SCALING TECHNIQUES
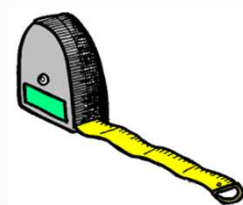
LECTURE OUTLINE

- **SCALING – MEANING**

- **SCALE CLASSIFICATION BASES**

- **IMPORTANT SCALING TECHNIQUES**

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THE PROBLEM

We may need to measure **physical objects** (weight, age, height, income…) or **abstract concepts** (liking, opinion, political alignment, personality, choice, social status, marital adjustment, motivation, satisfaction…)

- It is easy to assign numbers in respect to physical properties – they can be measured directly with some standard unit of measurement

- It is difficult and complex in case of qualitative/ abstract concepts – we are less confident about the accuracy of results of measurement

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THE PROBLEM

We want to
- Turn a series of **qualitative facts** (attributes) into **quantitative series** (variable)
- **Order** a series of items along some sort of continuum

Why?
- Qualitative analysis does not always suffice.
- Scientific studies rely greatly on mathematics
- Attributes are not amenable to mathematical manipulation. Variables are more flexible
- Scientific research calls for precise, quantitative and comparable measurement - for measuring **gradations**
- We need some way to measure small differences between adjacent classes

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Purpose of SCALING
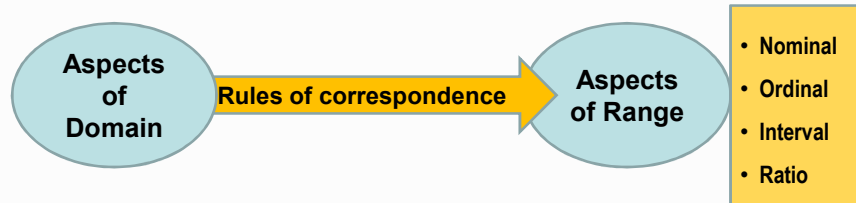
- In research we often face measurement problem especially when the concepts to be measured are complex and abstract…. and when there are no standardised measurement tools

- While measuring attitudes and opinions, we face the problem of valid measurement

Problem- How to scale the statements?

Solution – Assigning numbers to them (at least on interval scale) which represents that person's overall attitude or belief.

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SCALING IS THE ASSIGNMENT OF OBJECTS

TO NUMBERS ACCORDING TO RULE

Aspects of Domain → **Rules of correspondence** → Aspects of Range

- Nominal
- Ordinal
- Interval
- Ratio

Objects are text statements – indicative of attitude or belief

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SCALING - MEANING

- **Scaling** describes the **procedures of MEANINGFULLY** assigning numbers to various degrees of opinion, belief, attitude and other concepts

- In other words, scaling is the SET OF PROCEDURES for attempting to determine quantitative measures of subjective abstract concepts

QUALITATIVE FACTS (Attributes)

SCALING

QUANTITATIVE SERIES (VARIABLES)
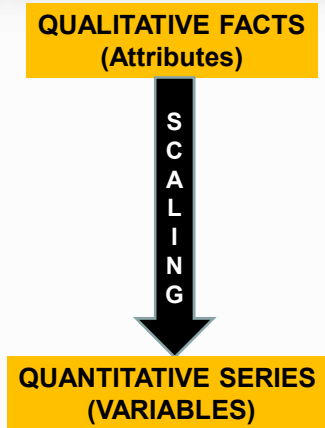
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THUS SCALING ENABLES US TO ….

- *Measure* attributes precisely

- Order a series of items along some sort of continuum

- Order the cases according to some principle

- Attributes are not amenable to mathematical manipulation.

  Variables, being expressible in numerical fashion, are more flexible

- Enables comparison among the cases

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THE PROCESS

It is four stage process

1.Concept development : Researcher should understand the basic concepts pertaining to his study. Thorough knowledge of the subject is essential.

Answer questions like-

•**What is it that you wish to measure quantitatively?**

•**Does a continuum exist?**

•**Are the items being selected logically related to the aspect being measured?**

•**Is the sample being selected representative of the Universe?**

•**What is the nature of population which is being scaled..does the continuum exist in that population? Relevance of scale may be different for different places, times and population groups**

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THE PROCESS

2. Specification of concept dimensions :

You want to measure the image of a company. Identify the dimensions:
- **Product reputation**
- **Customer treatment**
- **Corporate leadership**
- **Concern for individuals**
- **Sense of social responsibility**

And so on….

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THE PROCESS

3. **Selection of indicators**

Develop indices for measuring each of the dimensions

Specific questions, scales, or other devices by which respondents' knowledge, opinion, expectation, performance etc. may be measured

Use of more than one indicator gives stability to the scores and it also improves their validity

4. **Formation of Index**

How to combine measurements of different dimensions into a single index?

Provide scale values to the responses and then sum up the corresponding scores

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THE SCALE CONTINUUM

- **Scale is a CONTINUUM**

- **There is a highest point (in terms of some characteristic) and a lowest point along with several intermediate points between the two extremes**

- **The scale point positions are so related that *second* point indicates a higher degree in terms of a given characteristic as compared to the *third* point...the *third* point indicates a higher degree as compared to *fourth* point ..and so on..**

- **Numbers for measuring the distinctions of degree in the attitude/opinion are assigned to individuals corresponding to their scale-positions**

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SCALE vs RESPONSE SCALE

SCALE	RESPONSE SCALE
Procedures followed to come up to a numerical value for the object	The way you collect response on a survey instrument
Scaling procedures are done independent of the respondent	Used to collect response for an item from the respondent
Each item has a scale value	Item not associated with scale value.
It results from a process	You are simply attaching a response scale to an object or statement. You might chose a binary scale like agree/disagree or Yes/No… It may be an interval scale like 1-5 or 1-7 rating
Refers to set of items	Used for a single item

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SCALE CLASSIFICATION

The scaling procedures may be broadly classified on one or more of the following bases

Bases of Classification

- Subject orientation
- Form of Response
- Degree of subjectivity
- Scale mathematical properties
- Number of dimensions
- Scale construction technique

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SUBJECT ORIENTATION

- **Whether the scale has been designed to measure characteristics of respondent who completes it (we assume that the stimuli presented are sufficiently homogenous and variation among respondents is larger) or to judge the stimulus object which is presented to the respondent (we assume that between respondent variation is small as compared to variation among different stimuli).**

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FORM OF RESPONSE

Categorical (Rating) scale

Respondent scores some object without direct reference to other objects.

Comparative (Ranking) scale

Respondent is asked to compare two or more objects on the basis of certain property.

In this sense the respondent may rank the objects in an order (1,2,3...) relative to others.

Relative comparison of certain property of two or more objects

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DEGREE OF SUBJECTIVITY

- The scale data is based on whether we measure respondents' **subjective personal preferences** (respondent's likes/ choice etc. for the object – what does he prefer?) or simply make **non-preference judgements** (asked to judge which person would be more effective - without reflecting any personal preference)

- Eg.   SPP – Which person he favours?

-         NPJ – Which solution will take fewer resources?

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SCALE PROPERTIES

- Ratio
- Interval
- Ordinal
- Nominal

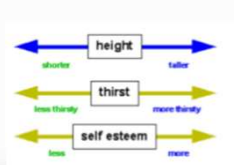**Based on level of measurement**

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Number of Dimensions

If we want to measure a construct, whether it can be measured well with one number line or it will need more
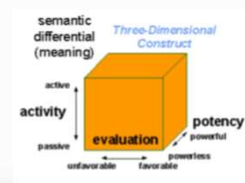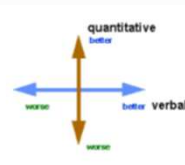
UNIDIMENSIONAL

We measure **only one attribute** of the respondent or object along one number line. Example: Thirst, Weight, Height

MULTIDIMENSIONAL

Object is measured by using 'n' dimensional attribute space. It is needed to locate the object as a point in two /three /n-dimensional space. Eg. Academic achievement

Scale Construction Techniques

There are five main techniques by which scales can be developed

1. **ARBITRARY APPROACH** - Most widely used approach. Scale is developed on ad hoc basis. It is assumed that the scale measures the concepts for which it has been designed, although there is little evidence to support this assumption.

2. **CONSENSUS APPROACH –** A panel of judges evaluate the items chosen for the scale. Whether the topics are relevant to the chosen area? Are they unambiguous?

3. **ITEMS ANALYSIS APPROACH** - We develop a number of individual items and give them to a group of respondents. Then total scores are calculated for every respondent. Some respondents may score high and some may score low. We then analyse which items discriminate between respondents scoring high and low.

Scale Construction Techniques (Contd.)

4. **CUMULATIVE SCALES** - Consist of a series of statements to which a respondent expresses his agreement or disagreement. The statements are ordered meaningfully in a manner that they tap progressively higher levels of an attribute (i.e. a cumulative series). A person whose attitude is at a certain point in cumulative scale implies that he is agrees to all items on one side of this point (all previous items) and does not agree with all items on the other side .

| | | Items | | | |
Person	1	2	3	4	Score
A	1	1	1	1	4
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C	1	1	0	0	2
D	1	0	0	0	1
E	0	0	0	0	0

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CUMULATIVE SCALE - Example

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Cumulative scale: example
(Also known as an 'implicational' scale)

5) I would have no objections to my son or daughter marrying a Scottish person

4) At a party I would not hesitate to dance with a Scottish person

3) I would have no objections to having a Scottish person dine in house

2) I would not object to having a Scottish family live next door

1) I would not object to sitting next to a Scottish person on a bus

Response format: "yes" = 0/"no" = 1

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Scale Construction Techniques (Contd.)

5. FACTOR SCALES - Measured through Factor Analysis method. Constructed mathematically on the basis of inter-correlations of items which indicate that a common factor accounts for the relationship between items.

Rot. Component Matrix^a

	Components (Factors)				
	1	2	3	4	5
Literacy Rate	.977				
Illiteracy Rate	-.977				
Male Literacy Rate	.946				
Female Literacy Rate	.918				
Other Workers (Total Population %)		.929			
Other Workers (% of workers)		.881			
Cultivators (% of workers)		-.700	-.563		
Household Workers (% of workers)		.623			
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Ag. Labourers (% of workers)			.948		
Marginal workers			.703		
Non Workers				-.953	
Work Participation Rate				.953	
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SC Population					.809
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Factor scale (Measures literacy status)

EXAMPLE

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Scale mathematical properties

Number of dimensions

Scale construction technique

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- **Whether the scale has been designed to measure characteristics of respondent who completes it (we assume that the stimuli presented are sufficiently homogenous and variation among respondents is larger) or to judge the stimulus object which is presented to the respondent (we assume that between respondent variation is small as compared to variation among different stimuli).**

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Comparative (Ranking) scale

Respondent is asked to compare two or more objects on the basis of certain property.

In this sense the respondent may rank the objects in an order (1,2,3...) relative to others.

Relative comparison of certain property of two or more objects

RATING SCALES

- A rating scale is a method that requires the rater to assign a value, sometimes numeric, to the rated object, as a measure of some rated attribute

- Qualitative description of a limited number of aspects of a thing or of traits of a person.

- Best used when you want to measure your respondents' attitude toward something.

- We are judging in absolute terms without reference to other similar objects

- Respondents are asked to indicate their personal levels on things such as agreement, satisfaction or frequency.

RATING SCALES

- In practice 3 to 7 point scales are generally used

- No specific rule - More points on a scale – greater sensitivity of measurement

Example – 2 to 5 Point scale

✓ Like – dislike

✓ Above average – average- below average

✓ Like very much – like somewhat – neutral- dislike somewhat – dislike very much

✓ Excellent- good – average – below average – poor

✓ Always – often – occasionally – rarely - never

RATING SCALES

Two types

1. GRAPHICAL

2. ITEMIZED

THE GRAPHICAL RATING SCALE

- **Very simple and common**

- **Various points are put along a line to form a continuum**

- **The rater indicates the rating by simply putting a √ mark at the appropriate point on the line which runs from one extreme to another**

- **Scale points with brief descriptions may be added along the line**

- **Boxes may be used to replace lines**

EXAMPLES

Please evaluate each of the following attributes of compact disc players according to how important the attribute is to you personally by placing an "X" at the position on the horizontal line that most accurately reflects your feelings.

Attribute	Not Important	Important
1. Sound Quality	_____	
2. Physical Size	_____	
3. Brand Name	_____	
4. Durability	_____	

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Graphic Rating Scale: Performance is assessed along one or more continua with specified intervals.

Example: A supervisor of a nurse answers the question"How would you rate the quality of care this nurse provides to patients?"

1	2	3	4	5
Low				High
Very low quality	Low quality	Neither low quality nor high quality	High quality	Very high quality

1. Respondent may check at almost any position along the line.

2. The meanings of descriptive terms used may depend upon respondent's frame of reference

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CONTINUOUS & DISCONTINUOUS RATING SCALE

DISCONTINUOS RATING SCALE

You must have seen this when you dine out...

Q4 How do you rate the following?

	Very poor	Poor	OK	Good	Very good
Q4a Service	☐	☐	☐	☐	☐
Q4b Cleanliness	☐	☐	☐	☐	☐
Q4c Parking	☐	☐	☐	☐	☐
Q4d Quality of Food	☐	☐	☐	☐	☐
Q4e Choice of Food	☐	☐	☐	☐	☐

ITEMIZED RATING SCALES

- Also known as **NUMERICAL SCALE**

- Respondents are provided with a scale that has a **number** or **brief description** associated with each category

- Presents a series of statements from which a respondent selects <u>ONE</u> as best reflecting his evaluation

- These statements are ordered progressively in terms of more or less of some property

- Chief merit of this type of scale is that it provides more information and meaning of the rater, thereby increasing reliability.

- Designing precise statements is difficult to develop and the statements may not say exactly what the respondent would like to express

EXAMPLE

Suppose we want to enquire as to how well a worker gets along with his fellow worker. We may ask him to express his opinion by selecting one of the given choices:

- He is always involved with some friction with a fellow worker

- He is often at odds with one or more of his fellow workers

- He sometimes gets involved in friction

- He infrequently becomes involved in friction with others

- He almost never gets involved in friction with fellow workers

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PROS & CONS – RATING SCALES

- Require less time

- Are interesting to use

- Have wide range of applications

- May be used with large number of properties or variables

- Reliability depends upon the assumption that the respondent can and do make good judgements

- If respondents are not careful while rating, errors may occur

PROS & CONS

Possibility of three types of errors

1. **The error of leniency –** easy raters or hard raters

2. **The error of central tendency –** reluctance to give extreme judgements

3. **The error of halo effect –** occurs when rater is asked to rate many factors, on a number of which he has no evidence of judgement

RANKING SCALES (Comparative scales)

Allows respondents to identify which objects are most and least preferred.

- Relative judgements are made against other similar objects

- Respondents directly compare two or more objects and make choices among them

- Two approaches:

  1.Method of paired comparisons

  2.Method of rank order

RATING Vs RANKING

A rating question asks you to compare different items using a common scale (e.g., "Please rate each of the following items on a scale of 1-10, where 1 is 'not at all important' and 10 is 'very important'")

while

A ranking question asks you to compare different items directly to one another (e.g., "Please rank each of the following items in order of importance, from the #1 most important item through the #10 least important item").

https://community.verint.com/b/customer-engagement/posts/ranking-questions-vs-rating-questions

3. DEGREE OF SUBJECTIVITY

- The scale data is based on whether we measure respondents' subjective personal preferences (respondent's likes/ choice etc. for the object – what does he prefer?) or simply make non-preference judgements (asked to judge which person would be more effective - without reflecting any personal preference)

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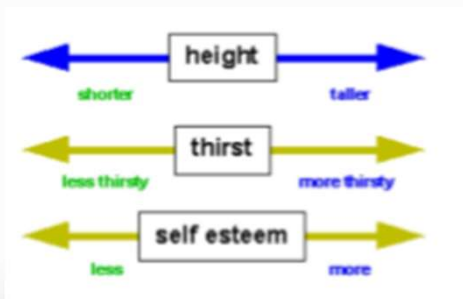
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Based on level of measurement

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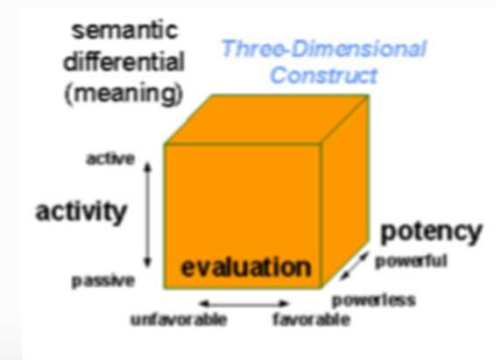
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6. SCALE CONSTRUCTION TECHNIQUES

Scale construction techniques refer to **approaches to develop an appropriate scale** for a particular study.

While developing statements, **two points** to be kept in mind:

1. Statements must elicit responses which are psychologically related to the attitude being measured

2. Statements need to be such that they discriminate not merely between extremes of attitude but also among individuals who differ slightly

Scale Construction Techniques

There are five main techniques by which scales can be developed

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Scale Construction Techniques (Contd.)

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Factor scale (Measures literacy status)

EXAMPLE

SCALE CONSTRUCTION TECHNIQUES

How scale is developed?

Arbitrary approach	It is presumed that the scale measures the concepts for which they have been designed, with little evidence to support this assumption
Consensus approach	A panel of judges evaluate the items chosen for inclusion in the instrument- whether they are relevant to the topic, unambiguous???
Item analysis approach	Number of individual items are developed into a test and administered to a group of respondents- total scores calculated – then individual items are analysed to determine which items are able to discriminate between the persons or objects
Cumulative scales	Chosen on the basis of ranking of items with ascending or descending discriminatory power
Factor analysis approach	Constructed on the basis of intercorrelations of items which indicate that a common factor accounts for the relationship between items. It is measured through factor analysis method

TYPES OF ATTITUDINAL SCALES

1. **ARBITRARY SCALE** –   Arbitrary approach

2. **LIKERT SCALE**   –   The summated rating scale (Item analysis

     approach)

3. **THURSTONE DIFFERENTIAL SCALE** – the equal appearing interval

     scale (Consensus scale approach)

4. **GUTTMAN SCALE** – the cumulative scale (Cumulative scale

     approach)

5. **FACTOR SCALE** – Factor analysis approach

ARBITRARY SCALE

- **Designed largely through the researcher's own subjective selection of items**

- **The researcher first collects and then selects few statements which he believes are unambiguous and appropriate to a given topic and includes them in measuring instrument**

- **People are asked to check the statements with which they agree**

- *Widely used in practice* **owing to their ease, speed and less cost of developing**

THE SUMMATED SCALE -LIKERT SCALE

- *Most frequently used summated scales – a RATING SCALE – used in questionnaires to measure peoples' attitude, opinion, perception*

- *Devised by Rensis Likert, an American Social Scientst in 1932, hence referred to as Likert Scale*

- *Subjects are presented with question or statement*

- *The respondent choose from a range of possible responses – typically a five (or seven) point scale which allow the individual to express how much they agree or disagree with a particular statement*

ATTITUDES & RESPONSE CATEGORIES - 5 Point scale

Attitudes

Response & values

Response Set	1	2	3	4	5
Frequency	Never	Rarely	Sometimes	Often	Always
Quality	Very poor	Poor	Fair	Good	Excellent
Intensity	None	Very mild	Mild	Moderate	Severe
Agreement	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Approval	Strongly disapprove	Disapprove	Neutral	Approve	Strongly approve
Awareness	Not at all aware	Slightly aware	Moderately aware	Very aware	Extremely aware
Importance	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Familiarity	Not at all familiar	Slightly familiar	Moderately familiar	Very familiar	Extremely familiar
Satisfaction	Not at all satisfied	Slightly satisfied	Moderately satisfied	Very satisfied	Completely satisfied
Performance	Far below standards	Below standards	Meets standards	Above standards	Far above standards

McLeod, S. A. (2019, August 03). *Likert scale*. Simply Psychology. https://www.simplypsychology.org/likert-scale.html

Responses – 5 point scale

Likelihood
Almost Always True
Usually True
Occasionally True
Usually Not True
Almost Never True

Likelihood
Definitely
Probably
Possibly
Probably Not
Definitely Not

https://www.simplypsychology.org/likert-scale.html

CONSIDERATIONS

Issues to consider while using/ constructing Likert scales

1.DIRECTIONALITY - Whether the attitude to be measured is to be classified into one, two or three directional categories (i.e. negative, positive and neutral positions with respect to attitude under study)

       Eg.   Knows the subject well – Positive

                  Has poor communication skills – Negative

                  Is liked by some students and not by others - Neutral

If your scale is one- directional it will contain only positive statements

CONSIDERATIONS…

2. *CATEGORIES OF RESPONSE -*

   Whether you want to use categories or numerical scale?

   Questions or statements?

   Statement scale?

   Positive, negative or neutral opinion?

   In which way your study population will better express their opinion?

5 Point Categorical Scale

The lecturer:	Strongly agree	Agree	Uncertain	Disagree	Strongly Disagree
1 Knows the subject well	☐	☐	☐	☐	☐
2 Is unenthusiastic about teaching	☐	☐	☐	☐	☐
3 Shows concern for students	☐	☐	☐	☐	☐
4 Makes unreasonable demands	☐	☐	☐	☐	☐
5 Has poor communication skills	☐	☐	☐	☐	☐
6 Knows how to teach	☐	☐	☐	☐	☐
7 Can explain difficult concepts in simple terms	☐	☐	☐	☐	☐
8 Is hard to approach	☐	☐	☐	☐	☐
9 Is liked by some students and not by others	☐	☐	☐	☐	☐
10 Is difficult to get along with	☐	☐	☐	☐	☐

Figure 10.1   An example of a categorical scale

Source: Ranjit Kumar (2014)

7 Point Numerical Scale

		7	6	5	4	3	2	1
1	Knows the subject well	7	6	5	4	3	2	1
2	Is enthusiastic about teaching	7	6	5	4	3	2	1
3	Shows no concern for students	7	6	5	4	3	2	1
4	Demands too much	7	6	5	4	3	2	1
5	Communicates well	7	6	5	4	3	2	1
6	Knows how to teach	7	6	5	4	3	2	1
7	Can explain difficult concepts in simple terms	7	6	5	4	3	2	1
8	Is seldom available to the students	7	6	5	4	3	2	1
9	Is liked by some students and not by others	7	6	5	4	3	2	1
10	Has published a great deal	7	6	5	4	3	2	1

Source: Ranjit Kumar (2014)

Statement Scale

Statements reflect varying degrees of an attitude

The Lecturer

(a)   **Knows the subject *extremely well***

(b)   **Knows the subject *well***

(c)   **Has an *average* knowledge of the subject**

(d)   *Does not know* **the subject**

(e)   **Has an *extremely poor knowledge* of the subject**

Source: Ranjit Kumar (2014)

CONSIDERATIONS…

3. SIZE OF SCALE - *Number of points or categories on the categorical scale?*

3 point, 5 point, 7 Point…..

This will depend on how finely you want to measure the intensity of attitude in question and on the capacity of population to make fine distinctions.

Traditionally 5 point scale is employed

A larger scale (7 point) could offer more choice, but it has been suggested that people tend not to select extreme categories in large scales Moreover, it may not be easy to discriminate between categories that are only subtly different.

Smaller scale (3 point) may not afford sufficient discrimination

Even scale (4 point, 6 point) forces respondents to come down broadly "for" or "against" a statement

https://www.britannica.com/

CONSIDERATIONS…

4. ORDINAL SCALE AND USE OF DESCRIPTIVE AND   INFERENTIAL STATISTICS -

Likert scale does not measure attitude per se

It is an ORDINAL scale – it places respondents in relation to each other in terms their intensity of attitude towards the issue , shows relative strength of attitude but not the absolute attitude

Thus responses have directionality, but interval cannot be presumed equal.

Choice of descriptive and inferential statistics should be made accordingly

Median, Mode, Frequency, Non-parametric Inferential Statistics - Chi-square test

LIKERT SCALE - CONSTRUCTION

Step 1: Construct statements that are reflective of the attitudes towards the main issue in question

- *Ideally statements should reflect both positive and negative attitude towards the issue*

- *All statements should be logically linked with the main issue*

- *Decide the categories of response*

- **Positive, negative and neutral items**
- **Assigning weights (values) to responses**

The lecturer:	SA	A	U	D	SD
1 Knows the subject well (+)	5	4	3	2	1
2 Is unenthusiastic about teaching (−)	1	2	3	4	5
3 Shows concern for students (+)	5	4	3	2	1
4 Makes unreasonable demands (−)	1	2	3	4	5
5 Has poor communication skills (−)					
6 Knows how to teach (+)					
7 Can explain difficult concepts in simple terms (+)					
8 Is hard to approach (−)					
9 Is liked by some students and not by others (+/−)					
10 Is difficult to get along with (−)					

SA = strongly agree, A = agree, U = uncertain, D = disagree, SD = strongly disagree

Source: Ranjit Kumar (2014)

Step 4. Calculate each respondent's total attitudinal score

Add the numerical values assigned in step 3

Step 5. Compare all respondents' total attitudinal score. Identify Non-discriminative items.

There will be respondents having high and low attitudinal scores

Analyse the responses of 'high' scorers and 'low' scorers to individual items. There will be some items to which both groups have responded in the same manner. These are called as 'non-discriminative items' – i.e. which do not help us distinguish between respondents. Everyone responds to them in the same way.

Calculating attitudinal score

The lecturer:	SA	A	U	D	SD
1 Knows the subject well (+)	@				#
2 Is unenthusiastic about teaching (−)		#			@
3 Shows concern for students (+)			@		#
4 Makes unreasonable demands (−)		#			@
5 Communicates poorly (−)		#			@
6 Knows how to teach (+)			@	#	
7 Can explain difficult concepts in simple terms (+)	@	#			
8 Is hard to approach (−)			@#		
9 Is liked by some students and not by others (+/−)				@#	
10 Is difficult to get along with (−)				#	@

More Positive attitude

Less positive attitude

SA = strongly agree, A = agree, U = uncertain, D = disagree, SD = strongly disagree

Statement no.	1	2	3	4	5	6	7	8	9	10	
Respondent @ =	5 +	5 +	3 +	5 +	5 +	4 +	5 +	3 +	2 +	5 = 42	**High scorer**
Respondent # =	1 +	2 +	1 +	2 +	2 +	2 +	4 +	3 +	2 +	3 = 22	**Low scorer**

LIKERT SCALE - CONSTRUCTION

Step 6. *Eliminate non-discriminative items*

Step 7. *Construct a questionnaire/ interview schedule comprising the selected items*

The lecturer:	SA	A	U	D	SD
1 Knows the subject well (+)	@				#
2 Is unenthusiastic about teaching (−)		#			@
3 Shows concern for students (+)			@		#
4 Makes unreasonable demands (−)		#			@
5 Communicates poorly (−)		#			@
6 Knows how to teach (+)			@	#	
7 Can explain difficult concepts in simple terms (+)	@	#			
8 Is hard to approach (−)			@#		
9 Is liked by some students and not by others (+/−)				@#	
10 Is difficult to get along with (−)				#	@

SA = strongly agree, A = agree, U = uncertain, D = disagree, SD = strongly disagree

non-discriminative items

Likert Scales - Advantages

- **Very popular in social surveys relating to measurement of attitudes – opinion research**

- **Easy and take less time to construct**

- **More reliable, respondents answer all statements included in the instrument**

- **Each statement is tested empirically for its discriminating ability**

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Likert Scales - Limitations

- **ORDINAL SCALE - Provides only direction of difference in attitude of respondents, does not quantify the how much more or less?**

- **The total score has little clear meaning- same total score may be secured by variety of answer patterns**

- **Reliability of responses – "there is a possibility that people may answer according to what they think they should feel rather than what they feel."**

Thurstone Scale – Consensus approach

❏ **Developed by Louis Thurstone in late 1920s**

❏ **He invented three methods of developing a uni-dimensional scale**

- **Method of equal appearing intervals - easiest**

- **Method of successive intervals**

- **Method of paired comparisons**

❏ **The three methods differ in how the scale values for items are constructed**

Thurstone Scale – Method of equal appearing intervals

❑ Scale is for situations when we are interested in something with many ordinal aspects but want a measure that combines all information into a single interval level continuum.

❑ Researcher gives a group of judges many items and asks them to sort the items into categories along a continuum (on basis of the degree to which each item relates to the core attitude being measured), and then considers the sorting results to select items on which the judges agree.

Law of Comparative Judgement

❑ **Uses the law of comparative judgement (Thurstone, 1927) to address the issue of comparing ordinal attitudes when each person makes a unique judgement.**

❑ **The law of CJ states that we can identify the most common response for each object or concept being judged.**

❑ **Although different people arrive at different judgements, the individual judgements cluster around a single most common response. Individual judgements are *normally distributed* around the *common* response.**

Law of Comparative Judgement

❑ **According the Law of CJ, if many people agree that** **two objects differ****, then the most** **common response for the two objects will be distant** **from each other.**

❑ **By contrast,** **if many people are confused** **or disagree, the** **common responses for the two objects will be closer** **to each other**

fppt.com

Method of Equal Appearing Intervals

STEPS

- **Developing the focus**

- **Generating potential Scale items**

- **Rating the Scale items**

- **Computing Scale Score Values for Each Item**

- **Administering the Scale**

THURSTONE SCALE

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1. Developing the focus

THURSTONE SCALE

- **Define the focus of the scale you want to develop – the idea/ concept of what is to be measured**

- **The set of statements to be designed will be guided by the focus**

- **Thus focus defines the universe of statements**

- **The concept should be uni-dimensional**

Eg. Variable to be measured: Opinion with regard to the death penalty

Source: Lawrence Neuman (2014) pp. 236

2. Generating potential Scale items

THURSTONE SCALE

- **Develop or gather a large number of candidate statements**

- **No. of statements must be large enough (20 to more than 100)**

- **These statements cover all shades of opinion towards the identified focus (Eg. favourable to unfavorable)**

- **Each statement should be clear and precise**

- **They should be unlikely to be endorsed by everyone**

- **All statements should be worded similarly – for eg. structured in such a way that respondent could agree or disagree with.**

- **Avoid words such as *always* and *never***

2. Generating potential Scale items – How?

- **Review the literature**
- **From media reports**
- **Ask others – field experts**
- **Personal experience**

Step 1: Develop 120 statements about the death penalty using personal experience, the popular and professional literature, and statements by others.

Example Statements
1. I think that the death penalty is cruel and unnecessary punishment.
2. Without the death penalty, there would be many more violent crimes.
3. I believe that the death penalty should be used only for a few extremely violent crimes.
4. I do not think that anyone was ever prevented from committing a murder because of fear of the death penalty.
5. I do not think that people should be exempt from the death penalty if they committed a murder even if they are insane.
6. I believe that the Bible justifies the use of the death penalty.
7. The death penalty itself is not the problem for me, but I believe that electrocuting people is a cruel way to put them to death.

Source: Lawrence Neuman (2014) pp. 236

3. Rating Scale items

- **Locate 50 to 300 judges , say 100, who should be familiar with the object or concept in the statements and agree to serve as Judges**

- **Place each statement on a separate card or sheet of paper and make 100 sets of the 120 statements (eg. on previous slide)**

- **Statement cards and instructions are submitted to panel of judges**

- **Each of the judges is to place each card in one of several piles.**

- **The number of piles is usually 7, 9, 11, or 13.**

- **The piles represent a range of values (e.g. favorable to neutral to unfavorable) with regard to the object or concept being evaluated**

3. Rating Scale items…..

- **Each judge rates the cards say on 11 point scale based on their 'favourableness' to the issue independently of the other judges.**

- **Thus all statements are arranged in 11 piles by all judges, ranging from one extreme position (most unfavourable) in 1st pile to the other extreme (most favourable) in 11th pile.**

1 = least favorable to the concept
11 = most favorable to the concept

| 1 | 2 | | 4 | | 6 |

| 7 | | 9 | 10 | 11 |

Source: https://socialresearchmethods.net
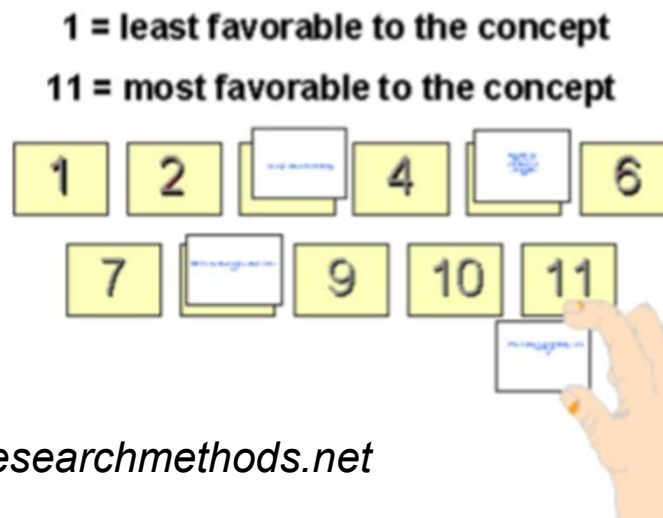
3. Rating Scale items .....

THURSTONE SCALE

Different judges may place same statement in different piles

- **Judge 1 puts statement 1 into Pile 1**

- **Judge 2 puts statement 1 into Pile 2**

- **Judge 3 also puts statement 1 into Pile 1**

- **Judge 4 puts statement 1 into Pile 3**

Collect piles from judges and create a chart summarizing their responses.

3. Rating Scale items ....

For eg. 100 statements and 11 piles result in an 11 x 100 chart, with 1100 boxes

Number of judges who assigned a rating to a given statement is written into each box.

NUMBER OF JUDGES RATING EACH STATEMENT RATING PILE

Statement	Unfavorable				Neutral					Favorable		Total
	1	2	3	4	5	6	7	8	9	10	11	
1	23	60	12	5	0	0	0	0	0	0	0	100
2	0	0	0	0	2	12	18	41	19	8	0	100
3	2	8	7	13	31	19	12	6	2	0	0	100
4	9	11	62	10	4	4	0	0	0	0	0	100

Statistical measures are used to compute **the average rating** of each statement and the **degree to which the judges agree or disagree**

THURSTONE SCALE

Analyse the rating data for each statement

For each item, plot the distribution of pile numbers...

get the median
and interquartile range
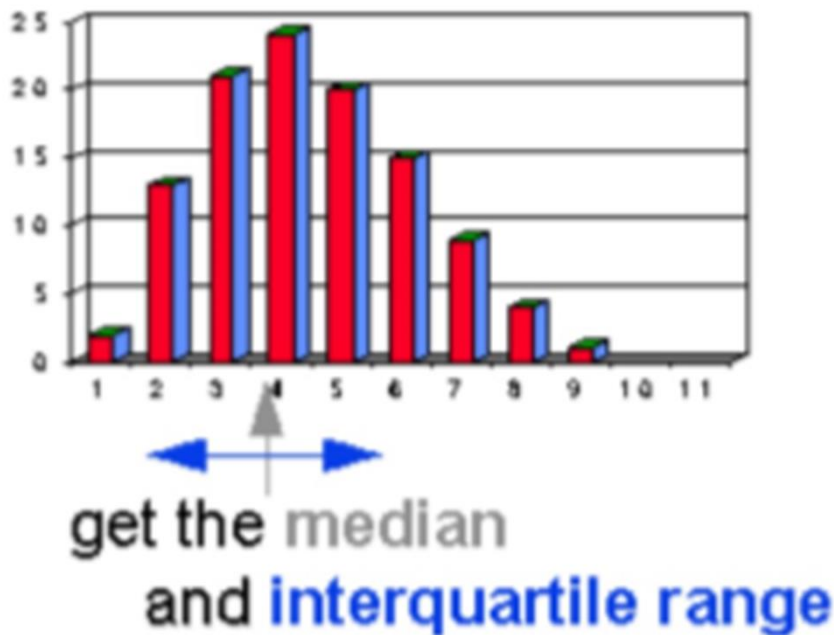
- **For each statement, compute the median (Average rating)**

- **Inter-quartile range of ratings (Measure of degree of agreement between judges)**

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4. Computing average rating

- **Tabulate the statement-wise median values and inter-quartile range**

- **Structure the table in ascending order by median and within that, in descending order by inter-quartile range**

Statement Number	Median	Q1	Q3	Interquartile Range
23	1	1	2.5	1.5
8	1	1	2	1
12	1	1	2	1
34	1	1	2	1
39	1	1	2	1
54	1	1	2	1
56	1	1	2	1
57	1	1	2	1
18	1	1	1	0
25	1	1	1	0
51	1	1	1	0
27	2	1	5	4

4. Selecting statements

17	→	5.5		4	8	4
49	→	6		5	9.75	4.75
50		8		5.5	11	5.5
35	→	8		6.25	10	3.75
29	→	9		5.5	11	5.5
38		9		5.5	10.5	5
3		9		6	10	4
55		9		7	11	4
10	→	10		6	10.5	4.5
7		10		7.5	11	3.5
46		10		8	11	3
5		10		8.5	11	2.5
53	→	11		9.5	11	1.5
4		11		10	11	1

- Select the statements that are at equal intervals across the range of medians

- We might select **one statement for each of the eleven median values**

- **The range reflects the entire range of opinion,** from favorable to neutral to unfavorable

4. Judging degree of agreement

17	5.5	4	8	4
49	6	5	9.75	4.75
50	8	5.5	11	5.5
35	8	6.25	10	3.75
29	9	5.5	11	5.5
38	9	5.5	10.5	5
3	9	6	10	4
55	9	7	11	4
10	10	6	10.5	4.5
7	10	7.5	11	3.5
46	10	8	11	3
5	10	8.5	11	2.5
53	11	9.5	11	1.5
4	11	10	11	1

- **Within each median value select the statement which has the smallest inter-quartile range** (least variability across judges)

- **The condition is not binding-** select the best statement within each sub-group which makes most sense

Assigning Scale Values

- **Chose the final statements to include in the Scale**

- **Assign the median value as the Scale Value to each statement**

- **Items with higher scale value should indicate a more favourable attitude towards the issue.**

- **For e.g. Set of statements for issue " Specific attitudes that people might have towards persons with AIDS."**

When we went through our statements, we came up with the following set of items for our scale:

- People with AIDS are like my parents (6)
- Because AIDS is preventable, we should focus our resources on prevention instead of curing (5)
- People with AIDS deserve what they got. (1)
- Aids affects us all (10)
- People with AIDS should be treated just like everybody else. (11)
- AIDS will never happen to me. (3)
- It's easy to get AIDS (5)
- AIDS doesn't have a preference, anyone can get it (9)
- AIDS is a disease that anyone can get if they are not careful (9)
- If you have AIDS, you can still lead a normal life (8)
- AIDS is good because it helps control the population. (2)
- I can't get AIDS if I'm in a monogamous relationship. (4)

Source: https://socialresearchmethods.net

Value in parentheses is the scale value.

In case of multiple statements with same scale value, keep the more appropriate one.

5. Administering the Scale

- The set of final selected statements constitute the final scale to be administered to respondents.

- Statements need not be arranged in order of their value.

- Respondents are asked to check the statements with which they agree

Agree ●	Disagree ○	People with AIDS are like my parents.
Agree ●	Disagree ○	Because AIDS is preventable, we should focus our resources on prevention instead of curing.
Agree ○	Disagree ●	People with AIDS deserve what they got.
Agree ●	Disagree ○	Aids affects us all.

Source: https://socialresearchmethods.net

Administering the Scale

THURSTONE SCALE

- Average the scale values of all the items that the person

  agreed with.

- The final average score quantifies their opinion.

Source: https://socialresearchmethods.net

Thurstone Scale – Pros & Cons

- **Widely used**

- **Considered most appropriate and reliable when used for measuring a single attitude**

- Measures agreement or disagreement with statement but not intensity of agreement/ disagreement

- Important deterrent is the cost , time and effort required to develop them.

- Another weakness is the judges may not be objective in assigning values to statements and their own attitudes may reflect in their judgement. Thus it is not completely objective.

- It is possible to get the same overall score in several ways. A/ DA with different combinations of statements can produce the same average

Guttman's Scalogram

- Developed by Louis Guttman, an American mathematician and sociologist in 1944

- Also known as Cumulative Scaling or Scalogram Analysis

- Guttman developed the scale to determine whether there was a structured relationship among a set of indicators?

- He wanted to learn whether multiple indicators about an issue had an underlying dimension or cumulative intensity?

- After data are collected, whether a hierarchical pattern exists among responses so that people who give responses at a higher level also tend to give lower level ones?

Guttman's Scalogram

- He wanted to improve upon the limitations of Likert or Thurstone scaling.

- He believed that an individual object could be measured by presenting the person with statements that had been ordered in terms of their favorableness or unfavorableness towards the target object.

- He theorized that a perfect scale would consist of a set of statements that were hierarchically cumulative in the sense that an individual who endorsed a particular statement would also endorse all less extreme statements in the set.

- An individual who failed to endorse a given statement would not endorse any statements

Guttman's Scalogram - Example

- **Deals with binary information, i.e. information with a yes or no answer, where that information can be assembled in a particular order.**

- **For eg. An information that can be assembled in a particular order might be**

- **I know what numbers are.**

- **I can add numbers**

- **I can do mathematical equations**

The responses of 3 persons to the 3 propositions have been arranged in Table A

Table A
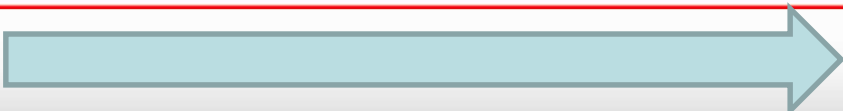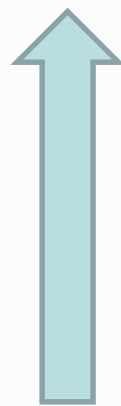
	Person A	Person B	Person C
adding numbers	+	+	-
understanding quadrilateral equations	+	-	-
understanding numbers	+	+	+

' + ' means Yes
' – ' means No

Source : Rochelle Forester (2019) " Guttman scale analysis and its use to explain cultural evolution and social change"

EXAMPLE

- **Table A does not show any particular pattern**

- **Without changing the data it has been arranged in Table B .**

- **We arrange** the statements (propositions) in order of complexity from bottom to top

- The respondents are arranged with least knowledgeable being listed first **and one with the greatest knowledge last**

Such tabular arrangement is called a Scalogram

Table B

	Person C	Person B	Person A
understanding quadrilateral equations	-	-	+
adding numbers	-	+	+
understanding numbers	+	+	+

Rochelle Forester, 2019

SCALOGRAM

- The scalogram has a stair stepped look known as 'Perfect scale'

- Number of '+' increase as one moves from left to right through the respondents.

- The scaling effect is not caused by manipulating the data, It must be present within the data for it to appear.

- This indicates that the data is not random but itself involves a process of accumulation

Table B			
understanding quadrilateral equations	-	-	+
adding numbers	-	+	+
understanding numbers	+	+	+
	Person C	Person B	Person A

Rochelle Forester, 2019

The CRUX – Scalogram analysis

- **The scale should be uni-dimensional**

- **It should comprise items which bear a hierarchical relationship**

- **We begin by measuring a set of items**

- **Such items are selected for which we believe there is a logical relationship among all of them**

- **Measurement is done in yes/no; present/absent or agree/disagree format**

- **We place the results into a Guttman scale chart**

- **Determine whether there is a hierarchical pattern among them**

- **Scalogram analysis allows us to test whether a patterned hierarchical relationship exists in the data**

Source: Lawrence Neuman, 2017, pp 239)

Guttman's Scalogram

- Consists of a series of statements to which a respondent expresses his **agreement or disagreement.**

- The **statements form a cumulative series**

- A respondent who agrees with a specific item in the list will also agree with all the previous items, and will disagree with all the items on the other side of it.

For example, we imagine a 10 item cumulative scale

If a respondent agrees with the 4th item, it should mean that he agrees with the first four statements

- The individual score is worked out by counting the number of points concerning the number of statements he answers favorably

- If **one knows this total score , one can estimate as to how a respondent has answered individual statements constituting cumulative scale**

A Uni-Dimensional Scale

- The objective is to find a set of items which perfectly matches this pattern

- Scalogram Analysis refers to the procedure used to determine how closely a set of items corresponds with this idea of cumulativeness, i.e. whether a set of items forms a uni-dimensional scale.

- If the scale is uni-dimensional, the response pattern will be as under

Item Number				Respondent Score
4	3	2	1	
X	X	X	X	4
–	X	X	X	3
–	–	X	X	2
–	–	–	X	1
–	–	–	–	0

X = Agree
– = Disagree

This pattern of responses reveals the universe of content is scalable.

Guttman's Scalogram (Louis Guttman, 1944)

A Scale is said to be unidimensional if the responses fall into a pattern in which endorsement of an item reflecting the extreme position results also in endorsing all items which are less extreme.

The respondents are asked to indicate in respect of each item whether they agree or disagree with it. If the scale is uni-dimensional, the response pattern will be as under

4	3	2	1	Respondent Score
	Item Number			
X	X	X	X	4
–	X	X	X	3
–	–	X	X	2
–	–	–	X	1
–	–	–	–	0

X = Agree
– = Disagree

Source : C.R. Kothari (pp. 87-89)

Step 2: Develop items

P
R
O
C
E
D
U
R
E

Develop a large set of items that reflects the concept

- I would permit a child of mine to marry an immigrant.
- I believe that this country should allow more immigrants in.
- I would be comfortable if a new immigrant moved next door to me.
- I would be comfortable with new immigrants moving into my community.
- It would be fine with me if new immigrants moved onto my block.

- I would be comfortable if an immigrant travels with me in a public transport.

…. And many more

(more than 4 times the number of items in final scale)

Eliminate by inspection those items which are ambiguous, irrelevant or too extreme

Step 3 : Pre-testing the items

- **To determine whether the issue at hand is scalable**

- **Guttman suggests that the pre-test should include 12 or more items if the final scale may have only 4 to 6 items**

- **The number of respondents in the pre-test may be small, say 20 to 25 but final scale should involve relatively more respondents, say 100 or more**

**P
R
O
C
E
D
U
R
E**

Rate the items

- Respondents are asked to record their opinion on **all selected statements/ items on a binary scale (Eg. agree /disagree)**

- Items are rated by the respondents in terms of **how favourable they are** to the concept of immigration.

- We are not asking the respondents whether they personally agree with the statement. We are just asking them to make judgement regarding **how the statement is related to the construct of interest**.

- Judges would give a '**Yes/ agree**' if an item is favourable, and '**No/ disagree**' if it is not.

Develop the cumulative scale

- Construct a matrix or a table that shows the **responses of all the respondents on all of the items.** Sort the matrix in such way that the **respondents who agree with more statements are listed at the top (highest total score)** and those agreeing with fewer are at the bottom.

- For respondents with same number of agreements, we sort the statements from left to right from those that most agreed to, to those that fewest agreed to.

	Health states							
	A	B	C	D	E	F	G	H
Patient 1	✓				✓	✓	✓	
Patient 2	✓	✓			✓	✓	✓	✓
Patient 3	✓							
Patient 4	✓				✓	✓	✓	
Patient 5	✓	✓	✓		✓	✓	✓	✓
Patient 6	✓				✗	✓	✓	✓
Patient 7	✓	✓	✓	✓	✓	✓	✓	✓

	Health states							
	A	F	G	E	H	B	C	D
Patient 7	✓	✓	✓	✓	✓	✓	✓	✓
Patient 5	✓	✓	✓	✓	✓	✓	✓	
Patient 2	✓	✓	✓	✓	✓	✓		
Patient 4	✓	✓	✓	✓				
Patient 1	✓	✓	✓	✓				
Patient 6	✓	✓	✓	✗	✓			
Patient 3	✓							

Step 4: Analysing pre-test results

- **If the responses for items form a cumulative scale, their response category scores should decrease in an orderly fashion.**

- **Failure to show the decreasing pattern means the item concerned is not a good cumulative scale item – delete it**

- **After analysing pre-test results, a few items, say 5 items may be chosen**

when sorted by row and column it will show whether there is a cumulative scale

Respondent	Item 2	Item 7	Item 5	Item 3	Item 8	Item ...
7	Y	Y	Y	Y	Y	Y
15	Y	Y	Y	–	Y	–
3	Y	Y	Y	Y		–
29	Y	Y	Y	Y		–
19	Y	Y	Y	–		–
32	Y	Y	Y	Y		–
41	Y	Y	Y	–		–
6	Y	Y	–	–		–
14	Y	–	–	Y		–
33	–	–	–	–		–

Exceptions

Step 4: Final selection of items

- Again total the scores of various opinionnaires, to rearray them to reflect any shift in order as a result of reducing the items from 15 to 5.

- Tabulate the final pre-test result as shown in table

Scale type	Item					Errors per case	Number of cases	Number of errors
	5	12	3	10	7			
5 (perfect)	X	X	X	X	X	0	7	0
4 (perfect)	–	X	X	X	X	0	3	0
(nonscale)	–	X	–	X	X	1	1	1
(nonscale)	–	X	X	–	X	1	2	2
3 (perfect)	–	–	X	X	X	0	5	0
2 (perfect)	–	–	–	X	X	0	2	0
1 (perfect)	–	–	–	–	X	0	1	0
(nonscale)	–	–	X	–	–	2	1	2
(nonscale)	–	–	X	–	–	2	1	2
0 (perfect)	–	–	–	–	–	0	2	0
	$n = 5$						$N = 25$	$e = 7$

Cited from C.R. Kothari (2004)

Step 5: The Perfect Scale & Non-scale responses

The final table has 5 items and responses of 25 respondents

- **Perfect scale types** are those in which the respondent's answers fit the pattern that would be reproduced by using the person's total score as guide

- **Non-scale types** are those in which category pattern differs from that expected from respondent's total score – that means the non-scale cases have deviations from uni-dimensionality or errors

Scale type	Item 5	12	3	10	7	Errors per case	Number of cases	Number of errors
5 (perfect)	X	X	X	X	X	0	7	0
4 (perfect)	–	X	X	X	X	0	3	0
(nonscale)	–	X	–	X	X	1	1	1
(nonscale)	–	X	X	–	X	1	2	2
3 (perfect)	–	–	X	X	X	0	5	0
2 (perfect)	–	–	–	X	X	0	2	0
1 (perfect)	–	–	–	–	X	0	1	0
(nonscale)	–	–	X	–	–	2	1	2
(nonscale)	–	–	X	–	–	2	1	2
0 (perfect)	–	–	–	–	–	0	2	0
	$n = 5$						$N = 25$	$e = 7$

Calculation of CR

The formula for the coefficient of reproducibility is

$$1 - \frac{\text{number of errors}}{\text{traits} \times \text{societies}}$$

Traits – items
Societies – Respondents/ Cases

Table G

	A	B	C	D	E	F
6	-	-	-	-	-	+
5	-	-	-	-	+	+
4	-	-	-	-	+	+
3	-	-	-	+	-	+
2	-	-	+	-	+	+
1	-	+	+	+	+	+

The number of errors for society D is 2 as it does not have trait 2 and it has trait 3 when it only has a total of 2 traits. Society E also has 2 errors as it does not have trait 3 and it has trait 5 when it only has 4 traits. This gives 4 errors in total which becomes the numerator while the denominator is the product of traits x societies as is shown below.

Cited from Rochelle Forester, 2019

Step 6: Evaluate selected items for their degree of fit in the expected hierarchical pattern

Compute Coefficient of Reproducibility

Scale type	Item					Errors per case	Number of cases	Number of errors
	5	12	3	10	7			
5 (perfect)	X	X	X	X	X	0	7	0
4 (perfect)	–	X	X	X	X	0	3	0
(nonscale)	–	X	–	X	X	1	1	1
(nonscale)	–	X	X	–	X	1	2	2
3 (perfect)	–	–	X	X	X	0	5	0
2 (perfect)	–	–	–	X	X	0	2	0
1 (perfect)	–	–	–	–	X	0	1	0
(nonscale)	–	–	X	–	–	2	1	2
(nonscale)	–	–	X	–	–	2	1	2
0 (perfect)	–	–	–	–	–	0	2	0
			$n = 5$				$N = 25$	$e = 7$

$$1- [7/ (5 *25)]$$

$$= 0.94$$

- Interpretation: Items nos. 5,12,3,10 and 7 in this order constitute the Cumulative scale or Uni-dimensional scale

- We can reproduce responses to each item, knowing only the total score of the respondent concerned

ADMINISTERING THE SCALE

- **Respondents are asked to check items with which they agree**

- **To compute a respondent's scale score, sum the scale values of every item they agree with**

- **The final value is an indication of their attitude towards the issue.**

Guttman's Scale – Pros & Cons

- **Ensures uni-dimensionality of scale**

- **Free from researcher's subjectivity**

- **Small number of items make scale easy to administer**

- **Can appropriately be used for personal, telephone and mail surveys**

- **Perfect cumulative scales are rarely found. We have to use its approximation testing it through CR**

- **Not frequently used due to complex and tedious development procedure**

- **Reliability is doubtful if for assessing attitudes of persons towards complex objects and for predicting behavioural responses of individuals towards such objects**

- **Conceptually difficult as compared to other scaling methods**

FACTOR SCALES

- **Multi-dimensional scales**

Two Scales

1. **Semantic Differential scale (S.D scale)**

2. **Multi-dimensional scaling (MDS)**