

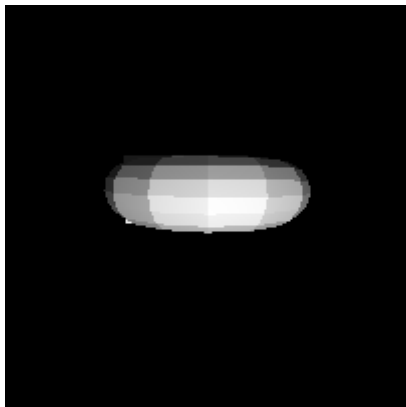
MAGR Practical 2

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What have we done:

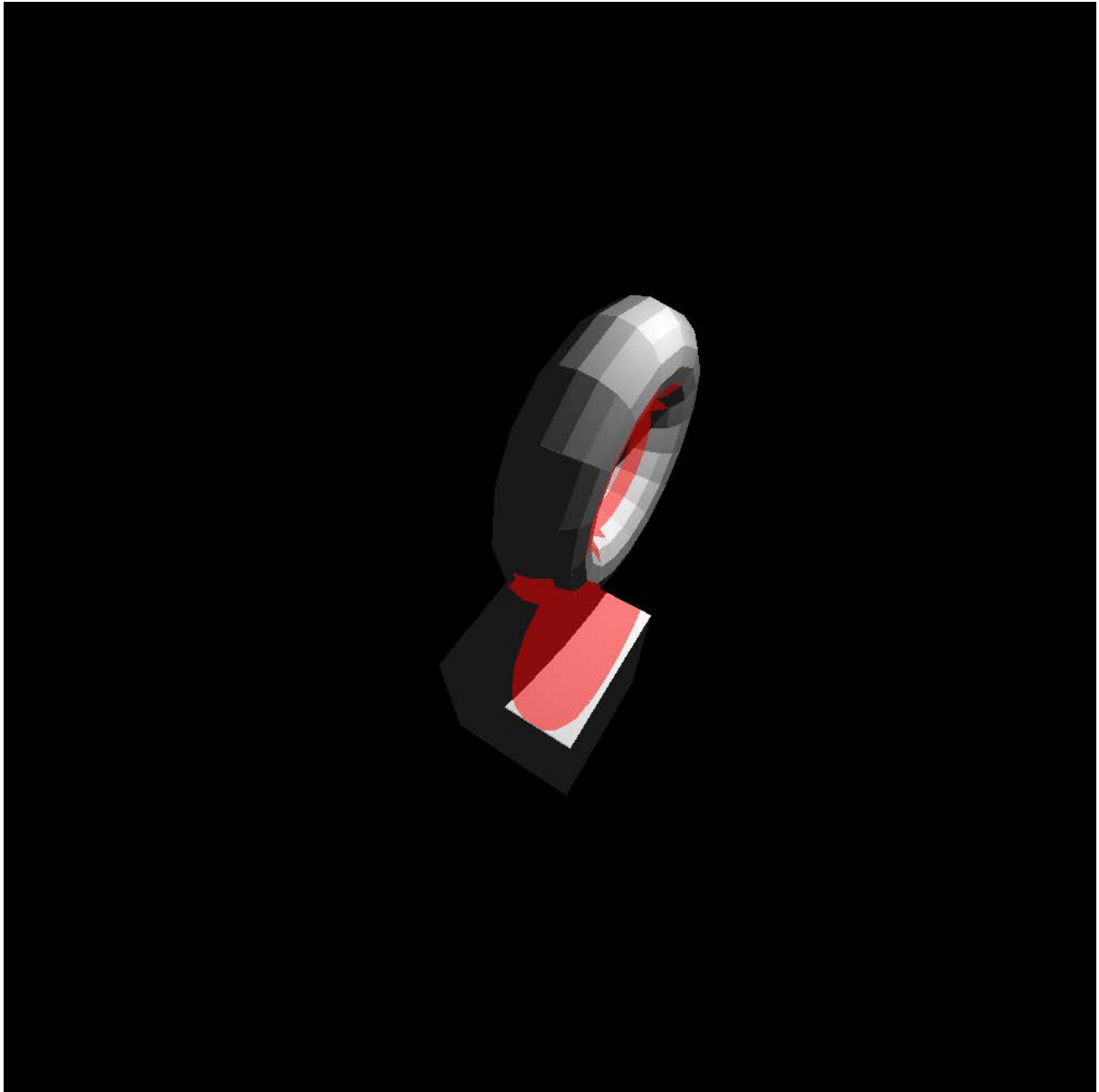
- Basic shading
- Reflections
- Shadows
- Anti-Aliasing

Local Shading



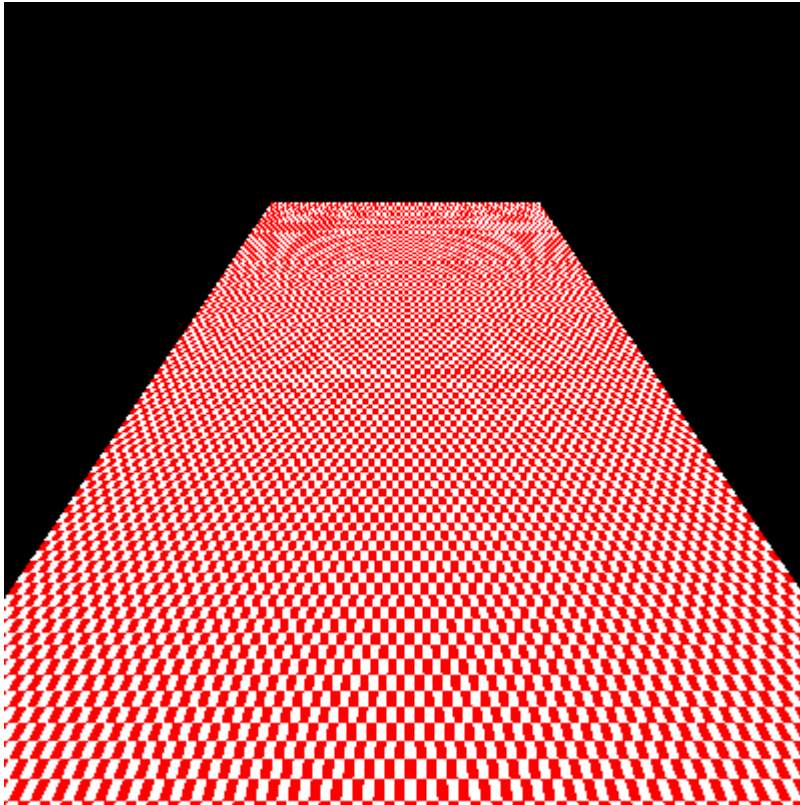
Top of torus seen from above. Light source above it.

Local shading + shading + reflections.



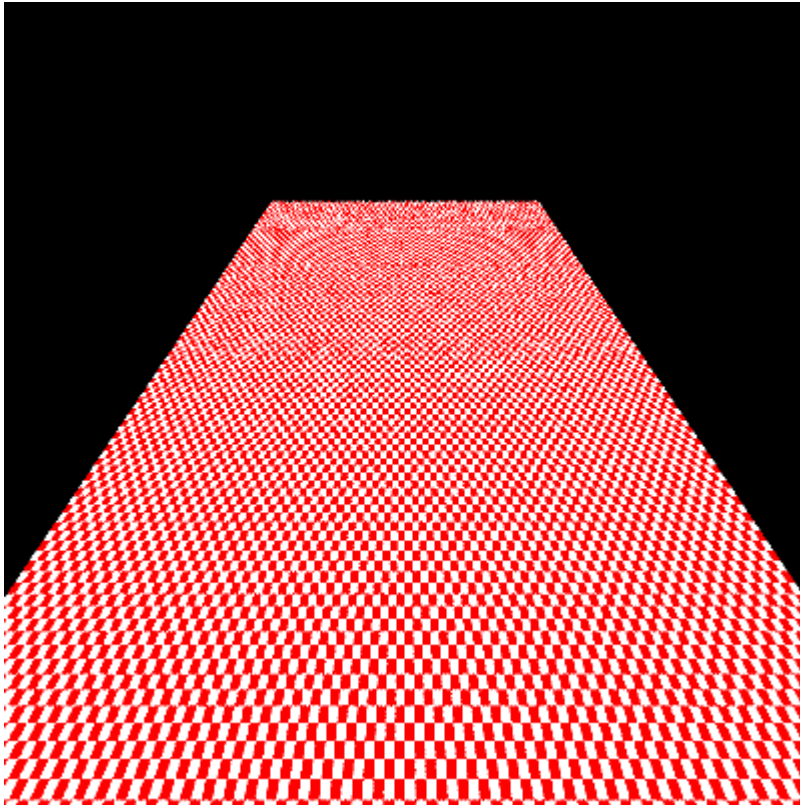
Reflections are made red for visibility purposes. Dark grey and red areas are shaded areas (they can not see the light source unobstructed). Light source is again above the objects.

Anti-Aliasing

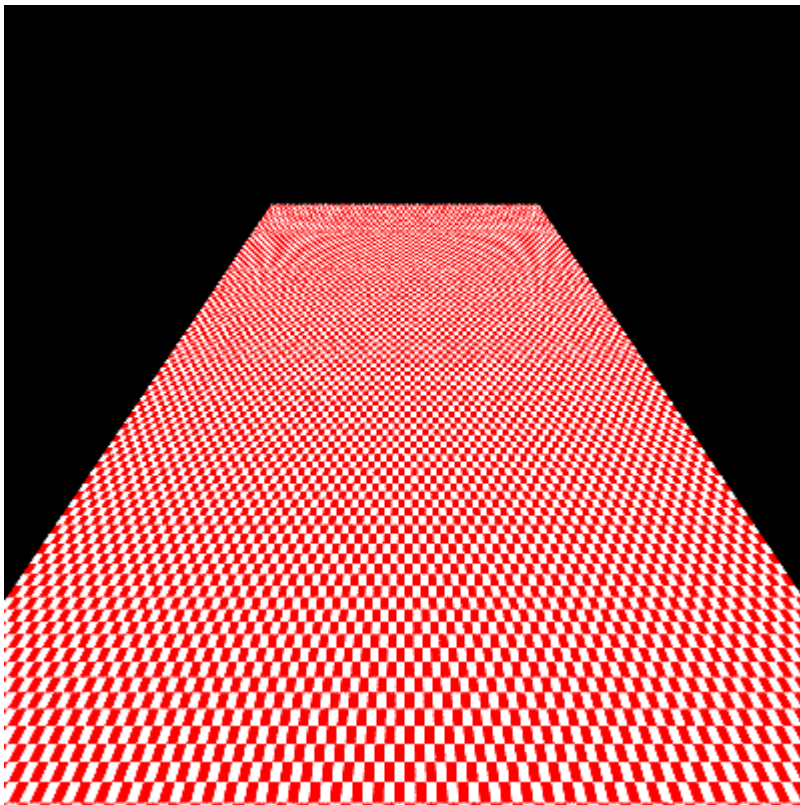


The checkerboard rendered with one ray through the center of each pixel. Moire patterns can be seen.

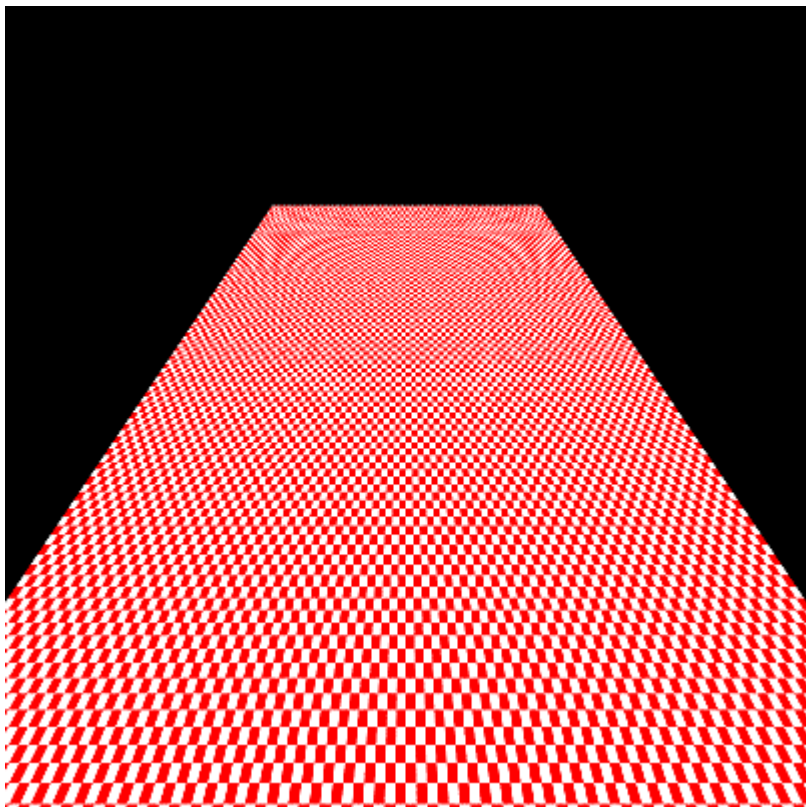
Using more rays per pixel



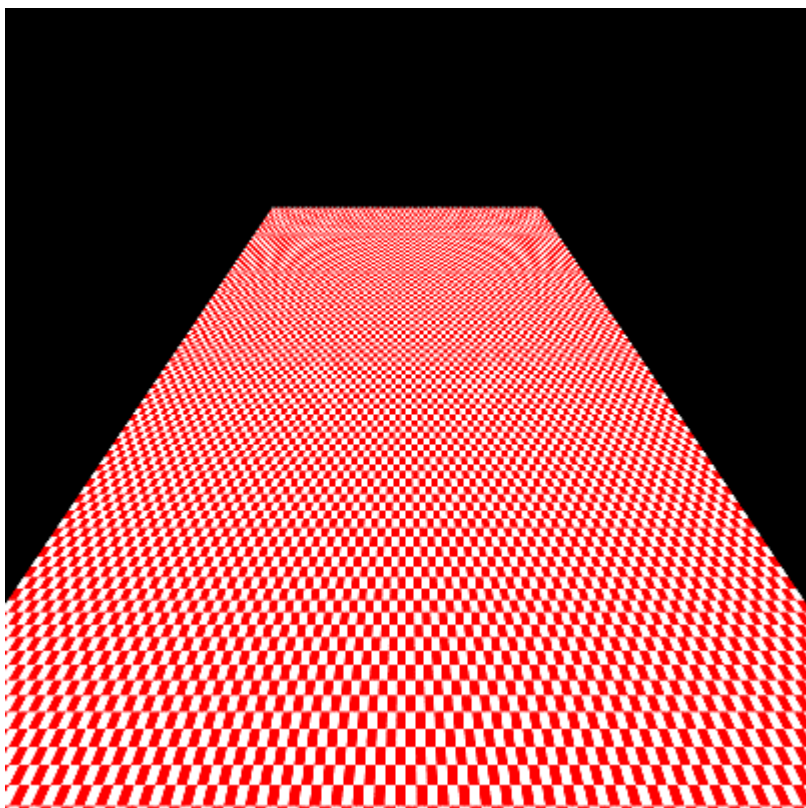
Here you can see the result when using 3 random rays inside each pixel. It slightly improves the picture but you can still see aliasing.



With 10 rays, the upper has improved and looks less noisy.



With 30 rays through a pixel, the checkered pattern becomes better visible on the upper part of the rectangle.

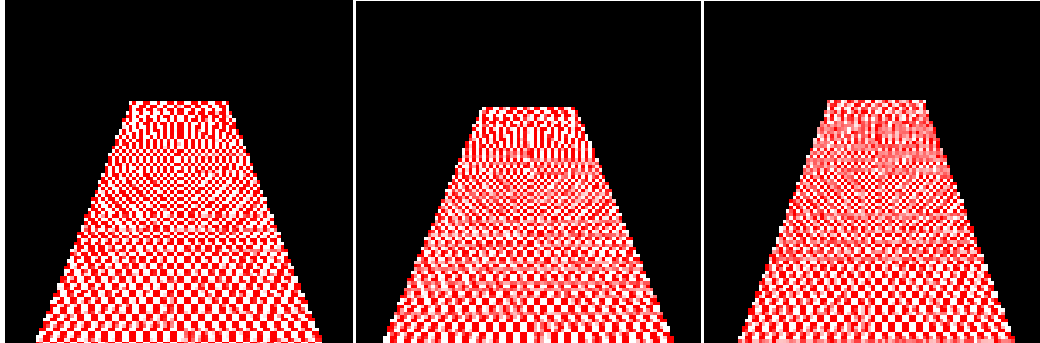


Compared to 30 rays, 50 rays are hardly an improvement. A lot more rays are needed when you want to let the moiré pattern disappear.

Gaussians

We found that increasing the sigma increases the smoothing/blurring. Tests with different sigmas (100*100):

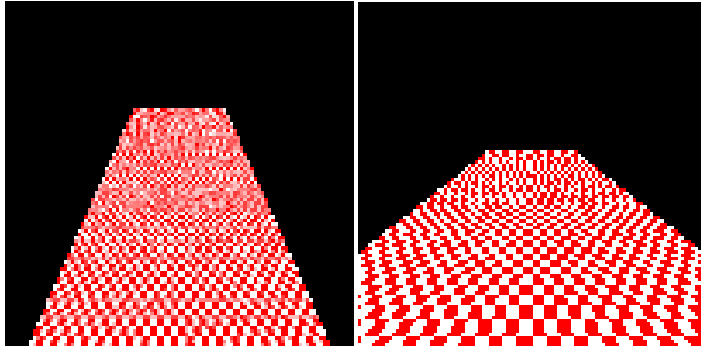
(for some reason enlarging in word also adds blurring so for clear images see pictures testWithGaussians0.5, testWithGaussians1, etc.)



0.5

1

2

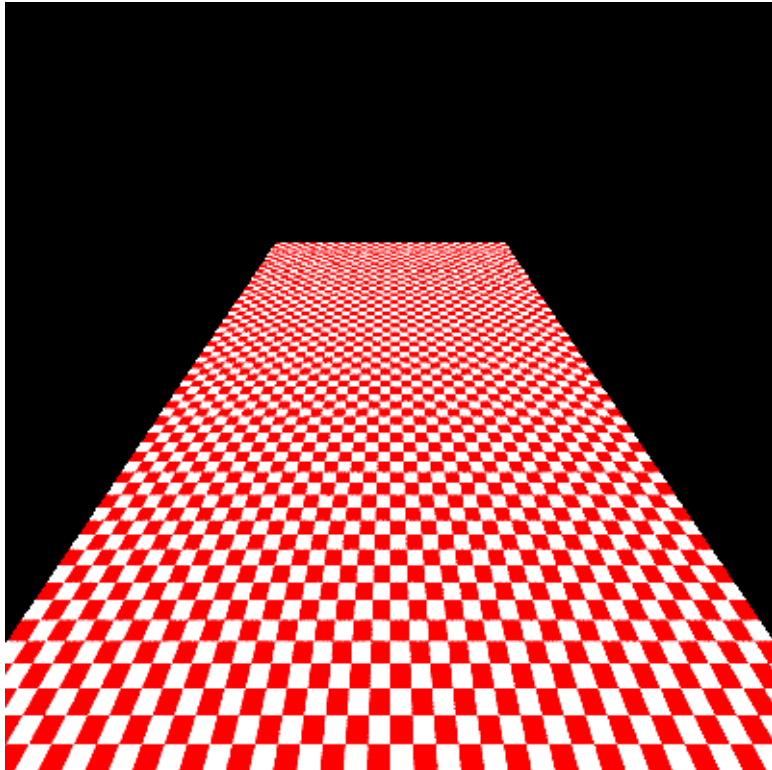


4

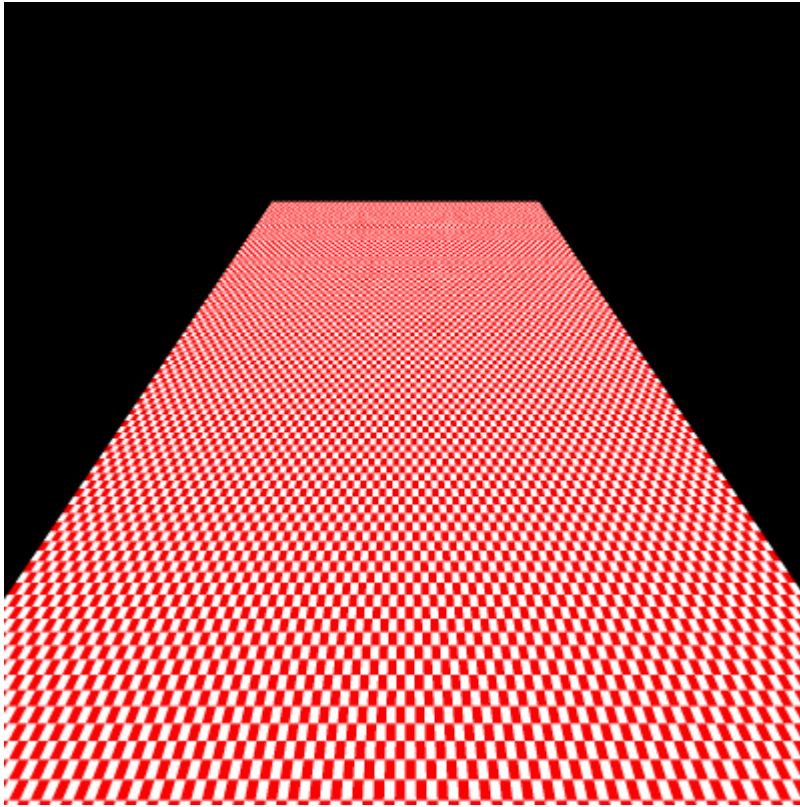
100*100 without AA

The tradeoff seems to be that the larger the sigma the more aliasing disappears but also more blurring occurs.

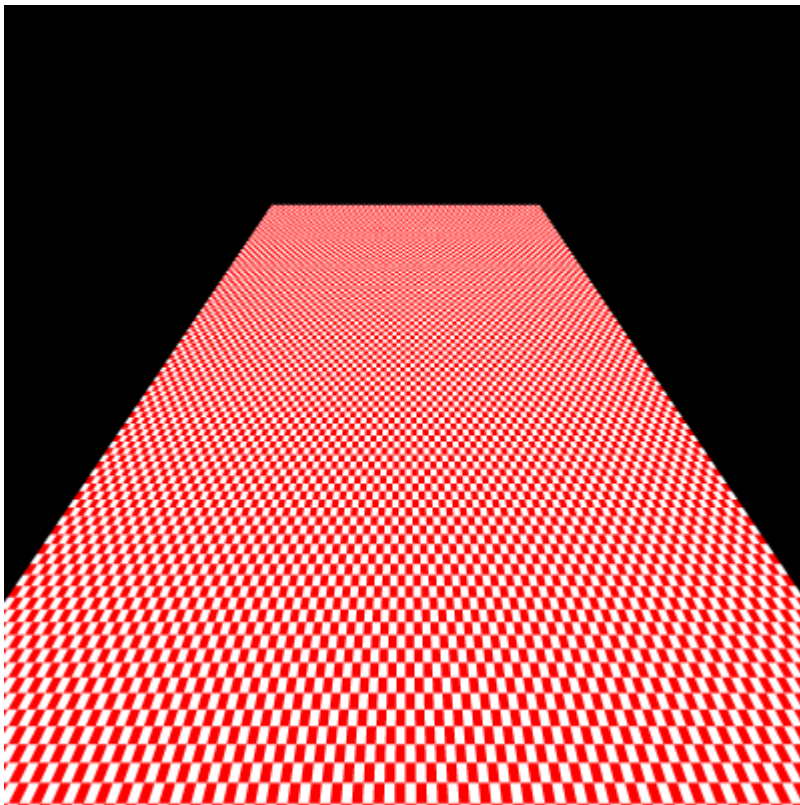
Below is a 400*400 picture with sigma = 4. Little aliasing can be seen.



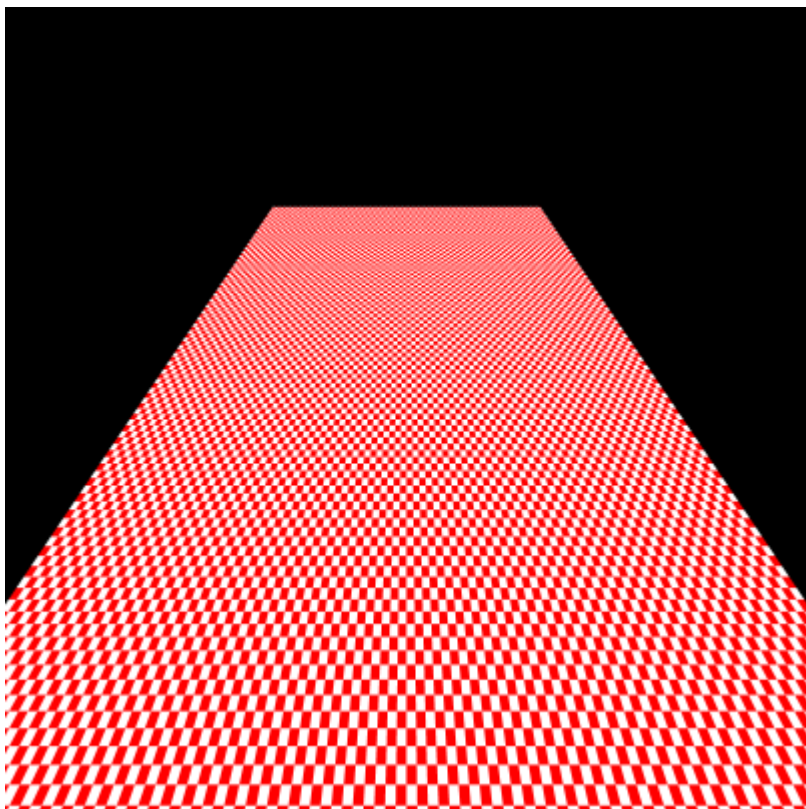
Jitter + center sampling



k=3 This image is rendered with jittering using a 3x3 grid where the ray was shot through the center of the subpixel. The result is very nice, but a vague pattern can be seen at the very end.

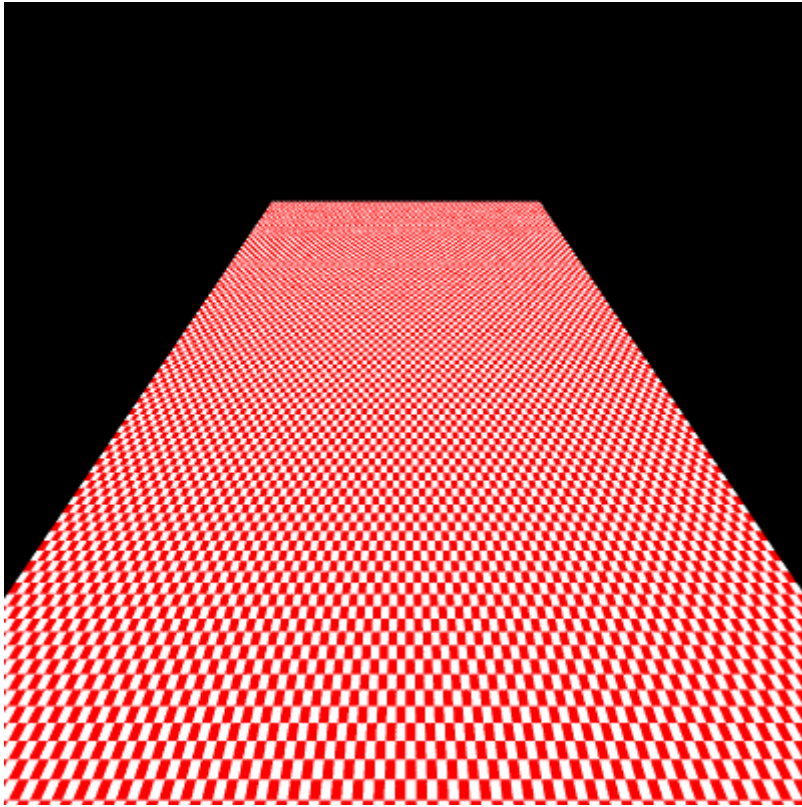


k=5 The improvement the vague patterns at the end of the triangle are gone with a 5x5 grid. The difference is not big though.

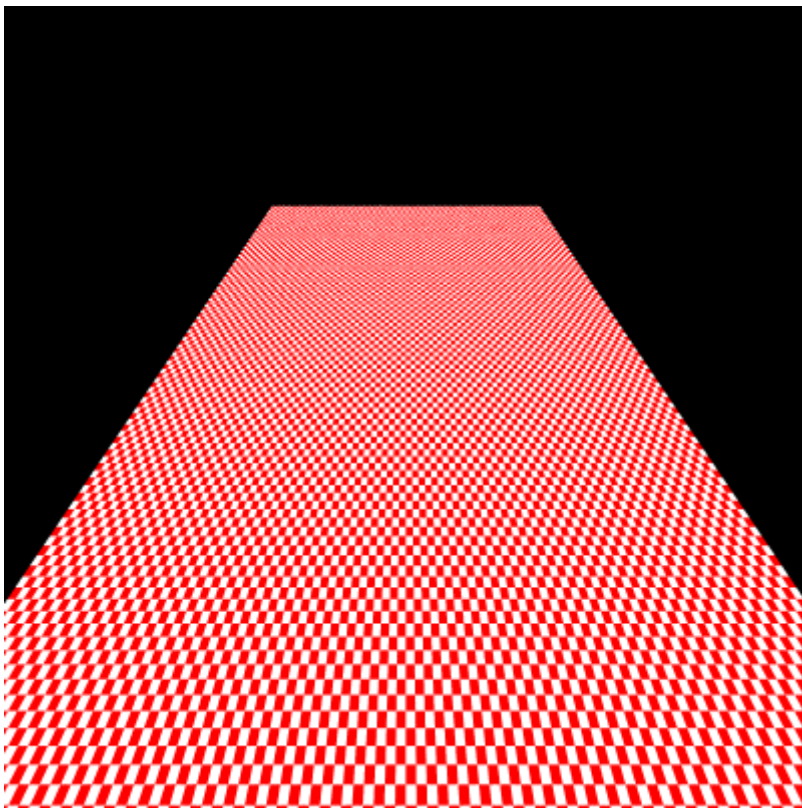


k=9The difference between 5x5 and 9x9 is hardly visible. The moiré patterns are pretty much gone with this jitter technique.

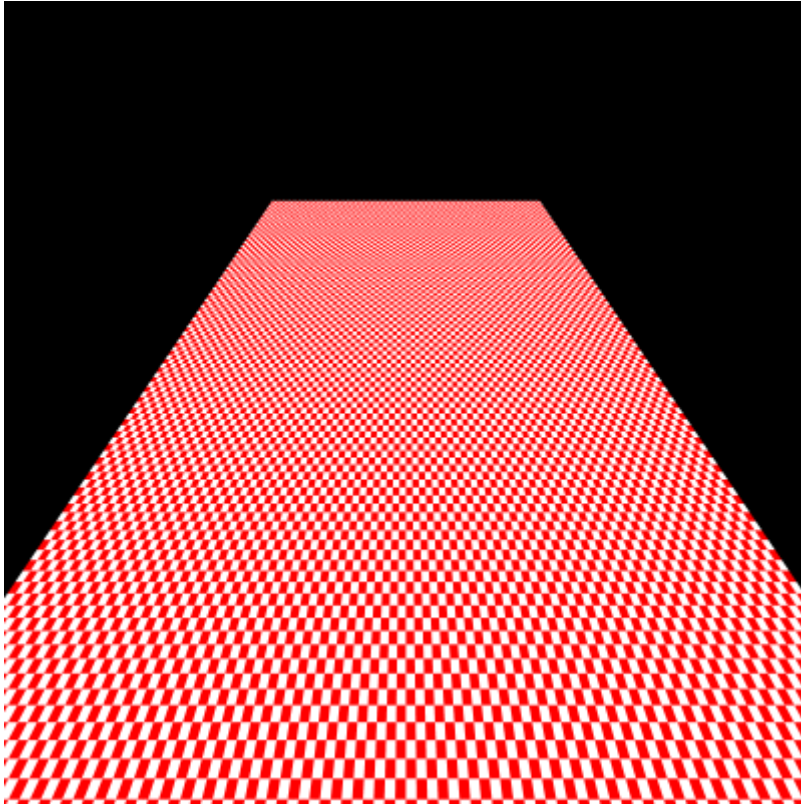
Jitter + Random sampling



k=3 This image was created by using random rays while jittering in a 3x3 grid.



k=5 The image has improved when using a 5x5 grid. The checkers look more squared.



k=9 Difference between 5x5 and 9x9 is minimal.

Conclusion

Gaussian filtering, random ray sampling and Jittered ray sampling - both random and not random -, all show improvements for anti-aliasing.

Based on comparisons of the images, jittering and Gaussian filtering are better than increasing the number of rays with ray sampling. However the difference between jittering and Gaussian filtering is not clearly visible.

Another observation made is that taking larger sampling size or grid size does not necessarily mean a visible improvement. Though mathematically it does improve, the improvements do not outweigh the costs, since time is expensive.