Compositing and Painting

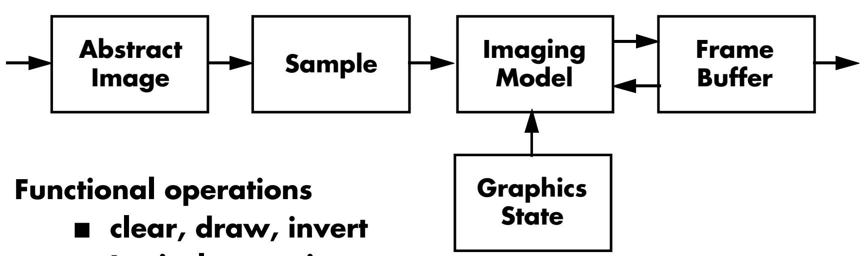
Imaging model and abstract images

Mattes and alpha channel

Compositing operators

Painting

Imaging Model



Functional operations

- **clear, draw, invert**
- **Logical operations**
  bitblt: clr, mov, set, xor, and, or
- **Arithmetic operations**
  blend: cross-dissolve, painting and compositing

Context

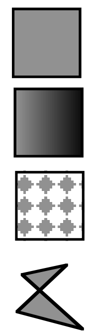
- **color, texture, pattern, clipping**

Abstract Images

Definition: Returns color as a function of x and y

Examples

- **card**
- **ramp**
- **pattern or texture**
- **text**
- **lines and polygons**
- **"gleams" and "glows"**
- **sampled image arrays**



Mattes

Mattes are used to control the composition of multiple images or elements.

A matte is a single channel image that defines the presence or absence of imagery, or more generally whether another image is *transparent* or *opaque.*

Four examples:

- **Mounting a photograph**
- **Cel animation**
- **Optical printing**
- **Video keyer**

Cel Animation

Overlay multiple elements to form a composite

Video Keying

Optical Printing

Matte Creation and Extraction

From digitized images

- Luminance or self-matting
  - Opacity proportional to luminance
  - Range of lumiances marked transparent - video keying
  - Set of colors marked transparent
- Chroma keying
  - Separate blue background from foreground image

From computer generated images

- Coverage
- Transparency
- Screen door transparency

Color and Matte Representation

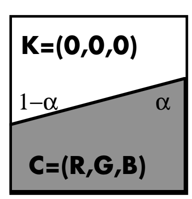
Unassociated matte

- **Color channel: (r,g,b)**
- **Matte channel: (β)**

Associated matte

- **RGBA channels: (αr,αg,αb,α)**
- **Examples:**
  - **black = (0,0,0,1)**
  - **white = (1,1,1,1)**
  - **clear = (0,0,0,0)**

Composite Pixels



Pixel

α = Area of C

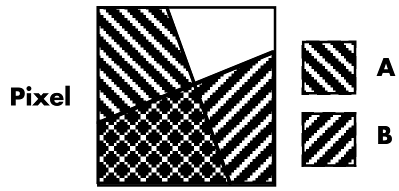
Final color of pixel is a weighted average of C and K

$$c = \alpha C + (1-\alpha) K = \alpha C$$

Thus, premultiplication corresponds to combining with black

More generally, sum color fragments to form final color

Pixel Fragments



Region	Fraction
A * B	
~A * B	
A * ~B	
~A * ~B	

$C = F_A C_A + F_B C_B$
$\alpha = F_A \alpha_A + F_B \alpha_B$

Porter-Duff Compositing Algebra

- Composite foreground with background element
- 12 possible cases

Painting

***Canvas* : Current image representing the painting**

***Brush* : Small matte specifying the brush**

***Paint* : Color and texture properties of the paint**

Paint equation

paint* = *color* IN *texture

canvas* +=(*canvas* OP *paint*) IN *brush

Paint modes

- **Smudge, dissolve, sharpen, blur, saturate, desaturate, lighten, darken, tint, erase, ...**

Brush and Stroke Properties

- **Shape: round vs. calligraphic, rubber stamp**
- **Diameter**
- **Hardness**
- **Spacing**
- **Opacity, pressure, or exposure**
- **Fade-out rate**