CS4405

Compositing Video

Caption Examples

Video Formats With Alpha Channel

File Format	Maximum Alpha Bit-Depth
Apple Animation	8-bit
Apple ProRes 4444	16-bit
Avid Meridien Compressed	8-bit
Avid Meridien Uncompressed	8-bit
Cineon	16-bit
DPX	16-bit
Maya IFF	32-bit
OpenEXR	32-bit
PNG	16-bit
RLA	32-bit
RPF	32-bit
SGI	16-bit
SGI RAW	16-bit
Targa (TGA)	8-bit
TIFF	32-bit

Most formats supporting an alpha channel are image formats used for animation/ modelling/compositing workflows

From: Digital Rebellion Blog

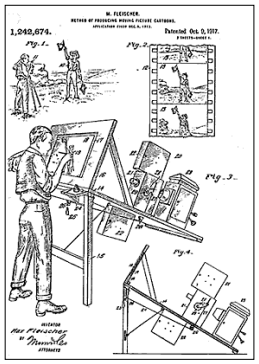
Rotoscoping

- Rotoscoping is the process of manually tracing shapes through a captured image sequence
- Rotoscoping is used to
  - Create mattes to place an actor into a different scene
  - Replace a real prop with a CGI element
  - Apply image filters selectively over parts of a video frame
  - Create 2D animations from captured video

History

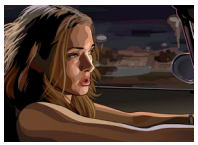
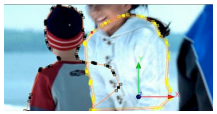
- Invented in 1915 by Max Fleischer
- Goal to make more fluid animation style
- Created in response to mechanical form of previous animation techniques



Modern Uses

- Effects painting
- Cloning/Paint touch-up
- Matte creation
- Motion tracking
- Match moving


Adobe After Effects CS5.5 Rotobrush

Rotoscoping

- CGI production uses keyframe "roto-curves"
  - Splines that bound the desired shape
  - Drawn by the animator at certain key frames in the animated sequence
  - Interpolation is used to generate roto-curves for the frames in between
- Whenever the intermediate roto-curves appear too far from the shapes the control points are manually adjusted
  - Linear interpolation fails to track any kind of complex motion

Rotoscoping Problems

Compositing

- As video formats assume all content is opaque techniques are needed to extract distinguish a video frame into foreground and background
  - Chroma key
  - Luma key
  - Difference key
- The matting problem applied to a sequence of video frames

Matting

- For every pixel in the composite image we have
  - The background colour $C_k = [R_k\ G_k\ B_k]$
  - The composite colour $C = [R\ G\ B]$
- Compute the uncomposited foreground pixel colour
  - $C_o = [R_o\ G_o\ B_o]$
- Such that the matting equation holds
  - $C = \alpha_o C_o + (1 - \alpha_o)\ C_k$

The Matting Problem

- The matting equation
  - $C = \alpha_o C_o + (1 - \alpha_o)\ C_k$
- Expands into three equations as $C = [R\ G\ B]$
  - $R = \alpha_o R_o + (1 - \alpha_o)\ R_k$
  - $G = \alpha_o G_o + (1 - \alpha_o)\ G_k$
  - $B = \alpha_o B_o + (1 - \alpha_o)\ B_k$
- But we have four unknowns (R_o, G_o, B_o, α_o)
  - Infinite number of solutions can be found
  - Need to constrain the problem to find the proper solution

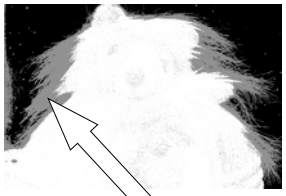
Chroma Key

- A coloured area (generally blue or green) is eliminated from one shot and filled with new video information from another source
- A colour (or a limited colour range) is removed from one image to reveal another image behind it
  - The removed colour (C_k) becomes transparent
  - A matte is created

Chroma Key Problems

The source

The matte



Uncertain (fractional) α values

Specific Chroma Key Problems

Colour Spill

Desaturate

Motion

Isolate problem area

Chroma Lighting

- The most difficult part of setting up a chromakey screen is even lighting and the avoidance of shadow
- It is required to have as narrow a colour range as possible
- A shadow would present itself as a darker colour to the camera and might not register for replacement
- This can be seen in live broadcasts where the errors cannot be manually repaired

Chromakey Problems

Chroma Lighting

- Materials that reflect light more will be less successful than those that do not
  - For example a plastic sheet will have a hotspot centre
  - Will come out as a pale area
  - While the edges will create a darker area
- Some modern screens appear grey
  - But are coated with tiny half-silvered glass beads to give a significant degree of retro-reflectivity

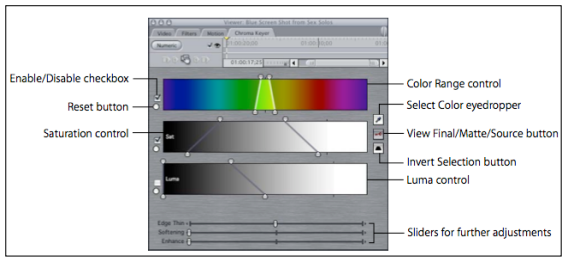
Chroma Lighting

- A ring of coloured lights (usually LEDs) is placed around the camera lens, and the screen reflects this colour back to the camera
- This technique reduces problems from performers casting shadows on the screen
- Allows operation at low lighting levels
- The screen colour is defined by the colour of the ring light, making it easier to change the screen colour quickly

Retroreflective Chromakey

Selecting the Chroma Key Colour

- Typically due to uneven lighting and reflections the background colour will not be pure



Chroma Key

- It is important to have a tight a key
- Poorly defined edges that may not apparent in the still jump out and shimmy in the motion footage
- Digital Video editors allow you to select a temporary plain background to gauge tightness of the key

Background Colour Range

Before clicking with the eyedropper tool

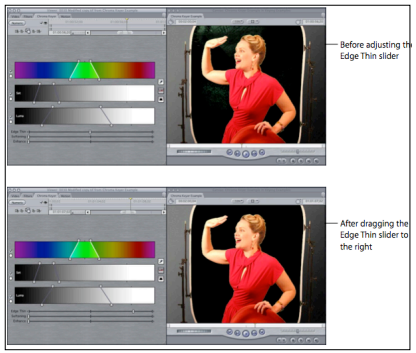
After selecting the first key color (not all of the green is keyed out)

Background Colour Range

Chroma Key

- If the edge of the subject contains less definable edges extending out into the key colour (e.g. hair)
  - Use a black background so that you can monitor how much colour spill remains in this area
- If there is reflected key colour into the subject side of the keying edge
  - A white background can make it easier to identify subtler shades of the key colour in the subject

Tightening the Key



Tightening the Key

- An optional step is to blur the edges of the foreground subject (introduce fractional α values)
- This is especially helpful if the edges of the foreground subject look rough because of compression artefacts
  - May appear as blocky edges around the foreground object
- Detail will be lost

Tightening the Key

- Filters such as a Spill Suppressor filter can be applied
  - This desaturates the colour spill that may appear anywhere on the foreground subject
  - Not just on the edges
  - Make it less noticeable
- For example a little of the background colour may show through translucent areas of the foreground subject such as wispy hair

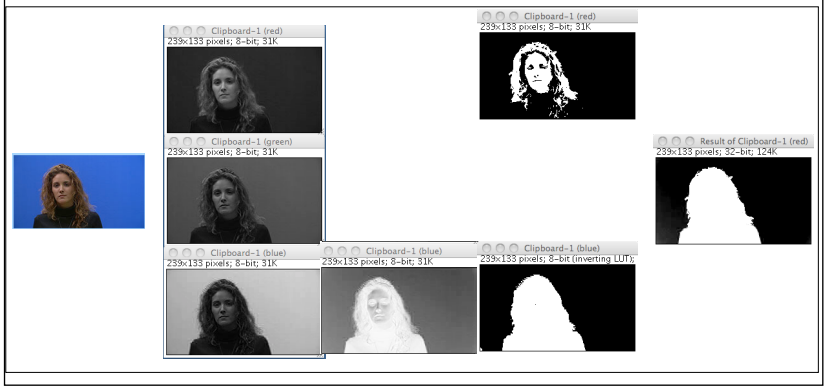
Difficult Task

KeyLight Matte Filter

Alternative Ways of Matting

- Adobe After Effects "Color Difference Key" creates transparency by dividing an image into two mattes
  - Matte Partial A
  - Matte Partial B
- Matte Partial A bases transparency on areas of the image that do not contain a particular colour
- Matte Partial B bases the transparency on a specified key colour
- The "Color Difference Key" combines the two mattes into an alpha matte

Adobe Difference Key



Why Does It Work?

- It works better than it should
  - In particular with careful choice of subject and background
  - Notably for bluescreen work containing people
  - But can be used for any background colour
- Uses Red and Blue channels only
  - The bluescreen background has a very high blue component
  - Skin and hair normally have a high red content ([d 0.5d 0.5d])

Example

- The blue channel is first isolate and inverted
- The darker values are scaled down to zero
  - To clear the background region to zero

Example

- The Red channel is light where the Blue channel is dark
  - Use the red channel to fill-in the inverted Blue channel
- Scale the matte to black and white