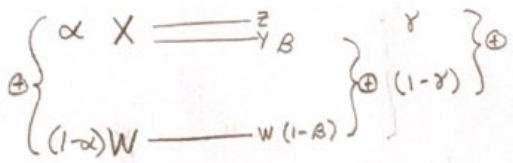


$$\underbrace{\alpha' X'}_{W_1} + \underbrace{(1-\alpha')W'}_{W} = \gamma Z + (1-\gamma)\left(\beta Y + (1-\beta)W'\right)$$

$$= \gamma Z + \left[(1-\gamma)\beta\right] Y + (1-\gamma)(1-\beta)W$$

Problem:
You know colors Y & Z, and you want to get the average of them for some fixed α (opacity).
overall

You do this by putting two semi-opaque layers over an opaque background of an arbitrary color W. What do the opacities of the individual Y & Z layers need to be.

Y Z
β γ

$\gamma = (1-\gamma)\beta$

$= \beta - \gamma\beta$

$\gamma + \gamma\beta = \beta$

$\gamma(1+\beta) = \beta$

$\gamma = \frac{\beta}{1+\beta}$

$\beta = 0 \rightarrow \gamma = 0$

$\beta = 1 \rightarrow \gamma = \frac{1}{2}$

$(1-\alpha) = (1-\beta)(1-\gamma)$

A

$A = (1-\beta)\left(1 - \frac{\beta}{1+\beta}\right)$

$= (1-\beta)\left(\frac{1}{1+\beta} - \frac{\beta}{1+\beta}\right)$

$A = \frac{(1-\beta)}{(1+\beta)}$

$A + A\beta = 1-\beta$

$(A+1)\beta = 1-A$

$\beta = \frac{1-A}{1+A}$

$= \frac{1-(1-\alpha)}{1+(1-\alpha)}$

$= \frac{\alpha}{2-\alpha}$

$\frac{\beta}{1+\beta} + \left(1 - \frac{\beta}{1+\beta}\right)\frac{\beta}{1+\beta}$ ✓

$= \frac{1+\beta}{1+\beta} - \frac{\beta}{1+\beta}$

$= \frac{\alpha/2-\alpha}{1+\alpha/2-\alpha}$

$= \frac{\alpha/2-\alpha}{\frac{2-\alpha}{2-\alpha} + \frac{\alpha}{2-\alpha}}$

answer →

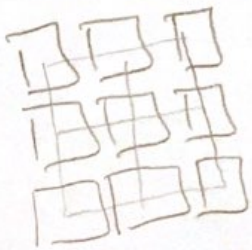
$\beta = \frac{\alpha}{2-\alpha}$ $\gamma = \frac{\alpha}{2}$

$\alpha = 0$ → $\beta = 0$, $\gamma = 0$

$\alpha = 1$ → $\beta = 1$, $\gamma = \frac{1}{2}$

$\left(1 - \frac{\alpha}{2}\right)\left(\frac{\alpha}{2-\alpha}\right)$

$\left(\frac{2-\alpha}{2}\right)\left(\frac{\alpha}{2-\alpha}\right) = \frac{\alpha}{2}$



Idea: by having offset layers of ~~staggered~~ semi-transparent pixels, a visual effect of 4x as many pixels can be created for 2x as many pixels ... saves file size, but harder on reader engine: browser