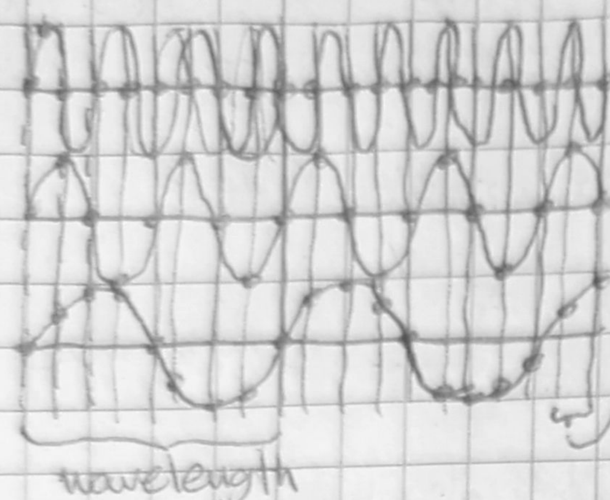
22 - Signal processing

Audio signal

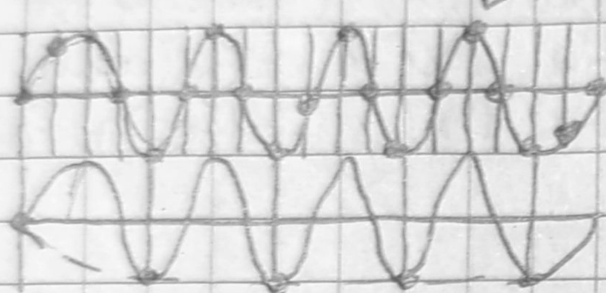


As the frequency increases, we get more screwed up sampled curved at the same sampling resolution.

sampling resolution

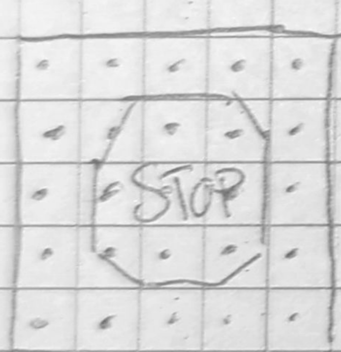
Aliasing

sample



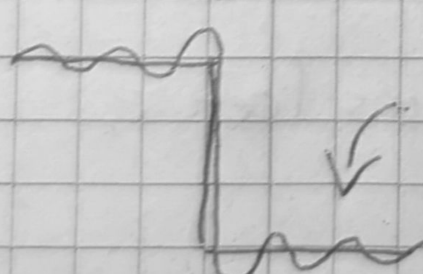
Aliasing is the problem of a wrongly sampled curve when the sample resolution is too low

Raster images

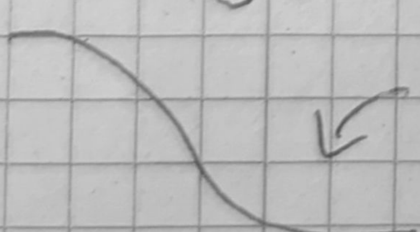


"A pixel is not a little square".
When talking about high frequencies in raster images, we talk about moving from, for example, a light color to a dark color between two pixels.

This creates a sharp "discrete" curve ~~with high amplitude~~ with high ampitude (?)



The reason for this is that we're adding many curves of ~~smaller~~ higher and higher frequencies.



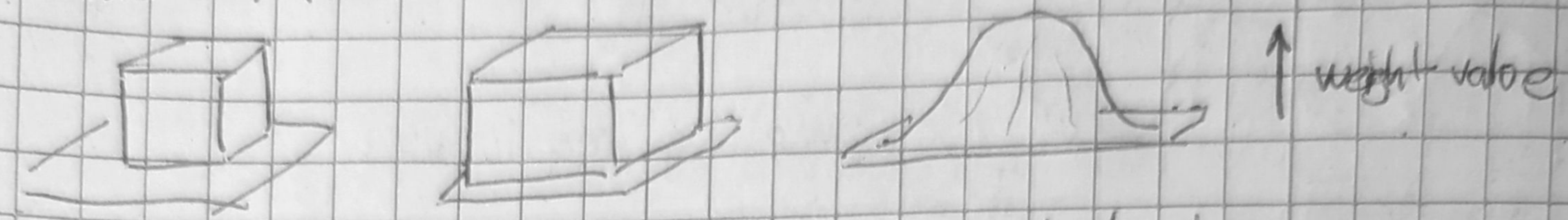
Having a smooth edge with lower frequen creates a blurry image

So when talking aliasing in rendering, high frequencies creates "sharper" images, and low frequencies blurry ones

Image filters

Box filter takes adjacent pixels, plus the current, all with weight 1, and takes the average. We can have 3x3, 5x5 etc.
Gaussian filter has different weights, higher towards the middle.

3x3 box filter   5x5 box filter   5x5 gaussian filter

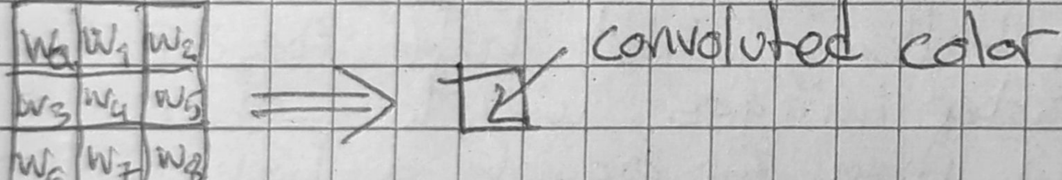


Convolution

$a \ast b = c$, a = input
$\ast$ = convolution
b = filter
c = output

like multiplication
- Commutative: $f \ast g = g \ast f$
- Associative: $(f \ast g) \ast h = f \ast (g \ast h)$
- Distributive: $f \ast (g+h) = (f \ast g) + (f \ast h)$

Box filter and Gaussian filter are called convolution filters. There are also tent, edge and sharpening filters. More probably.



Here we take $\frac{w_0 c_0 + w_1 c_1 + w_2 c_2 + \dots + w_8 c_8}{9}$ = convoluted color.

We can actually chose the weights as we want, for example based on some function.

Denoising filters, as talked about previous lecture, is a form of convolution filter.