

1. What percentage of the work did each group member do?
  - Rachel- 33%
  - Michaela- 33%
  - Irina- 33%
2. What effort did each group member put forth?
  - Rachel- 33%
  - Michaela- 33%
  - Irina- 33%

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# Human Dimensions Lab

## Wingspan, Height, Forearm Length, and Foot Length

### Purpose

To find out if the dimensions of a human being is the same throughout the world in terms of length ratios of the arm span to the height and the forearm to the foot.

### Question

- 1) Are people's "wingspans" equal to their height?

2) Are people's forearm lengths equal to the lengths of their feet?

## Background

"I heard that our wingspan is the same as our height." "Your forearm is the length of your foot." Many people have heard or even said these statements and today we find out if they are true.

## Hypothesis

If there is a relationship between the forearm/foot and the arm span/height, then it will show up in the data but it will not be that height/arm span and forearm/foot will be the same length.

## Predicted Outcome

The height and the arm span depends on the way the person is built.

# Methods and Materials

## Materials

1. Tape measure, meter stick, or ruler
2. Three test subjects

## Procedure

- 1) Form a group of three
- 2) Measure each other's dimensions as outlined below.
- 3) Trade data with other groups until you have data from 15 students.
  - a) **Wingspan**
    - i) While standing, extend arms in opposite directions horizontally at shoulder height.
    - ii) Using a tape measure, meter stick, or ruler measure wingspan in cm. Wingspan is defined as the distance from the tip of the middle finger of one hand to the tip of the middle finger of the other hand.
    - iii) Record measurement in your data table
    - iv) Repeat steps 1 and 2 for your partner.
  - b) **Height**
    - i) Remove your shoes.
    - ii) Have the person being measured lean against the wall. Make sure his/her head and heels are touching the wall.
    - iii) Place a ruler flat on top of his/her head and ensure that it is parallel to the floor.
    - iv) Have a partner mark the height on the wall.
    - v) Place tape measure, meter stick, or ruler at the bottom of the wall and pull the tape measure up to your marked height. Find the height in cm.
    - vi) Repeat the procedures with your partner.
    - vii) Record data in your data table.
  - c) **Forearm**
    - i) Place forearm flat against the floor with your upper arm flat against a wall so that

your upper arm and forearm form a 90 degree angle.

ii) Measure the length of forearm from your elbow skin wrinkle to the wrinkle line on your wrist.

iii) Record your measurement in your data table.

**d) Foot**

i) Take off the right shoe.

ii) Using a meter stick placed against the wall, line your right heel up to the zero line.

Keep the meter stick on the inside of your foot.

iii) Stand up straight and have another student use a ruler to line up the tip of your longest toe to the meter stick.

iv) Measure to the nearest millimeter.

v) Record your measurement in your data table.

## Data and Calculations

### Observations

We originally thought that both assumptions were wrong (that wingspan and height were the same, and that the length of forearm and foot are the same) and that it could only be true depending on the build of the person in question. We thought immediately that wingspan would be shorter than the height just because of what we saw with our eyes. We guessed the same thing about the forearm-foot relationship. We assumed that since the body is made of different proportions, that these would be no different.

### Data Table

Name	Wingspan (cm)	Height (cm)	Forearm (cm)	Foot (cm)
Rachel	151	152	19	23
Michaela	160	159	21	24
Irina	155.5	152	18	22
Laura	172	174	22	26
David	172	179	21	26
AnnaMarie	155	161	21	24
Andy	176.5	173	23	25
Eric	169	172	21	23

<b>Moose</b>	<b>183</b>	<b>185</b>	<b>28</b>	<b>28</b>
<b>Jake</b>	<b>177</b>	<b>179</b>	<b>23</b>	<b>25</b>
<b>Rose</b>	<b>163</b>	<b>162</b>	<b>20.5</b>	<b>23</b>
<b>Samantha</b>	<b>164.5</b>	<b>161</b>	<b>20.5</b>	<b>24</b>
<b>Tasha</b>	<b>162</b>	<b>160.5</b>	<b>20.5</b>	<b>24</b>

## Calculations

- We got the average for each unit (height, wingspan, forearm length, and foot length).
- We rounded the averages and created a ratio for wingspan to height (166.2:166.1).
- We rounded the averages and created a ratio for forearm length to foot length (21.4:24.4)
- We used the resources on the spreadsheet to find the averages. It basically multiplies all the numbers in each section, then divides that number by the number of data points there are. The ending balances were basically a compression of all the data we gathered (Wingspan-166.2 cm, Height-166.1 cm, Forearm-21.4 cm, Foot-24.4 cm).

## Graph

[Michaela's Graph](#)

# Discussion

## Results

The results were fairly close to our hypothesis. The relationship between the arm span/height was about one centimeter of difference and the foot/forearm ratio was about .9 centimeters. The average height of the class was 166.9 cm. The average wingspan of the class was 166.2 cm. The average forearm: 21.4. The average foot: 24.4.

## Conclusion

People's forearms are not equal to the length of their feet and their arm spans are not equal to their height. The data proves this theory false with an average arm span/height ratio of 1cm and an average forearm/foot ration of .9cm. Our hypothesis was proven correct with the fact that the body parts do have a certain ratio to each other but are not the same length. The data was consistent for the most part, only differing with the things we were unable to control like height, foot size, arm length, etc. Some people may have measured wrong as a source of error, the calculations could have been more exact had a computer been doing the measuring. If someone were to have a prosthetic arm made based on height or the length of a foot, they would have made the device too short or too long for the patient. In conclusion, this was a fairly reliable experiment with few flaws that

has proved our hypothesis correct.