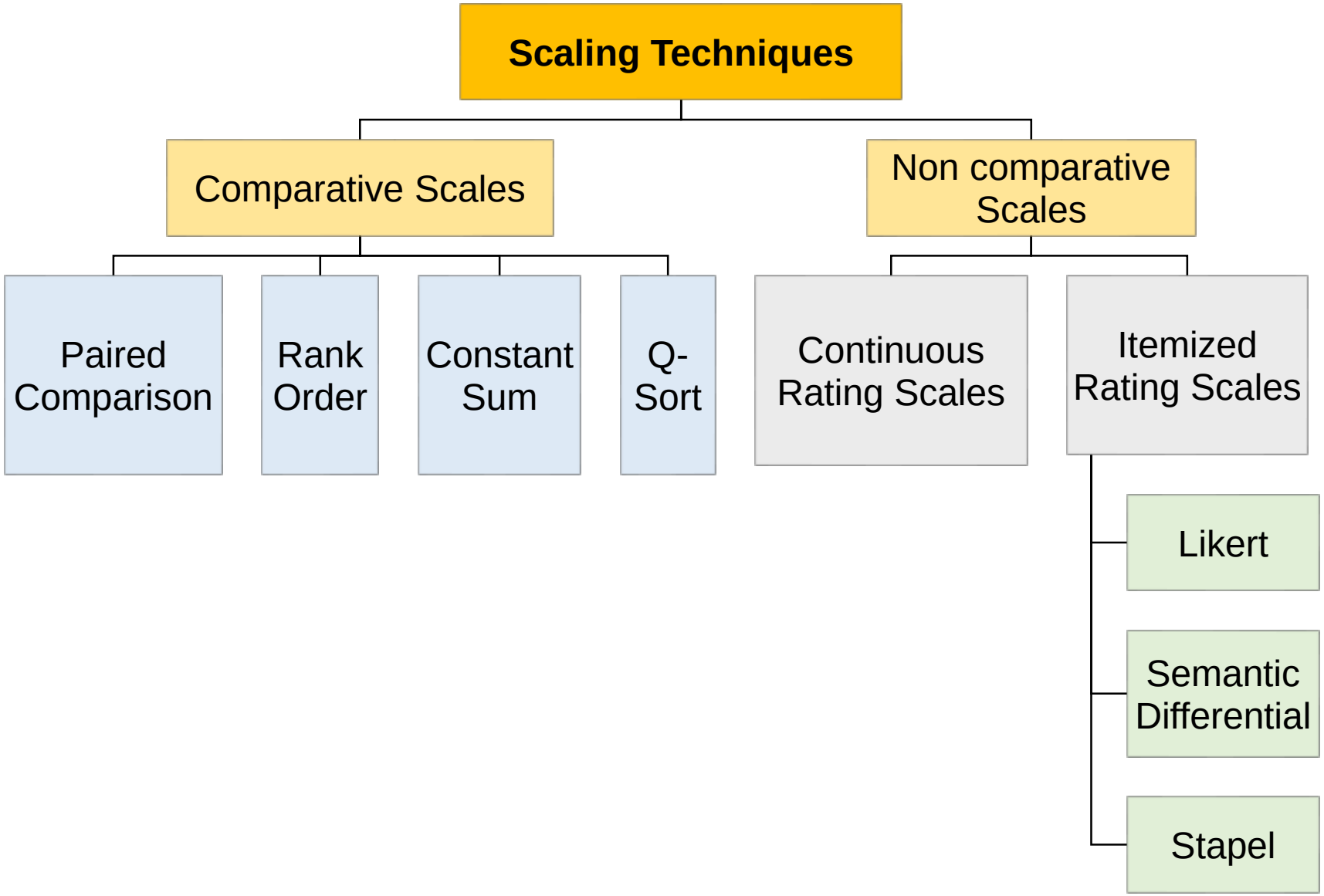
- Measurement means assigning numbers or other symbols to characteristics of objects according to certain pre-specified rules.
- We measure not the object but some characteristic of it, eg. consumers perceptions, attitudes, preferences or other relevant characteristics.
- Assigning numbers helps in statistical analysis and facilitate universal communication of measurement rules and results.
- The assignment process must be isomorphic, i.e. there must be one-to-one correspondence between the numbers and the characteristics being measured.
- Scaling involves creating a continuum upon which measured objects are located.

- **Measurement: Quantification of characteristics of objects.**
- **Scaling: denotes the level of measurement**

Scale Characteristics	Description	Order	Distance	Origin
Primary Scales	Codification Ex: Male=1, Female=2	Ranking <, >, =	Differences is comparable	Zero point is fixed
Nominal	√			
Ordinal	√	√		
Interval	√	√	√	
Ratio	√	√	√	√

Scale	Basic characteristics	Common examples	Marketing example		Permissible statistics
				Descriptive	Inferential
Nominal	Numbers identify and classify objects	Student registration numbers, numbers on football players' shirts	Gender classification, bank types	Percentages, mode	Chi-square, binomial test
Ordinal	Numbers indicate the relative positions of the objects but not the magnitude of differences between them	Rankings of the top four teams in the football World Cup	Ranking of service quality delivered by a number of banks. Rank order of favourite TV programmes	Percentile, median	Rank-order correlation, Friedman ANOVA
Interval	Differences between objects can be compared; zero point is arbitrary	Temperature (Fahrenheit, Celsius)	Attitudes, opinions, index numbers	Range, mean, standard deviation	Product moment correlations, *t* tests, ANOVA, regression, factor analysis
Ratio	Zero point is fixed; ratios of scale values can be computed	Length, weight	Age, income, costs, sales, market shares	Geometric mean, harmonic mean	Coefficient of variation

Classification of Scaling Techniques



- Paired Comparison Scaling:
  - respondent is presented with two objects at a time and are asked to select one object according to some criterion
  - Transitivity of preference
  - Saaty's pair-wise comparison nine point scale for AHP preference

Scale	Numerical rating	Reciprocal
Extremely importance	9	1/9
Very to extremely strongly importance	8	1/8
Very strongly importance	7	1/7
Strongly to very strongly importance	6	1/6
Strongly importance	5	1/5
Moderately to strongly importance	4	1/4
Moderately importance	3	1/3
Equally to moderately importance	2	1/2
Equally importance	1	1

AHP: Analytic hierarchy process

- Rank Order Scaling:
  - respondent is presented with several objects simultaneously and are asked to rank them according to some criterion
  - Ties may be given same rank

- Constant sum scaling:
  - respondent is required to allocate a constant sum of units among a set of objects with respect to some criterion
  - May be divide 100 into various attributes

- Q-sort scaling:
  - uses rank order procedure to sort objects based on similarity with respect to some criterion.
  - For example, respondents are given 100 attitude statements on individual cards and asked to place them into 11 piles, ranging from ‘most highly agreed with’ to ‘least highly agreed with’.
  - The number of objects to be sorted should not be less than 60 nor more than 140; a reasonable range is 60 to 90 objects.
  - The number of objects to be placed in each pile is pre-specified, often to result in a roughly normal distribution of objects over the whole set.

- Continuous rating scale:

Probably the worst ---------- Probably the best

0 20 40 60 80 100

- Likert scale:

Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree
1	2	3	4	5

- Semantic Differential scale: bipolar labels

powerful	-	-	-	-	-	weak
reliable	-	-	-	-	-	unreliable

- Stapel scale: single adjective in the middle

+5	+5
+4	+4
+3	+3
+2	+2
+1	+1
Quality	Reliability
-1	-1
-2	-2
-3	-3
-4	-4
-5	-5

The researcher must make six major decisions when constructing any of these scales:

- The number of scale categories to use
- Balanced versus unbalanced scale: the number of favourable and unfavorable categories is equal or unequal

Balanced scale

Clinique moisturiser for men is:

Extremely good	
Very good	✓
Good	
Bad	
Very bad	
Extremely bad	

Unbalanced scale

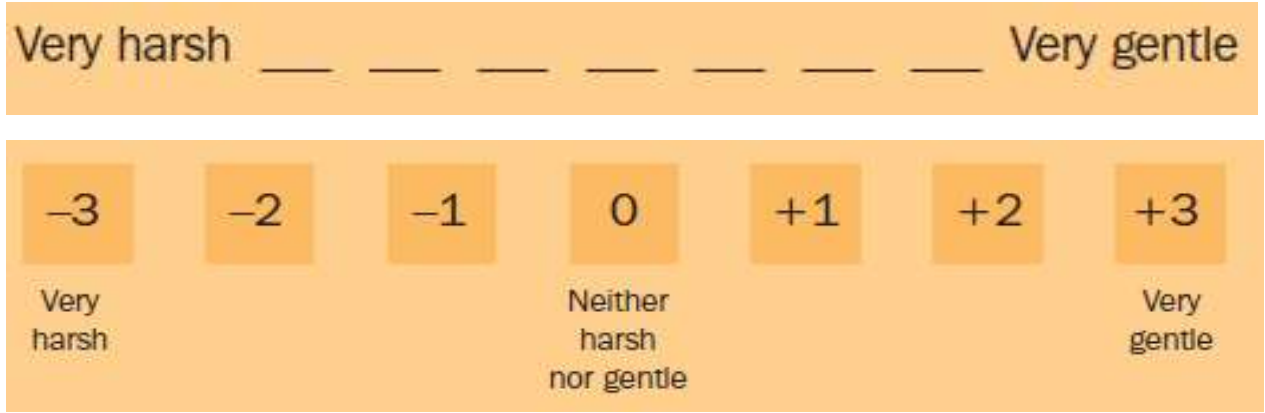
Clinique moisturiser for men is:

Extremely good	
Very good	✓
Good	
Somewhat good	
Bad	
Very bad	

- Odd or even number of categories: With an odd number of categories, the middle scale position is generally designated as neutral or impartial

The researcher must make six major decisions when constructing any of these scales:

- Forced versus non-forced choice: On forced rating scales the respondents are forced to express an opinion because a ‘no opinion’ option is not provided. In such a case, respondents without an opinion may mark the middle scale position.
- The nature and degree of the verbal description



- The physical form of the scale: Scales can be presented vertically or horizontally. Categories can be expressed by boxes, discrete lines or units on a continuum and may or may not have numbers assigned to them. If numerical values are used, they may be positive, negative or both.

Measurement accuracy

A measurement is a number that reflects some characteristic of an object. A measurement is not the true value of the characteristic of interest but rather an observation of it.

Measurement error
The variation in the information sought by the researcher and the information generated by the measurement process employed.

True score model
A mathematical model that provides a framework for understanding the accuracy of measurement.

Random error
An error that arises from random changes or differences in respondents or measurement situations.

presence of other people, noise and distractions

transient personal factors, such as health, emotions and fatigue

$$X_O = X_T + X_S + X_R$$

where X_O = the observed score or measurement
X_T = the true score of the characteristic
X_S = systematic error
X_R = random error

Systematic error
An error that affects the measurement in a constant way and represents stable factors that affect the observed score in the same way each time the measurement is made.

such as poor printing, overcrowding items in the questionnaire and poor design

Scale Evaluation

- A multi-item scale should be evaluated for accuracy and applicability: Assessment of Reliability and Validity
- Reliability: extent to which a scale produces consistent results. Systematic sources of error does not have impact on reliability. Basically, we try to minimize the random error.
    - Test-Retest : Respondents are administered identical set of scale items at two different time points.
    - Alternative- Forms: Two equivalent forms of scale are constructed, and responses are collected at two different time points.
    - Internal consistency: used to assess the reliability of a summated scale where several items are summed to form a total score. In a scale of this type, each item measures some aspect of the construct measured by the entire scale, and the items should be consistent in what they indicate about the construct (Cronbach's alpha)

Validity:

- The validity of a scale may be considered as the extent to which differences in observed scale scores reflect true differences among objects on the characteristic being measured.
- The differences between true and observed value should be low. No systematic or random error.
  - **Content validity,** sometimes called face validity, is a subjective but systematic evaluation of how well the content of a scale represents the measurement task at hand.
  - **Criterion validity,** reflects whether a scale performs as expected in relation to other selected variables (criterion variables) as meaningful criteria. If, for example, a scale is designed to measure loyalty in customers, criterion validity might be determined by comparing the results generated by this scale with results generated by observing the extent of repeat purchasing.
  - **Construct validity,** the researcher attempts to answer theoretical questions about why the scale works and what deductions can be made concerning the underlying theory. Thus, construct validity requires a sound theory of the nature of the construct being measured and how it relates to other constructs.

Questionnaire design (Survey Instrument)

Questionnaire
A structured technique for data collection consisting of a series of questions, written or verbal, that a respondent answers.

Pilot-testing
Testing the questionnaire on a small sample of respondents for the purpose of improving the questionnaire by identifying and eliminating potential problems.

Any questionnaire has three specific objectives

- translate the information needed into a set of specific questions that the respondents can and will answer.
- uplift, motivate and encourage the respondent to become involved, to cooperate, and to complete the task.
- minimise response error.

Questionnaire design (Survey Instrument)

- Question Content: Is the question necessary?
  - **Double-barrelled question:** A single question that attempts to cover two issues. Such questions can be confusing to respondents and result in ambiguous responses.
  - Consider the question ‘Do you think Coca-Cola is a tasty and refreshing soft drink?’
  - To obtain the required information, two distinct questions should be asked: ‘Do you think Coca-Cola is a tasty soft drink?’ and ‘Do you think Coca-Cola is a refreshing soft drink?’
- Overcoming inability and unwillingness to answer.

Questionnaire design (Survey Instrument)

- Question structure:
  - Unstructured: Open-ended
  - Structured: Closed-ended, like Multiple-Choice, Scales, Dichotomous.
- Choosing proper question words: Define issue properly, use ordinary words, avoid biasness, etc.

In a typical month, how often do you visit a bank?

	✓
Never	
Occasionally	
Sometimes	
Often	
Regularly	

In a typical month, how often do you visit a bank?

	✓
Less than once	
1 or 2 times	
3 or 4 times	
More than 4 times	

- Select the order of the questions to be placed.

HOUSEHOLD TELEPHONE CALLING CARD SURVEY

Your Name? _____ Age _____

Marital Status _____ Income _____

1. Which, if any of the following telephone cards do you have?

1. _____ Airtel
2. _____ BSNL
3. _____ Reliance
4. _____ Others

2. How frequently do you use a telephone calling card?

Infrequently						Very frequently
1	2	3	4	5	6	7

3. What do you think of the telephone calling card offered by Airtel?

_____

4. Suppose your household were to select the telephone calling card. Please rate the importance of the following factors in selecting a card.

		Not Important				Very Important
1.	Cost per call	1	2	3	4	5
2.	Ease of use	1	2	3	4	5
3.	Bill charges	1	2	3	4	5
4.	Discounts	1	2	3	4	5
5.	Quality of service	1	2	3	4	5
6.	Customer care	1	2	3	4	5

5. How important is it for a telephone company to offer a calling card?

Not important						Very Important
1	2	3	4	5	6	7

Thank you for your response.

Customer Satisfaction Survey Questionnaire

I. Questions **Directions: Please indicate your level of agreement or disagreement with each of these statements regarding QRZ Family Restaurant. Place an "X" mark in the box of your answer.**

Q1: How many times per year do you visit QRZ Family Restaurant?

_____

Q2: Do you visit QRZ Family Restaurant with family or friends?

□ **Yes** □ **No**

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. The store is accessibly located.					
2. Store hours are convenient for my dining needs.					
3. Advertised dish was in stock.					
4. A good selection of dishes was present.					
5. The meals sold are a good value for the money.					
6. Store has the lowest prices in the area.					
7. Meals sold are of the highest quality.					
8. Store atmosphere and decor are appealing.					

Q9: How would you rate your overall experience at the QRZ Family Restaurant?

- □ **Highly satisfactory**
- □ **Satisfactory**
- □ **Neutral**
- □ **Unsatisfactory**
- □ **Highly Unsatisfactory**

Q10: What could we do to make your restaurant dining experience better?

_____
_____
_____

Notes: The questionnaire may contain mixed closed-ended and open-ended questions as well as response formats. However, it is ideal to begin with closed-ended questions for higher response rates.

III. Demographic Data

Name (optional):_____
Age: ____
Gender: ____
Number of Family Members:

- □ **1-2**
- □ **3-5**
- □ **6-10**
- □ **more than 10**

Email Address (optional): _____

Notes: This section is optional. The questions asking for demographic data should be relevant to the survey goal and must point to the characteristics of the target population.

IV. Thank you for sharing your thoughts with us. Enjoy dining at QRZ Family Restaurant.

EMPLOYEE BENEFITS SURVEY QUESTIONNAIRE

To help us provide benefits that meet your needs, please complete this survey and return it to Human Resources.

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Health Benefits					
I am satisfied with my health plan options.					
I am satisfied with my dental plan options.					
I am satisfied with my vision plan options.					
I am satisfied with my long-term disability insurance.					
I am satisfied with my short-term disability insurance.					
I am satisfied with my options for life insurance.					
Overall, I am satisfied with my health benefits.					
Financial Benefits					
I am satisfied with my retirement plan.					
I am satisfied with my salary.					
I am satisfied with the Employee Stock Purchase Program.					
I am satisfied with my opportunities for promotion, raises, and bonuses.					
Overall, I am satisfied with my financial benefits.					

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Paid Time Off					
I am satisfied with the number of vacation, sick, and personal days that I receive.					
Overall, I am satisfied with my paid time off.					
Additional Benefits					
I am satisfied with my continuing education and training opportunities.					
I am satisfied with my tuition reimbursement options.					
Overall, I am satisfied with my additional benefits.					
Overall					
I understand my benefit options.					
I know where to find information about my benefits.					
I know whom to call if I have questions about my benefits.					
Overall, I am satisfied with my employee benefits.					
Additional Comments:					