SWE3053
Human Computer Interaction

Lecture 19

Scientific Method

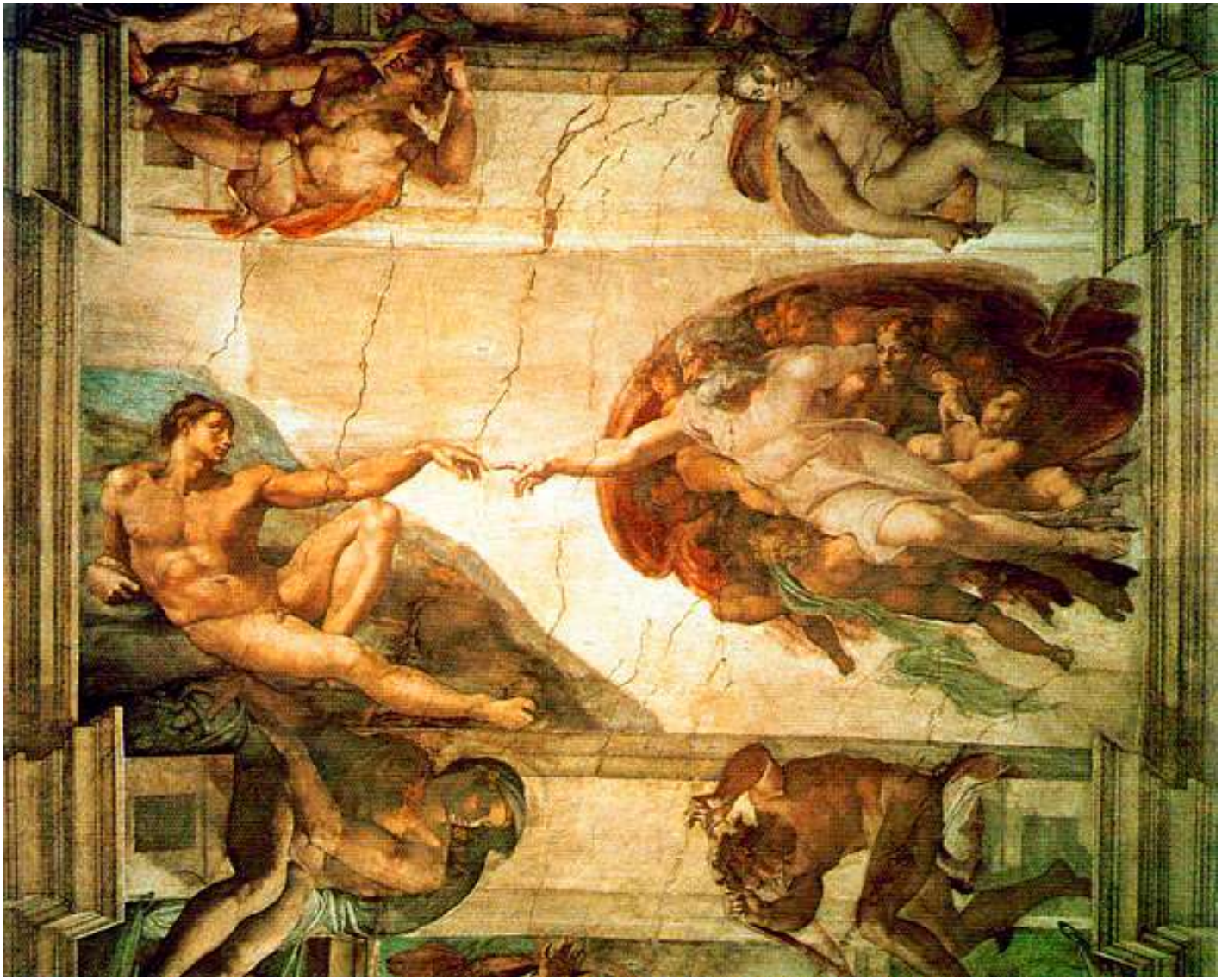
Digital Tattoo

- Our brain treats our body differently
  - Information on the body (or near body) will be processed differently
- Our brain treats tools as our body if it is being extensively used
- What about digital tools?
-
- Using the body as the interface...

Assignment #8 – Coming up with a Research Question

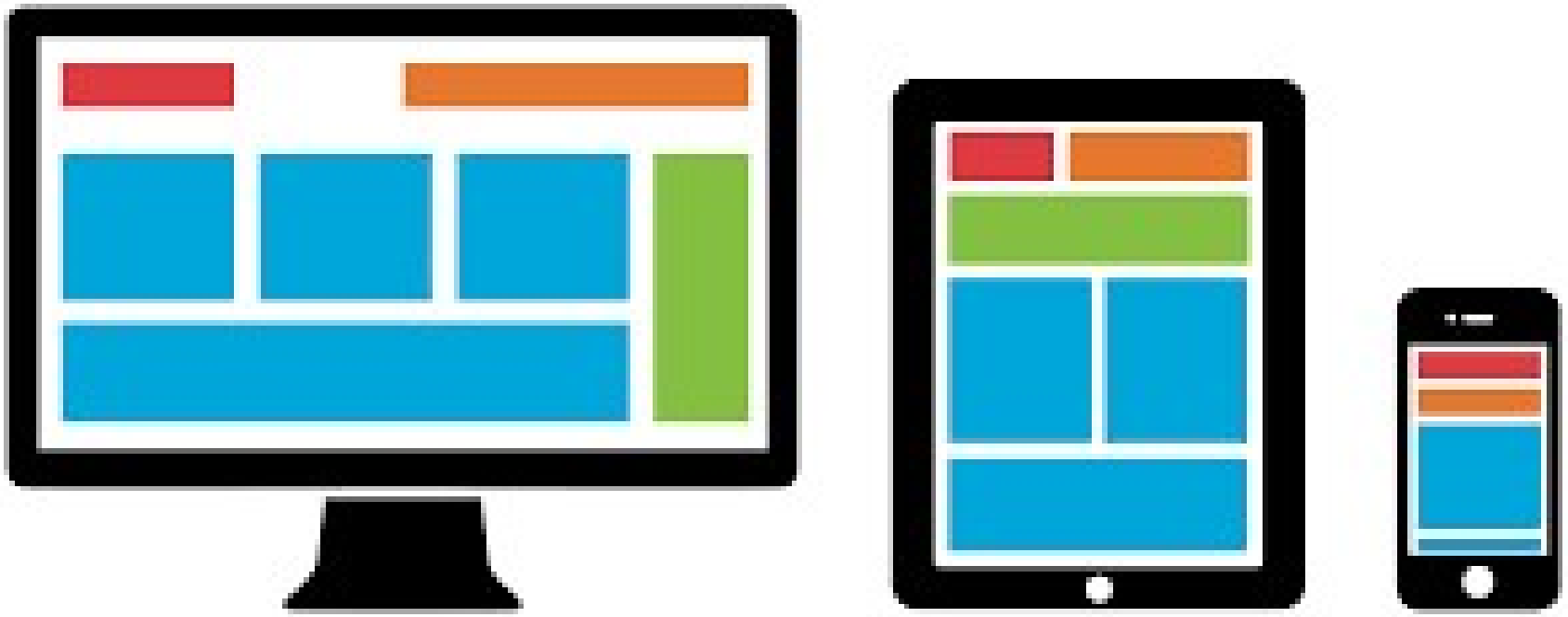
Submit on iCampus before **(Monday) May 9 <u>23:59 pm</u>**.

A Challenge to your Creativity ...



If you’re not prepared to be wrong, we will never come up with anything original.

Example 1: Position of website



Example 1: Effect of position/layout to choice

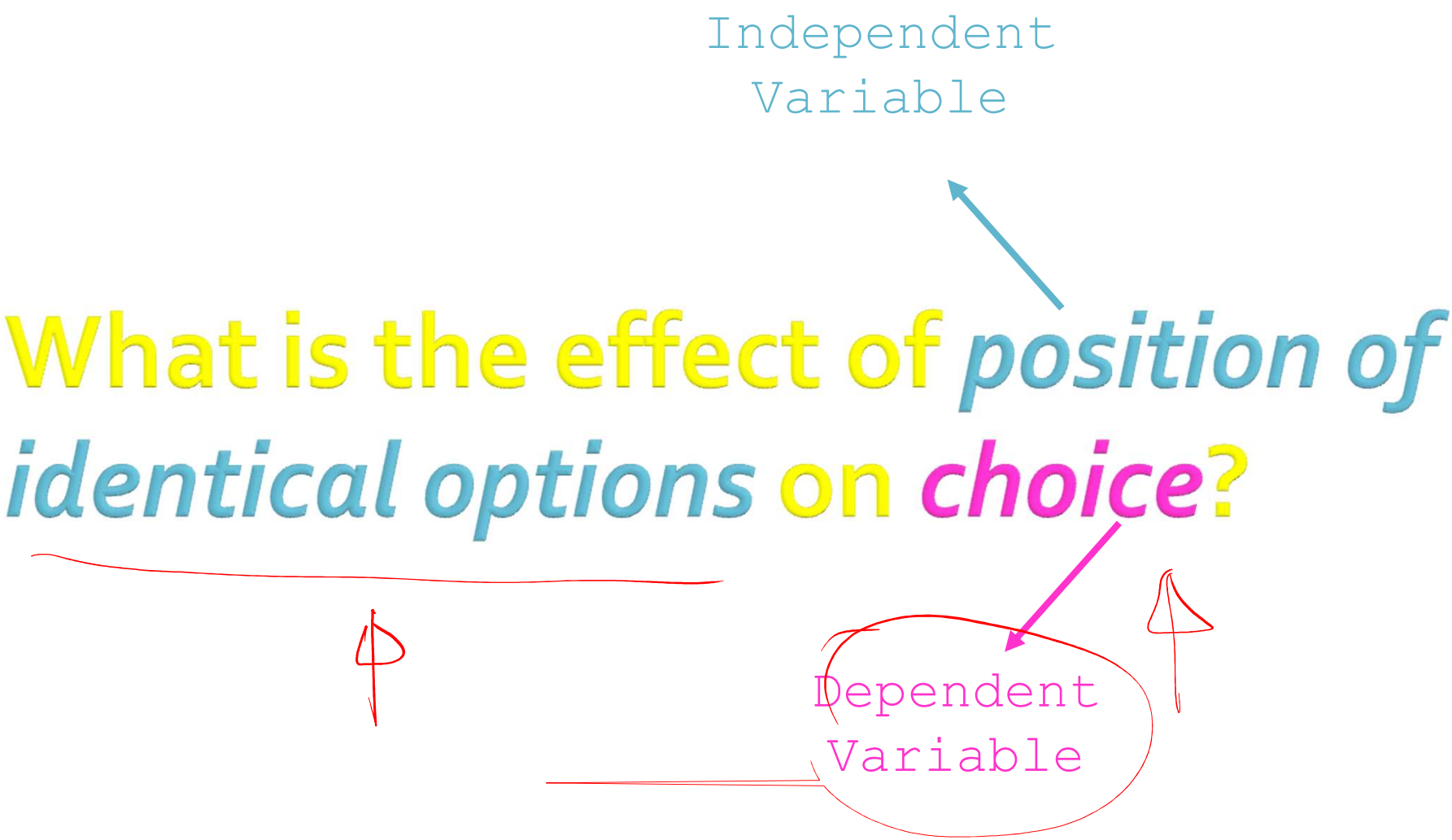
[General Topic]
I am interested in human behavior when browsing website, specifically how people make choice (e.g. purchasing decision).
- People make choice based on a lot of different criteria ……

[Be More Specific: effect of location to user's choice on a webpage]
If I place an item on a different location, is it going to have any effect to user's decision on making choice?

[Hypothesis]
Given everything being identical, will the position of an object affect user's choice on a webpage?

→ Go to do literature search
→ Design experiment to test out this hypothesis

1. Think BIG initially
2. Pick an area that you LOVE
3. Narrow it down to a very small question
4. Single out ONE variable you want to explore
5. Check if anyone did this before

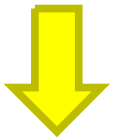

Independent Variable
What is the effect of position of identical options on choice?
Dependent Variable

Example 2: Big Screen

Question: Does the size of the screen have any effect to human behavior?

Example 2: Big Screen

- Why do people love big screen?
- Increase Enjoyment? Increase performance?
-
-
-



Sense of Presence Spatial Performance

- Is there a size that is too big?

Example 2a: Big Screen and Sense of Presence

- H: When every factor remain the same, a larger screen would facilitate the user a higher level of sense of presence.
  - Every factor, including field of view
- IV: Screen size
  - Two level: Big vs. Small
- DV: Sense of Presence
  - Measured by ITC-SOPI Sense of Presence Measurement

Example 2b: Big Screen and Spatial Performance

- H: When every factor remain the same, a larger screen would facilitate the user to perform better in spatial tasks.
  - Every factor, including field of view
- IV: Screen size
  - Two level: Big vs. Small
- DV: Performance in Spatial Task
  - Measured by Guilford & Zimmermann Spatial Ability Test

Example 2c: Big size too big?

- H: When every factor remain the same, user's perform in spatial tasks will deteriorate with an extra larger screen.
  - Every factor, including field of view
- IV: Screen size
  - Three level: Small vs. Big vs. Extra Big (e.g. height ~= 2 floors)
- DV: Performance in Spatial Task
  - Measured by Guilford & Zimmermann Spatial Ability Test

Example 2d: What about big screen and gender?

- Research Question: Previous research results suggest that female's spatial performance is slightly lower than male. Is big screen going to reduce this performance difference?
- H: When every factor remain the same, difference between female's and male's perform in spatial tasks will be smaller in big screen compared with small screen.
  - Every factor, including field of view
- IV: Gender and Screen Size
  - Two level: Male vs. Female
  - Two level: Small screen vs. Big screen
- DV: Performance in Spatial Task
  - Measured by Guilford & Zimmermann Spatial Ability Test

Example 3: Name

Question: Does the name of a person affect the life of a person?

Example 3: Effect of name to messenger response

[General Topic]
I am interested in how a person's name affect his/her life, especially cyber-life.

[Be More Specific: effect of person's name to response rate and response context at messenger message]
If I use different names, and I getting more response? Or more positive/negative response?

[Hypothesis]
For a random messenger message, will the response rate and context be different with different name used?

→ Go to do literature search
→ Design experiment to test out this hypothesis

1. Think BIG initially
2. Pick an area that you LOVE
3. Narrow it down to a very small question
4. Single out ONE variable you want to explore
5. Check if anyone did this before

Discussion 3: Name

- H: For resume with identical credentials, a “White” name will be given more interview opportunities comparing with “Black” name.
- IV: Name and Gender
  - Two level: Black vs. White
  - Two level: Male vs. Female
- DVs: Number of response in each condition
- Number of positive/negative response in each condition

Discussion 3: Name

"whitest" girl names
1. Molly
2. Amy
3. Claire
4. Emily
5. Katie
6. Madeline
7. Katelyn
8. Emma
9. Abigail
10. Carly
11. Jenna
12. Heather
13. Katherine
14. Caitlin
15. Kaitlin
16. Holly
17. Allison
18. Kaitlyn
19. Hannah
20. Kathryn

"Blackest" girl names
1. Imani
2. Ebony
3. Shanice
4. Aaliyah
5. Precious
6. Nia
7. Deja
8. Diamond
9. Asia
10. Aliyah
11. Jada
12. Tierra
13. Tiara
14. Kiara
15. Jazmine
16. Jasmin
17. Jazmin
18. Jasmine
19. Alexus
20. Raven

"Whitest" boy names
1. Jake
2. Connor
3. Tanner
4. Wyatt
5. Cody
6. Dustin
7. Luke
8. Jack
9. Scott
10. Logan
11. Cole
12. Lucas
13. Bradley
14. Jacob
15. Garrett
16. Dylan
17. Maxwell
18. Brett
19. Hunter
20. Colin

"Blackest" boy names
1. DeShawn
2. DeAndre
3. Marquis
4. Darnell
5. Terrell
6. Malik
7. Trevon
8. Tyrone
9. Willie
10. Dominique
11. Demetrius
12. Reginald
13. Jamal
14. Maurice
15. Jalen
16. Darius
17. Xavier
18. Terrance
19. Andre
20. Darryl

Discussion 5: Persuasion in Teleconference

Discussion 5: Persuasion in Teleconference

- Trend for using video conference is increasing
- People use it in everyday business meeting
- How does it affect the business partner negotiation outcome?

=> Narrow down: Persuasion

- Is there any way to increase/decrease ones persuasive power in video conference?

=> Idea: Position of the camera/screen

Discussion 5: Persuasion in Teleconference

- H: In a teleconference, people at a higher viewing angle (i.e. looking down) will perform better in a persuasion task than people at a lower viewing angle (i.e. looking up).
- IV: Viewing angle
  - Two level: High vs. Low
- DV: Persuasion Dessert survival task.

The Process of Academic Research

1. Initial Observation or Question
2. Hypothesis Formation
3. Study Design, Data Collection
4. Data Analysis and Conclusion
5. Report
6. Consider Open Questions
7. Respond to Open Questions

What's more dangerous, a drunk driver or a driver using a cellular phone?

performance level of a cellular phone user is equivalent to blood alcohol content of 0.10

and hands-free devices don't really help …

Source: Redelmeier, D.A. & Tibshirani, R.J. (1997). Association Between Cellular-Telephone Calls and Motor Vehicle Collisions. The New England Journal of Medicine, 336(7): 453-458.

vs.

Independent Variable

What is the effect of cell phone use

on driving ability?

Dependent Variable

Measure Driving Ability
-speed
-traffic violations
-missed signals
-accidents -> Driving score

missed signals
Driving Score : # traffic violations
accidents

Here's all the data lumped together

 20

 24

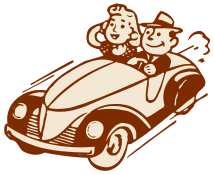
 13

 11

 22

 15

 19

 13

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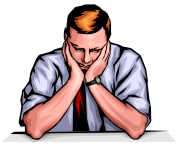
 20

 13

⋮ ⋮ ⋮ ⋮

What causes variability in driving scores?

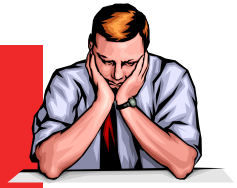
Sources of Variability in Driving Score?

Using a cell phone or not

Experience using a cell phone while driving

Different driving abilities and experience

They may be tired



They might be distracted or inattentive

They might be scared by the test

What is the effect of cell phone use on driving ability?

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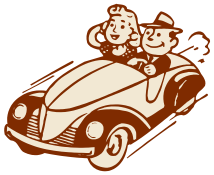 13

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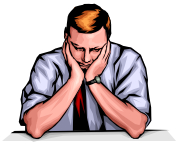 20

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What's the first thing we should do with this data?

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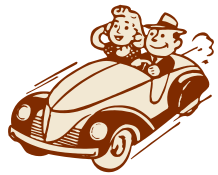

13

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13

Now what could or should we do?

• ANALYZING DATA (STATISTICS)

- Do you know how to calculate means, medians, and modes?
- Do you know how to calculate variance and standard deviation?
- Do you know how to make a histogram or a display a distribution of data?
- Have you ever performed an inferential statistical test?
- Etc…
-

- Descriptive Statistics

describe and summarize data

Inferential Statistics

draw inferences from data

Descriptive statistics

- Central Tendency
  - Mean
    - Geometric mean, harmonic mean, logarithmic mean…

    (Wikipedia lists 20 different kinds of means)
  - Mode
  - Median
  -
- Variability
  - Range
  - Variance

• Mean (‘average’)

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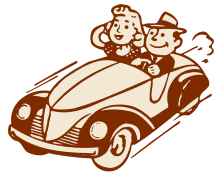

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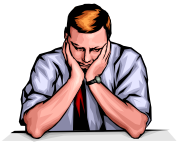

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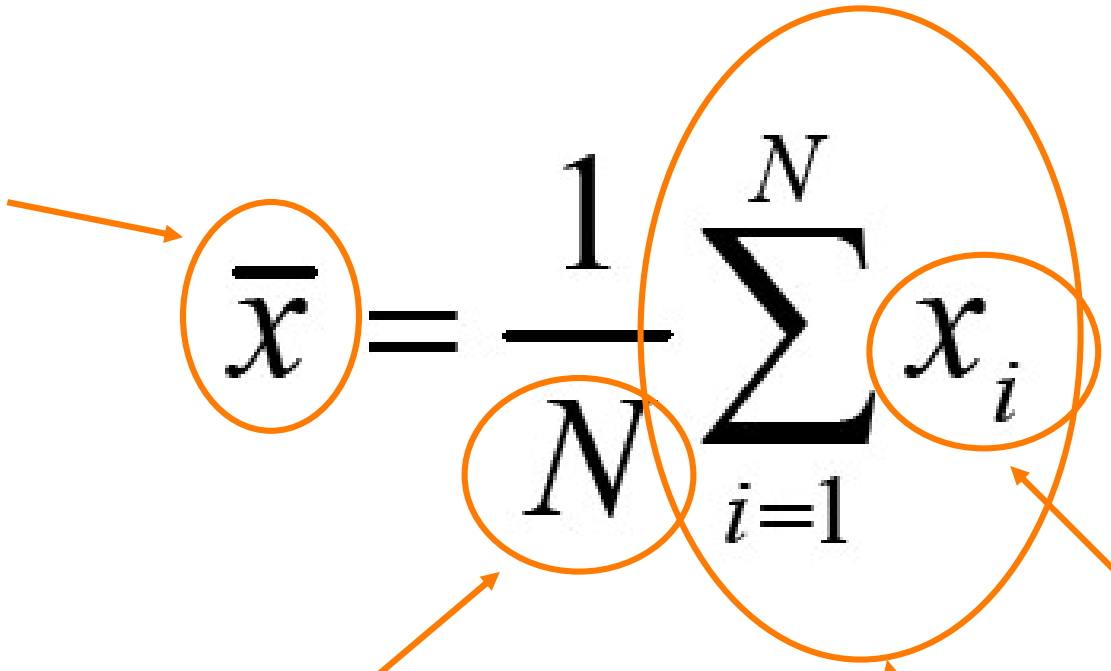
• Mean

shorthand for mean



N data points

data point Xi

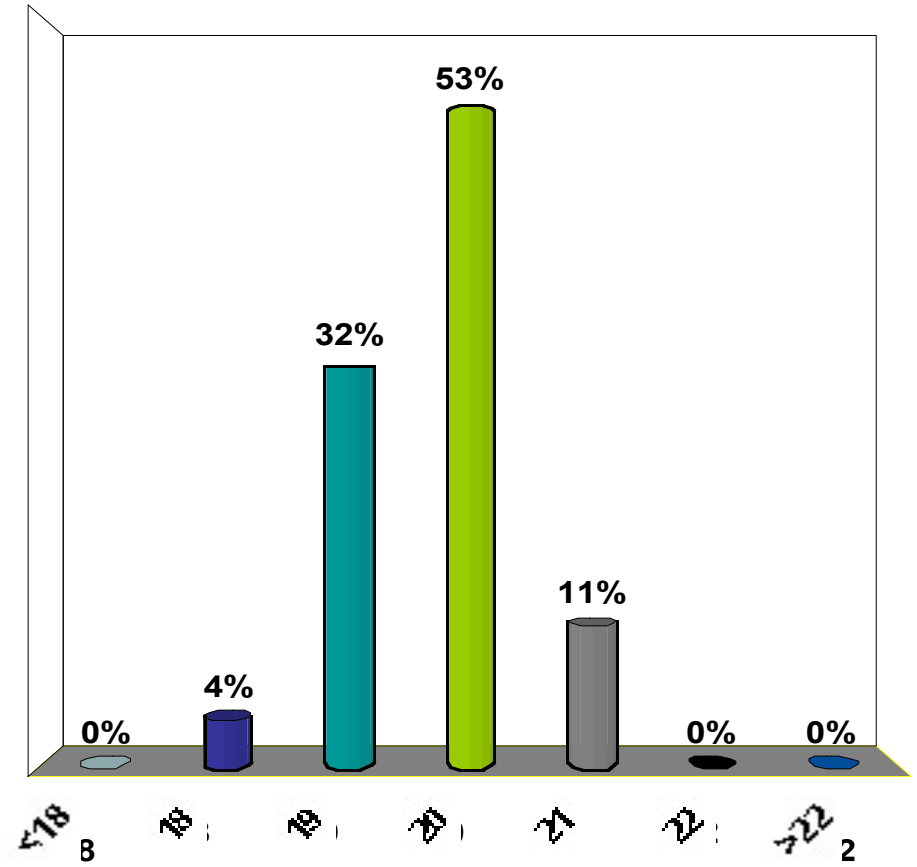
Summation over all N data points

$(X_1 + X_2 + X_3 + \ldots + X_N)$

• Mode (most common value)

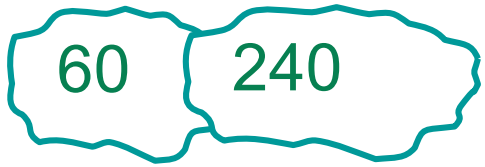
Example: What is your age?

1.
2. <18
3. 18
4. 19
5. 20
6. 21
7. 22
8. >22
•



- Median (middle value of ordered data)

18	18	18	18	19	19	19	19	19	19	19	19	19	19
19	19	19	20	20	20	20	20	20	20	20	20	20	20
20	20	20	20	20	20	20	20	20	20	20	20	20	20
20	21	21	21	21	21	21	21	21	21	21	21	21	21
			21	22	22	22	22	24	26	42			

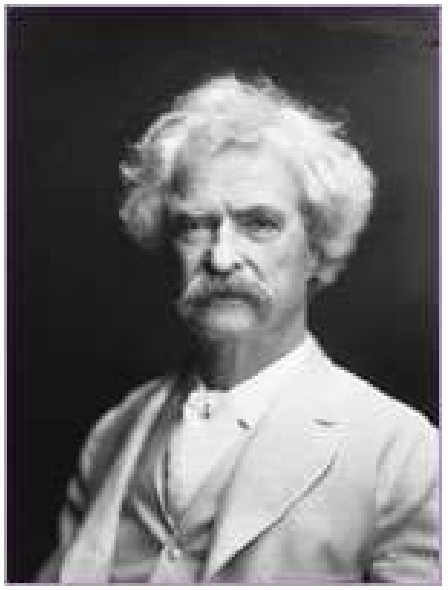


median = 20

Statistics Can Be Misleading

There are three types of lies:
Lies, damn lies and statistics.

BUT, if you understand statistics then the lies are obvious!



Mark Twain
wrote in his 1924 autobiography

2004

8K 8K 8K 9K 10K 12K 13K 15K 18K 18K 18K 19K 19K 20K 20M 21M 30M

2008

5K 7K 7K 8K 8K 11K 12K 14K 16K 16K 16K 17K 17K 17K 40M 45M 60M

Politicians say wages have decreased …

2004 median = $17K

2008 median = $14K

Government says wages have increased …

2004 mean = $25K

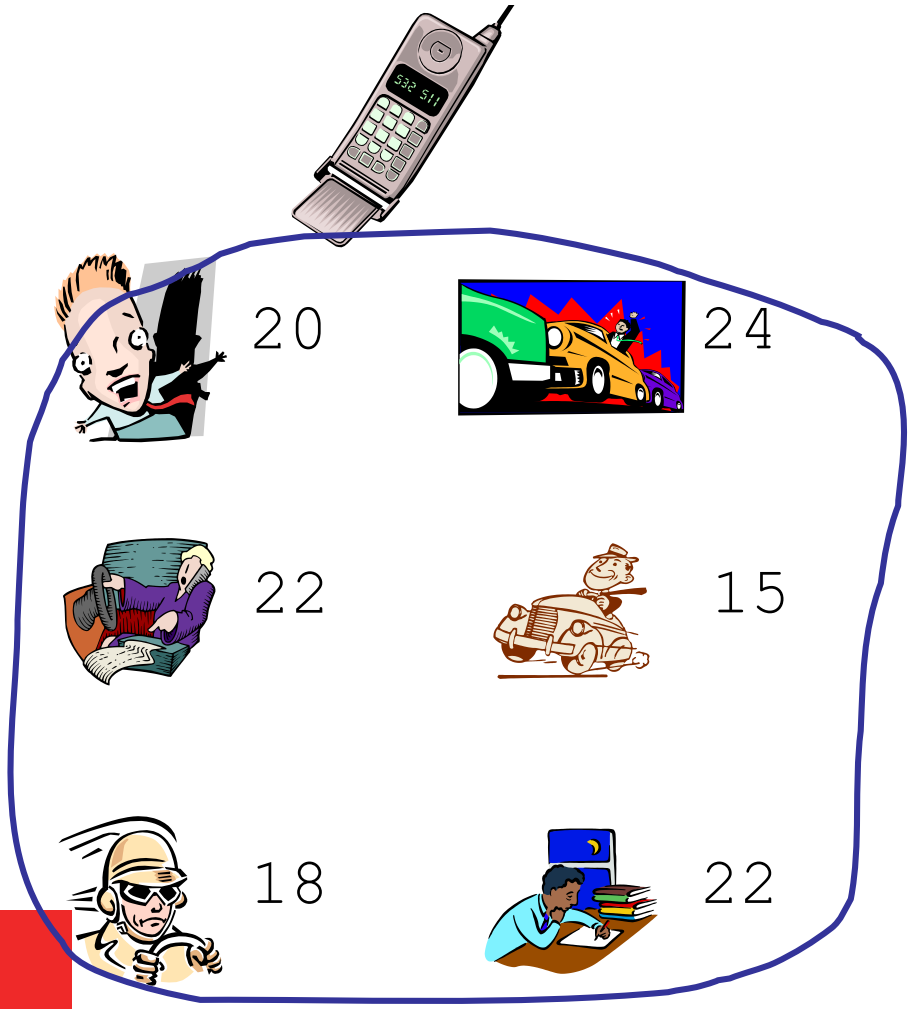
2008 mean = $30K

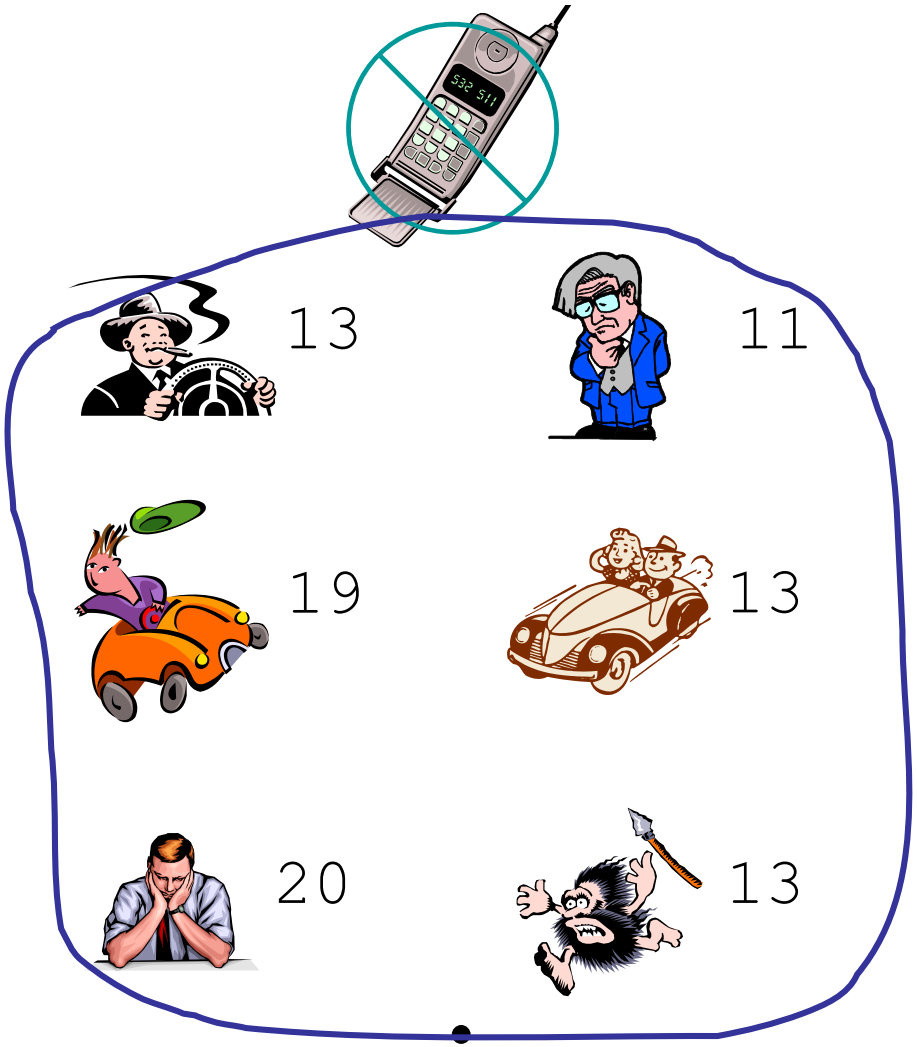
- In 1984, the University of Virginia's Department of Rhetoric and Communication announced that the starting salary for its graduates was over $50K …
-
- They failed to mention that a recent graduate was an NBA star.

$12K, $13K, $15K, $16K, $18K, $19K, $20K, $300K

vs

$12K, $13K, $15K, $16K, $18K, $19K, $20K, $25M



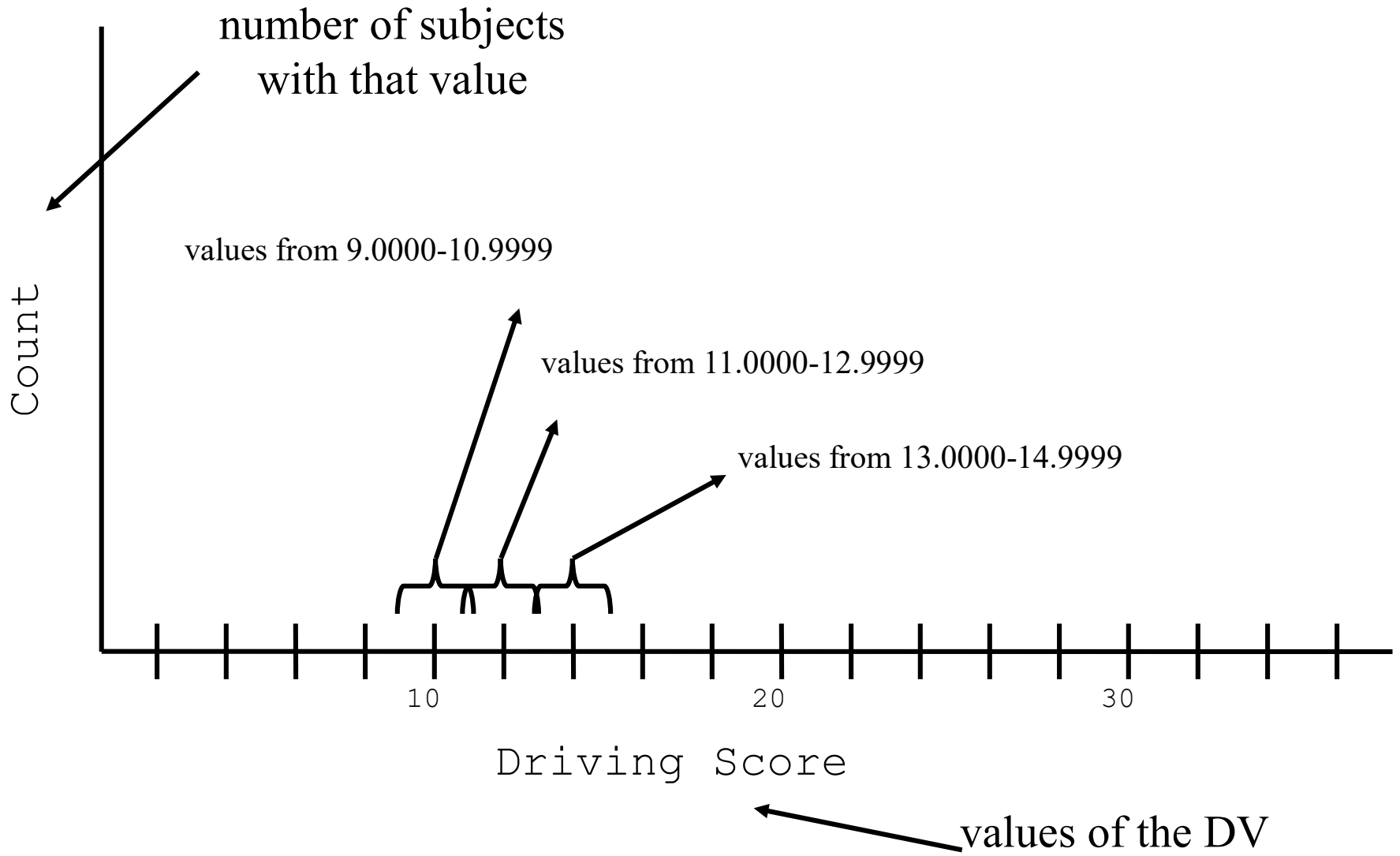


Mean = 21.5 ⟷ Mean = 15.3

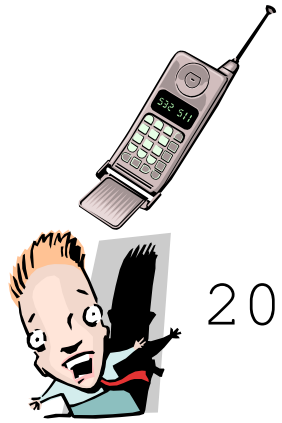
variability caused by the IV

what about all the rest of the variability?

Let's make a histogram to see the variability of data in the cell phone condition …



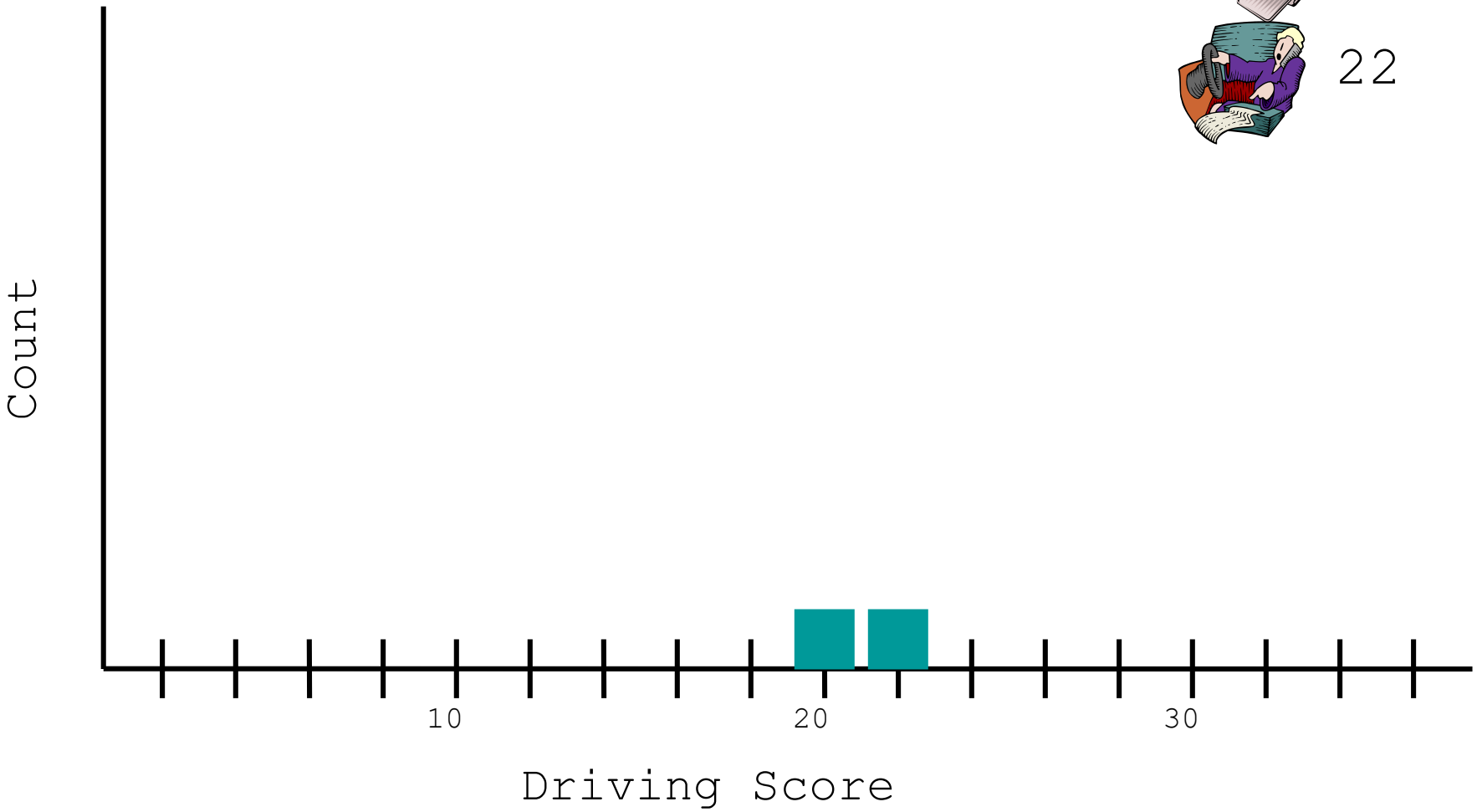
Let’s examine the cell phone condition …



20

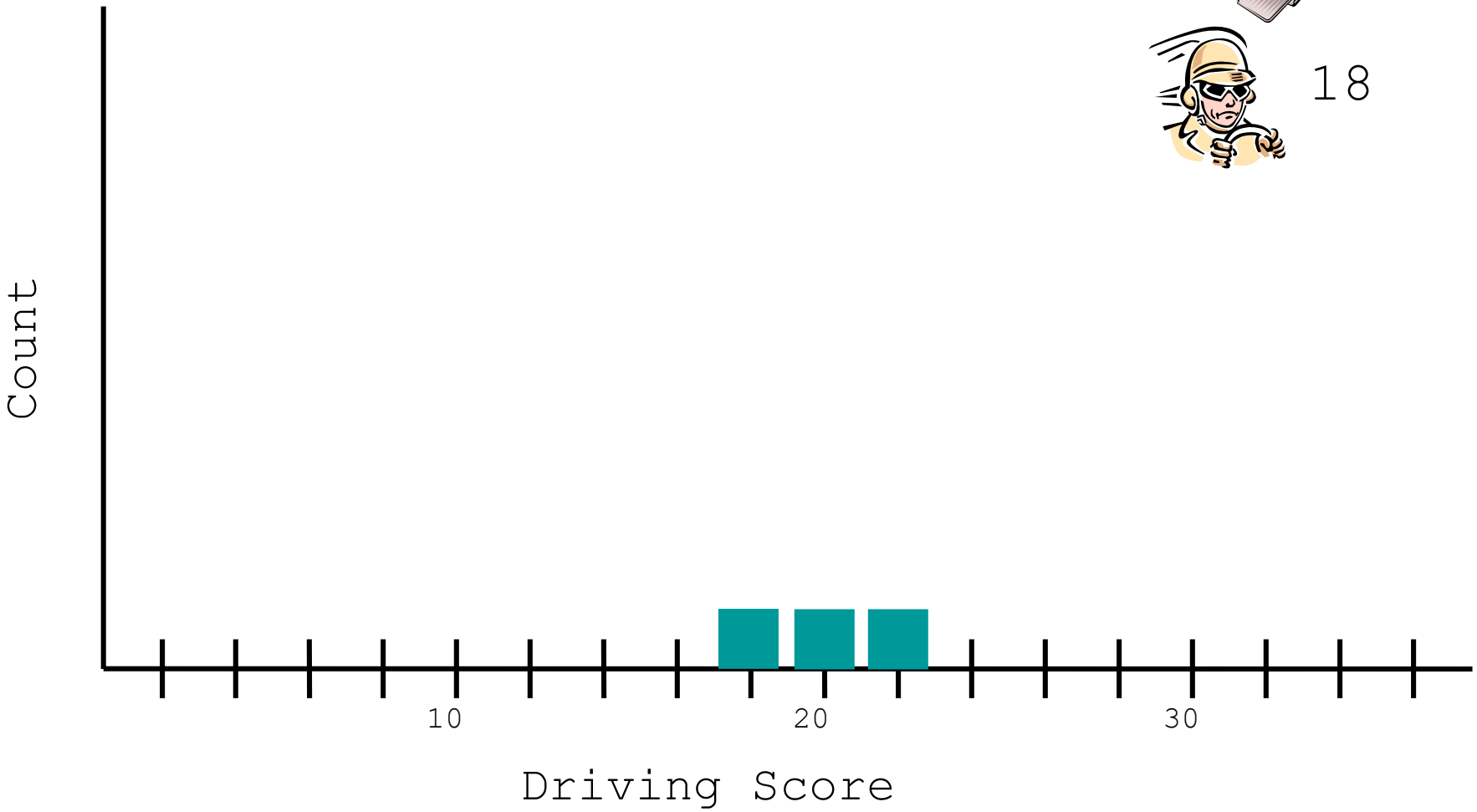
Let’s examine the cell phone condition …

22



Let’s examine the cell phone condition …

18

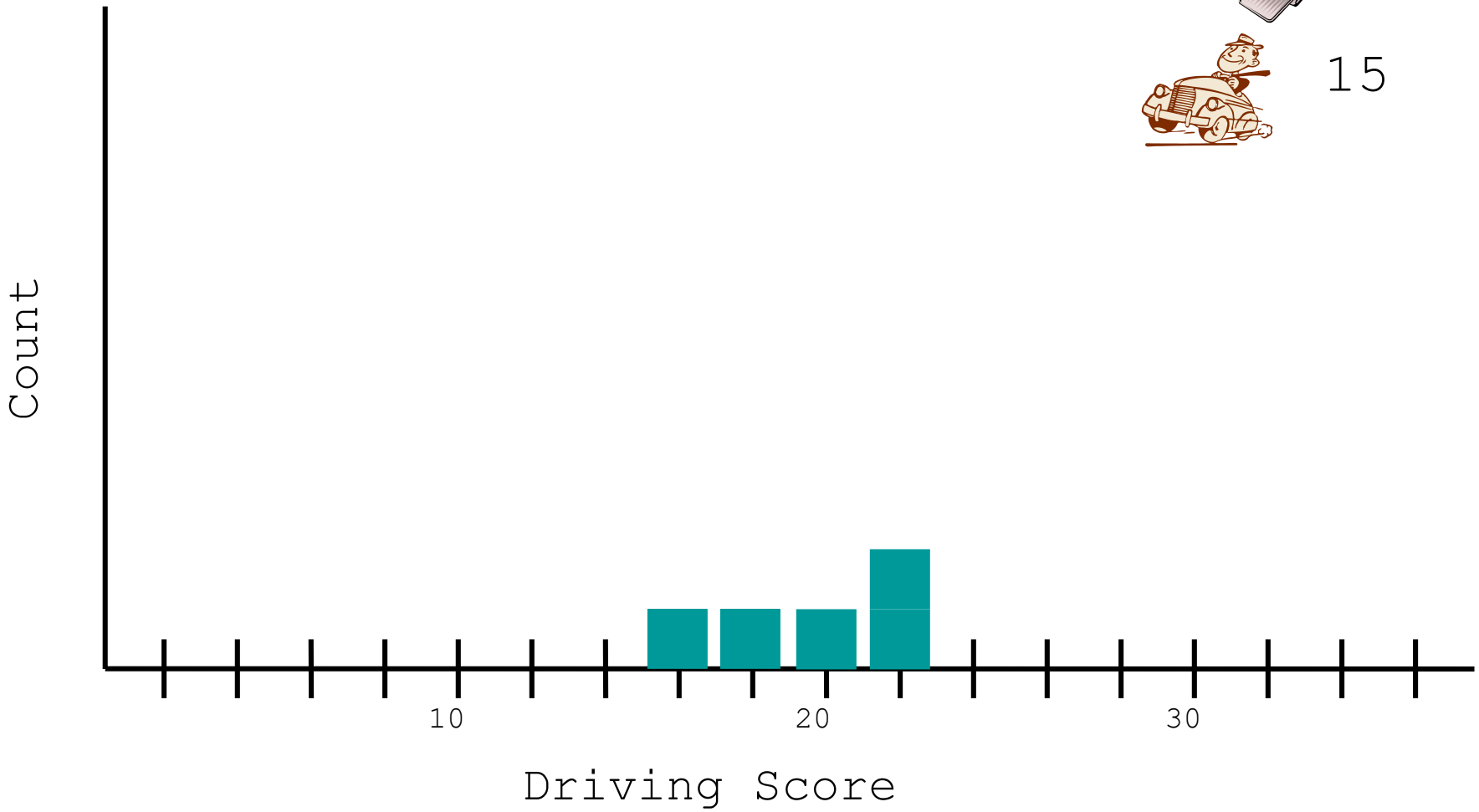


Let's examine the cell phone condition …

22

Let’s examine the cell phone condition …

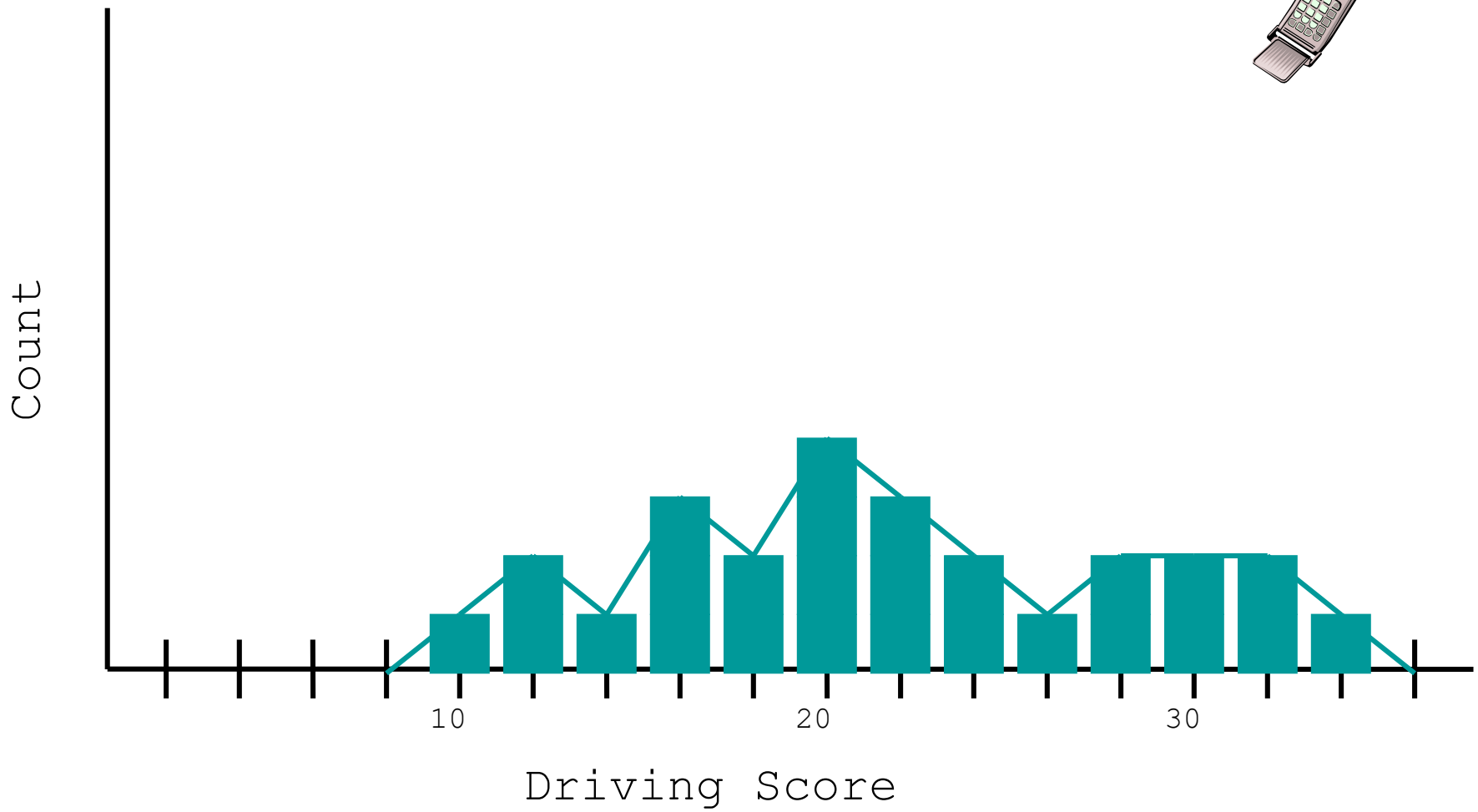
15



Let’s examine the cell phone condition …

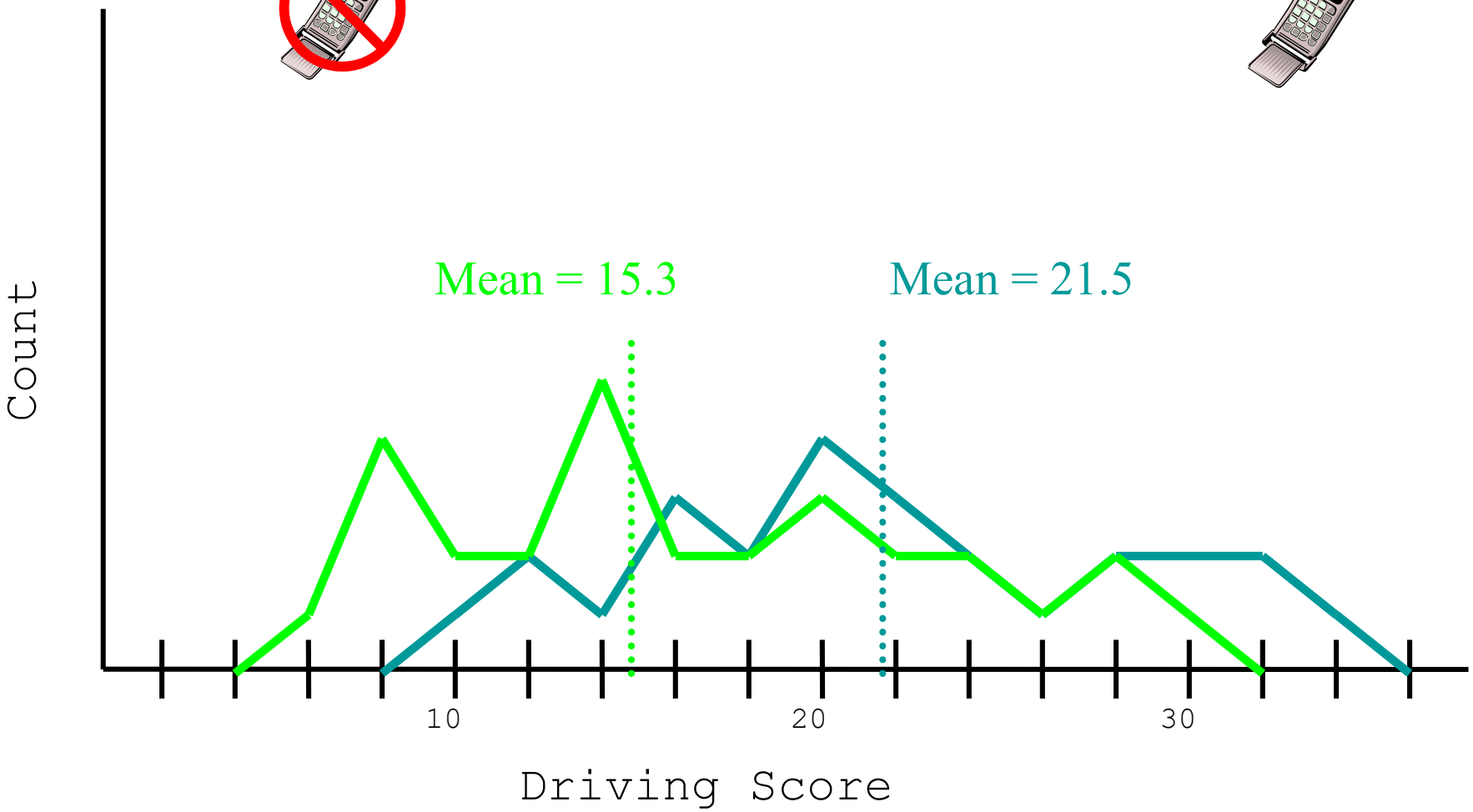
24

Let’s examine the cell phone condition …



the no cell phone condition …

Now here's the data from both conditions…



You need to look at the variability as well as the means …

Variability

- It's often useful to look at the whole distribution of data, not just the means.
-
- E.g., men and women report different "ideal numbers" of sexual partners over the next 30 years
  - Mean = 7.69 for men
  - Mean = 2.78 for women
-
- Evolutionary explanation: "because of a fundamental asymmetry between the sexes in minimum levels of parental investment, men devote a larger proportion of their total mating effort to short-term mating than do women" (Buss & Schmitt, 1993)
-
- A quote from someone, "Men can't help it when they act like pigs, they've evolved to act that way …"

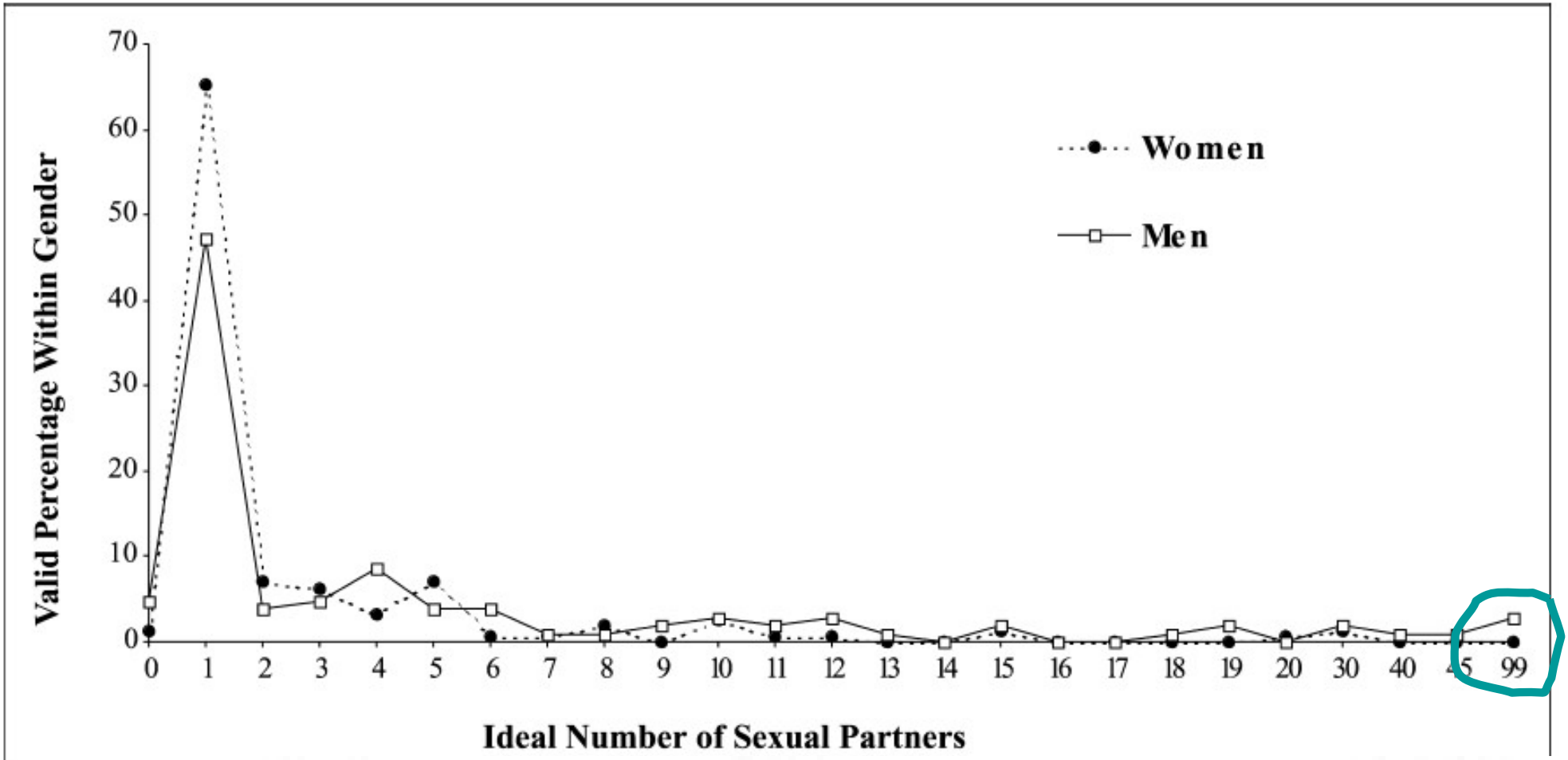
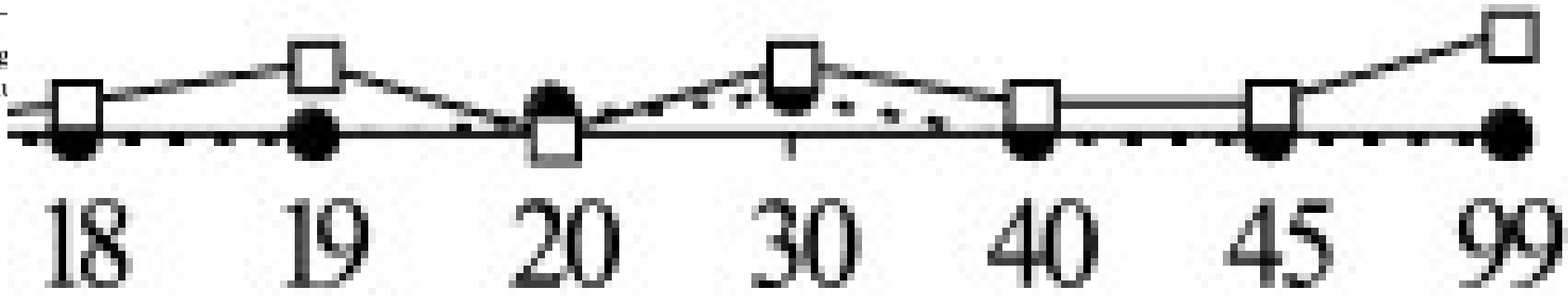
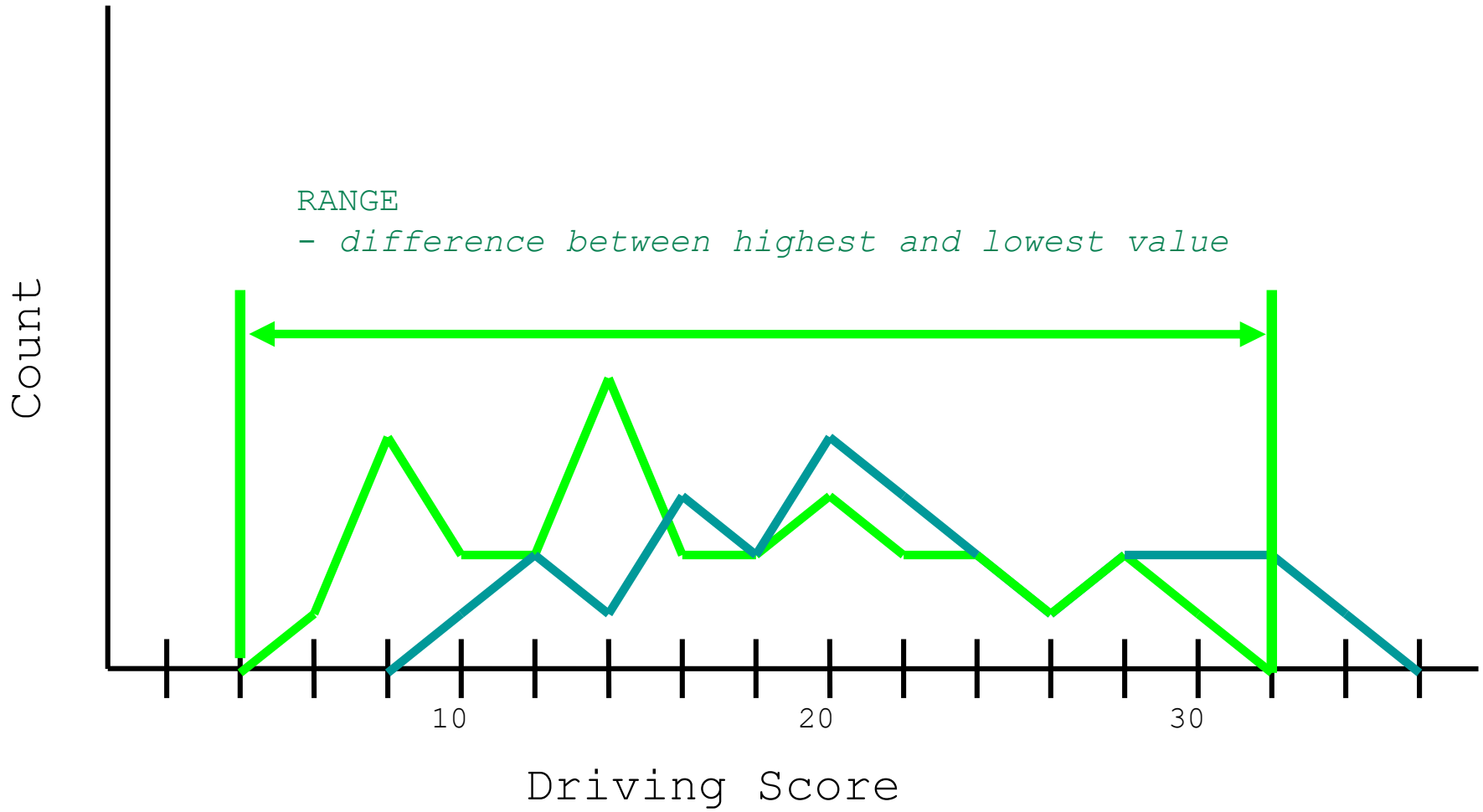
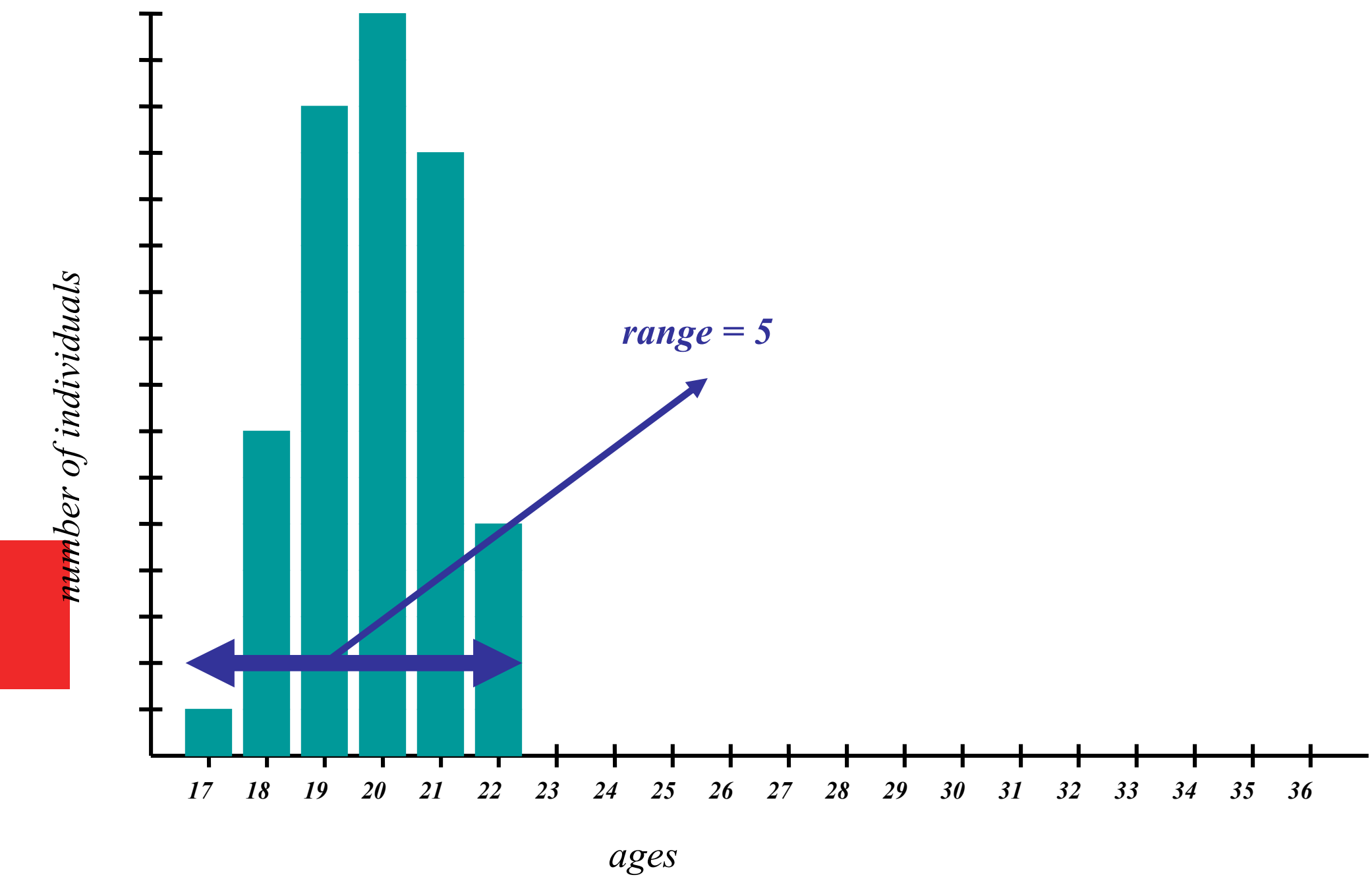

Valid Percentage Within Gender
70
60
50
40
30
20
10
0
Women
Men
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 30 40 45 99
Ideal Number of Sexual Partners

Fig
tim


18 19 20 30 40 45 99

Is there a short-hand way to summarize the variability in data?




number of individuals
range = 5
17
18
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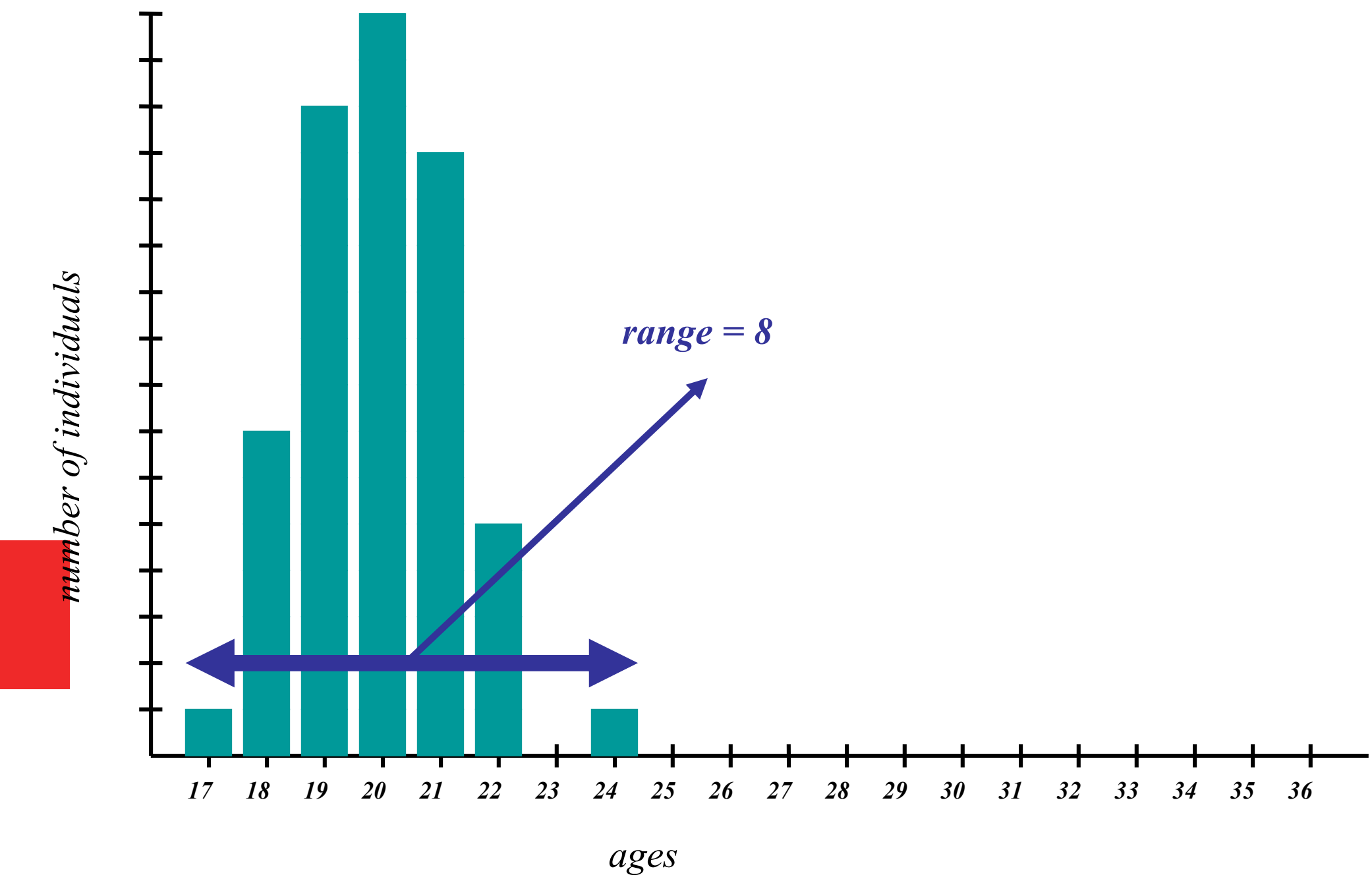
36
ages


number of individuals
range = 8
17
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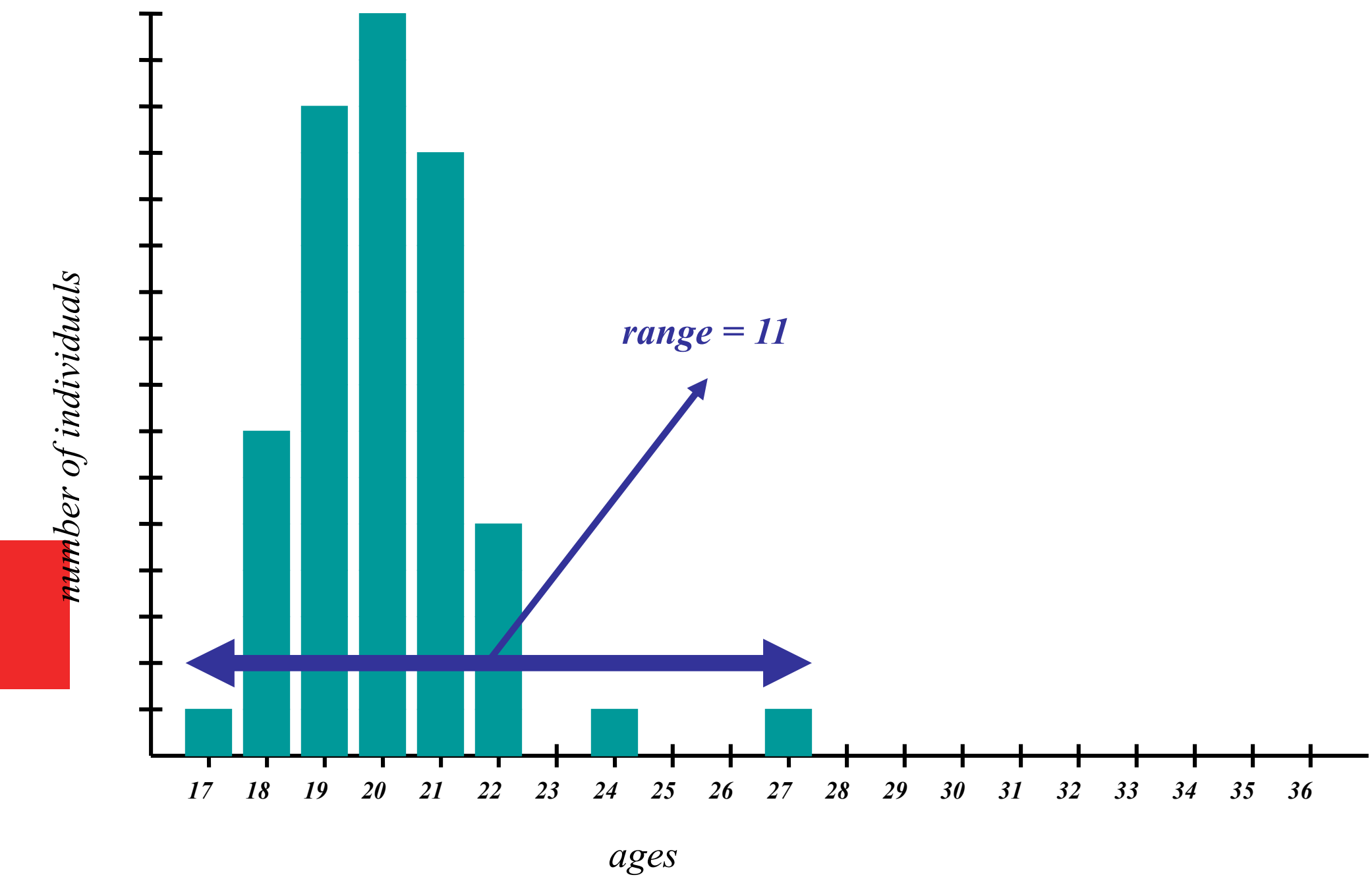
ages


number of individuals
range = 11
17
18
19
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22
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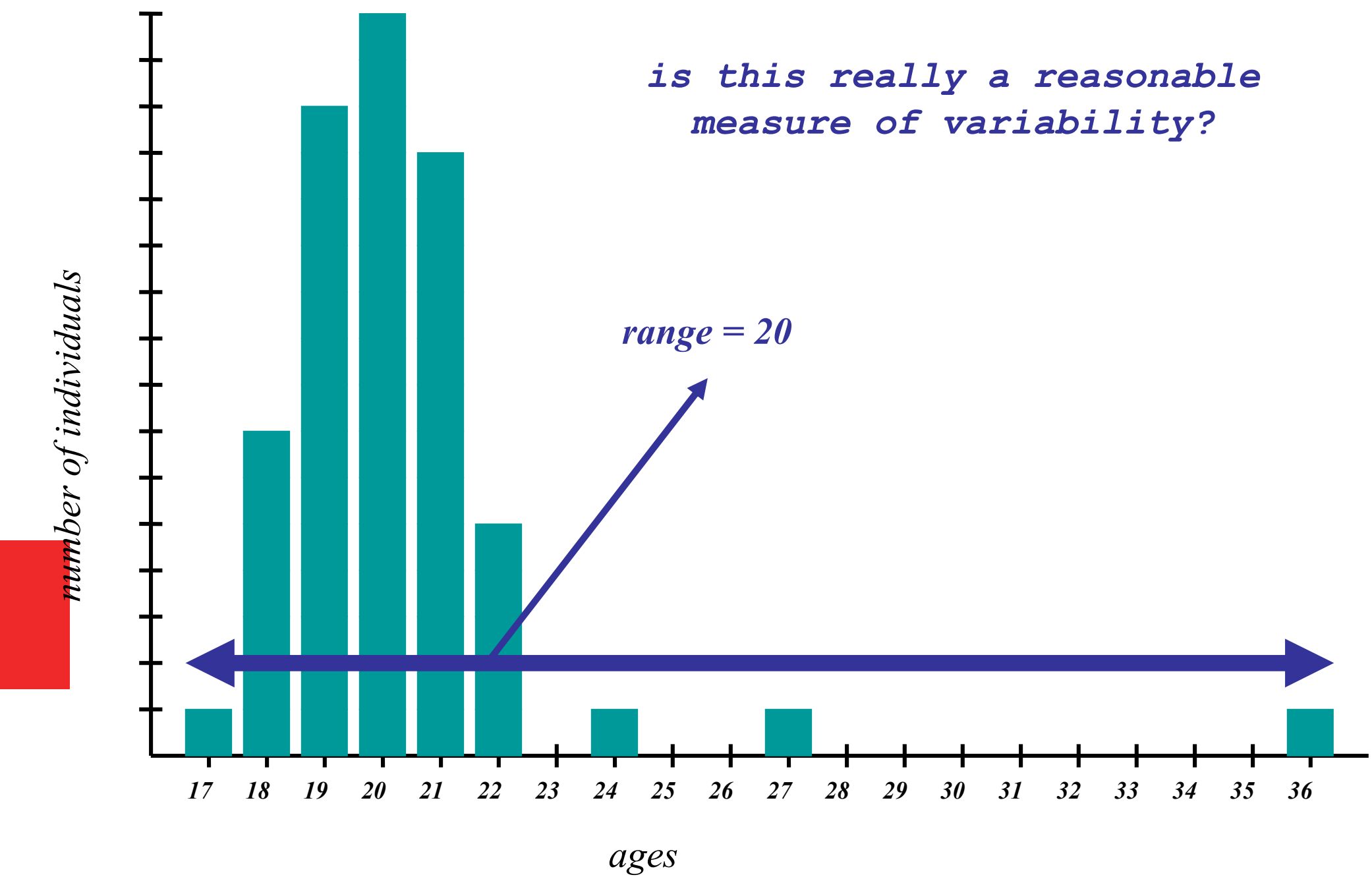
29
30
31
32
33
34
35
36
ages


is this really a reasonable measure of variability?
range = 20
number of individuals
17
18
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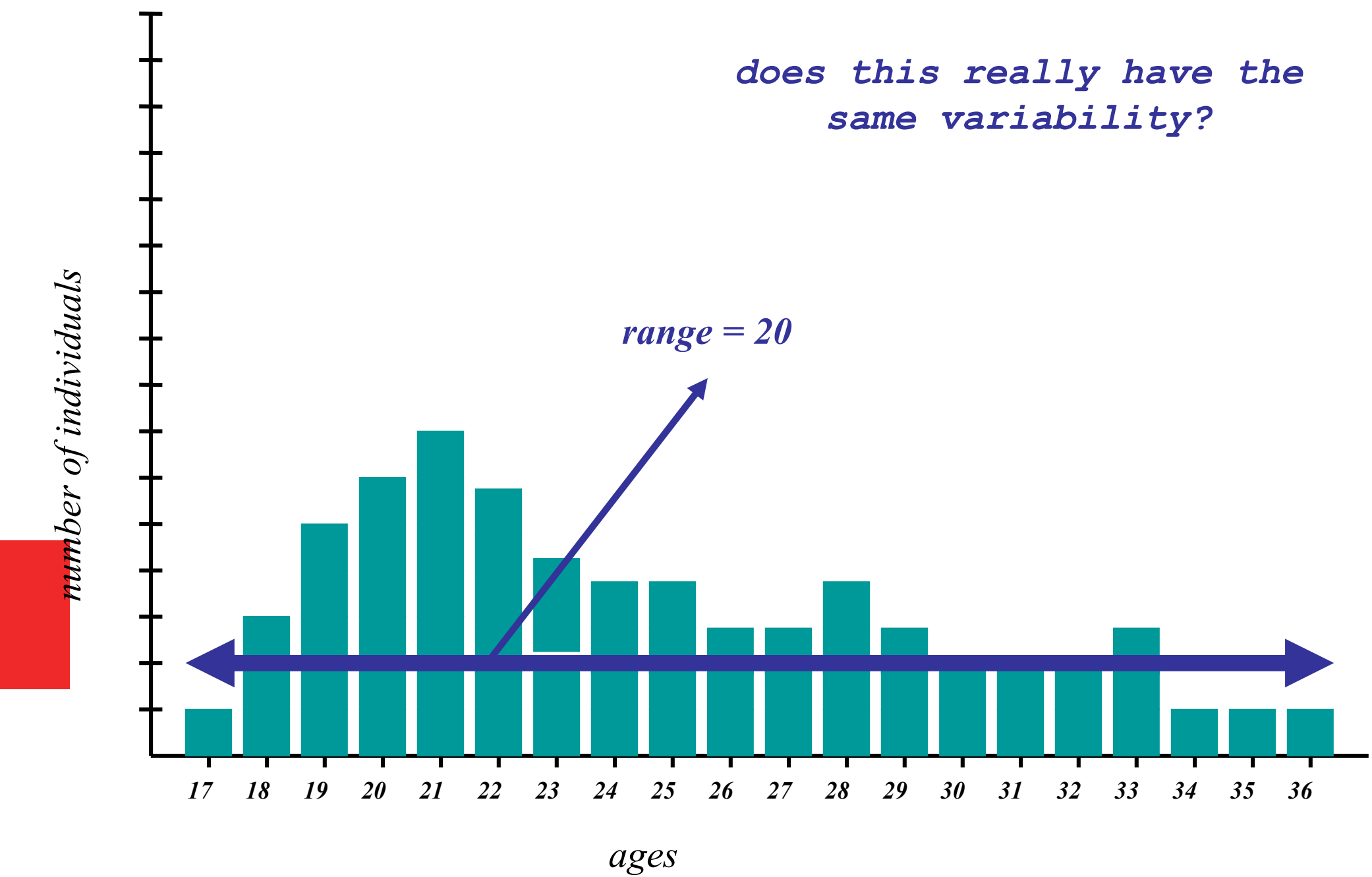
ages

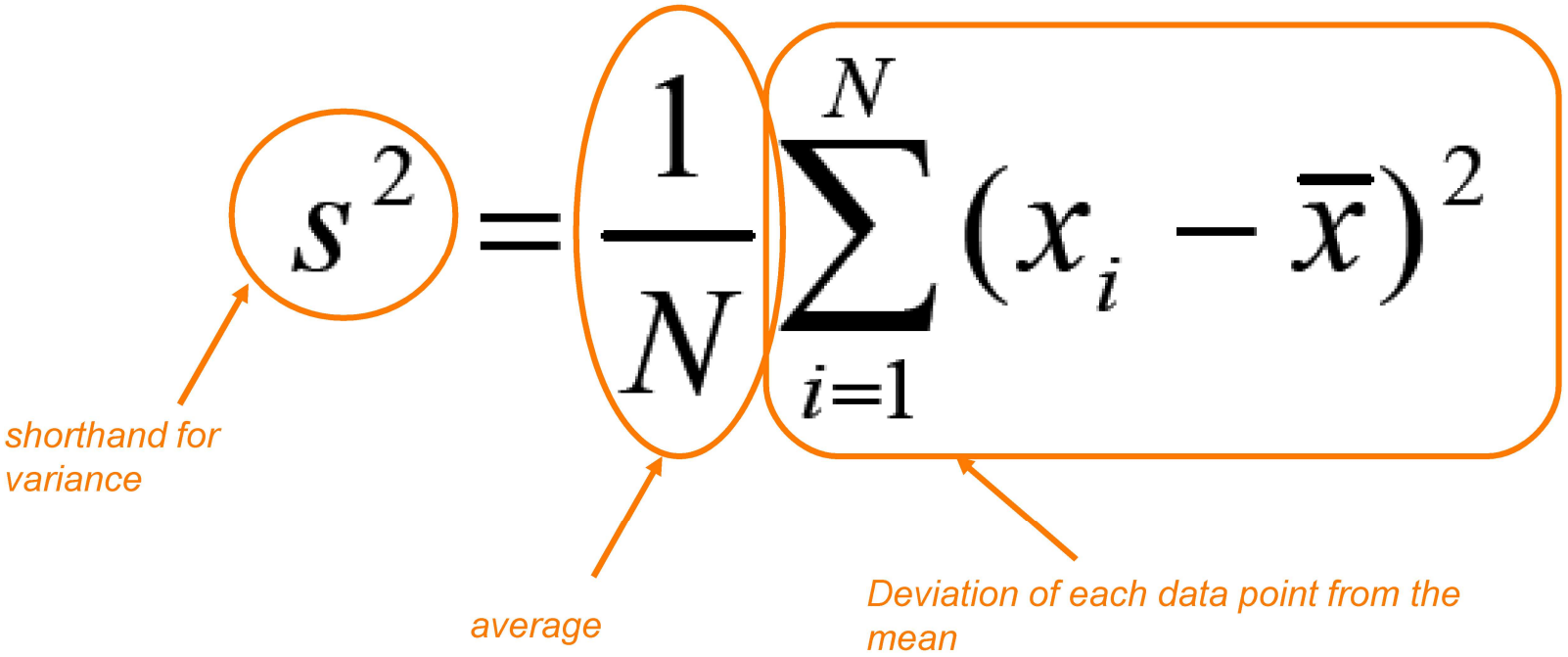

does this really have the same variability?
range = 20
number of individuals
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
ages

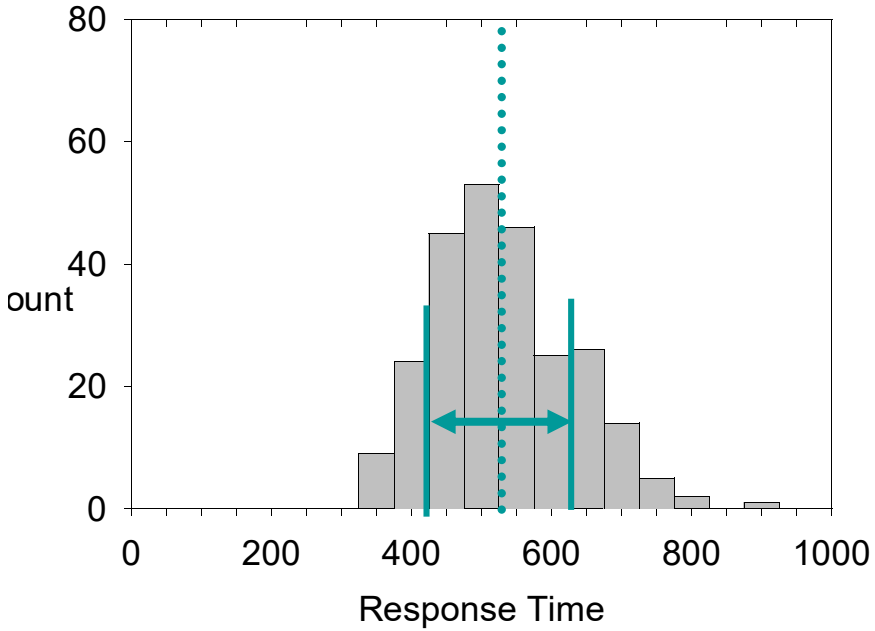
Variability

- RANGE is overly sensitive to the extreme values.
-
- One solution is to look at the range, but exclude the extreme outliers – an example is the interquartile range
  - http://mathworld.wolfram.com/InterquartileRange.html
  - http://en.wikipedia.org/wiki/Interquartile_range
-
- VARIANCE
  - Average deviation from the mean
  - A better measure of variability
-

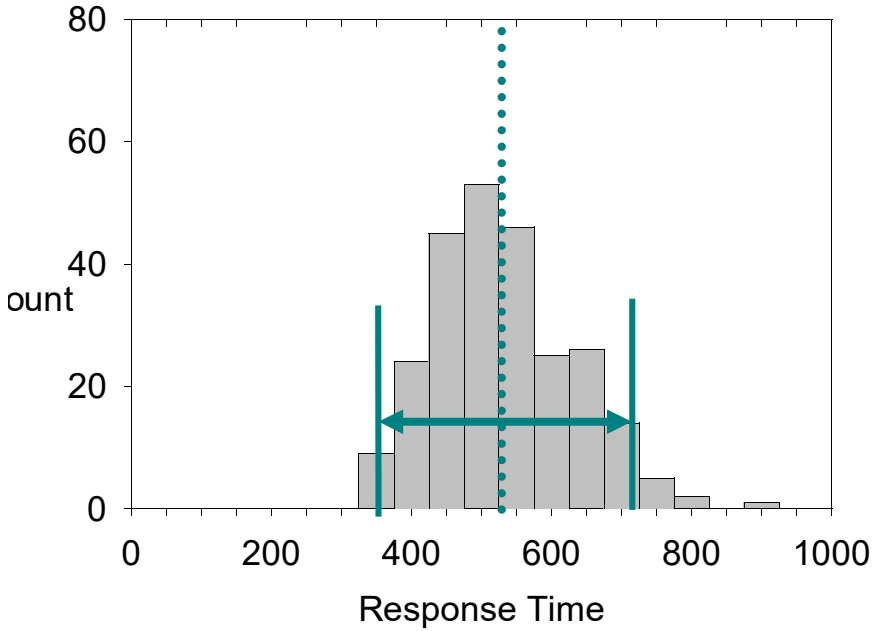
VARIANCE

- Average deviation from the mean



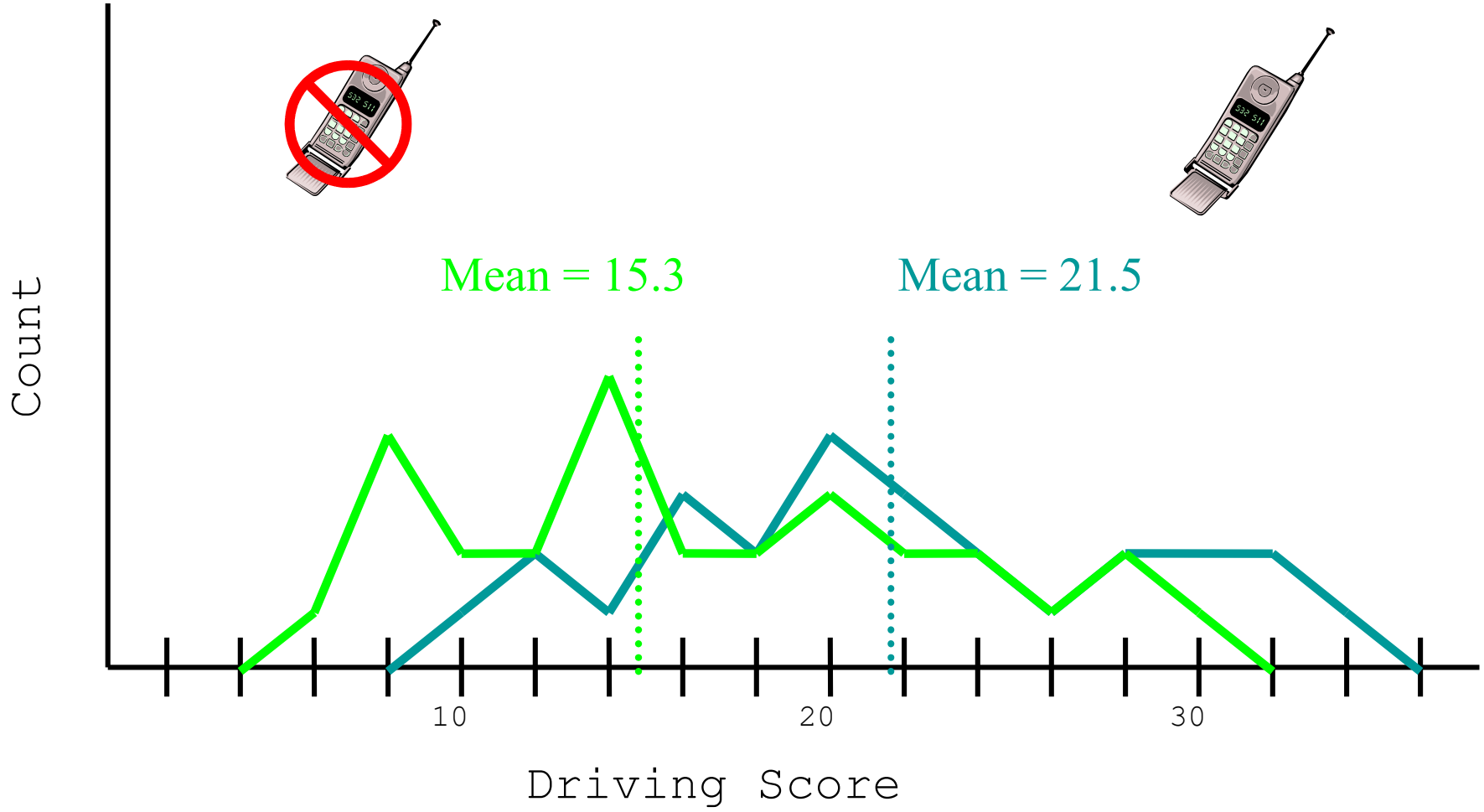


For "normally-distributed" (bell-shaped) histograms …
64% of data within one standard deviation of mean



For "normally-distributed" (bell-shaped) histograms …
64% of data within one standard deviation of mean
97% of data within two standard deviations of mean

Does cell phone use *significantly* impair driving?



You need to look at the variability as well as the means …