§ Constant Interpolation

Every time in 1D

e.g. The shading pixels in an image

Positive: Easy
Negative: Discontinuous
cause visual artifacts

§ Linear Interpolation

Problem in Interpolation: Find $c(t)$ given discrete values $c_0, c_1, \ldots$

$c(t) = a + bt$ Parametric equation of a straight line

Boundary conditions

$c(0) = c_0 = 0 + b$ so $b = c_0$
$c(1) = c_1 = a + 1 + b$ so $a = c_1 - c_0$

So

$$c(t) = (c_1 - c_0) t + c_0$$ (1)
Rewrite Eqn 1 as

\[ C(t) = C_0 \left(1-t\right) + C_1 \left(1-t\right) \]

Link: trivial, but key step

Generalizes easily to higher dimensional data and to "higher order" interpolation

- Refers to the order of the polynomial in \( t \)

§ Higher dimension.

- Trivial. Just use \( C_i = \left[ i \right] \).
- Higher dimensional array for data

§ Higher degree polynomials

- Quadratic, cubic, quartic, quintic, ...
- \( \text{deg} = 2 \), \( 3 \), \( 4 \), \( 5 \), ...

- Sweet spot

Can connect a sequence of curves together to create "Splines" (called "paths" in Illustrator)
Quadratic: \[ C(t) = c_0 b_0(t) + c_1 b_1(t) + c_2 b_2(t) \]

This is a Bézier curve

Cubic: \[ b_0 (1-t)^3 + 3b_1 (1-t)^2 t + 3b_2 (1-t) t^2 + b_3 t^3 \]

Next class: Shadows