Example: RGB colors

Imagine a 3-D real vector space with elements $[r, g, b]^T$, where $0 \leq r \leq 1$, $0 \leq g \leq 1$, and $0 \leq b \leq 1$.

$red = [1, 0, 0]^T$
$green = [0, 1, 0]^T$
$blue = [0, 0, 1]^T$
$magenta = [1, 0, 1]^T$
$yellow = [1, 1, 0]^T$
$white = [1, 1, 1]^T$
$black = [0, 0, 0]^T$
$gray = [0.5, 0.5, 0.5]^T$

Basis vectors:

$|R\rangle = red = [1, 0, 0]^T$
$|G\rangle = green = [0, 1, 0]^T$
$|B\rangle = blue = [0, 0, 1]^T$

Arbitrary color vector: $V = r|R\rangle + g|G\rangle + b|B\rangle$

Intensity is the vector length $\|V\|$, but suppose we don't care about intensity, only hue.

RGB "spheramid" restricts color intensity to $\|V\| = 1$, so that $|r|^2 + |g|^2 + |b|^2 = 1$

So no black or white allowed! Only red, green, blue, and linear combinations thereof. We can still make magenta, yellow, orange, etc. (and even gray), but they just won't be as intense as they were in the RGB cube.

$red = [1, 0, 0]^T$
$green = [0, 1, 0]^T$
$blue = [0, 0, 1]^T$
$magenta = [\frac{1}{\sqrt{2}}, 0, \frac{1}{\sqrt{2}}]^T$
$yellow = [\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0]^T$
$cyan = [0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}]^T$
$gray = [\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}]^T$

$turquoise = [0.18, 0.72, 0.67]^T = 0.18\,|R\rangle + 0.72\,|G\rangle + 0.67\,|B\rangle$