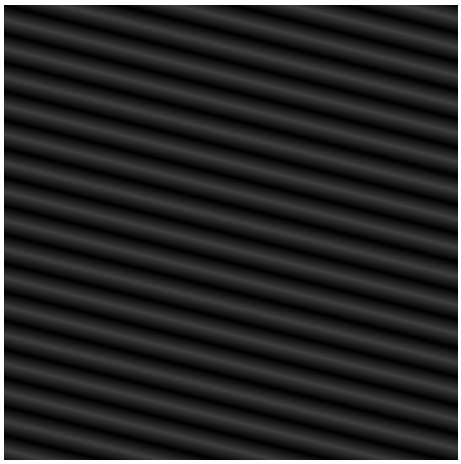
# 1 Visualization of prime numbers

Assume you create an image with 500x500 pixels where every pixel is represented by a number.

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | ... | | 500 |
| 501 | 502 | | | | |
| ... | | | | | |
| | | | | | |
| | | | | | |
| | | | | | 250 000 |

The image consists solely of grey level colors, starting with black rgb(0,0,0) up to a maximum value rgb(n,n,n). The first pixel is black and then every pixel is getting one level lighter (each of the values red, green and blue is incremented by 1). From the lightest pixel (n,n,n) on every pixel is getting a level darker until it is completely black. Then the whole procedure starts again. When arriving at the end of a line, one continues in the next line with the next color of the series.
If $2n$ is a divisor of 500, one can see light and dark vertical, parallel stripes (first image), otherwise there are diagonal, parallel stripes (second image).

n=50



n=63

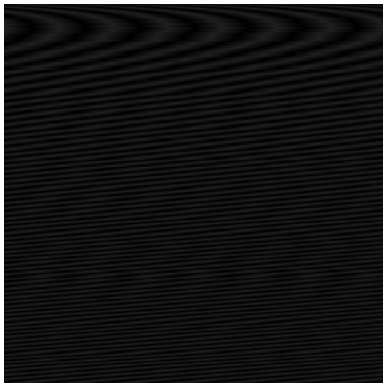
Now, the above procedure is modified as follows: At every pixel whose number is a prime number you do not go on with the next color in the series but it receives the same color as the pixel before:

| pixel | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| color code | (0,0,0) | (0,0,0) | (0,0,0) | (1,1,1) | (1,1,1) | (2,2,2) | (2,2,2) | (3,3,3) | (4,4,4) |

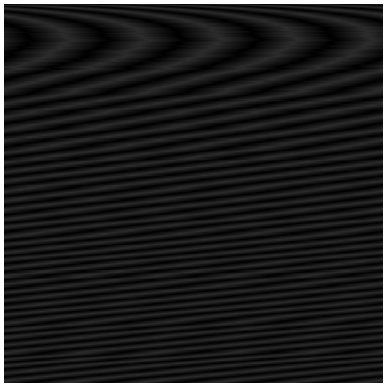
For certain values of $n$ beautiful patterns result, for other values of $n$ you cannot see anything but an amorph grey mixture (examples see images on next page).

You can also use square numbers instead of prime numbers. For certain $n$ you also get nice patterns, for others not. However, the outcoming patterns are much more regular than the prime number patterns. For examples see images on page 3.

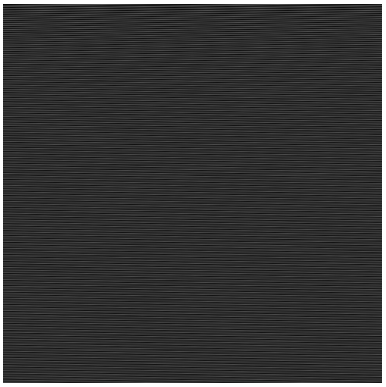
Prime numbers:



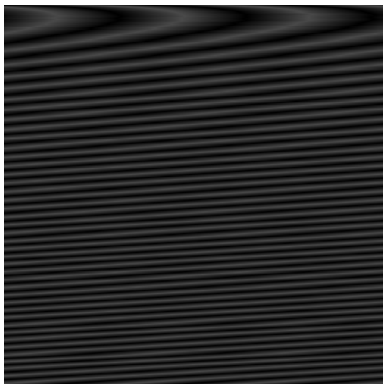
n=50



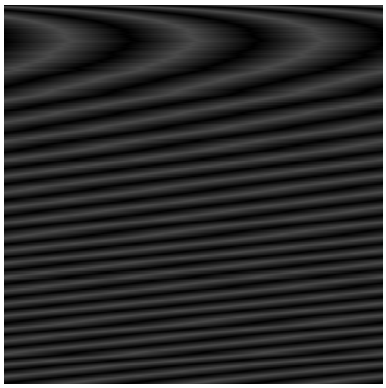
n=63



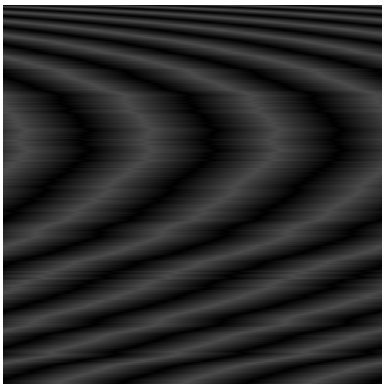
n=94



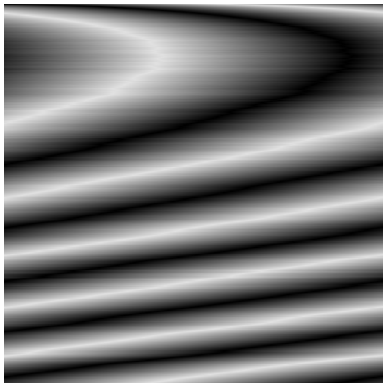
n=74



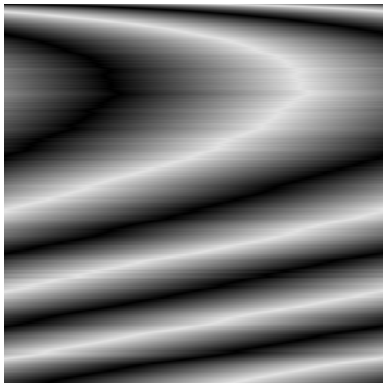
n=75



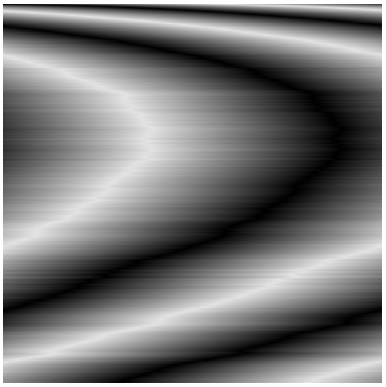
n=76



n=226



n=227



n=228

Possible steps for a further research could be:

- Can the curves be described with mathematical functions?
- Is there a relation between the values of $n$ and the "beauty" of the patterns?
- As a consequence: What can be said about the order and distribution of prime numbers ?

Next page: table of chosen square number patterns.

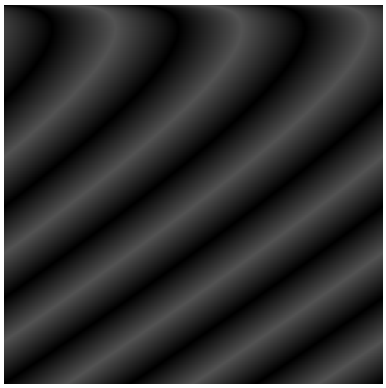
Square numbers:

n=25

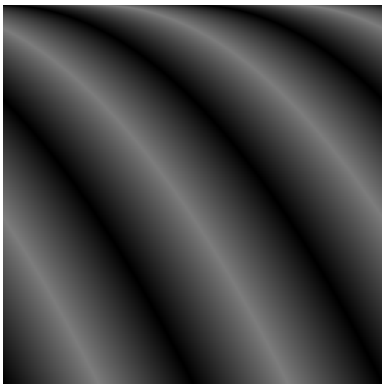
n=41

n=50

n=62



n=83



n=125