



VARIABLES

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Variables (Measurement Scales)

- Nominal

- Assignment of numbers to basketball players in order to identify them.
- The order of such numbers is of no consequence — they are just convenient labels with no quantitative value.

- Ordinal

- Scale places events in order but real difference between adjacent ranks may not be equal
- Person A's position in class is 10 and B's is 40. It cannot be said that A is four times as good as B.

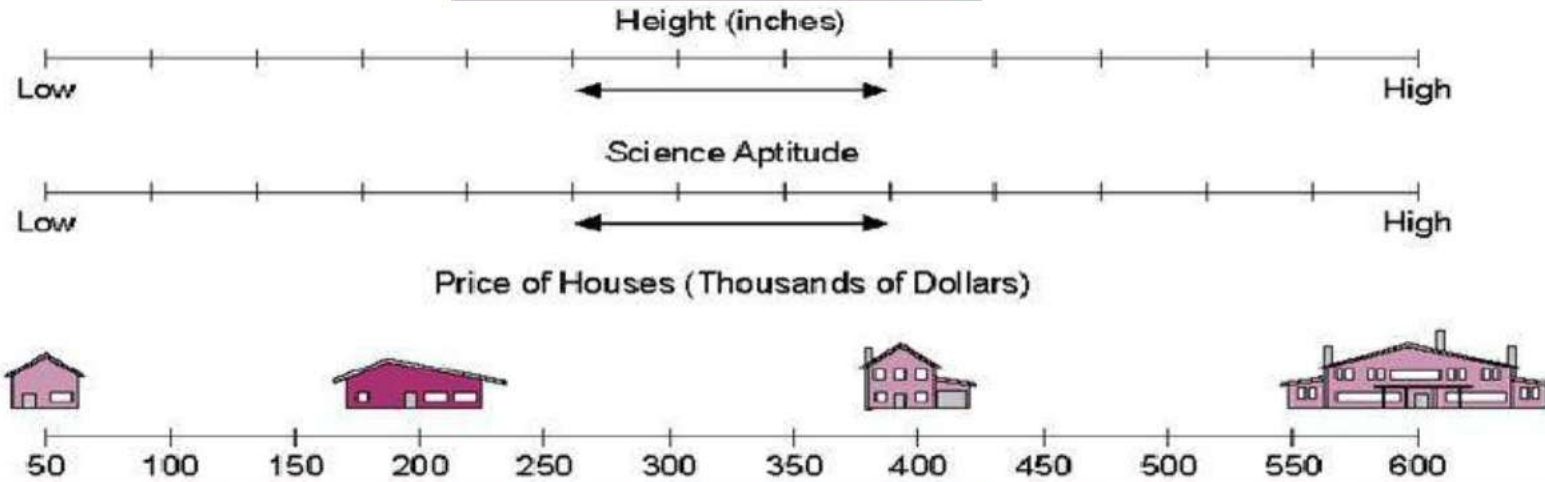
- Interval

- It can have an arbitrary zero but no absolute zero or origin. Incorporates equality of intervals
 - Fahrenheit scale

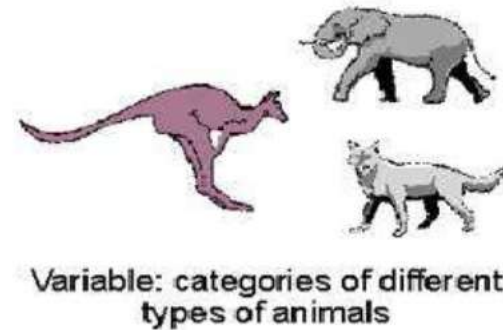
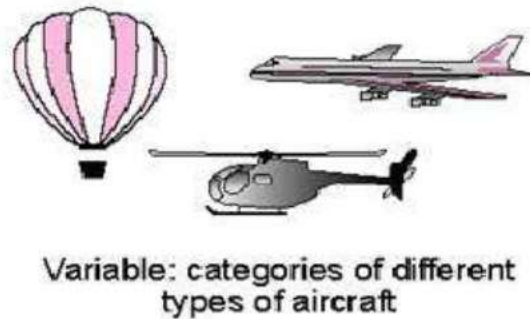
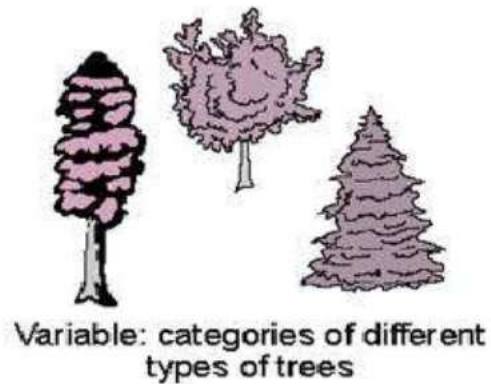
- Ratio

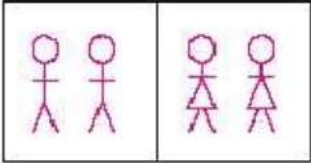
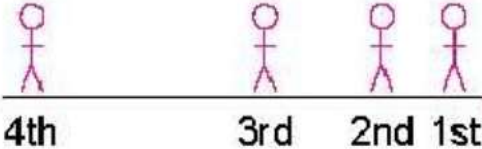
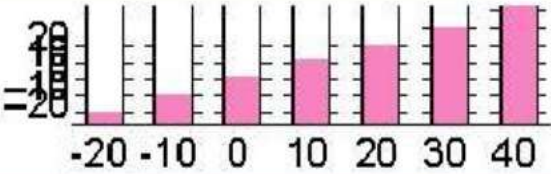
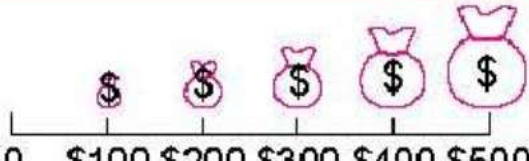
- Has an absolute or true zero of measurement
 - Mass, length, temperature in kelvin

Quantitative:



Qualitative:



SCALE	EXAMPLE
<u>Nominal:</u>	 Gender
<u>Ordinal:</u>	 Position in a race
<u>Interval:</u>	 Temperature (in Fahrenheit) <u>Ordered, Equal differences</u>
<u>Ratio:</u>	 Money <u>Zero</u>

Mathematical Operations, Central tendency

Variable	Examples	Central Tendency/Mathematical Operations
Nominal	gender, nationality, ethnicity, language, genre, style, biological species	Set membership, classification, categorical equality, and equivalence Mode
Ordinal	'completely agree', 'mostly agree', 'mostly disagree', 'completely disagree'	Median, Mode
Interval	Celsius, Date from arbitrary epoch	Mean, Median, Mode,...
Ratio	mass, length, duration, plane angle, energy and electric charge	+, Geometric Mean, Harmonic Mean

Types of variables

- Independent

- the presumed cause
— what you change or select

- Dependent

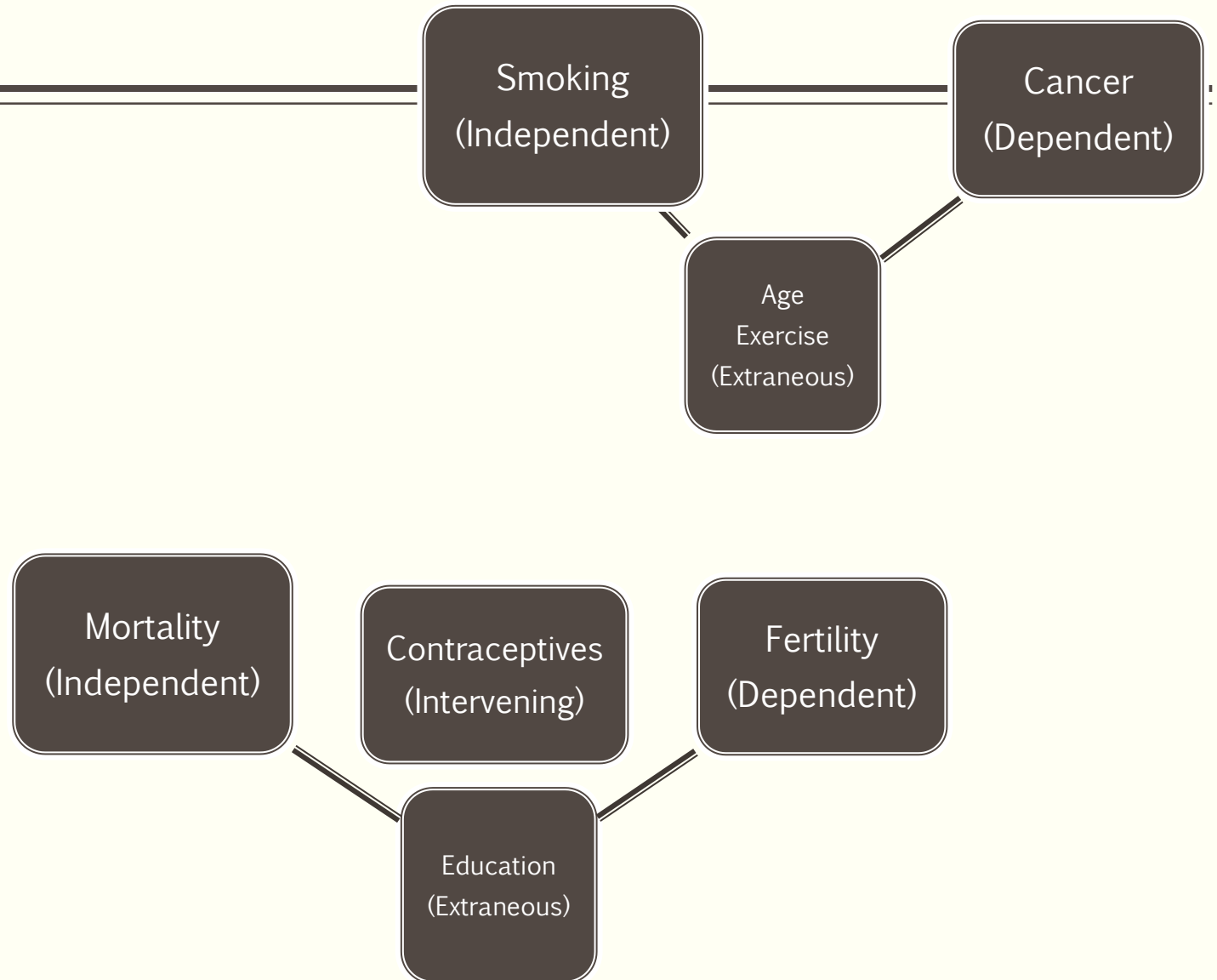
- the outcome you measure

- Extraneous

- other variables that could also affect the outcome; to be controlled

- Intervening

- the link between independent and dependent



Goodness of measure

- Validity
 - Degree to which an instrument measures what it is supposed to measure.
- Reliability
 - Measuring instrument is reliable if it provides consistent results.

Reliability is necessary but not sufficient for validity: a valid instrument must be reliable, but a reliable instrument need not be valid. (A weighing scale that always reads 2 kg heavy is reliable — but not valid.)

Q: Are the following Nominal, Ordinal, Interval or Ratio data? Explain your answer.

- Temperatures measured on the Kelvin scale
- Military ranks
- Aadhaar numbers
- Number of passengers on buses from Delhi to Mumbai
- Code number given to the religion of person

Data Preparation

Missing values and outliers

- A missing value is often replaced by the mean — or better, the median for skewed data. Either way, imputation shrinks the variance.
- An observation with a value that is more than 3 standard deviations from the mean is considered as an outlier.
- The researcher may like to delete it or modify the value of it or keep it as it is. It depends on the knowledge about the cause of the outlier.

Ordinal Variable examples

- Elementary school education
- High school graduate
- Some college
- College graduate
- Graduate degree