

Tristan Wright  
Data Visualization  
Lab 1

### Purpose

The purpose of the lab is to demonstrate accuracy and precision of measurements by measuring the area enclosed by four sidewalks at Earlham College. Furthermore to visualize the variety in the readings.

### Equipment

Measuring equipment includes as follows:

- Tristan Wright
  - Wearing *Men's Size 11 Tian Lang "Departure"* shoes measuring approximately 11.5 inches in length.
- *Kenson Road Runner model RR318n "Big Wheel"*
  - Handle attached to measuring head with a wheel 9.6cm in diameter, when this wheel is rolled on the ground a display increments signifying the number of feet pushed.
- *Kenson Road Runner model RR112 "Small Wheel"*
  - Handle attached to measuring head with a wheel 9.6cm in diameter. There is a sticker on the bottom of the head noting: "Note: This tool is designed for rough measuring and should not be used as an exact measuring ruler."
- *Google Earth*
  - Version 6.2.2.7373 for Mac OSX with a Ruler tool that either measures straight distances in lines or paths. Measurements can be taken in a variety of units but in this instance meters with accuracy to the hundredth's place.
- *Planimeter*
  - Measures area under a curve in square feet. Used on a scale map of Earlham College.

### Methods

The north and west sidewalks were measured five times with the following methods on both sidewalks.

- Tristan Wright
  - Steps were made placing one foot directly in front of the other end to end. Steps were counted on the iOS app VG Counter by tapping on the screen incrementing a value. If the step passed the end line of the side walk, the number of steps was rounded up.
- Large measuring wheel and Small measuring wheel
  - The wheel was rolled on the inner length of the sidewalk and the measurement was taken down at the end of the sidewalk segment. If the inches place in the measurement was not clear, result was rounded up.
- Planimeter
  - The result from this was multiplied by 20 and then converted to square meters.
- Google Earth

- Using the Ruler tool, when zoomed in on the map line segments were taken of the north and west sidewalks five times and recorded in meters.

### Results

The total standard deviation of all the data was 242.34 square meters. The largest average (planimeter) area from measurements was 655.25 square meters larger than the smallest average area (steps).

### Sources of Error

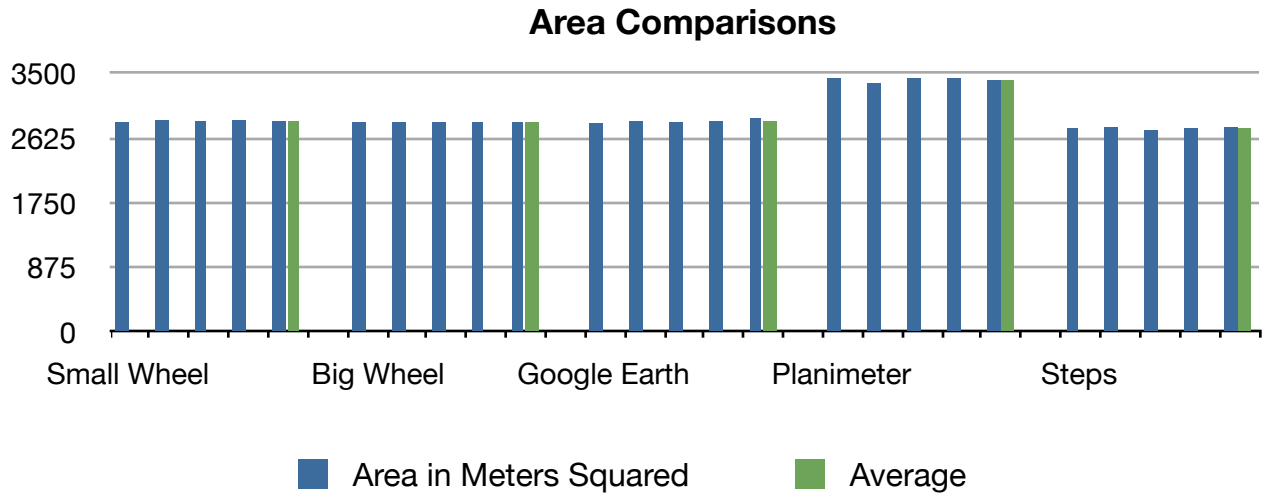
- Assumptions
  - When measuring with walking or some device that measures a distance, I am assuming that the north and west sidewalks are at a 90 degree angle and the area is a parallelogram.
- Error From Measurements
  - Tristan Wright
    - ▶ If walk is not in a straight line then the measurement will be longer.
    - ▶ If steps are not placed from most forward tow point to most rear heel point, measurements will be shorter.
  - Big wheel, Small Wheel.
    - ▶ Any curve while measuring with the wheel will lengthen the distance.
    - ▶ Any mud or debris that gets stuck to the wheel will increase the circumference of the wheel throwing off the overall measurement.
  - Planimeter
    - ▶ If the inner most lines of the sidewalks are not followed then area will be larger.
  - Google Earth
    - ▶ If inner most lines of sidewalks are not measured, then area will be larger.

## Data and Visualizations

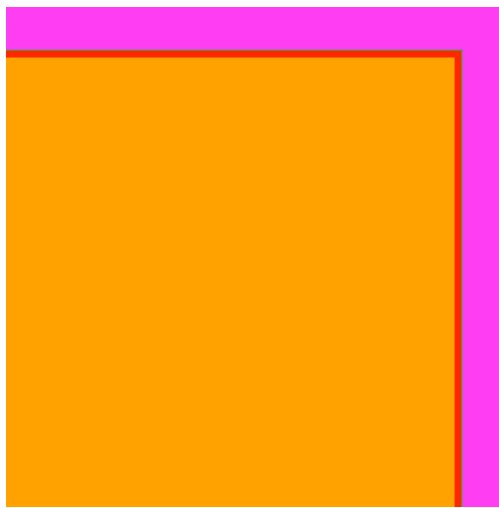
### Raw Data

	<b>N_f</b>	<b>N_i</b>	<b>W_f</b>	<b>W_i</b>	<b>N meters</b>	<b>W meters</b>	<b>Area m<sup>2</sup></b>	<b>Average</b>
Small Wheel	201	11	151	5	61.5442	46.1518	2840.376	
	203	6	151	11	62.0268	46.3042	2872.101	
	202	6	151	7	61.722	46.2026	2851.717	
	203	6	151	8	62.0268	46.228	2867.375	
	202	6	151	5	61.722	46.1518	2848.581	2856.03
Big Wheel	202	8	151	0	61.7728	46.0248	2843.081	
	202	8	151	1	61.7728	46.0502	2844.65	
	202	9	151	1	61.7982	46.0502	2845.819	
	202	9	151	1	61.7982	46.0502	2845.819	
	202	8	151	1	61.7728	46.0502	2844.65	2844.804
Google Earth					61.12	46.24	2826.189	
					62.32	45.84	2856.749	
					61.53	46.23	2844.532	
					62.12	45.84	2847.581	
					62.32	46.43	2893.518	2853.714
	<b>measure multiplier</b>		<b>ft<sup>2</sup></b>					
Planimeter	1846		20	36920			3429.868	
	1813		20	36260			3368.554	
	1848		20	36960			3433.584	
	1845		20	36900			3428.01	
	1835		20	36700			3409.43	3413.889
	<b>N steps</b>		<b>W Steps</b>					
Steps	209		155		61.0489	45.2755	2764.019	
	208		156		60.7568	45.5676	2768.542	
	208		154		60.7568	44.9834	2733.047	
	209		155		61.0489	45.2755	2764.019	
	208		156		60.7568	45.5676	2768.542	2759.634

*Charted Raw Data*

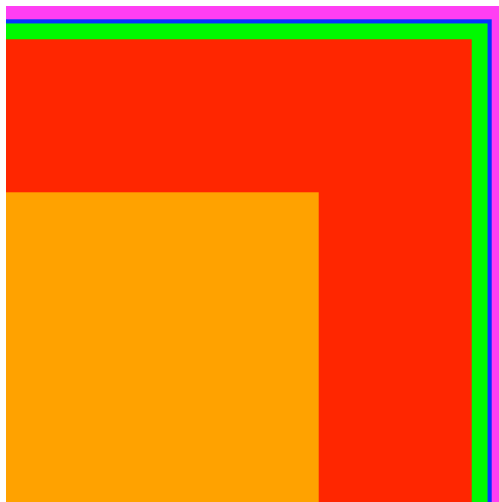


*Average Area Comparison*



*Sizes of squares from square roots of average area, image scaled down.*

- Small Wheel
- Big Wheel
- Google Earth
- Planimeter
- Steps



*Zoomed in so that "Small Wheel" and "Google Earth" are visible.*