Elements of Digital Special Effects

CS5245 Vision and Graphics for Special Effects

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Introduction

Digital special effects (DFX) are created using real images and, often, computer generated imagery (CGI).

Real Images

Real images include

- Live footages of real scenes, actors, objects, motions, actions, natural phenomena, etc.
- Include footages shot with miniatures, sets, etc.

Camera and Dolly

Real visual elements are shot using cameras.

- Shoot at high enough resolution to get good picture quality.
- Mount camera on tripod for stable shots.
- Use tripod for smooth camera panning and tilting.
- Need stable hand to get smooth zooming.
- For more flexible camera motion, use a dolly.

Dolly is a small wheeled vehicle for moving camera.

- Dolly grip pilots dolly to move camera around in a scene.
- Cameraman may pan, tilt, zoom camera at the same time.

- Need a lot of practice to perfect the skills.
  - Examples: NG example, Good example

If you don't have a dolly, you can still improvise.

- Rehearse the camera motion to obtain smooth motion before shooting.

Can shoot with more than one camera. Extreme case: a row of cameras

- Bullet time pioneered in Matrix (1999).

Videos recorded by older camcorders often have interlace problem.

- Saw-tooth edge distortion.
- Camcorders record odd and even lines separately at 50 fields per second, giving 25 frames per second.
- Use deinterlacing software to remove the problem.
- Newer camcorders can record in progressive non-interlaced mode. Then, no problem.

Lighting

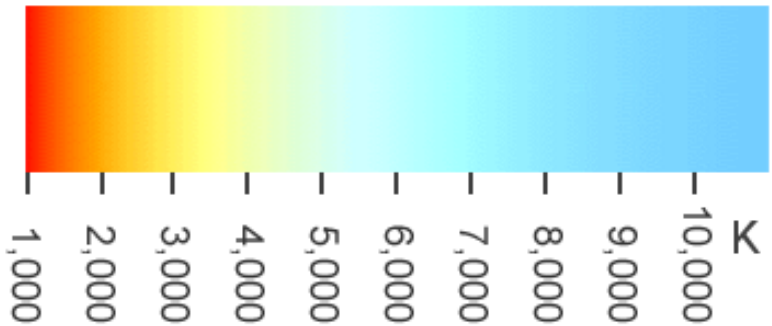
Lighting is very important in shooting live footages.
Poor lighting result in shots with unclear details.
Why Figure (a) has poor lighting?

(a) Poor lighting.

(b) Good lighting

Use studio lights to provide additional lighting.

Lights have different colour temperature. Choose the correct one.



Good lighting can evoke mood and visual impression in the viewer.

Different colour schemes evoke different moods.

Soft light vs. harsh light

- Soft light: no strong shadow on main subject. Comfortable feeling.
- Harsh light: has strong shadows on main subject. Tense feeling.

Capturing natural lighting conditions can also evoke mood.

(a) Tranquil

(b) Open

(c) Calm

(d) Gloomy

Nearly monochromatic greenish scenes in Matrix (1999, 2003) evoke eriee feeling.

In Sky Captain and the World of Tomorrow (2004), nearly monochromatic scenes softened with diffusion filter give a comic impression.

Background

Background is important for portraying the correct environment.

Sometimes, you can't find the required background.
Then, you create static image for the background.

Methods of creating large static background image:

- matte painting
- image mosaicking
- texture synthesis

Matte Painting

- Painting of static background. Can be digital painting.
- For far away background, painting often looks visually realistic.
- Of course, need a good painter to paint it well.

Image Mosaicking

- Shoot overlapping images of real scene and stitch them together.
- Easy to create realistic large static background.

before stitching

after stitching

Texture Synthesis

- Stitch small texture sample into large textured area.
- Good for creating sand, grass field, ripples, etc. with random texture.
- Not so good for creating areas with very structured textures.

(a) sample texture

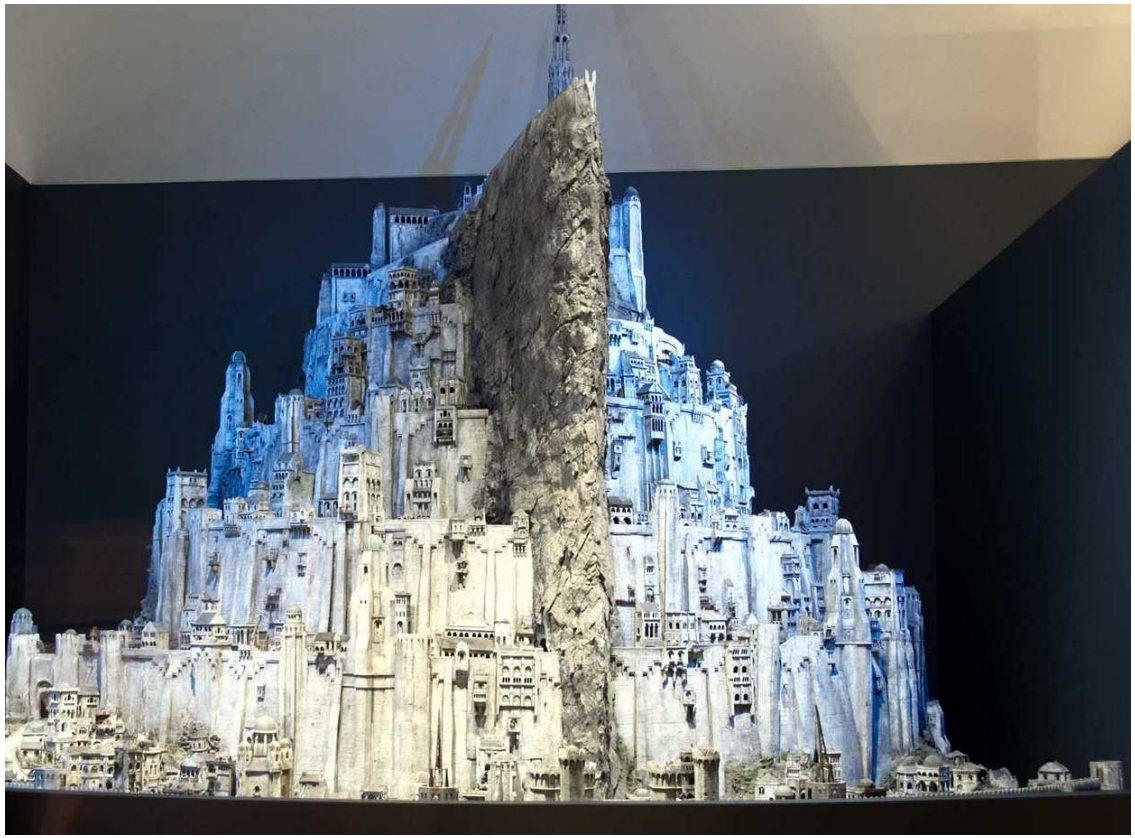
(b) synthesized texture

(a) sample texture

(b) synthesized texture

Miniatures

Miniatures are scaled models of real structures.



- With proper lighting, they can look very realistic.
- Provide details that are difficult to do in CG models.

Foreground Elements

Foreground elements are the focus of attention in a scene.

- Foreground elements are action figures or other objects.
- Can have multiple levels of foreground.
  The one in front may occlude the one behind.

Often, you want to place visual elements in a different background.

- Then, shoot visual elements in front of a blue or green screen.

- Visual elements in front of blue screen can be easily extracted – keying.
- Keyed out elements can then be blended into a background footage – compositing.

Why stop at one when you can have more? Many more!

Need to match motion of clones:
controlled animation of motion sprites [SE02].

Keyed out visual elements can be processed in various ways:

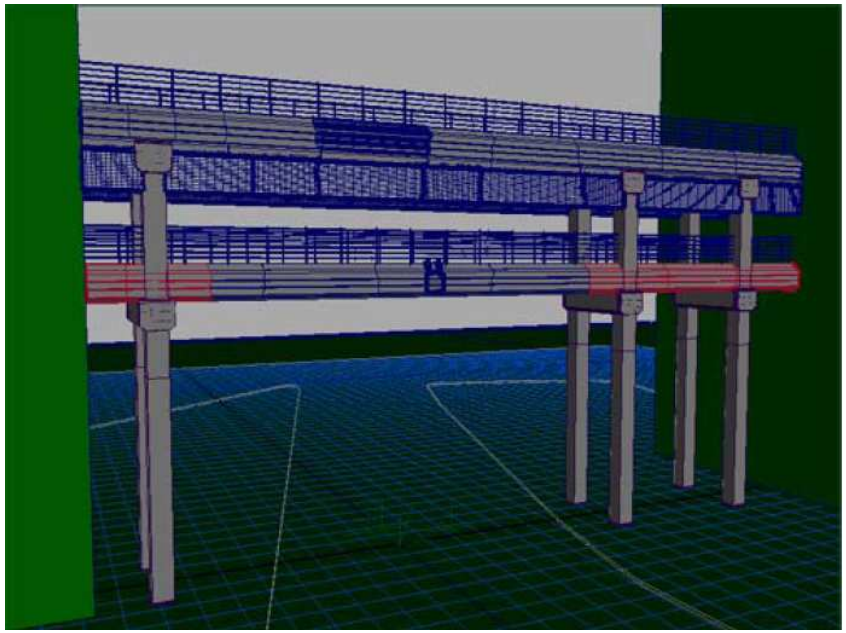
- change size, position, orientation
- change color, texture
- change transparency
- change shape (deformation, morphing)
- etc, etc.

Example: Image morphing in The Reflection (2004).

CGI

Computer generated imagery (CGI)

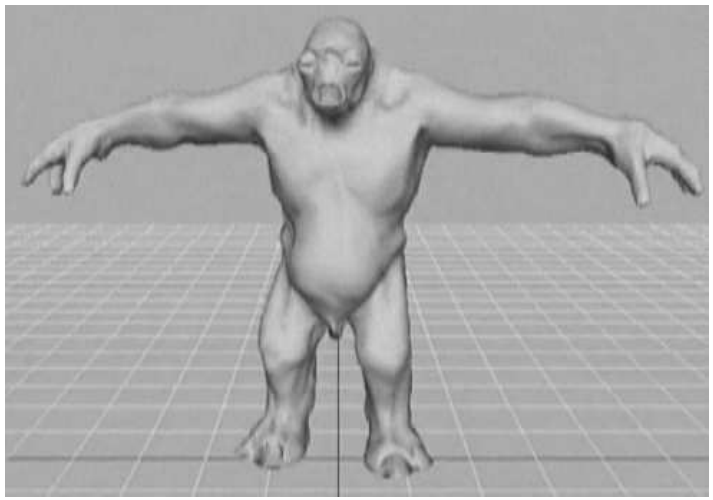
- Construct CG models of actors, objects, natural phenomena, etc.
- Transform and animate.
- Render CG models into CGI, often with camera motion.



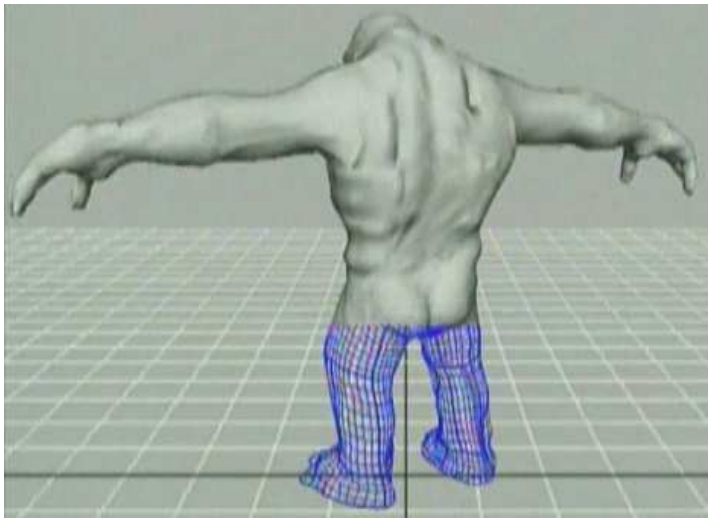
3D Modeling Methods

- Manual modeling
  - Create 3D models manually using software such as Maya.
  - Good for geometric objects.
  - Difficult to create complex objects with fine details.

- Sculpt and Scan
  - Sculpt a physical model and digitize using 3D scanner.
  - Can create complex objects with fine details.
  - Require artistry of sculptors.

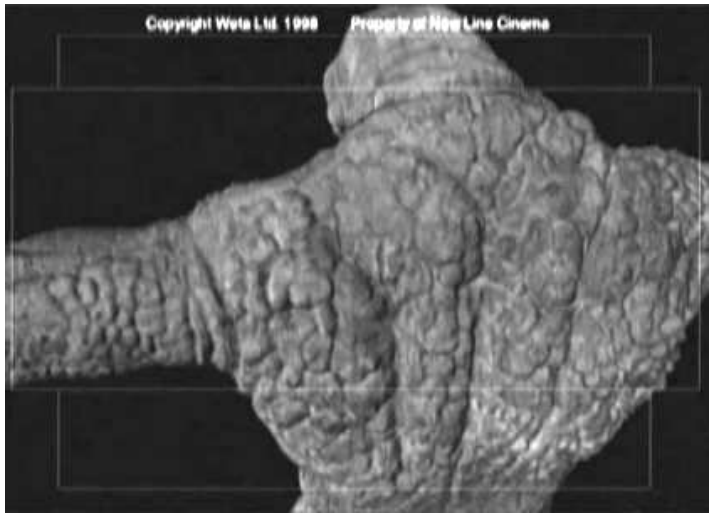


To get visually realistic models, apply proper color and texture [LoRa].



mesh and shade

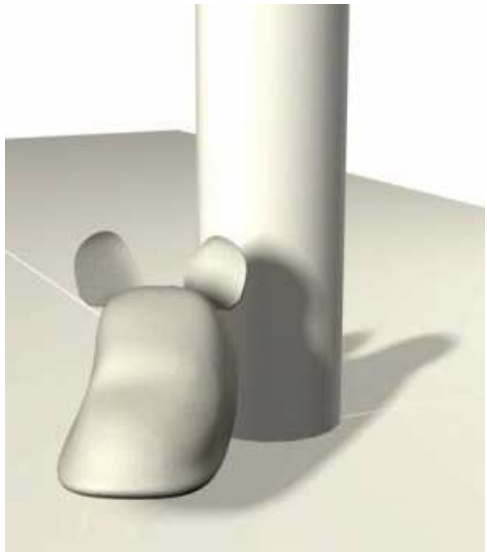
with skin color



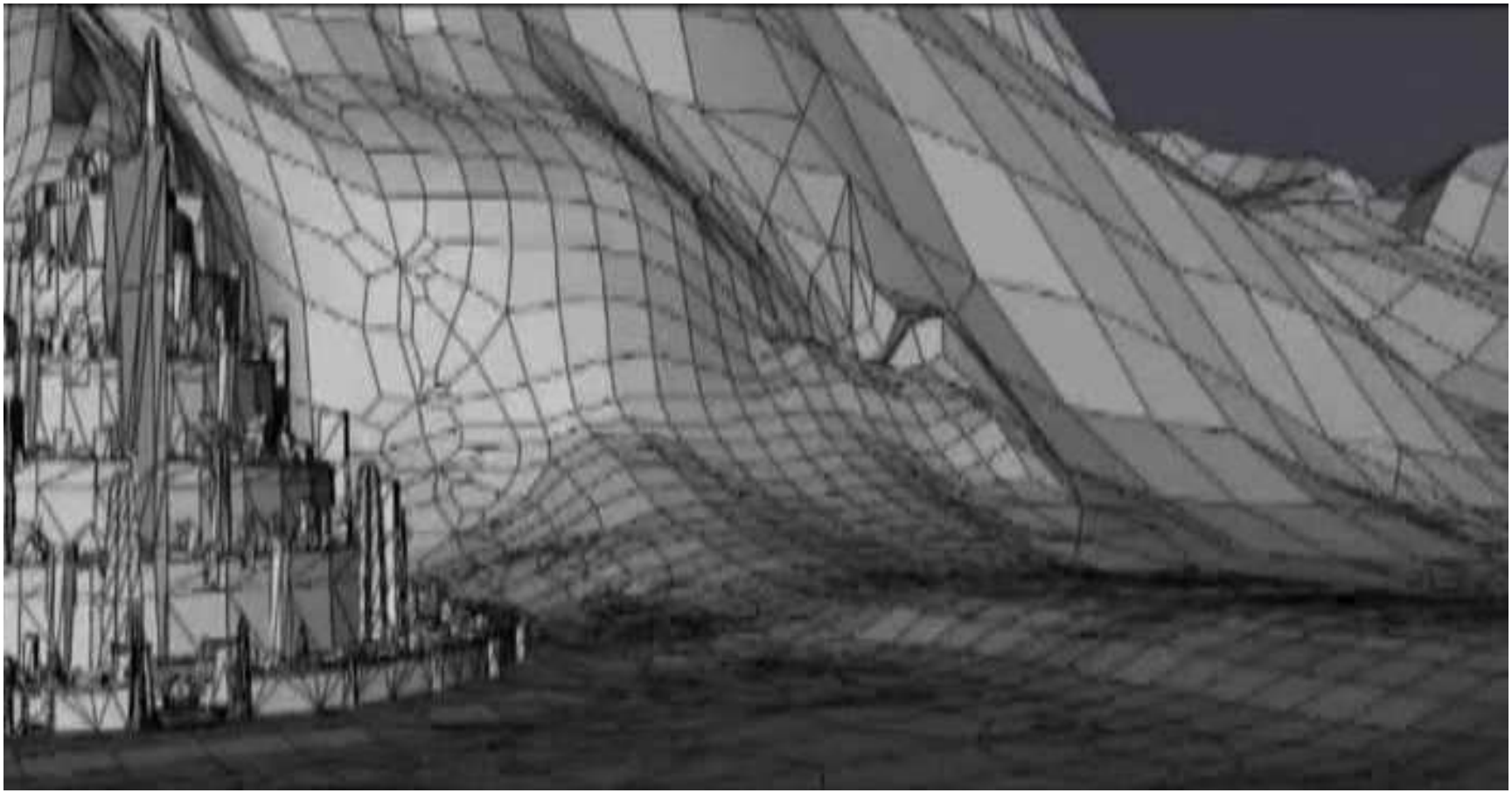
with texture

Sometimes, have to model real environment in 3D CG.

Then, can create realistic shadows.



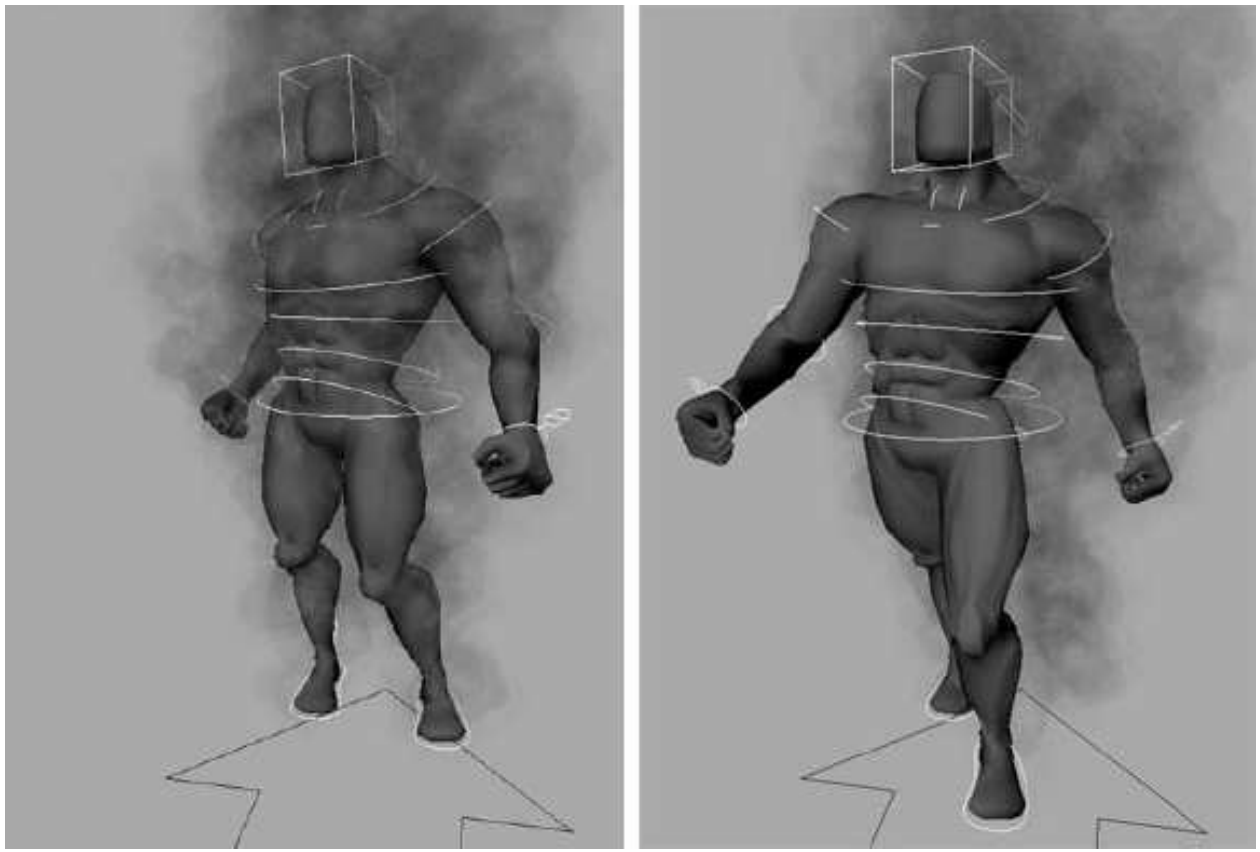
Can also create CG environment. [LoRb]



Then, can have camera motion in CG environment.

3D Animation Methods

- Key-frame Animation
  - Manually set the postures at key frames.
  - Software interpolate postures between key frames.
  - Good for fine details.
  - Difficult for complex motion.



- Motion Capture
  - Capture 3D motion using motion capture system.
  - Fast and convenient (after setting up).
  - Difficult to capture fine details.



Examples from The Lord of the Rings [LoRa]:

(a) Sculpt, scan, animate.

(b) Motion capture.

Like real visual elements, CG models can also be processed in many ways:

- change size, position, orientation
- change color, texture
- change transparency
- change shape (deformation, morphing)
- etc, etc.

Example: 3D morphing in The Accident (2005).

Digital Compositing

Combine all the visual elements.

Compositing tasks include:

- Keying: separate foreground from background
- Blending: blend foreground into new background
- Transformation: change position, size, orientation
- Animation: move things around
- Match Move: match camera motion
- Match Color: match colors of visual elements
- Match Lighting: match lighting conditions

Visual elements interact during compositing:

- Can occlude or be occluded.
- Can touch each other.
- Transparent foreground element can change the appearance of background element. Example: Hunter Hunted (2007).

- Must ensure that the visual elements interact realistically.

negative example
Looney Tunes: Back in Action (2003)

positive example
Forrest Gump (1994)

Comparative Examples

Fire Beast

negative example
The Storm Riders (1998)

positive example
The Lord of the Rings 1 (2001)

Tower Collapse

can be better

A Man Called Hero (1999)

positive example

The Lord of the Rings 3 (2003)

Elastic Floor

negative example
Softlander (2008)

positive example
Terminator 2 (1991)

Summary

- Real images are shot with cameras.
- CGI is produced by rendering of 3D CG models and animation.
- Visual elements are combined in digital compositing stage.
- Ensure that the visual elements interact realistically.

References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Controlled animation of video sprites.
In *Proc. ACM SIGGRAPH*, pages 121–127, 2002.