

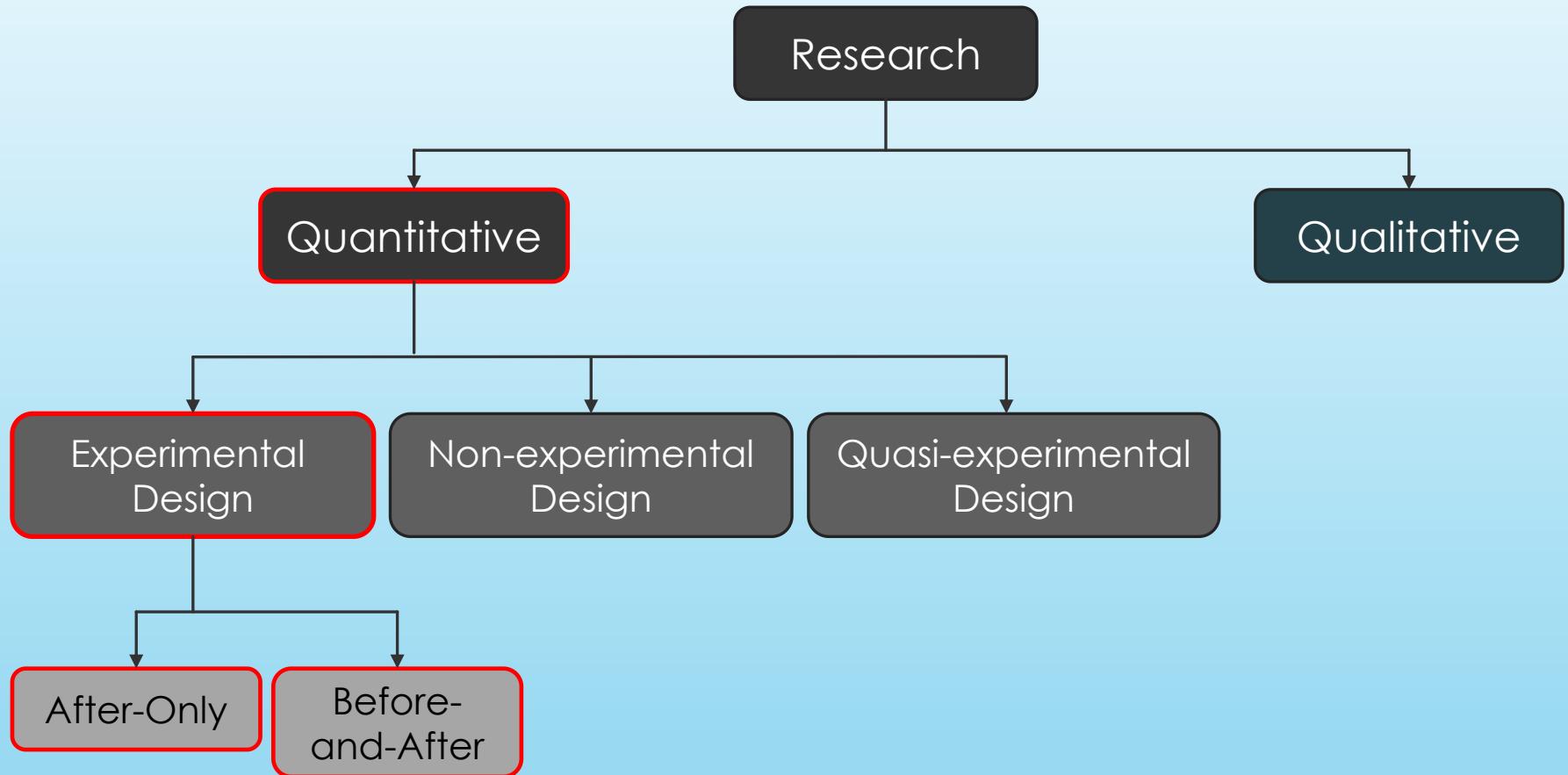
BACS2042 Research Methods

Data Collection and
Measurement Strategies

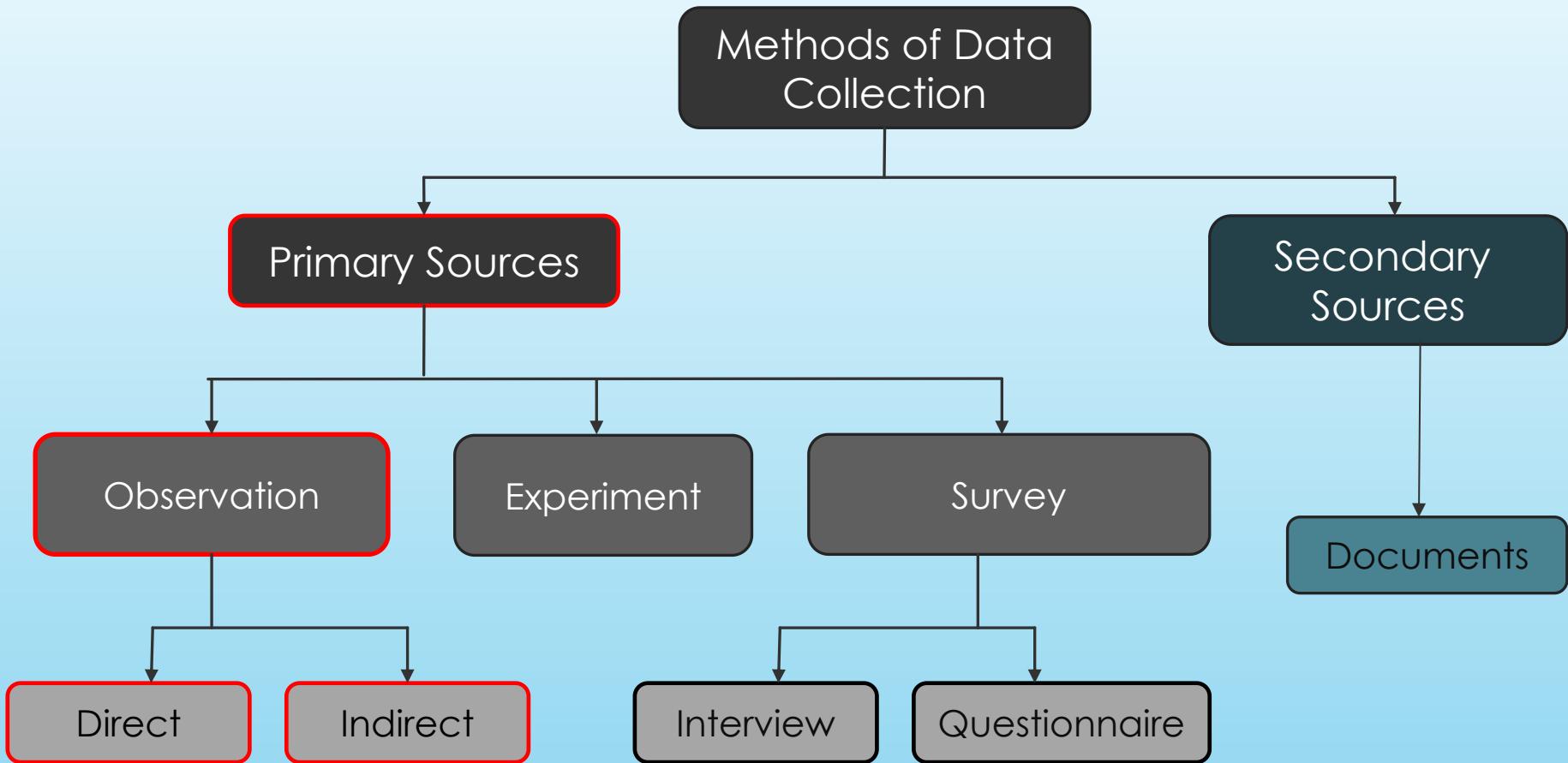
Contents

- ▶ Methods of Data Collection
- ▶ Data Sampling

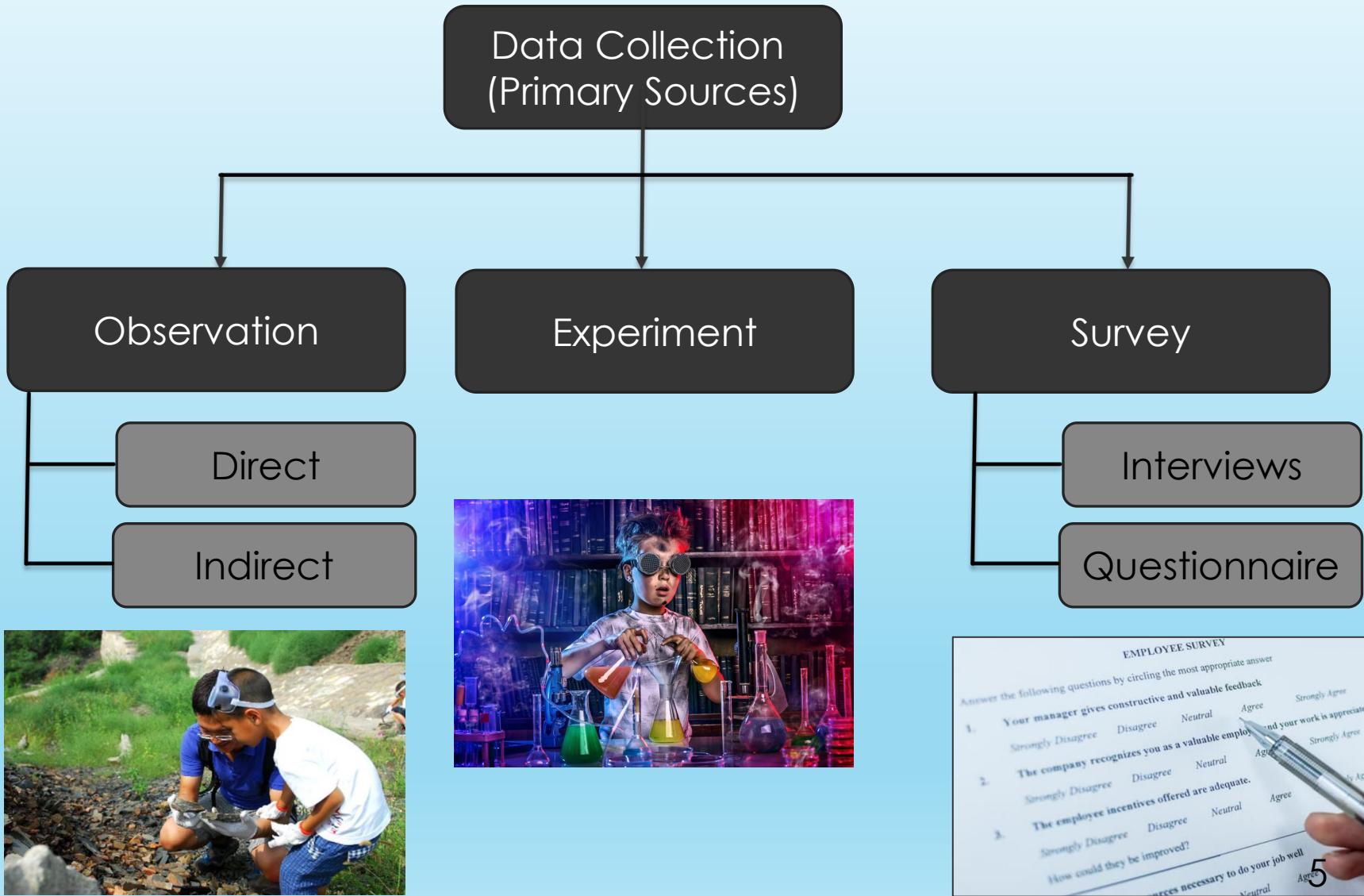
Recap



Methods of Data Collection

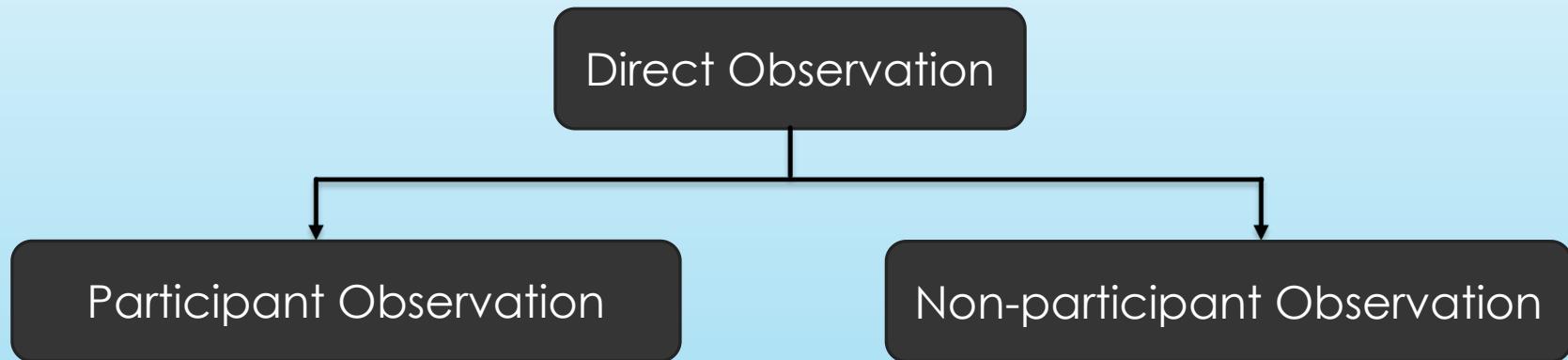


Methods of Data Collection



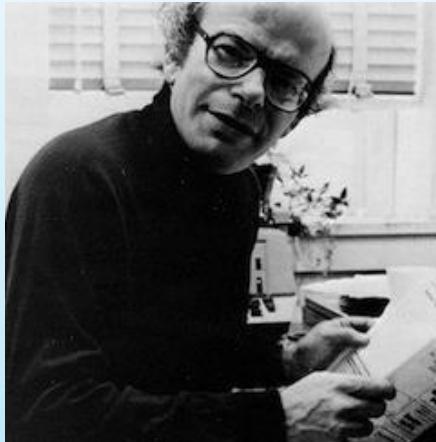
Direct Observation

- Observation is a purposeful, systematic and selective way of **watching** and **listening** to an interaction or phenomenon as it takes place.



Passive observer

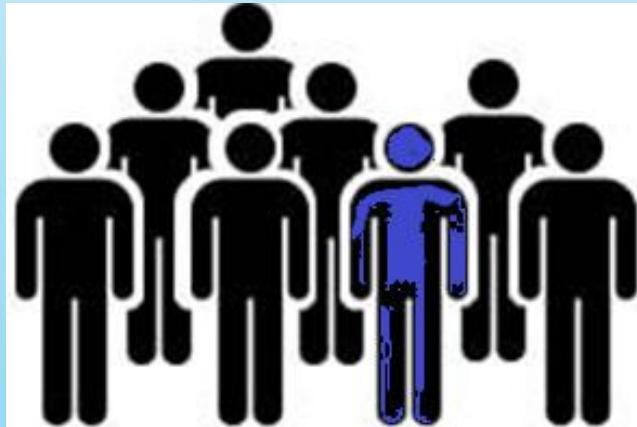
Direct: Participant Observation (Example)



Rosenhan Experiment

- To determine the validity of psychiatric diagnosis

Rosenhan, David (1973). "[On being sane in insane places](#)". *Science*. **179** (4070): 250–258

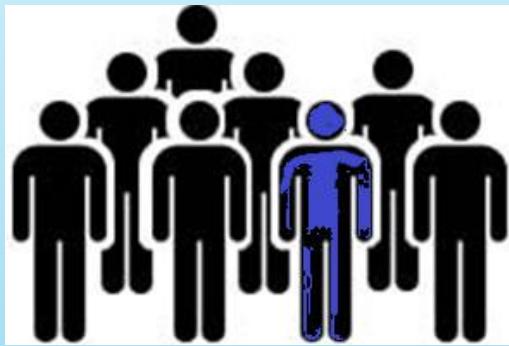


“Pseudopatients”
(researcher who poses as a patient)

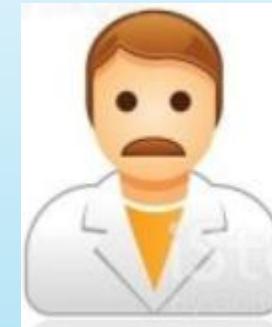




Auditory Hallucination



Psychiatric Disorders



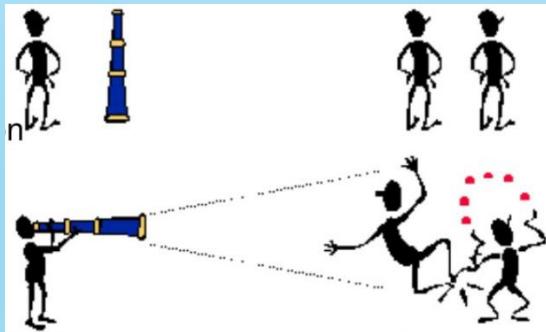
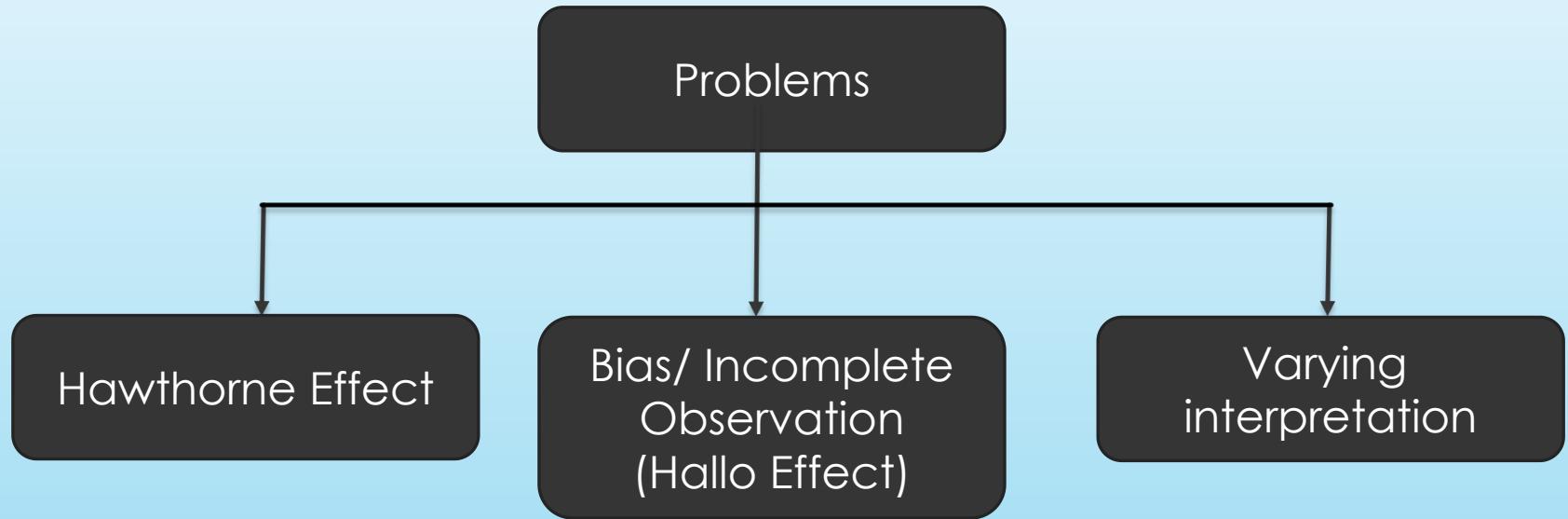
Conclusion: Psychiatrists **failed** to tell the **difference** between people who are **sane** and those who are **insane**

Direct: Non-participant Observation



Hawthorne Effect
Change in the behavior of persons when they know they are being observed

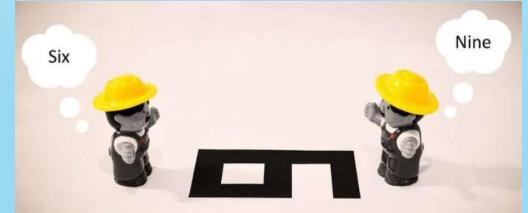
Direct: Non-participant Observation



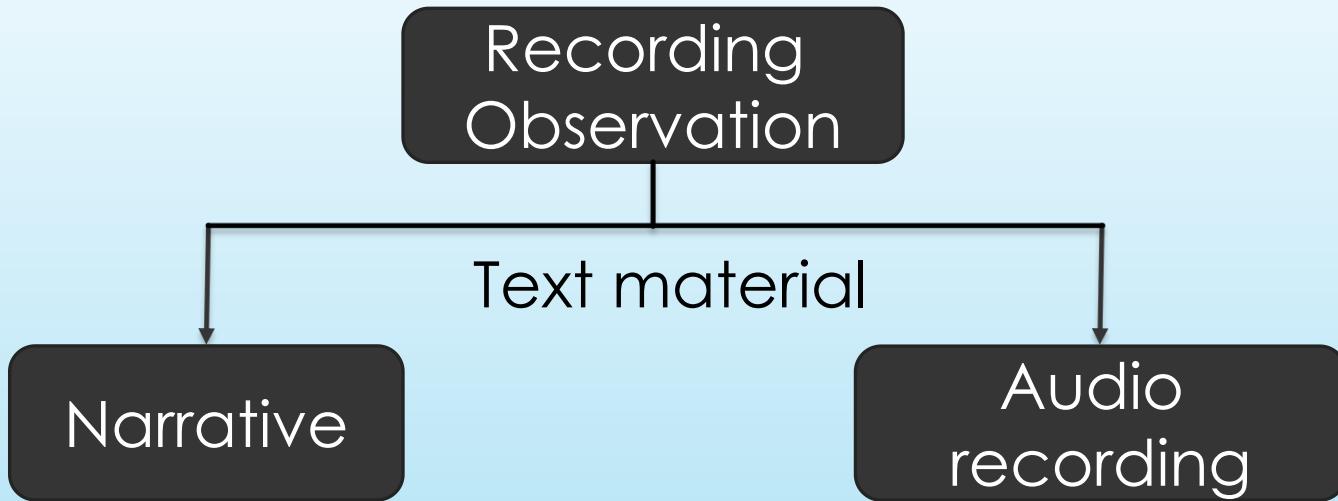
observee



observer



Indirect Observation



Text from the
observee's own
words

Complaint Letter

Sender Name
Sender's Title or Position
Sender's Organization Name
Sender Street Address
City, State, Zip Code
Date: DD/MM/YYYY

Recipient's Name
Recipient's Position or Title
Recipient's Organization Name
Recipient's Street Address
City, State, Zip Code

Dear Sir/ Madam,

I am writing this letter to bring your attention that I am not satisfied with your quality i _____ (business name). I am talking about the services i _____ and want to let you know I was very upset with your staff's performance. They used inefficiently and did not show their interest which they must show while dealing with re _____ I have been a regular client of your business but now I am completely disappointed. I _____ from you and request you to address this issue with immediate attention. I expect full forward to your replies within shortest time.

Yours Sincerely
Write Your Name Here

Donald J. Trump @realDonaldTrump · 5h
"President Trump to launch 2020 Campaign in Florida!" @foxandfriends Tuesday will be a Big Crowd and Big Day!

5.8K 8.6K 35K

Donald J. Trump @realDonaldTrump · 5h
All in for Senator Steve Daines as he proposes an Amendment for a strong BAN on burning our American Flag. A no brainer!

11K 11K 47K

Donald J. Trump @realDonaldTrump · 6h
Despite the Greatest Presidential Harassment of all time by people that are very dishonest and want to destroy our Country, we are doing great in the Polls, even better than in 2016, and will be packed at the Tuesday Announcement Rally in Orlando, Florida. KEEP AMERICA GREAT!

9.8K 13K 53K

Dan Scavino @DanScavino · May 22
Dems will keep their (embarrassing) games going on here in THE SWAMP until 2020 because they hate Trump & they think it helps them politically. It is their goal to make the lives of those who have supported/worked for Trump, miserable. They're failing. Great news, SIX MORE YEARS!

1.7K 5.2K 16K



Data Collection (Primary Sources)



EMPLOYEE SURVEY

Answer the following questions by circling the most appropriate answer

1. Your manager gives constructive and valuable feedback

Strongly Disagree Disagree Neutral Agree Strongly Agree

2. The company recognizes you as a valuable employee and your work is appreciated

Strongly Disagree Disagree Neutral Agree Strongly Agree

3. The employee incentives offered are adequate

Strongly Disagree Disagree Neutral Agree Strongly Agree

How could they be improved?

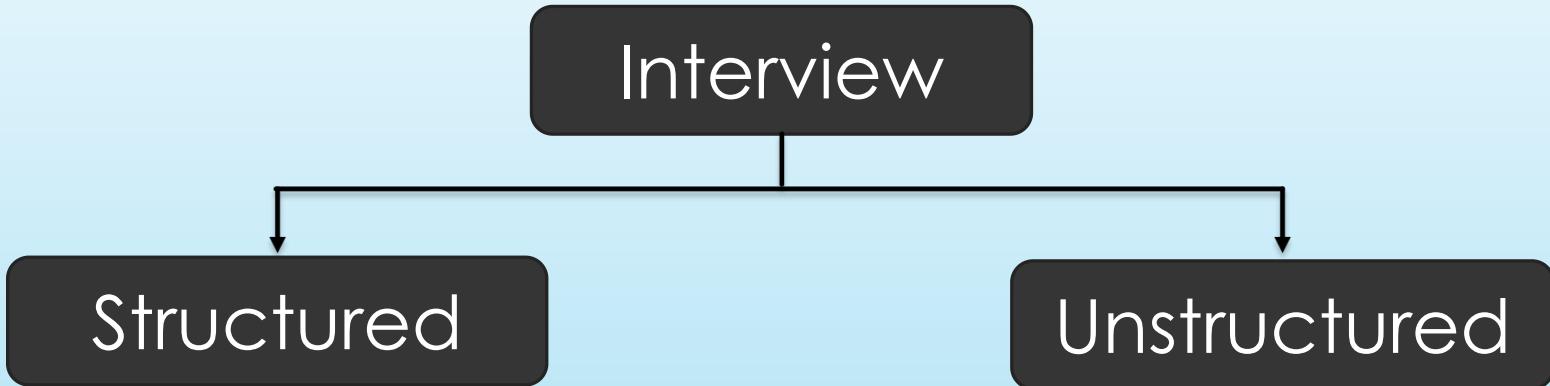
Strongly Disagree Disagree Neutral Agree Strongly Agree

ources necessary to do your job well

Neutral Agree

A hand holding a pen is shown pointing at the "Strongly Agree" option for the third question.

Survey: Interview



- Ask **pre-set** questions
- Face-to-face, telephone, or other electronic media

- 1. Describe the most embarrassing situation you experienced while you were learning English. What was the situation, what did you do, what happened as a result? What would you do differently if you experienced a similar circumstance now?
- 2. What motivates you most at work? How does this affect the work that you do? How does it affect the relationships you have with your colleagues?
- 3. Tell me about the best class you have ever taken. What was the class? Why was it good?

- Formulate questions spontaneously during interview – **“goes with the flow”**.
- One-to-one or with a group of respondents (focused group interview)

Survey: Questionnaire

- A questionnaire is a written list of questions, the answers to which are recorded by respondents.
- Since there is no one to explain the meaning of the questions, it is important to keep the questions, simple, clear and easy to understand.
- Over the years, a lot of thought has been put into the science of the design of survey questions.

Questionnaire (Design Principles)

Questionnaire

Please indicate your gender Male Female

Please select the category of your age under 30 30-50 above 50

Start with demographic questions

Have you watched End Game? Yes No

Who is your favourite character? Iron-man Captain American Thor Dr. Strange
 Non of the above

Short, simple, and clear questions

Why do you like the above selected character? Use open-ended questions cautiously

Most people do not like Thanos. What is your opinion on him? Avoid leading questions

Use (yes | no) and multiple choice questions

Keep questionnaire as short as possible

- Pretest on a small number of people.

Data Sampling

Population



Sample

- Less expensive
- More practical

WHO - To study the effect of depression on chronic diseases (Example)

Depression, chronic diseases, and decrements in health: results from the World Health Surveys

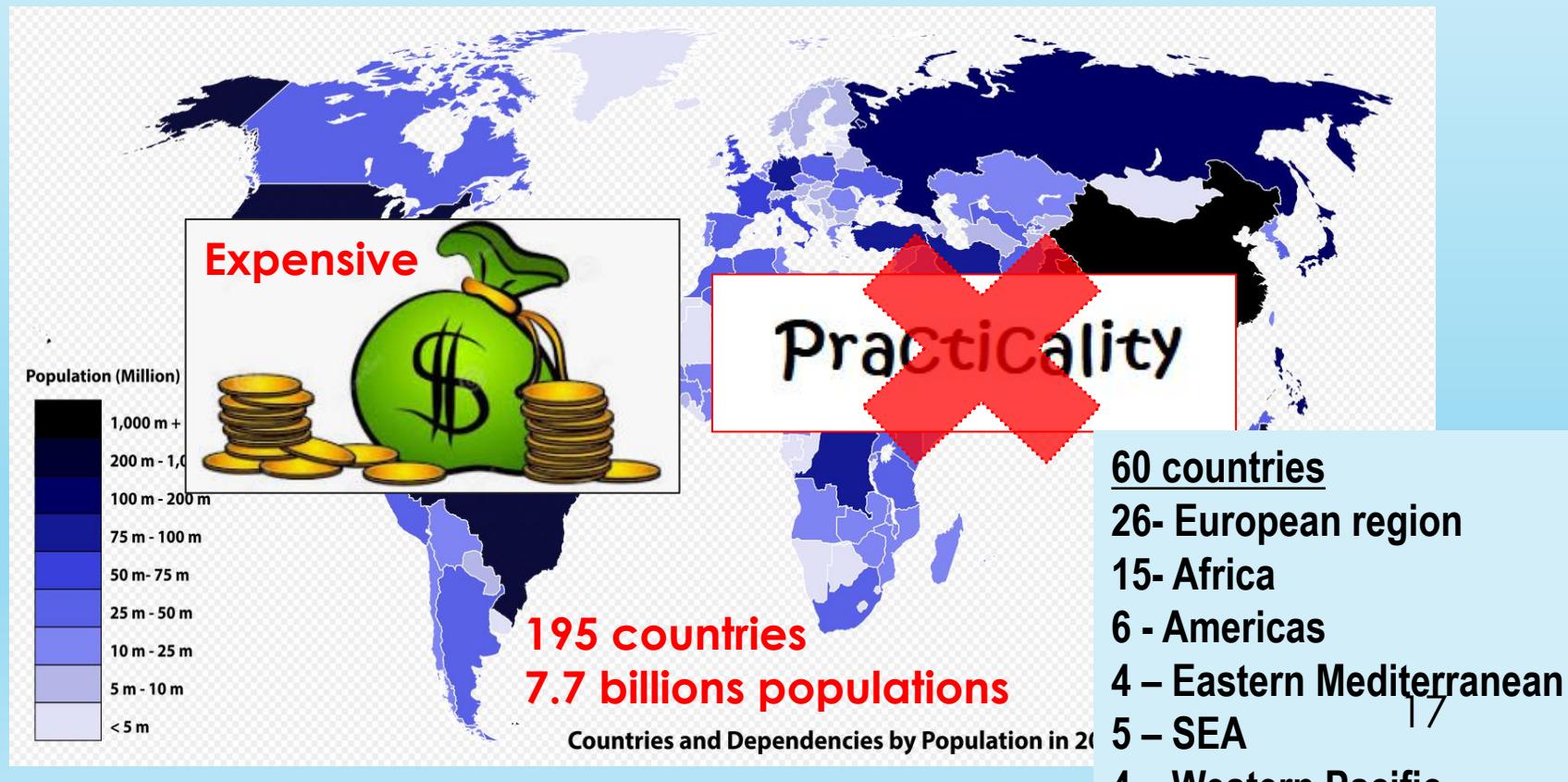
Saba Moussavi, Somnath Chatterji, Emese Verdes, Ajay Tandon, Vikram Patel, Bedirhan Ustun

Summary

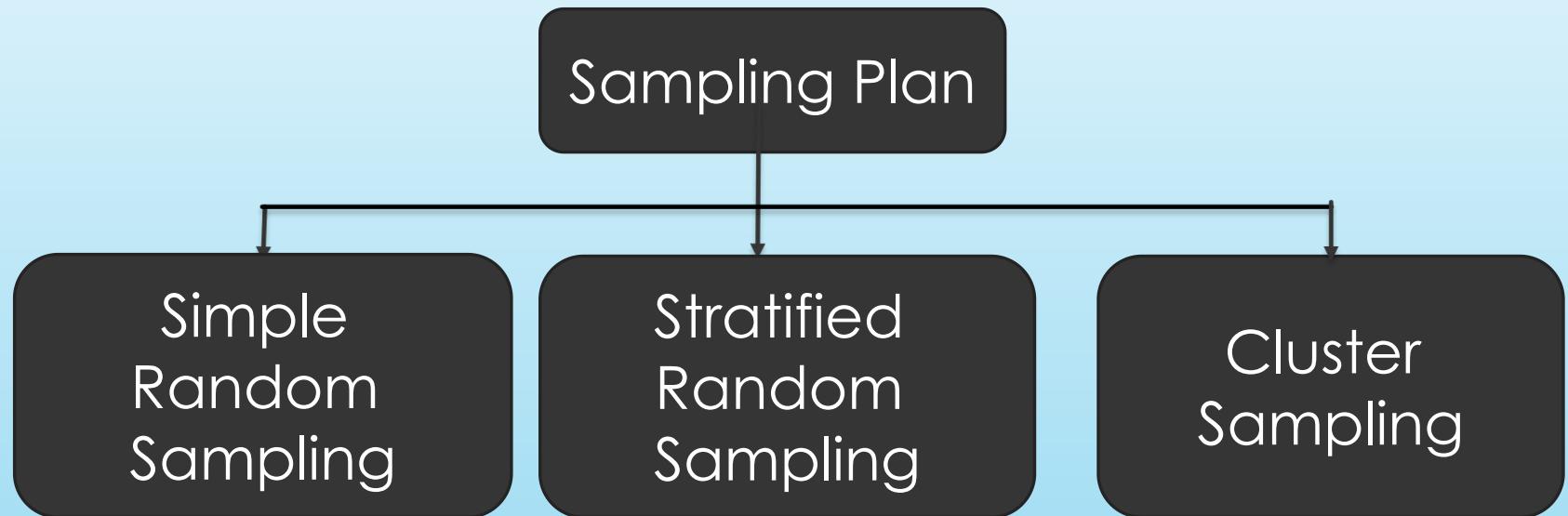
Background Depression is an important public-health problem, and one of the leading causes of disease burden worldwide. Depression is often comorbid with other chronic diseases and can worsen their associated health outcomes. Few studies have explored the effect of depression, alone or as a comorbidity, on overall health status.

Methods The WHO World Health Survey (WHS) studied adults aged 18 years and older to obtain data for health, health-related outcomes, and their determinants. Prevalence of depression in respondents based on ICD-10 criteria was estimated. Prevalence values for four chronic physical diseases—angina, arthritis, asthma, and diabetes—were also estimated using algorithms derived via a Diagnostic Item Probability Study. Mean health scores were constructed using factor analysis and compared across different disease states and demographic variables. The relation of these

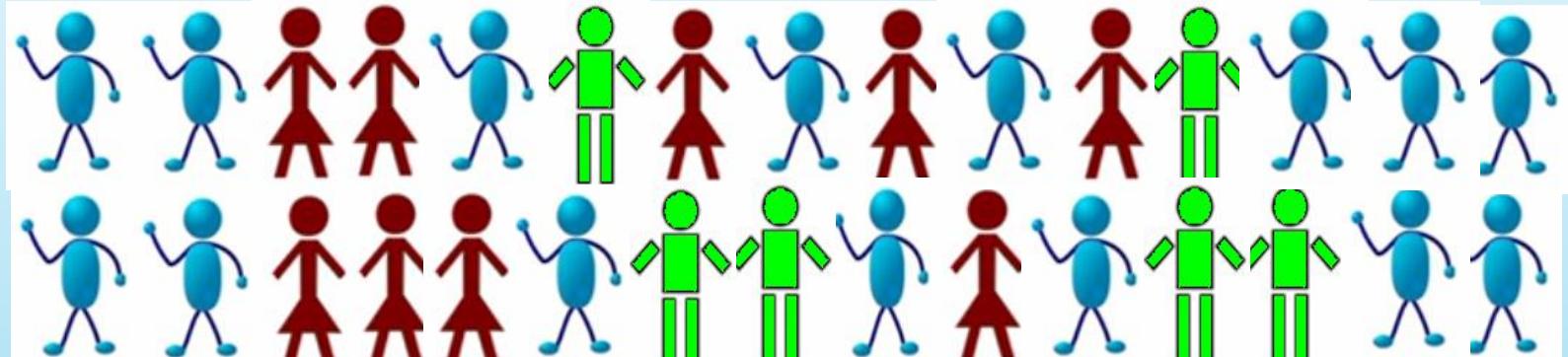
Lancet 2007; 370: 851-58
See Comment page 808
See Perspectives page 821
Department of Measurement and Health Information Systems, World Health Organization, Geneva, Switzerland (S Moussavi MPH, S Chatterji MD, E Verdes PhD, B Ustun MD); Economics and



Sampling Plan



Simple Random Sampling (SRS)

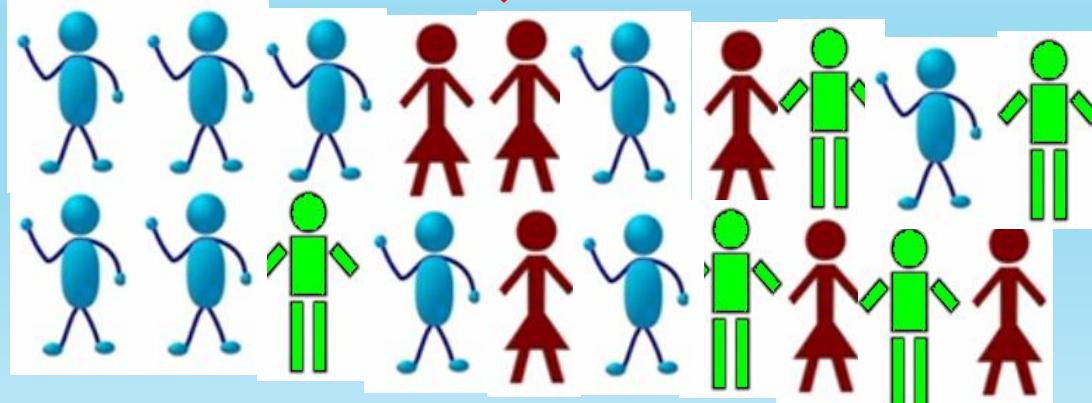


40



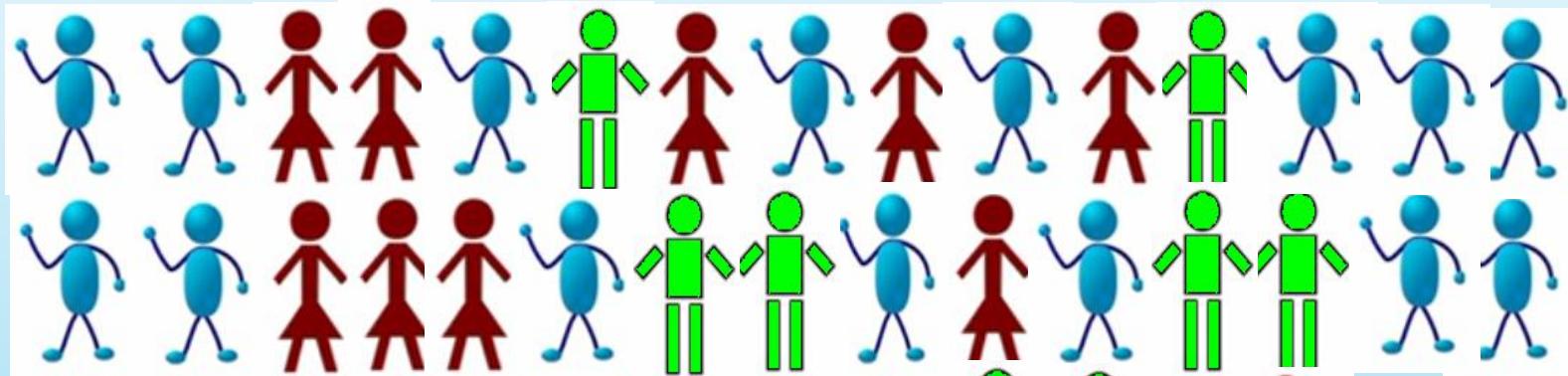
50%

20



19

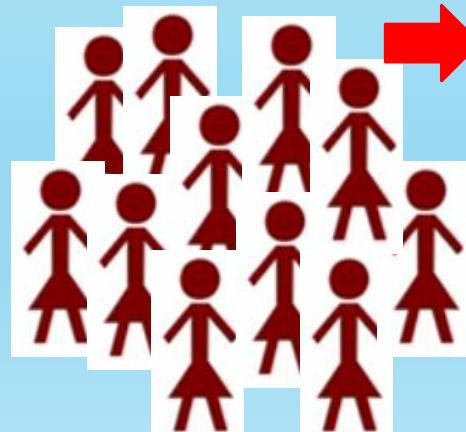
Stratified Data Sampling



40



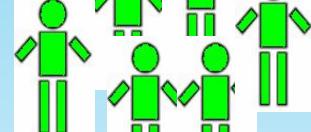
40



50%
(SRS)

Strata

Strata



50%
(SRS)

Strata

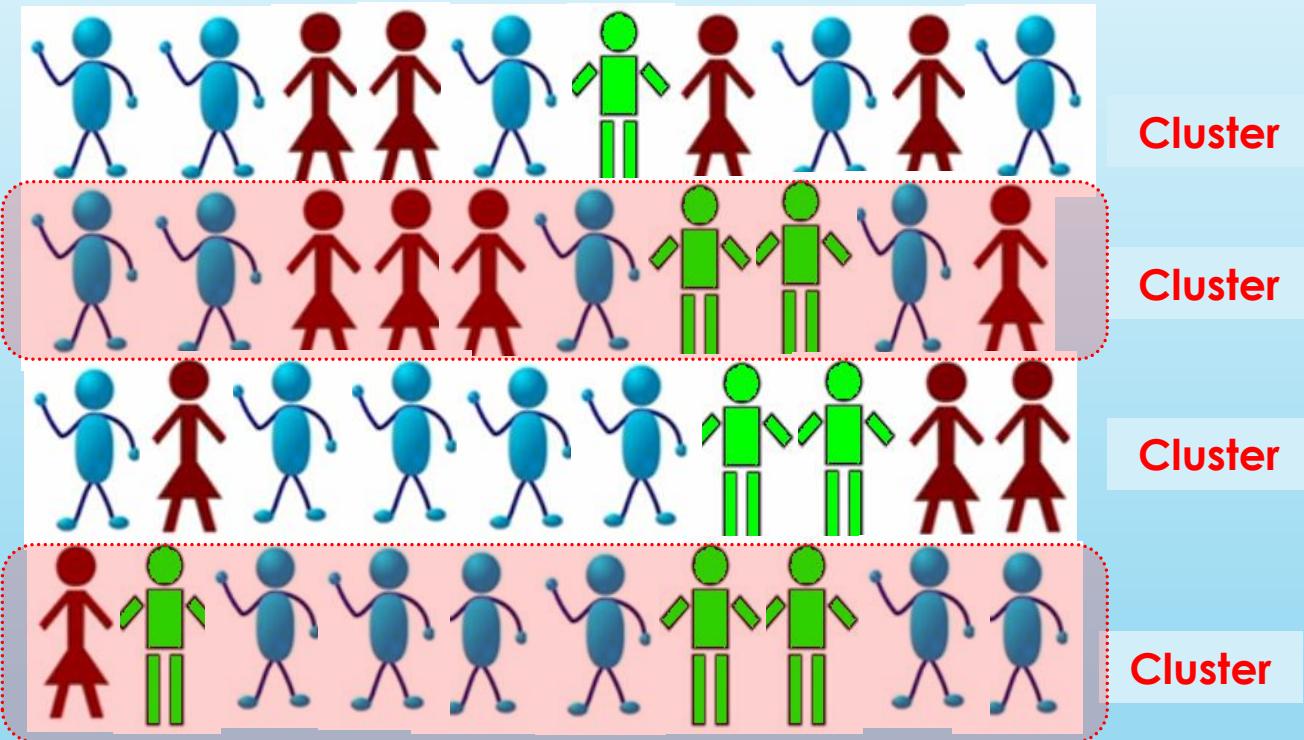


50%
(SRS)

10
6
4

20 20

Cluster Sampling



Data Sampling- Sample Size

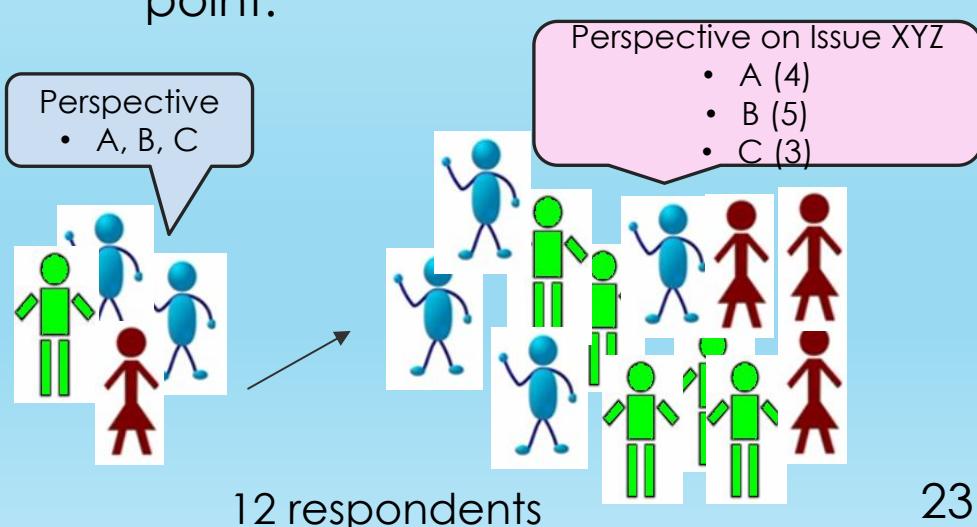
- The **larger** the sample size, the more **accurate** we can expect the sample estimates to be.



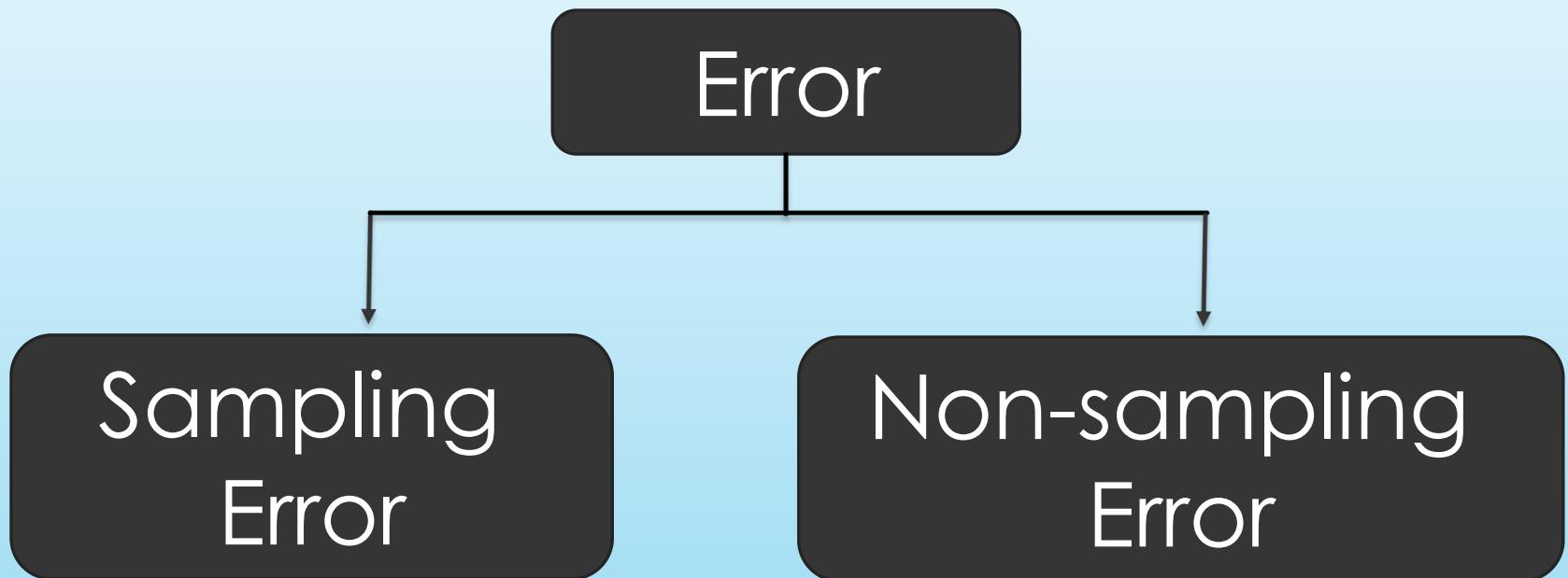
Data Sampling- Sample Size



- ❖ The **greater** the sample size, the more **accurate** the finding will reflect the “true” picture.
- ❖ Determined by data **saturation** point.



Data Sampling- Errors



- Collected sample **does not** represent the **true** population

Sampling Error (Example)

Lim Kok Thay



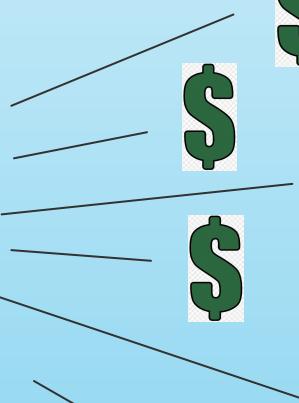
Tony Fernandes



Lim Wee Chai



Ananda Krishnan

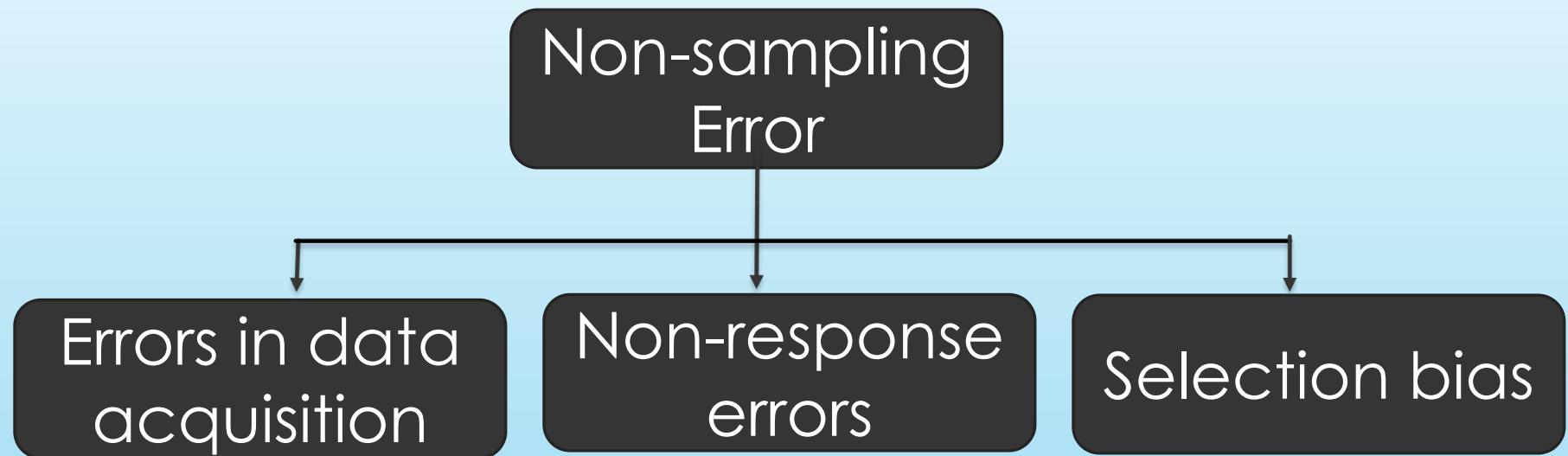


Robert Kuok



Increasing the sample size

Non-Sampling Error



Increasing the sample size will NOT reduce this type of error

Non-sampling Error: Error in Data Acquisition

- Arises from the recording of incorrect response, due to:
 - incorrect measurements being taken because of faulty equipment
 - mistakes made during transcription from primary sources
 - inaccurate recording of data due to misinterpretation of terms
 - inaccurate responses to questions concerning sensitive issues.

Non-sampling Error: Nonresponse Error

<p>Site Survey Form</p> <p><u>Location:</u> _____</p> <p><u>Owner:</u> _____</p> <p>'Short form' description of coach: _____</p> <p>Railway designed for: _____ Coach type: _____ Date built: _____</p> <p>First number: _____ Later numbers: _____ Number carried at present: _____</p> <p>Built by: _____ Where built: _____</p> <p>Gauge: STANDARD OTHER if 'other', state gauge: _____</p> <p>Wheel arrangement: 4 WHEELS 6 WHEELS 8 WHEEL BODIES 6 WHEEL BODIES BODY ONLY UNDERFRAME ONLY</p> <p>Diagram No: _____ Lot No: _____</p> <p>Original underframe? YES NO If 'No', please add further information: _____</p> <p>Are photos available? YES NO Please give details overleaf (and forward available photos with this survey form!!)</p> <p>Operating: available at short notice for passenger, film or demonstration use: YES NO</p> <p>Structural condition:</p> <table border="1"> <tr><td>Very good</td><td>External:</td><td>Internal:</td><td>Underframe/ running gear:</td></tr> <tr><td>Good</td><td>E01</td><td>I01</td><td>UC0</td></tr> <tr><td>Satisfactory</td><td>E02</td><td>I02</td><td>UC1</td></tr> <tr><td>Fair</td><td>E03</td><td>I03</td><td>UC2</td></tr> <tr><td>Poor but substantially complete</td><td>E04</td><td>I04</td><td>UC3</td></tr> <tr><td>Poor and incomplete</td><td>E05</td><td>I05</td><td>UC4</td></tr> <tr><td>Derelict/not present</td><td>E06</td><td>I06</td><td>UC5</td></tr> <tr><td>(Not applicable)</td><td>E07</td><td>I07</td><td>UC7</td></tr> <tr><td>E08</td><td>I08</td><td>UC8</td><td></td></tr> </table> <p>Surface finish: Paintwork/leather covering/etc.</p> <table border="1"> <tr><td>Very good</td><td>E01</td><td>I01</td></tr> <tr><td>Good</td><td>E02</td><td>I02</td></tr> <tr><td>Satisfactory</td><td>E03</td><td>I03</td></tr> <tr><td>Fair</td><td>E04</td><td>I04</td></tr> <tr><td>Poor but substantially complete</td><td>E05</td><td>I05</td></tr> <tr><td>Poor and incomplete</td><td>E06</td><td>I06</td></tr> <tr><td>Derelict/not present</td><td>E07</td><td>I07</td></tr> <tr><td>Gutted</td><td>E08</td><td>I08</td></tr> <tr><td>(Not applicable)</td><td>E09</td><td>I09</td></tr> </table> <p>Please CIRCLE where appropriate</p>	Very good	External:	Internal:	Underframe/ running gear:	Good	E01	I01	UC0	Satisfactory	E02	I02	UC1	Fair	E03	I03	UC2	Poor but substantially complete	E04	I04	UC3	Poor and incomplete	E05	I05	UC4	Derelict/not present	E06	I06	UC5	(Not applicable)	E07	I07	UC7	E08	I08	UC8		Very good	E01	I01	Good	E02	I02	Satisfactory	E03	I03	Fair	E04	I04	Poor but substantially complete	E05	I05	Poor and incomplete	E06	I06	Derelict/not present	E07	I07	Gutted	E08	I08	(Not applicable)	E09	I09	<p>Site Survey Form</p> <p><u>Location:</u> _____</p> <p><u>Owner:</u> _____</p> <p>'Short form' description of coach: _____</p> <p>Railway designed for: _____ Coach type: _____ Date built: _____</p> <p>First number: _____ Later numbers: _____ Number carried at present: _____</p> <p>Built by: _____ Where built: _____</p> <p>Gauge: STANDARD OTHER if 'other', state gauge: _____</p> <p>Wheel arrangement: 4 WHEELS 6 WHEELS 8 WHEEL BODIES 6 WHEEL BODIES BODY ONLY UNDERFRAME ONLY</p> <p>Diagram No: _____ Lot No: _____</p> <p>Original underframe? 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Non-sampling Error: Selection Bias

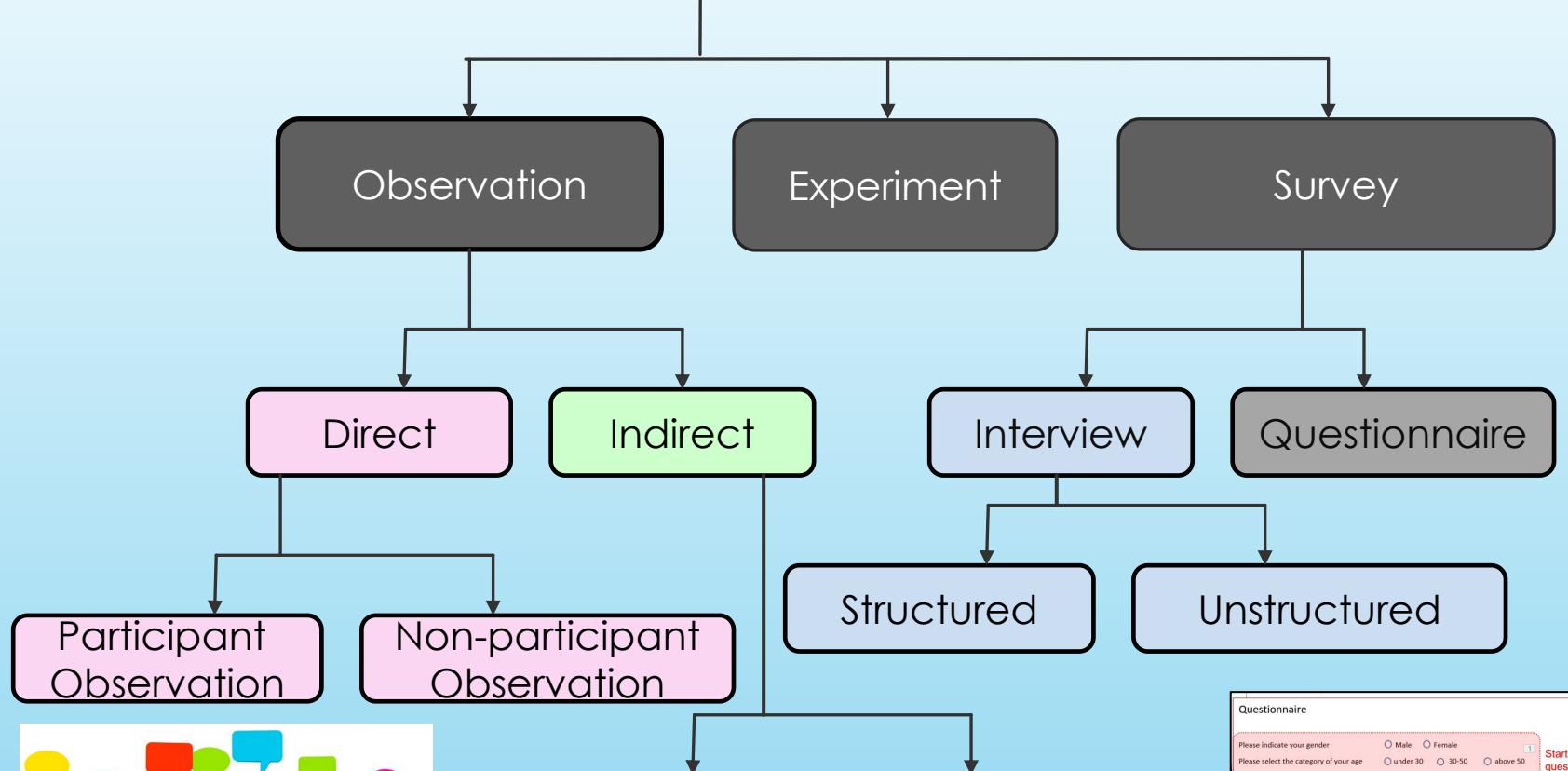
Sample



15 girls

Recap

Primary Sources



Complaint Letter

Sender Name: [Redacted] Position: [Redacted]
[Redacted] City, State, Zip Code: [Redacted]

Recipient Name: [Redacted] Position: [Redacted]
[Redacted] City, State, Zip Code: [Redacted]

Dear Sir/Madam,

I am writing this letter to bring your attention to the fact that [Redacted] has been very rude and disrespectful to me and my family. I have been a regular client of yours for many years now, and I have always been treated with respect and care. However, on [Redacted], he was extremely rude and unprofessional. I would like to complain about this incident and request that you take action against him.

Yours sincerely,
[Redacted]

Donald J. Trump (@realDonaldTrump) · 5h
"President Trump to Launch 2020 Campaign in Florida" @found4friends · Tuesday will be a Big Crowd and Big Day!
 5.8K 1.8K 39K

Donald J. Trump (@realDonaldTrump) · 5h
All in for Senator Steve Daines as he proposes an Amendment for a strong BAN on assault weapons and a ban on magazine fed semi-automatic weapons!
 1.1K 1.1K 4K

Donald J. Trump (@realDonaldTrump) · 5h
Despite the Greatest Presidential Handshake of all time by people that are very dishonest and want to destroy our Country, we are doing great in the Polls, even though we are not even in the race yet! See you all at the Tuesday Announcement Rally in Orlando, Florida. KEEP AMERICA GREAT!
 4.6K 1.1K 3K

Dan Scavino (@DanScavino) · May 22
The most interesting game going on here in THE SWAMP until 2020 because they hate Trump & they think it helps politically. It is their goal to make the lives of those who have supported/working for Trump, miserable. They're talking Great news, but NOT YET!
 1.7K 3.2K 7K

Questionnaire

Please indicate your gender Male Female

Please select the category of your age under 30 30-50 above 50

Short, simple, and clear questions

Have you watched End Game? Yes No

Who is your favourite character? Iron-man Captain America Thor Dr. Strange None of the above

Why do you like the above selected character? **Use open-ended questions cautiously**

Most people like don't like Thor. What's your opinion on him? **Avoid leading questions**

Start with demographic questions

Use (yes / no) and multiple choice questions

Keep questionnaire as short as possible

• Pretest on a small number of people.

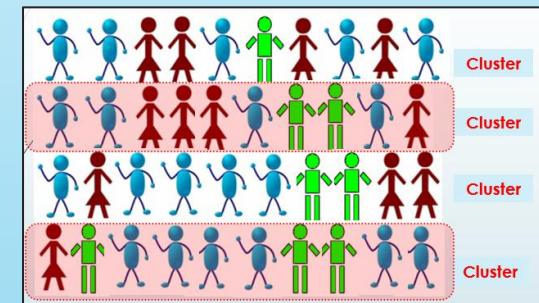
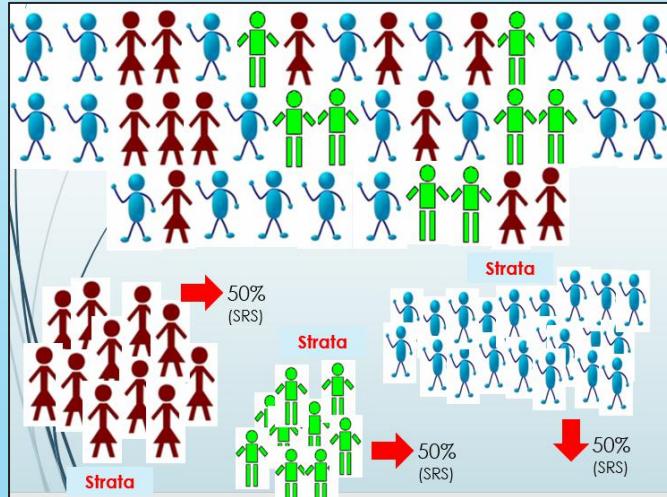
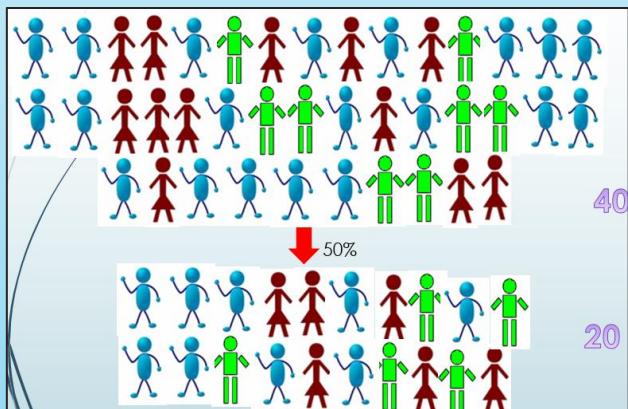
Recap

Sampling Plan

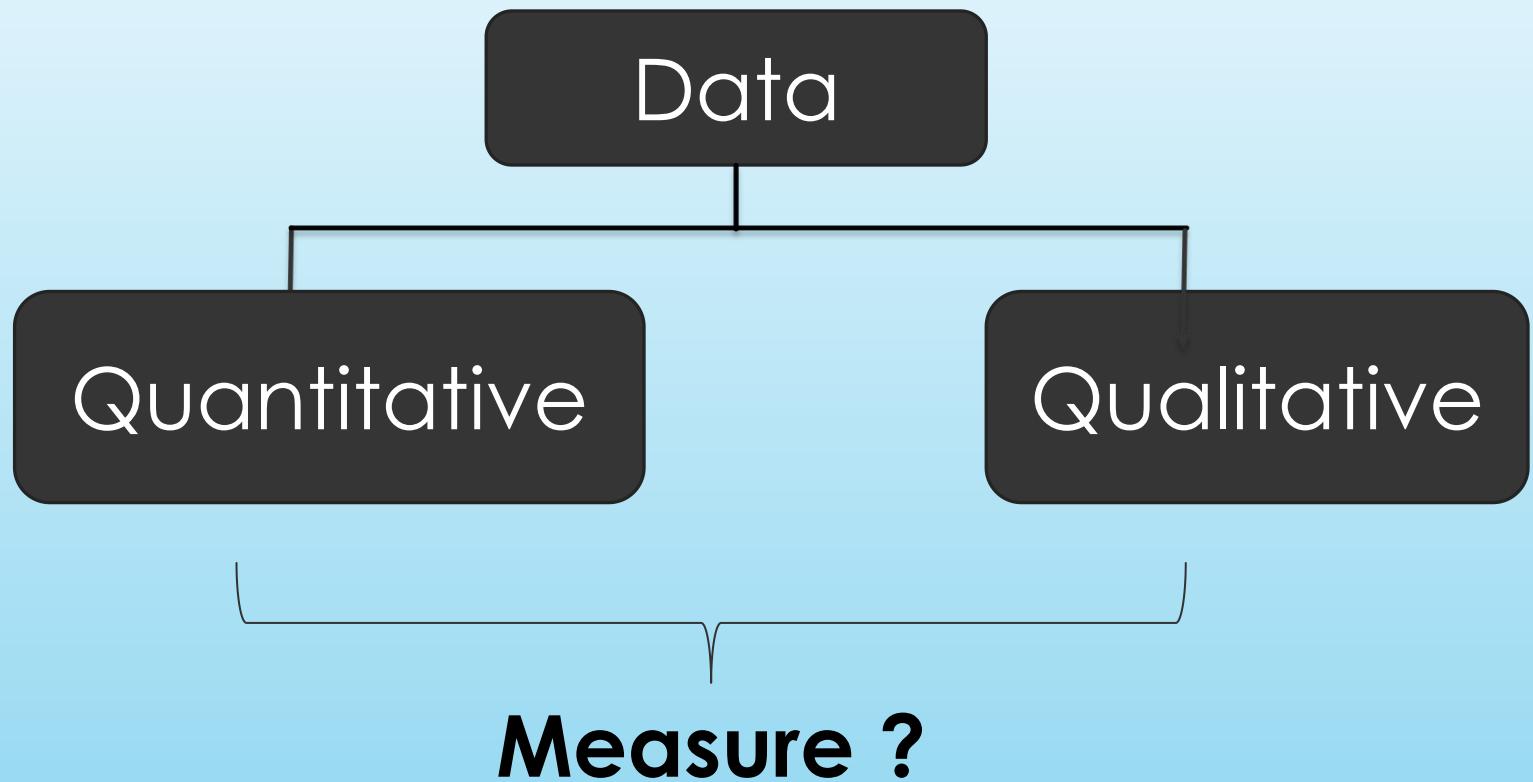
Simple Random Sampling

Stratified Random Sampling

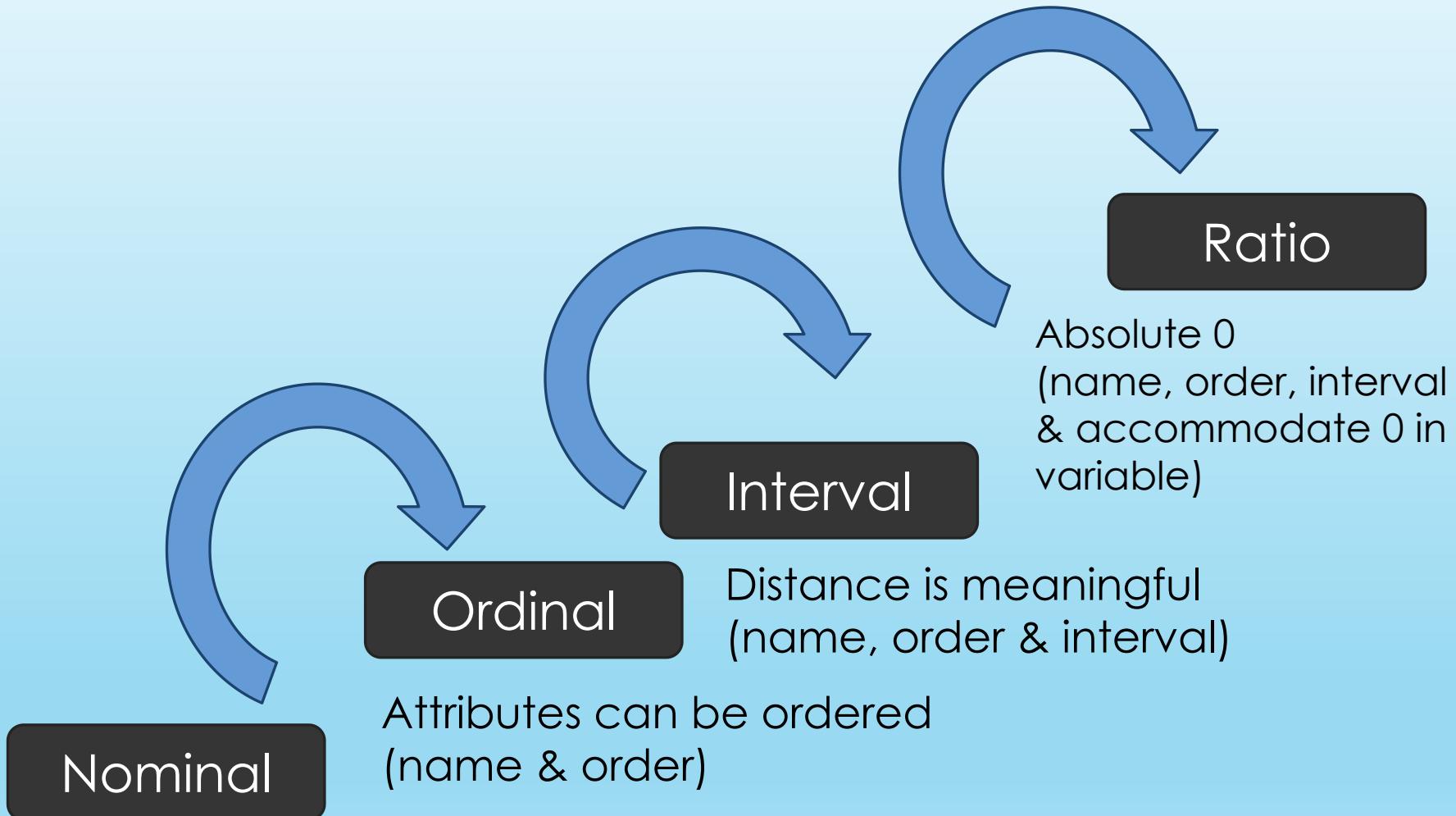
Cluster Sampling



Measurement Level



Level of Measurement



Nominal

Please indicate your gender

Male Female

No order

Have you watched End Game?

Yes No

No ranking

Who is your favourite character?

Iron-man Captain American Thor Dr. Strange



"Counts," aka
"Frequency of Distribution"

Ordinal



order



ranking

How happy are you with the ending of End Game?

- 1- Very Unhappy
- 2- Unhappy
- 3- OK
- 4- Happy
- 5- Very Happy

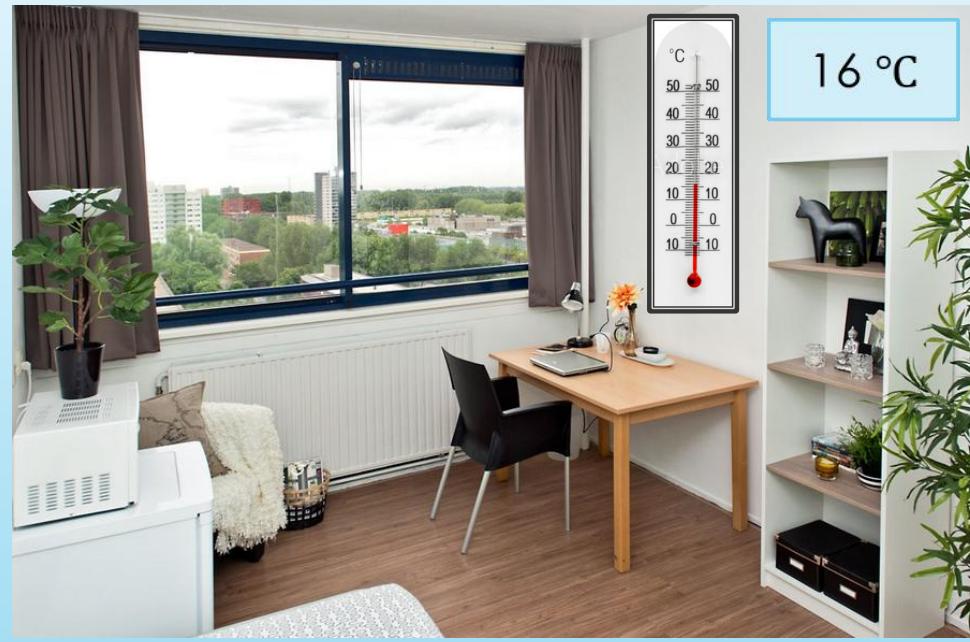
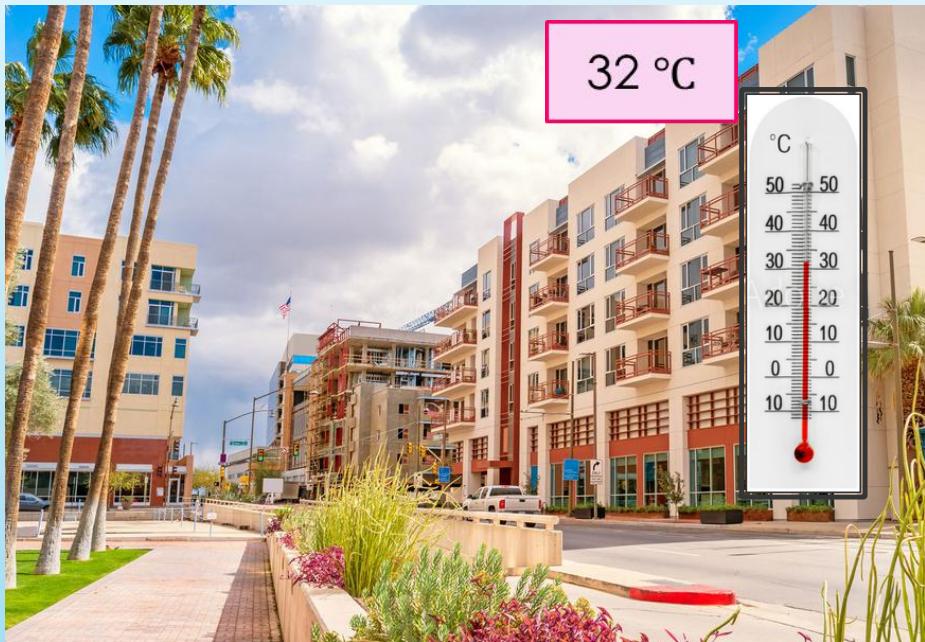


Will you recommend End Game to your friends?

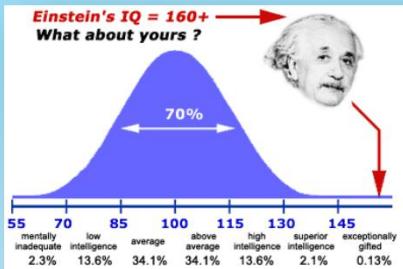
- 1- Extremely unlikely
- 2- Unlikely
- 3- Neither likely or unlikely
- 4- Likely
- 5- Extremely likely

Interval

$$diff = 16^{\circ}\text{C}$$



What is the temperature in your city?

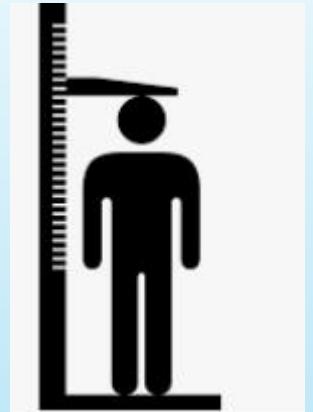


0 = arbitrary

Ratio

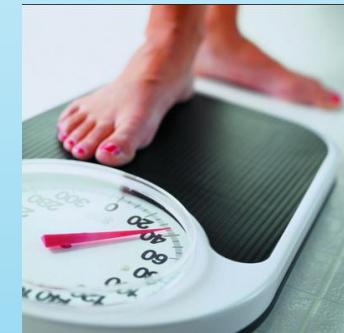
What is your daughter's current height?

- Less than 5 feet
- 5 feet 1 inch – 5 feet 5 inches
- 5 feet 6 inches – 6 feet
- More than 6 feet



What is your weight in kilograms?

- Less than 50 kg
- 51 – 71 kg
- 71 – 90 kg
- More than 90 kg



0 = 0

(x negative value)



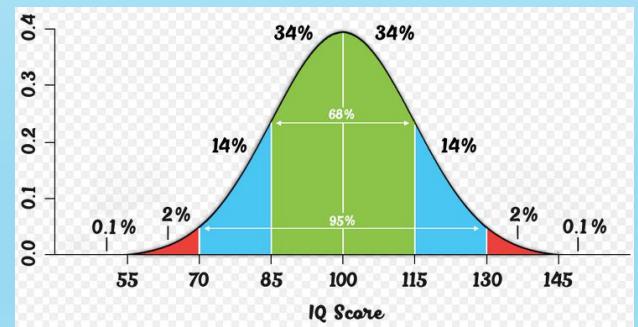
Ratio



Ratio



Interval





Ratio?

Interval?

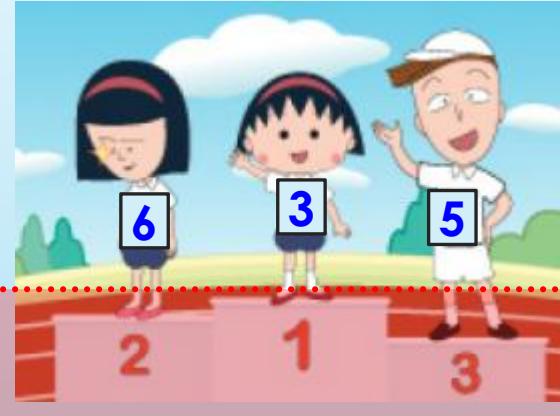
Exercise

Then state the Level of Measurement.

- ▶ Eye Color (blue, brown, green, hazel)
- ▶ Rating scale (poor, good, excellent)
- ▶ Salary
- ▶ Age
- ▶ Ranking of high school football teams in Missouri
- ▶ Nationality
- ▶ Temperature
- ▶ Zip code



Nominal



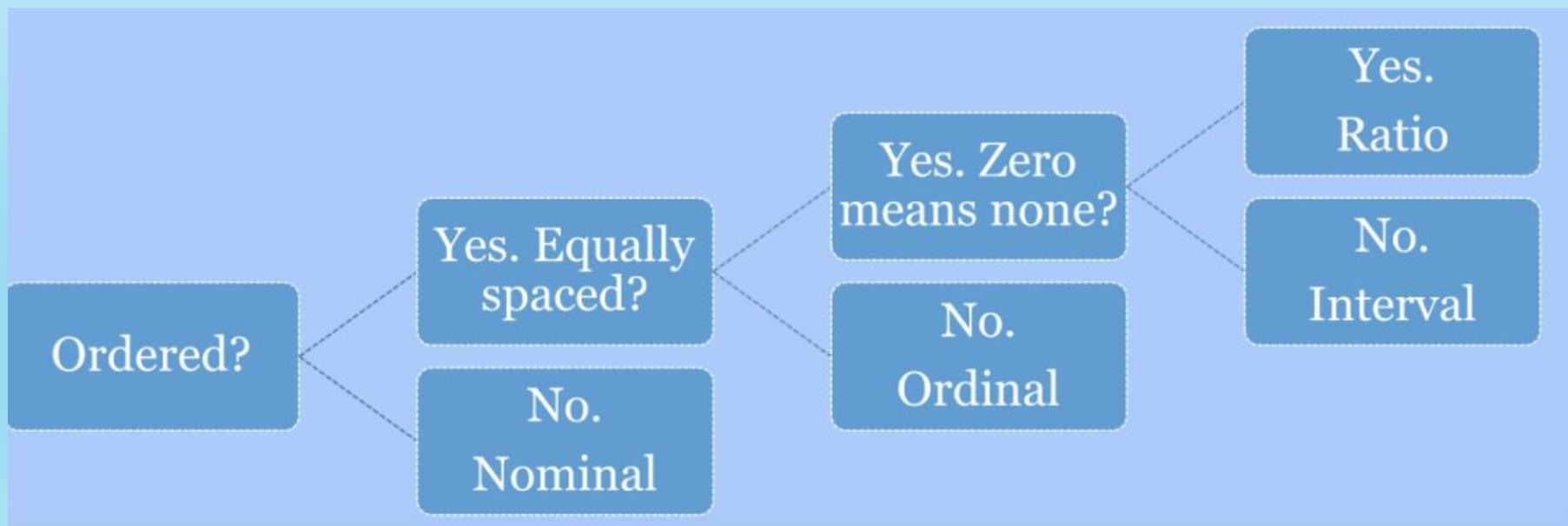
Interval



Ratio

	Nominal	Ordinal	Interval	Ratio
Labeled	✓	✓	✓	✓
Ordered	✗	✓	✓	✓
Known difference	✗	✗	✓	✓
Zero is arbitrary (exists)	N/A	✓	✓	✗
Zero means none (doesn't exist)	N/A	✗	✗	✓

	Nominal	Ordinal	Interval	Ratio
Labeled	<input checked="" type="checkbox"/> Yes			
Ordered	<input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes	<input checked="" type="checkbox"/> Yes	<input checked="" type="checkbox"/> Yes
Known difference	<input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes	<input checked="" type="checkbox"/> Yes
Zero is arbitrary	N/A	<input checked="" type="checkbox"/> Yes	<input checked="" type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Zero means none	N/A	<input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> No	<input checked="" type="checkbox"/> Yes



Precision and Accuracy in Measurement



Precision and Accuracy in Measurement

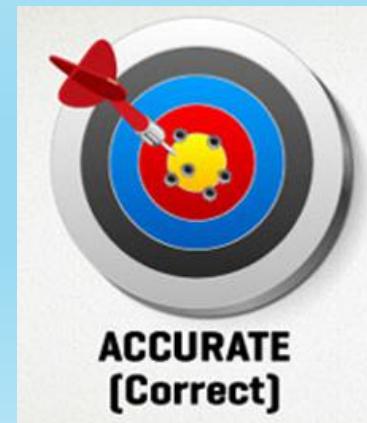


Precise?
Accurate?

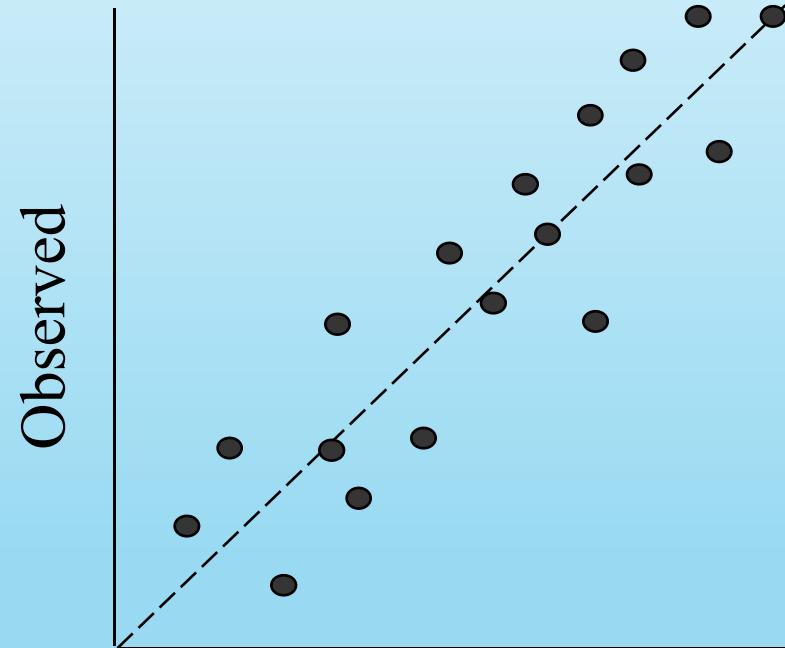
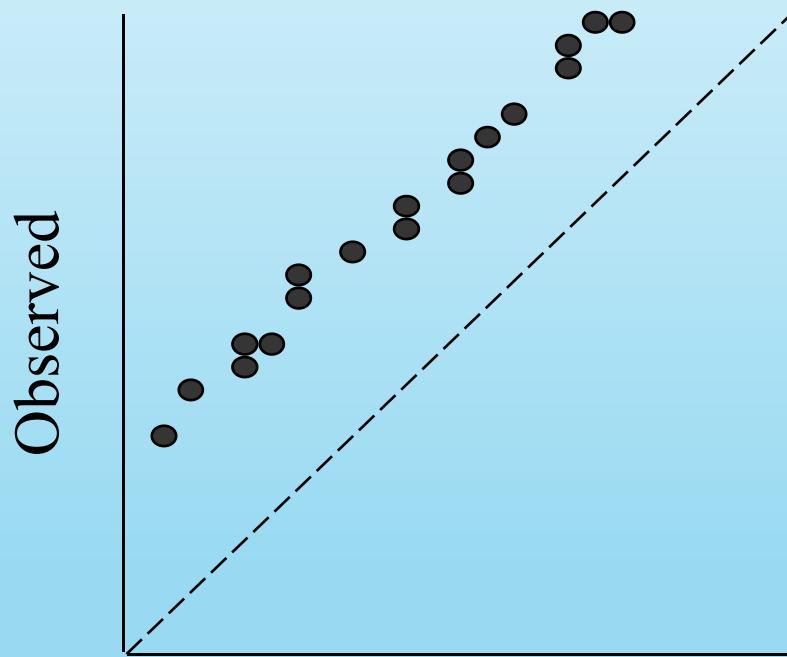
Precision and Accuracy



- ▶ **Precision:** Repetition between occasions, tests => gives same result
- ▶ **Accuracy:** Measurement agrees with the “real” cases, or “gold standard”



Precision and Accuracy in Measurement



Precision (Example: BP Measurement)

Brand X BP machine



200

		1 st Measurement		
		High	Normal	Total
2 nd Measurement	High	12	2	
	Normal	8	178	
				200

Precision=

$$12/14 = 0.86$$

$$\begin{aligned}178/186 &= 0.96 \\&\approx 0.91\end{aligned}$$

Accuracy(Example: BP Measurement)

Test Measurement	Actual Measurement			
		High	Normal	Total
	High	15	5	
	Normal	35	145	
				200

$$\text{Accuracy} = \frac{160}{200} = 0.8$$

Actual = 50 (H), 150 (N)
Test (Brand X) = 20 (H), 180 (N)



Measurement Scales

Discrete Data

Nominal

Ordinal

Interval

Ratio

Continuous Data

Data for points along a scale

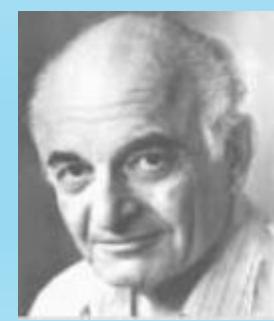
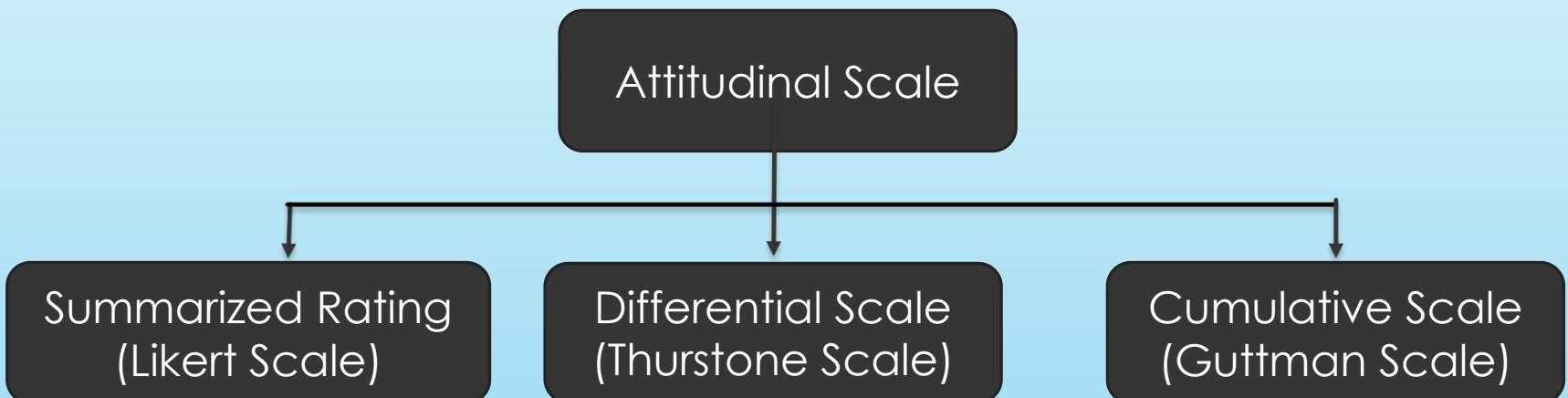
Data in which each item is a separate, whole unit

Exercise

- Classify each of the following variables as nominal, ordinal, interval or ratio and as discrete or continuous:
 - a) birth order
 - b) number of teeth
 - c) tail length
 - d) area of inhibited growth
 - e) species
 - f) major (i.e. biology, sociology etc.)
 - g) military rank

Measurement Scale- Attitudinal Scale

Attitude scales provide a quantitative measurement of attitudes, opinions or values by summarizing scores given by researchers to respondents



Likert Scale

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I believe this product is made of high quality materials	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
I would recommend this product to someone else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Are you happy with the way customer service handled your questions or concerns?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Please rate your satisfaction with your recent purchase.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How do you feel about our online prices?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thurstone Scale

List of statements relating to the issue of interest



- It is one of the most skewed results in the history of U.S elections.
- It is unfair that Trump won the elections despite the rampant hate for him among citizens.
- It is disappointing to see Trump being appointed as the U.S President.

Judges to rate

1. For each statement, circle the number that indicates the degree of favorability.

Extremely unfavorable						Neutral						Extremely favorable									
1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11

Average the judges' scores



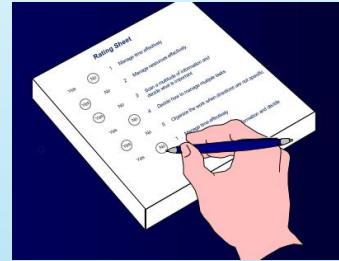
Respondent

Scale Statement	Score
It is one of the most skewed results in the history of U.S elections.	8.2
It is unfair that Trump won the elections despite the rampant hate for him among citizens.	5.9
It is disappointing to see Trump being appointed as the U.S President.	9.5
It is the best thing that has happened in the U.S politics.	5.5
Trump has been a believer of world peace and he will surely work towards it.	1.8
Trump believes in racial equality.	4.3

$$\text{Thurstone score} = (8.2+9.5+1.8)/3=6.5$$

Guttman Scale

Immigrants



1. Are you willing to permit immigrants to live in your country? (Least difficult)
2. Are you willing to permit immigrants to live in your community?
3. Are you willing to permit immigrants to live in your neighbourhood?
4. Are you willing to permit immigrants to live next door to you?
5. Would you permit your child to marry an immigrant? (Most difficult)