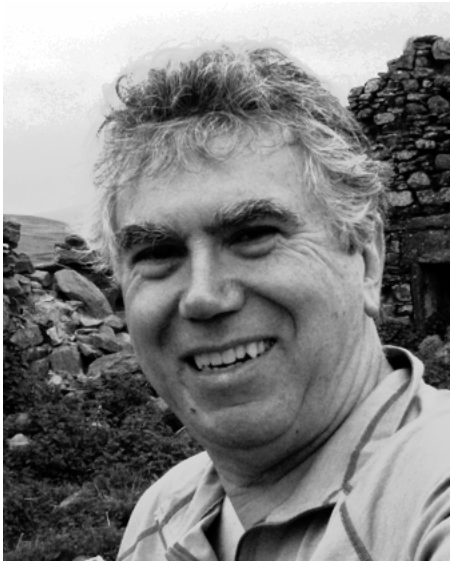
CSCI 111, Bonus Lab 3
Histogram equalization

Individual work: All work must be your own. Do not share code with anyone other than the instructor and teaching assistants. This includes looking over shoulders at screens with the code open. You may discuss ideas, algorithms, approaches, *etc.* with other students but NEVER actual code.

Histogram equalization: This is an addition to lab 7, which processed images using different filters.

A very useful filter for contrast enhancement is histogram equalization. As an example, here I am in an original grayscale and an enhanced contrast version:



This is accomplished by creating a histogram of brightness values. It will be best if you use integers for brightness values. You can use 0..255 for the brightness values if you like, it makes things simpler. Each brightness value (or luminance) is used as a key in a dictionary, and the number of times it occurse in an image is counted.

We then find the cumulative histogram for the image, where each success brightness in the dictionary stores the **sum** of all previous brightness entries.

If the total number of brightness entries is `n`, (the sum of the values in the histogram, or the last value in the cumulative histogram), then the new brightness of a pixel with brightness level `brightness_level` is

```
1    cumulstive_histogram[brightness_level]/n
```

This is a number between 0 and 1, so you can scale it to 255 to get the final image brightness for the pixel.