# Course overview

Digital Visual Effects, Spring 2009

*Yung-Yu Chuang*

2009/2/19

# Logistics

DigiVFX

- **Meeting time:** 2:20pm-5:20pm, Thursday
- **Classroom:** CSIE Room 104
- **Instructor:** Yung-Yu Chuang (cyy@csie.ntu.edu.tw)
- **Teaching assistants**: 李根逸
- **Textbook:** Readings from books, journals and proceedings.
- **Webpage**: (user name/password) http://www.csie.ntu.edu.tw/~cyy/vfx
- **Mailing list**: vfx@cmlab.csie.ntu.edu.tw subscribe via https://cmlmail.csie.ntu.edu.tw/mailman/listinfo/vfx/

# This course is NOT about …

# It isn’t about photography

# It isn’t about 3D animations

DigiVFX

# It isn’t about watching movies

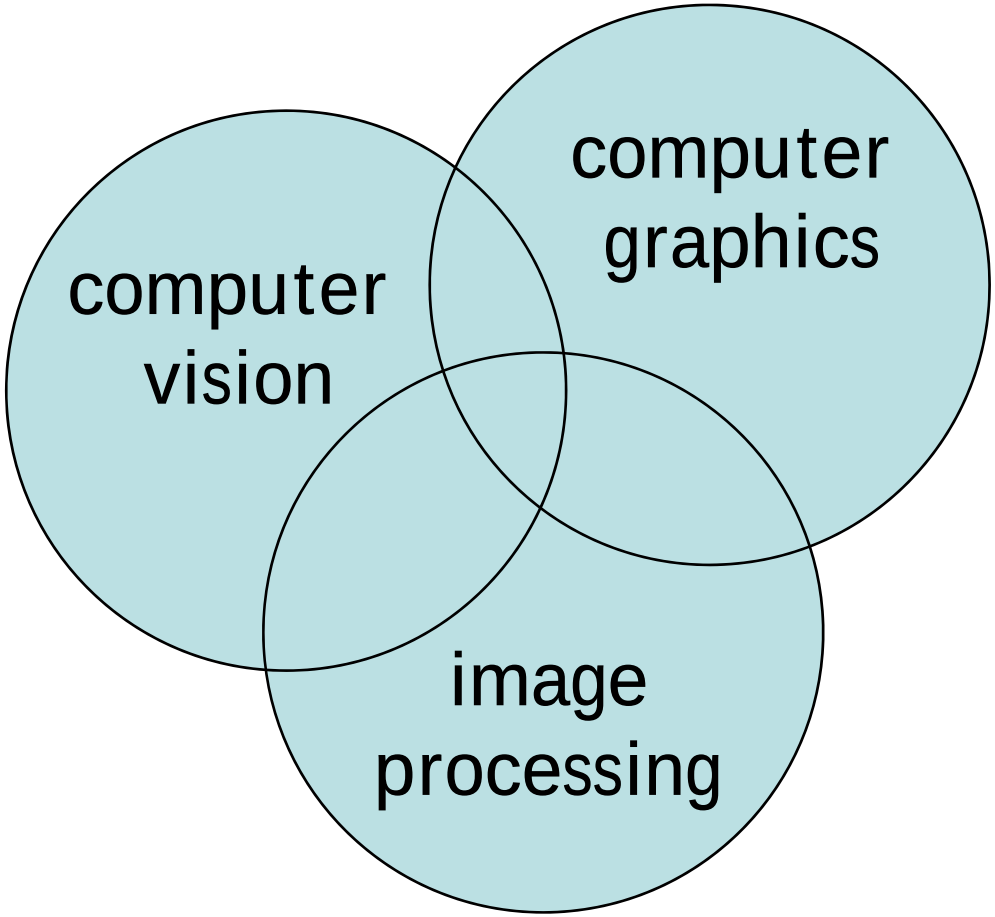
DigiVFX

# It isn’t about physical effects

# It’s not about industrial tricks

DigiVFX

You will learn more about Taylor and Poisson than Lucas and Spielberg in this course. If you hear Lucas in the class, it is more likely to refer to Bruce Lucas, not George Lucas.



# Prerequisites

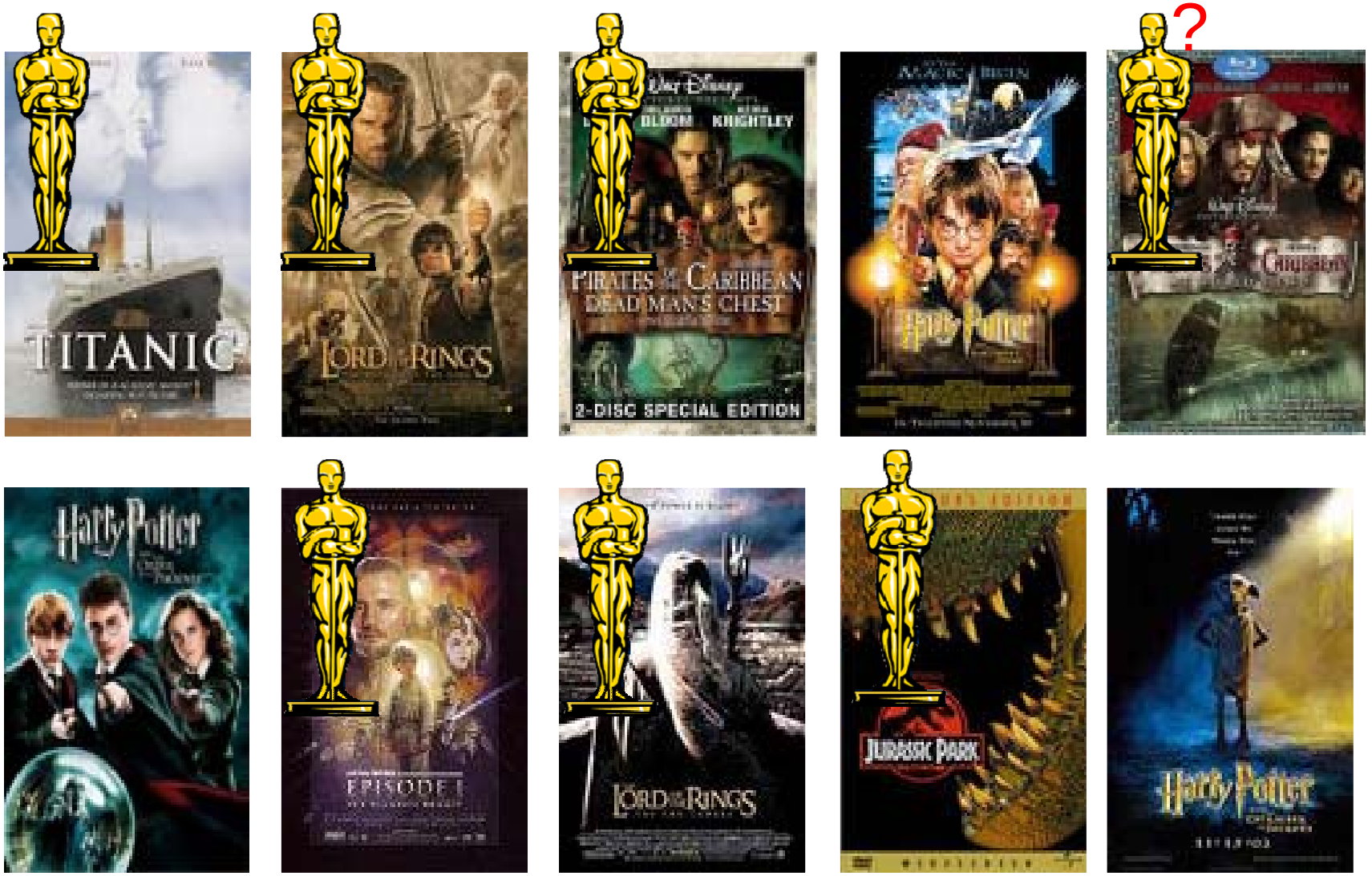
DigiVFX

- It is a *must* that you have programming experiences.
- It is a *must* that you have basic knowledge on linear algebra and probability.
- It is a *plus* if you have background knowledge on computer vision, image processing and computer graphics.
- It is a *plus* if you have access to digital cameras and camcorders.

# This course is about …

# Digital Visual Effects

DigiVFX



# Reality?

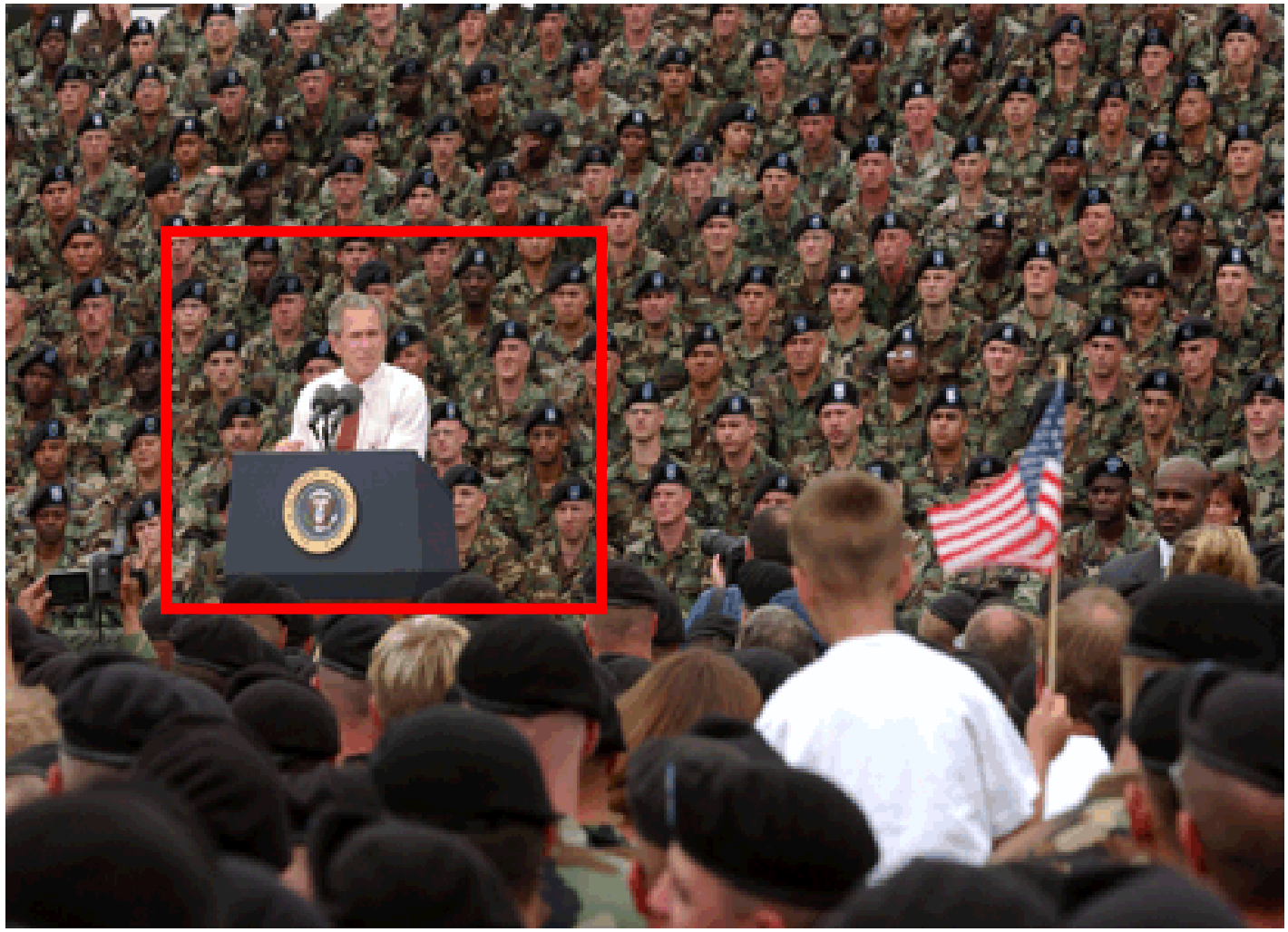
DigiVFX

# Retouching

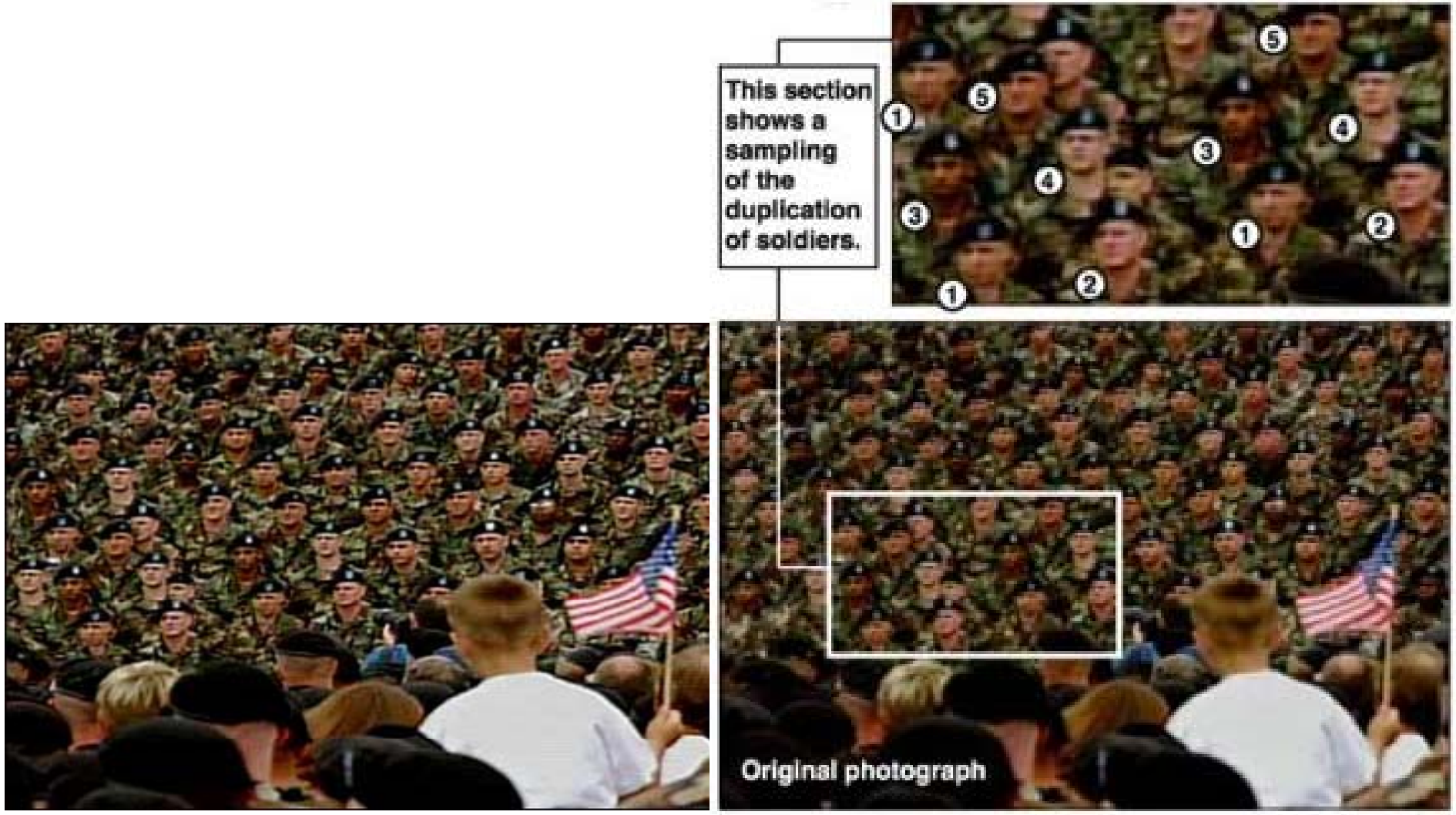
DigiVFX

# Iraq War, LA Times, April 2003

# Bush campaign's TV AD, 2004



# Texture synthesis and inpainting



# Domestic example

The Liberty Times
2007.12.17

# Special effects

# Stop action

*The execution of Mary, 1895*

# Glass shot

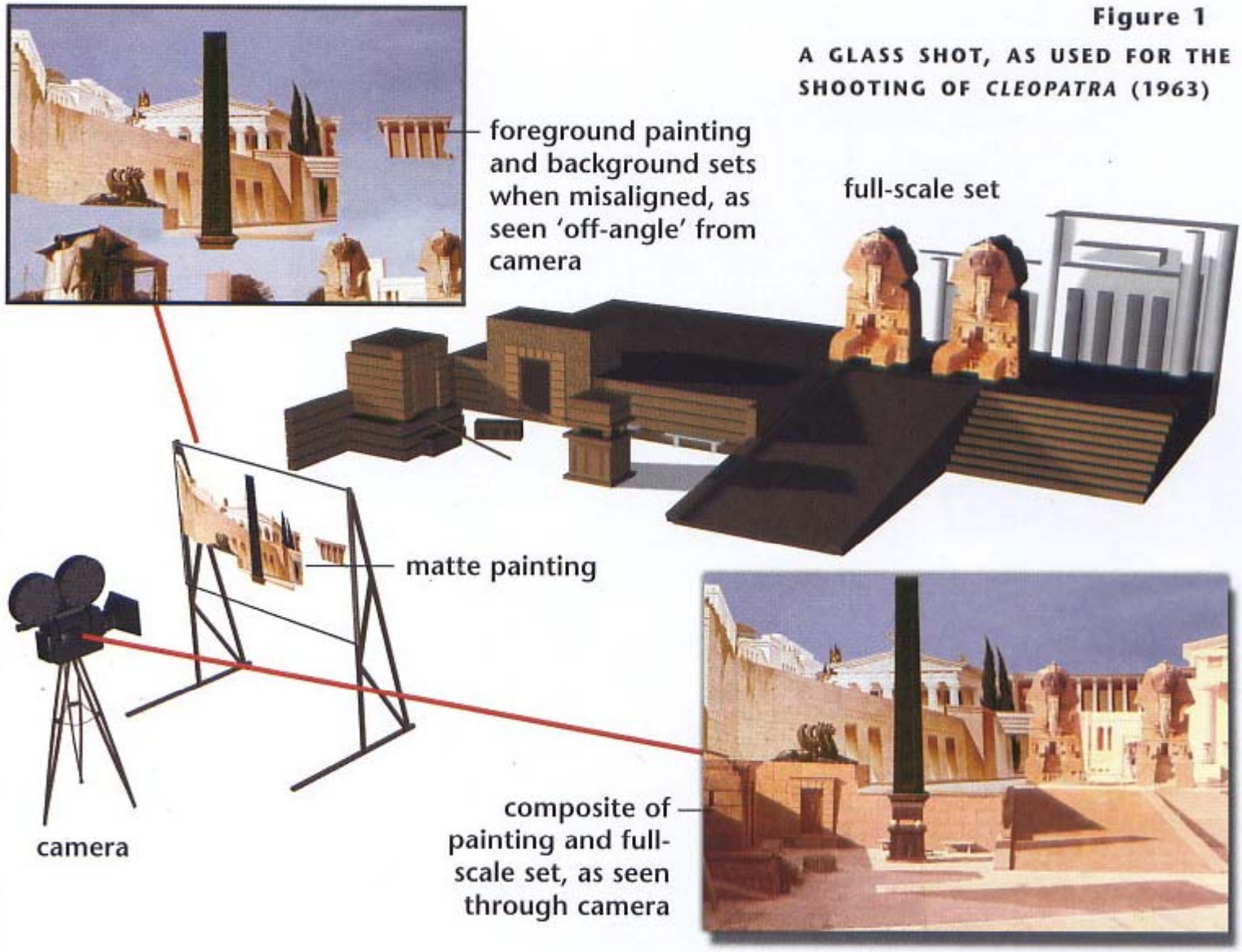
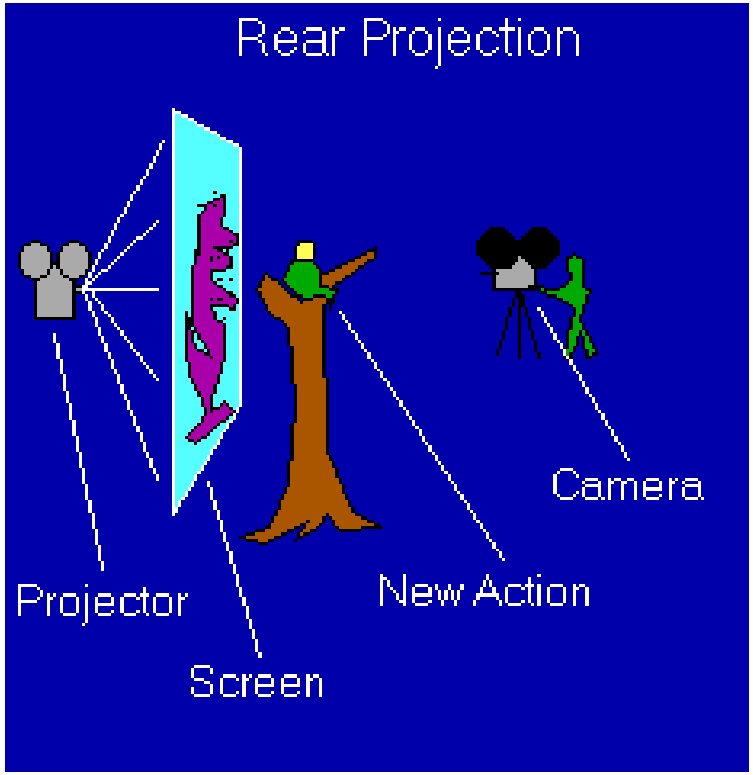


Figure 1
A GLASS SHOT, AS USED FOR THE SHOOTING OF CLEOPATRA (1963)
foreground painting and background sets when misaligned, as seen 'off-angle' from camera
full-scale set
matte painting
camera
composite of painting and full-scale set, as seen through camera

# Rear projection



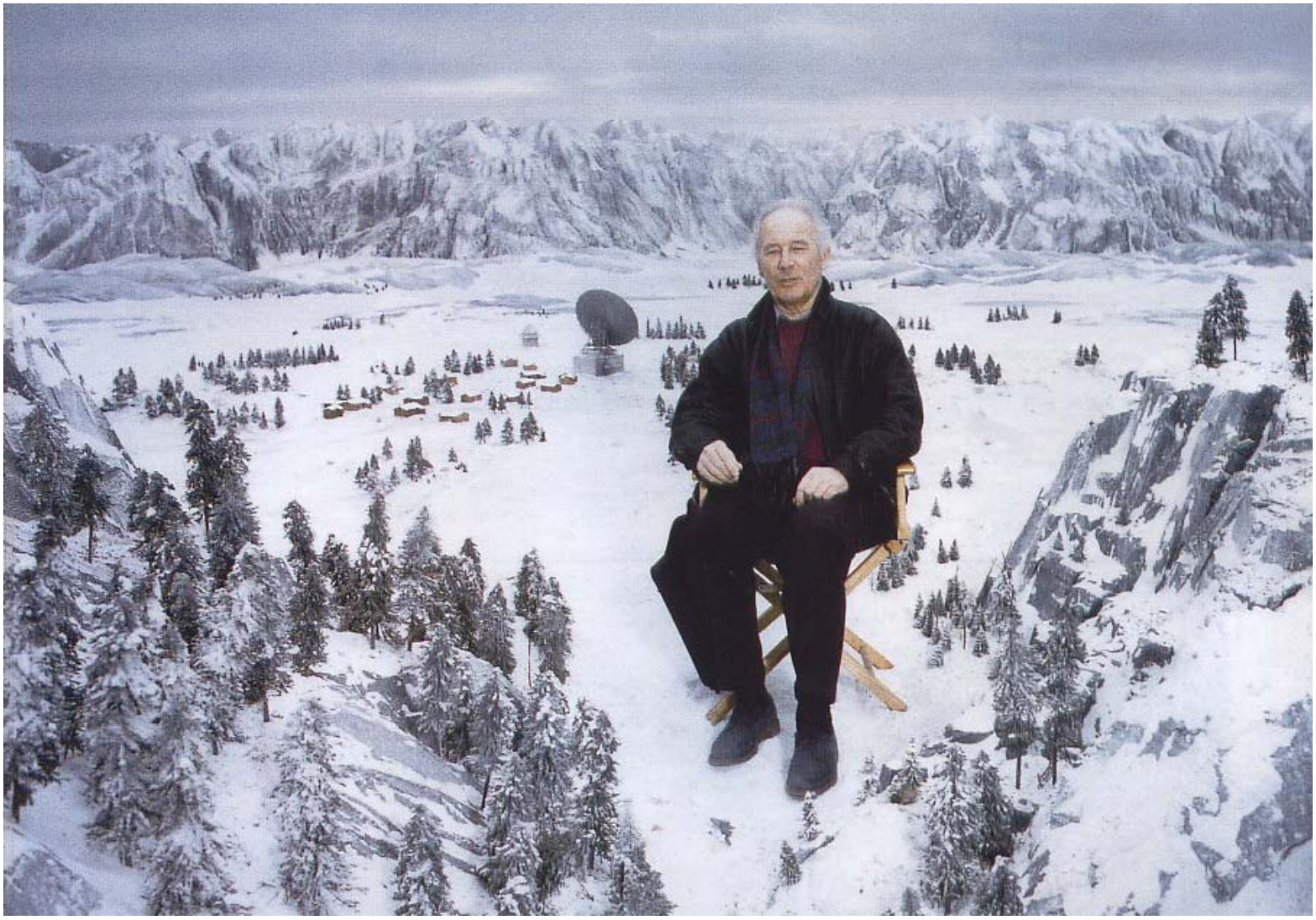
*King Kong, 1933*

# Special effects (make-up)

DigiVFX

# Special effects (physical effects)

# Special effects (miniature)



# Special effects (matte painting)

# Lord of the Rings

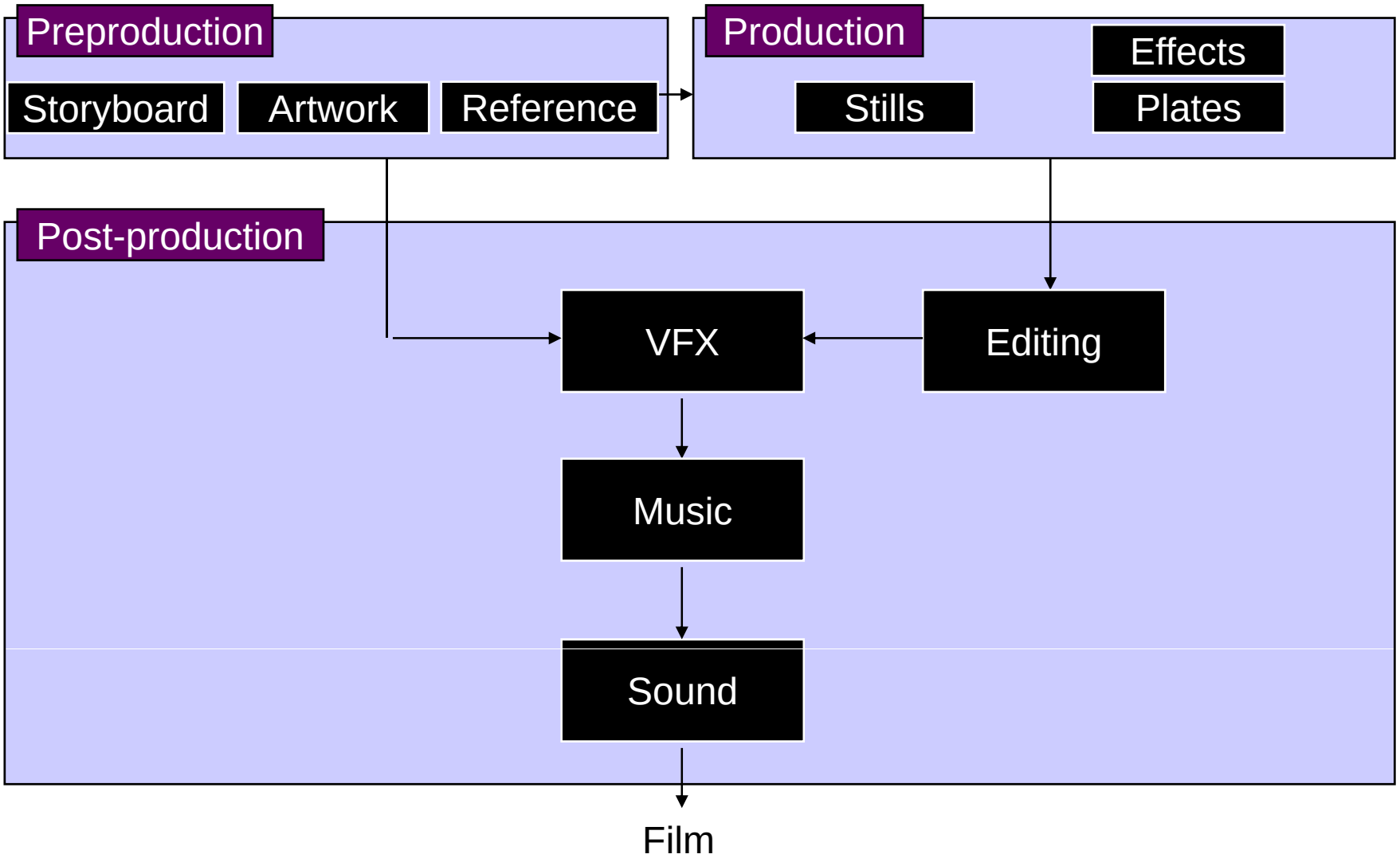
DigiVFX

# Illusion - forced perspective

# Computer-generated model

# Production pipeline

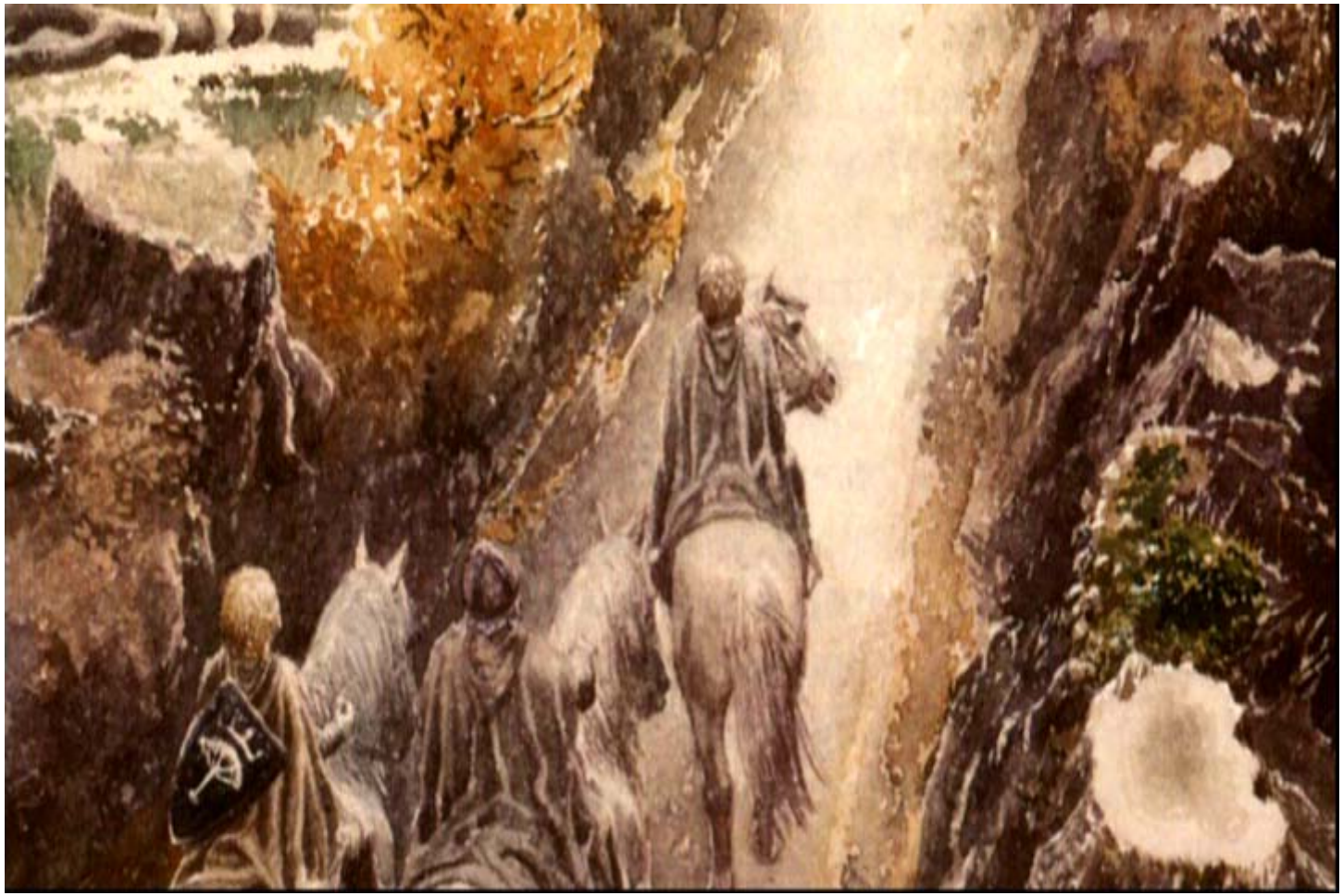
# Production pipeline



# Preproduction

Storyboard

# Preproduction



Artwork

# Preproduction

Reference & Research

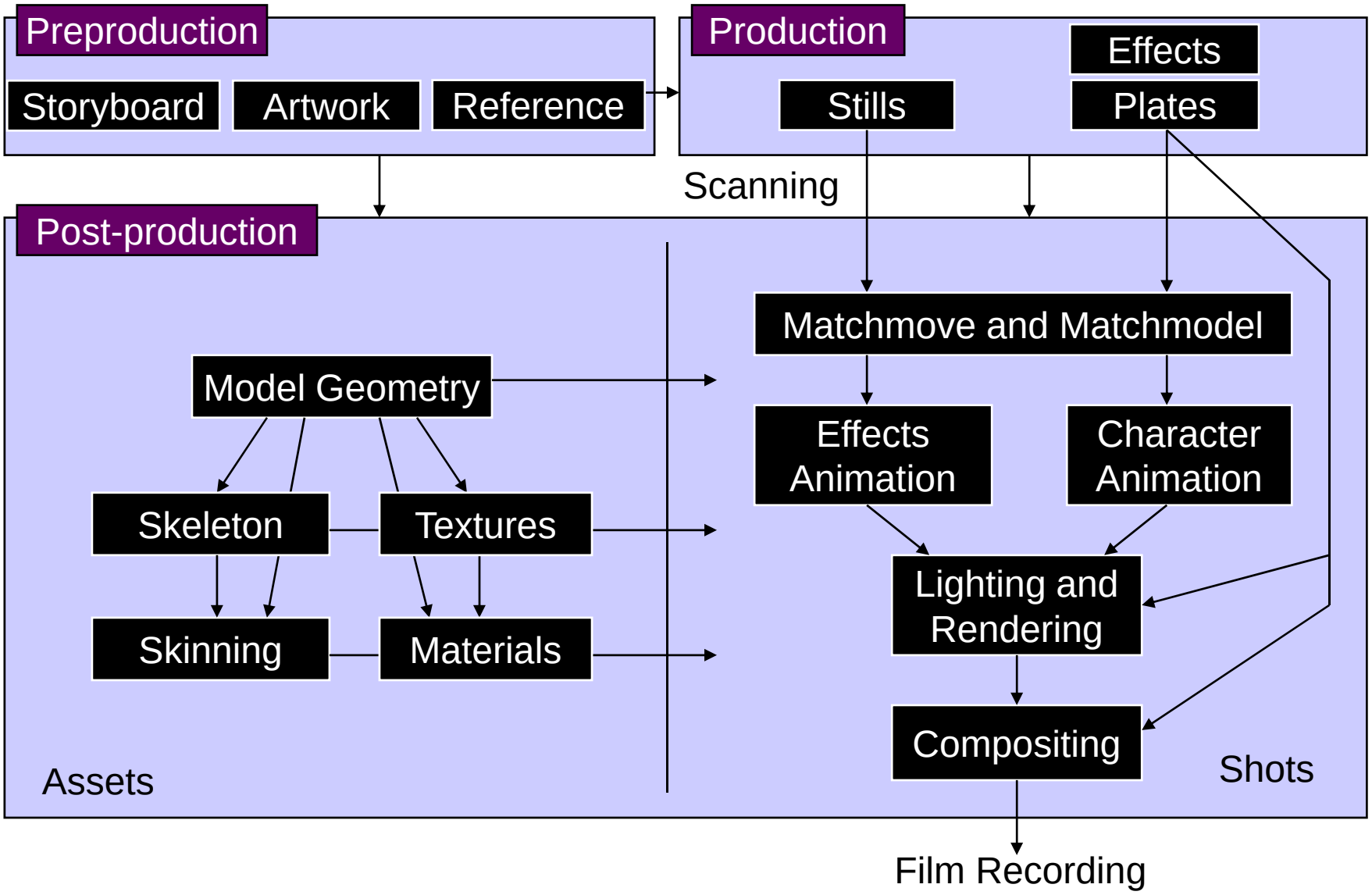
# Production

Shooting

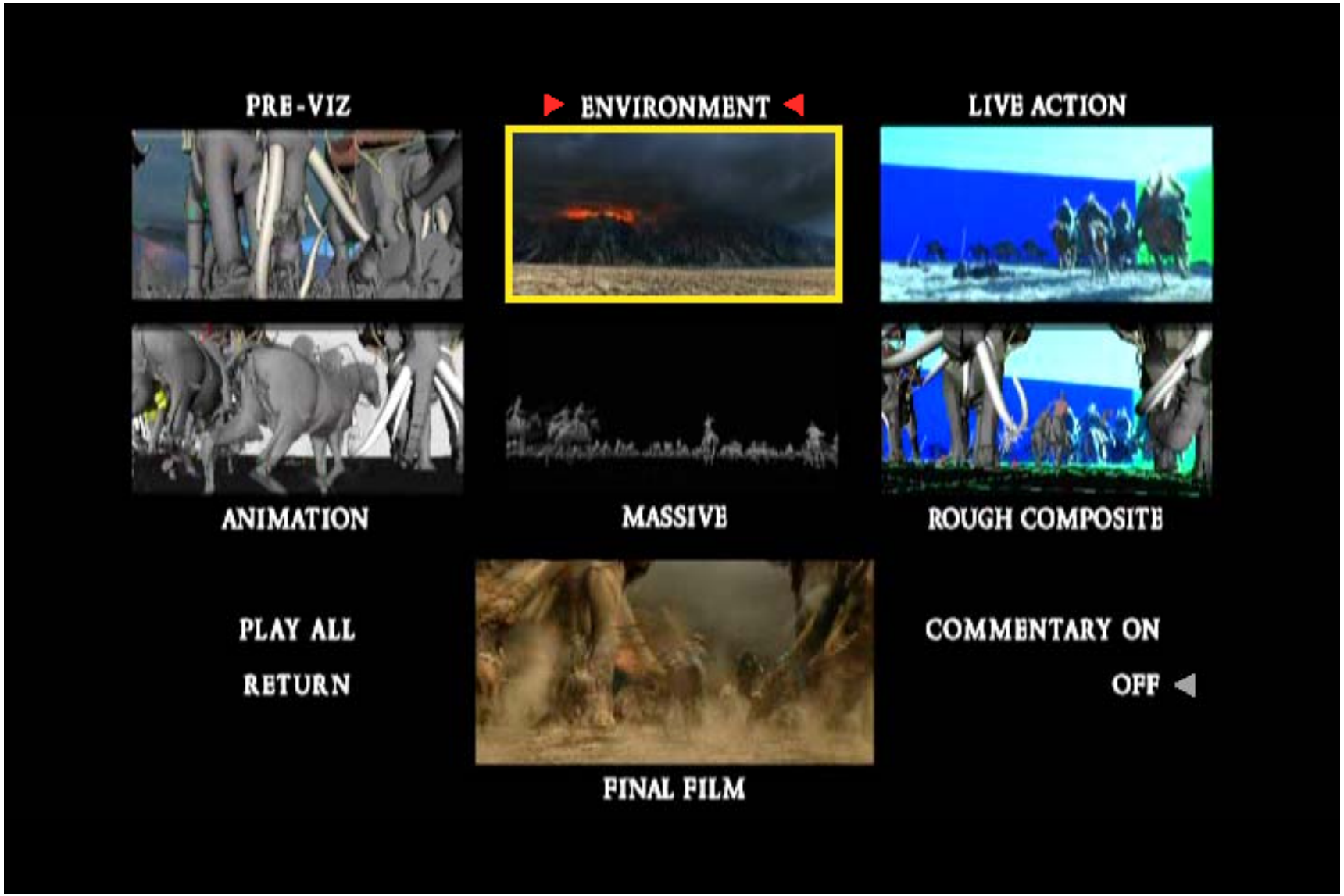
# Post-production

DigiVFX

# Visual effects production



# Visual effects post-production



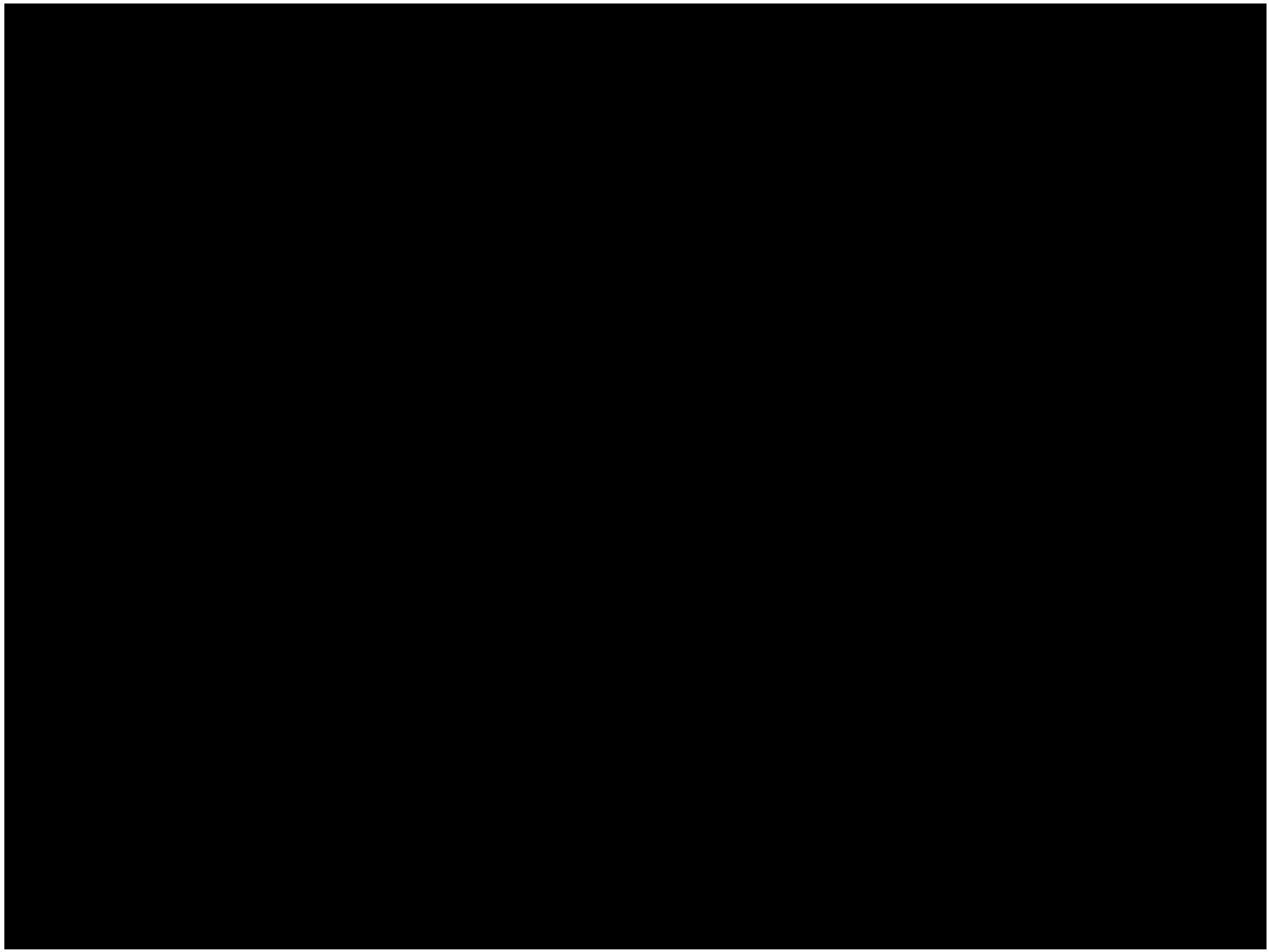
# A case study

# 405: The Movie

- This movie were created solely by two visual effects artists in the year of 2000. It was a process that took over three months of nights, weekends and any spare moments that they could find.
- http://www.405themovie.com/

# 405: The Movie

DigiVFX



# Making of 405

DigiVFX

## Step 0: script and shooting plan

| Shot# | Description | Full CG | CG | Length Frames |
|---|---|---|---|---|
| 01 | Title Animation | X | X | 401 |
| 02 | Freeway speeds beneath car | | | 123 |
| 03 | Speed Limit 65 | | | 120 |
| 04 | LA Freeway from Overpass | | | 238 |
| 05 | Empty Freeway--Car enters frame | X | X | 150 |
| 06 | Pan From Freeway J looks at lack of traffic | | | 237 |
| 07 | Plane swings into landing position toward freeway | X | X | 139 |
| 08 | Hand on Gear shift | | | 36 |
| 09 | Plane lowers into view through rear window | | X | 84 |
| 10 | Plane nears Car | X | X | 65 |
| 11 | J looks to side mirror--plane visible behind | | X | 84 |
| 12 | Plane in sideview mirror | | X | 65 |
| 13 | J looks from side view to rear view mirror -- plane behind | | X | 27 |
| 14 | J eyes react in rear view mirror--remove traffic | | X | 33 |
| 15 | Plane chases Car toward camera | X | X | 77 |

# Making of 405

DigiVFX

**Step 1: shooting**

two days with a Canon Optura DV camera with progressive mode.

⇨ a 70-minute raw footage

initial editing

⇨ pickup shots

Cuts to Driving with plane closing from behind

Cuts from Side then Rear view mirror looks

# Making of 405

DigiVFX

**Step 2: building CG world**

total 62 shots, 42 enhanced with digital VFX.

19 shots are entirely digital creations.

plane, two cars, freeway background are digital

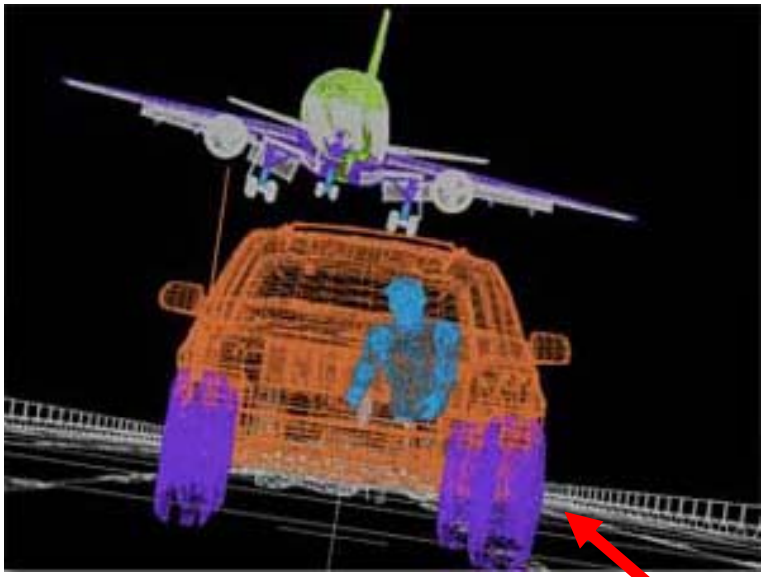


photo-based 3D environment

# Making of 405

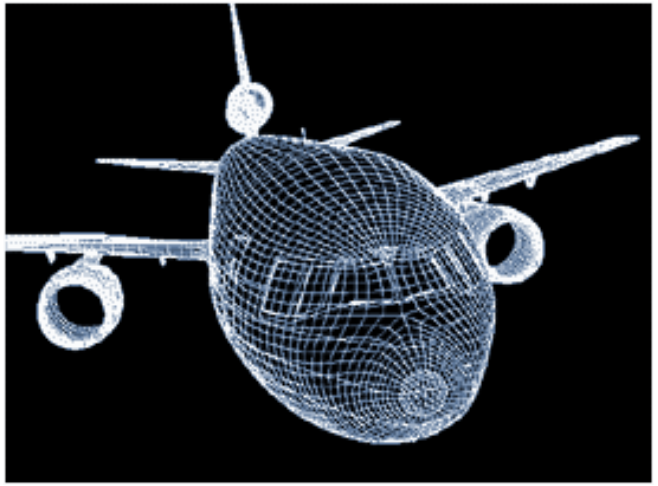
Real cars were used for close-up and interior shots

A low-resolution mesh scanned by a cyberscanner.
Mapped with photographs.

# Making of 405

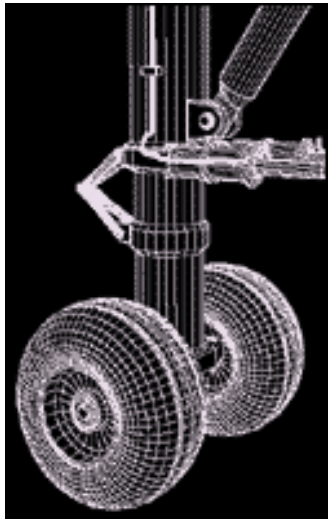
DigiVFX

DC-10 plane took a month to model in details for the needs of close-up shots.

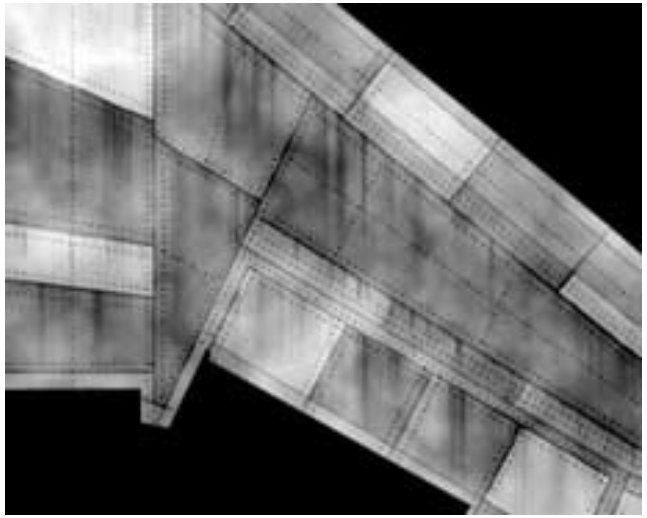


59 objects, 142,439 polygons

reference



modeling



material painting

# Making of 405

DigiVFX

## Step 3: traffic clearing

clean plate

close-up shots

inpainting

# Making of 405

DigiVFX

## Step 4: compositing

shot with the vehicle standing still in a backyard

# Making of 405

DigiVFX

# Making of 405

DigiVFX

## Step 5: fine touchup

3D hat

compositing and inpainting

# Making of 405

DigiVFX

## Step 6: music and delivery

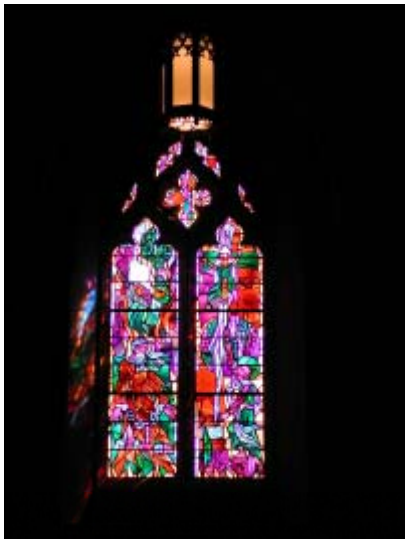
# Bloody Omaha

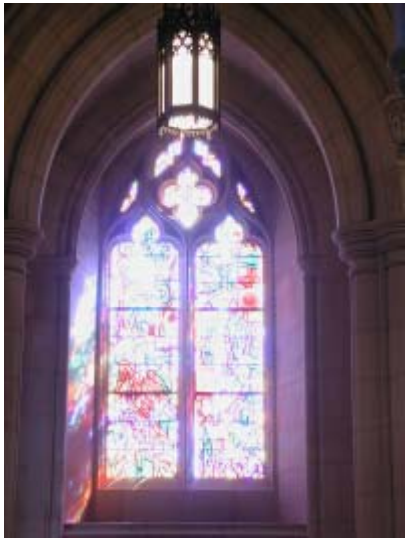
# Topics we plan to cover

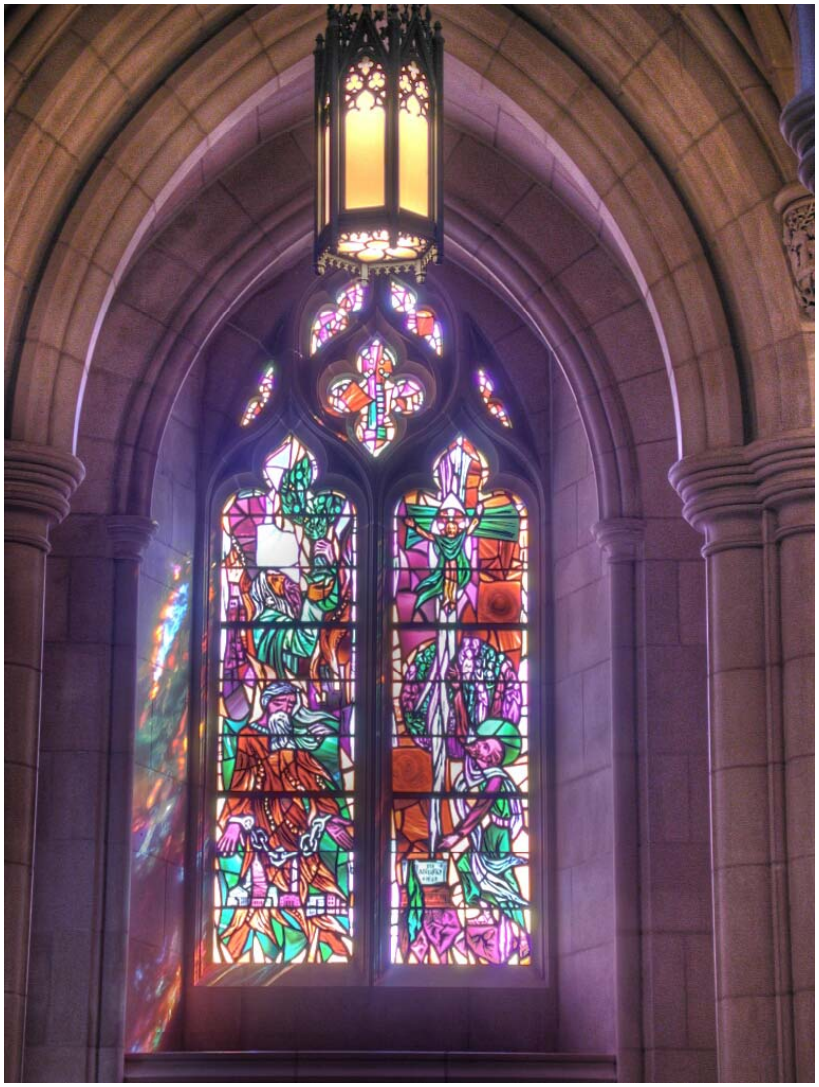
# Camera

Canon 10D

# High dynamic range imaging/display







# Image warping/morphing

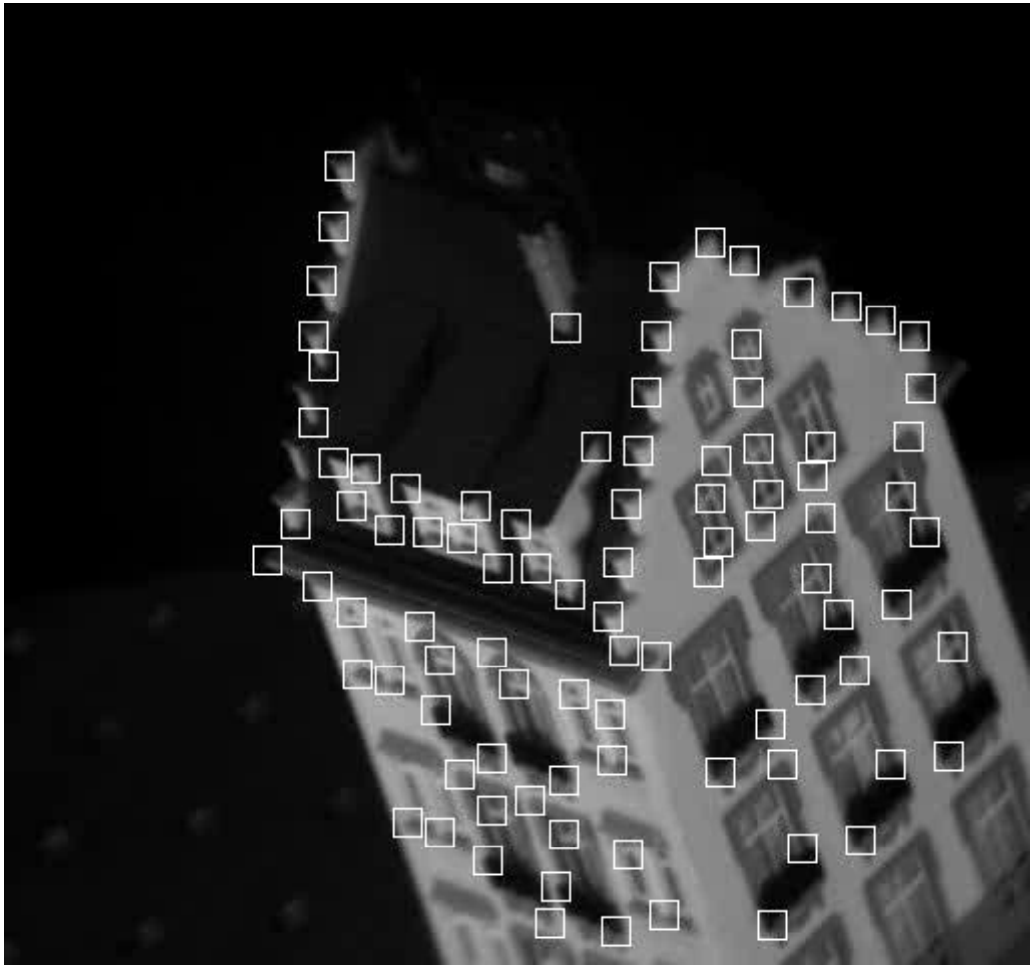
someone not that famous

someone very famous

video

# Image warping/morphing

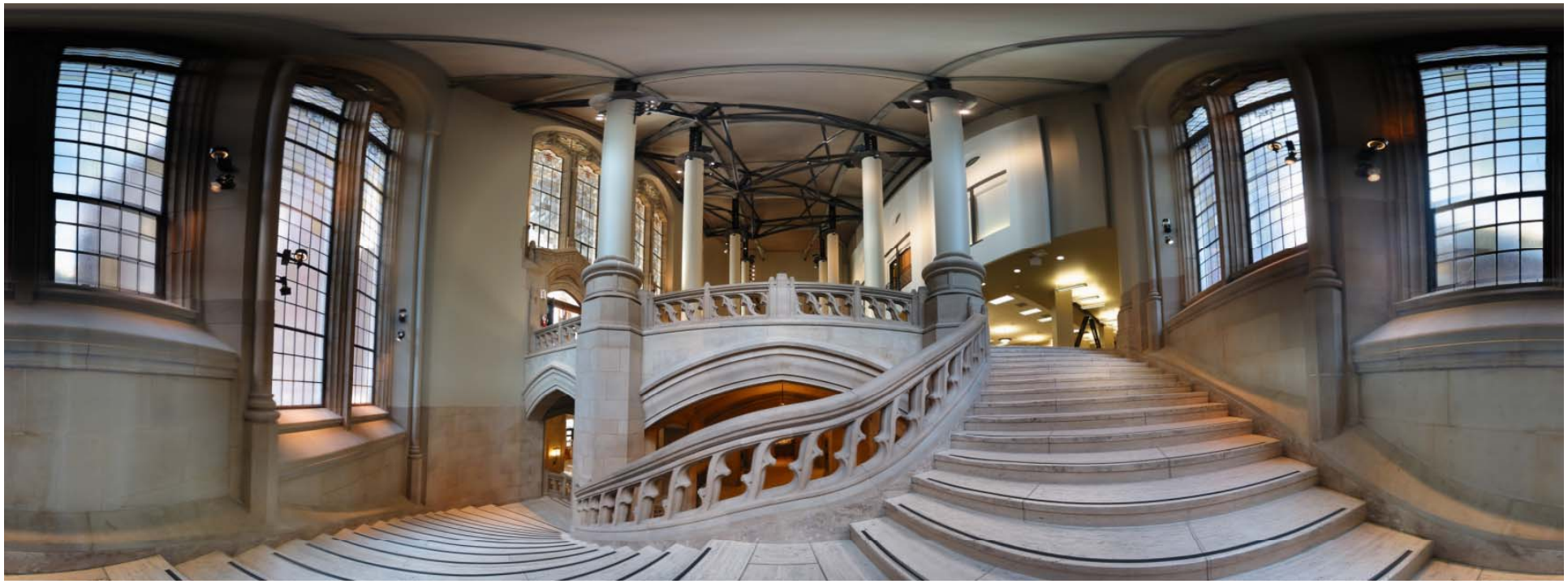
# Tracking



Feature tracking

# Image stitching

DigiVFX



# MatchMove

*Move matching using scene planes*

# Matchmove

*Move matching using scene planes*

# Matchmove

*Move matching using scene planes*

# Photo tourism

# Video matching

DigiVFX

*Matrix* *MOCO (Motion control camera)*

# Video matching

*Video matching*

# Matting and compositing

*Titanic*

# Matting

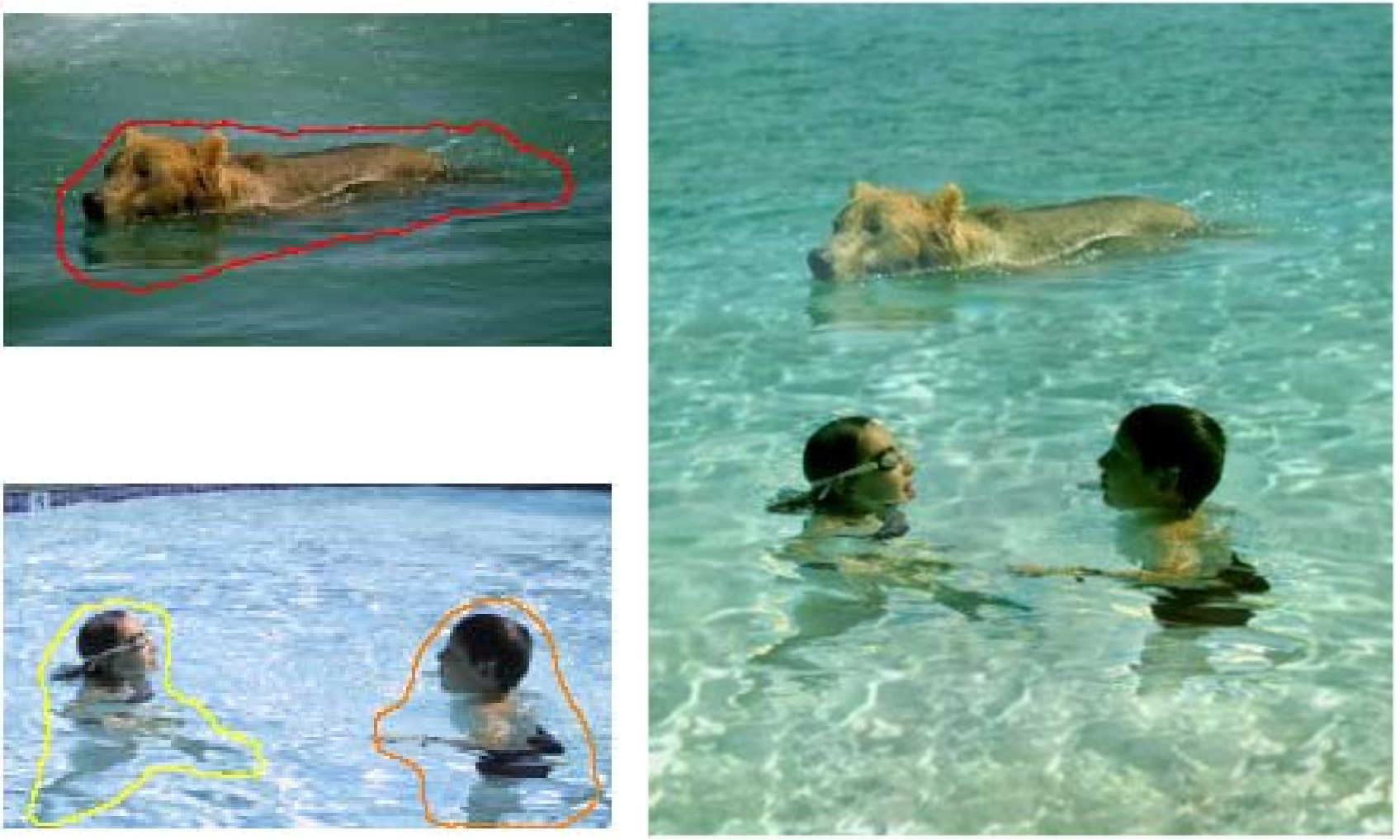
# Object selection

*LazySnapping*

# Image manipulation

*GraphCut Texture*

# Image manipulation



*Poisson blending*

# Image-based modeling

*photogrammetric modeling and projective texture-mapping*

# Image-based modeling

DigiVFX

*photogrammetric modeling and projective texture-mapping*

# Image-based modeling

DigiVFX

*photogrammetric modeling and projective texture-mapping*

# Image-based modeling

*Tour into a picture*

# Image-based modeling

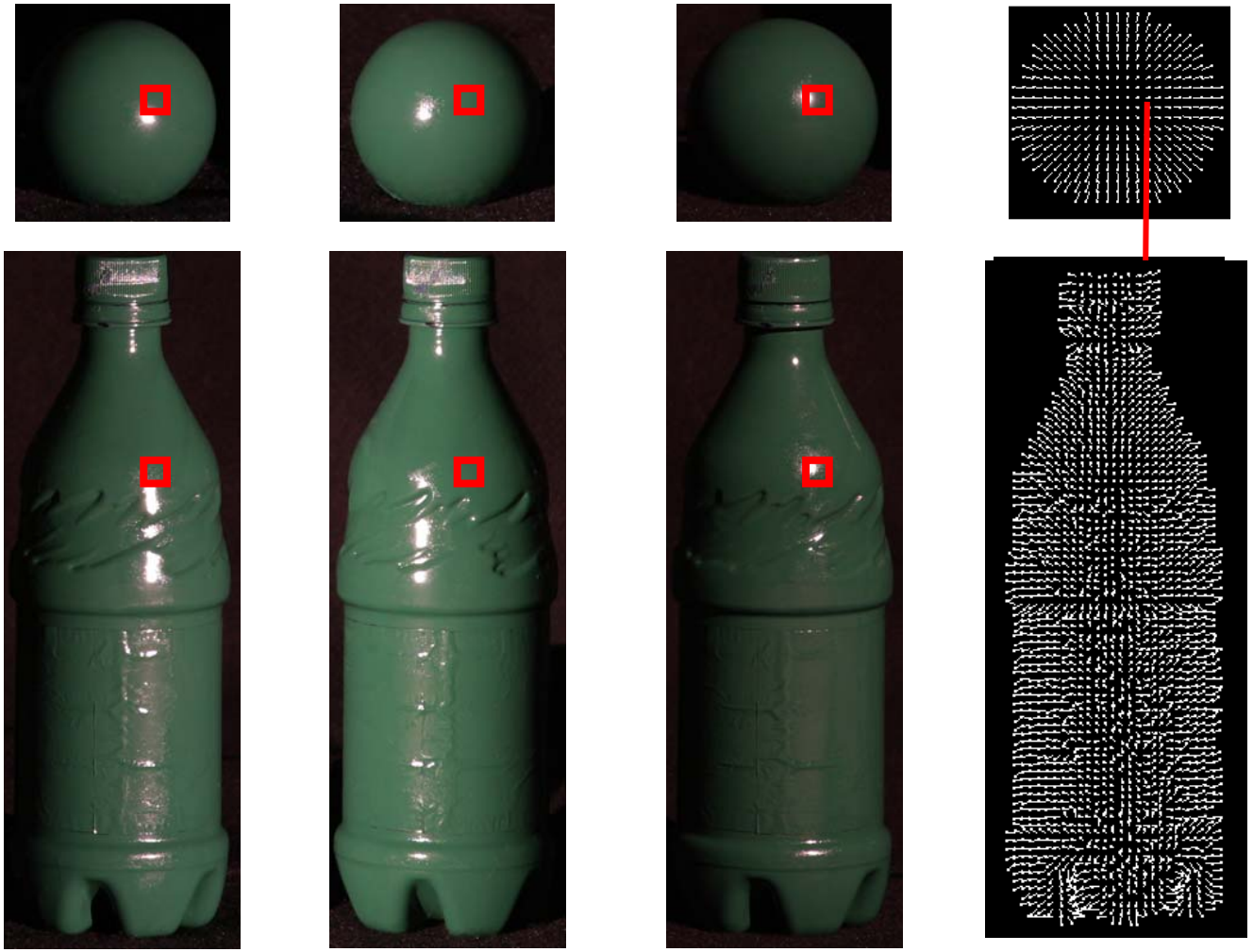
DigiVFX

*Tour into a picture*

# 3D photography (active)

*Cyberware whole body scanner*

# 3D photography (active)

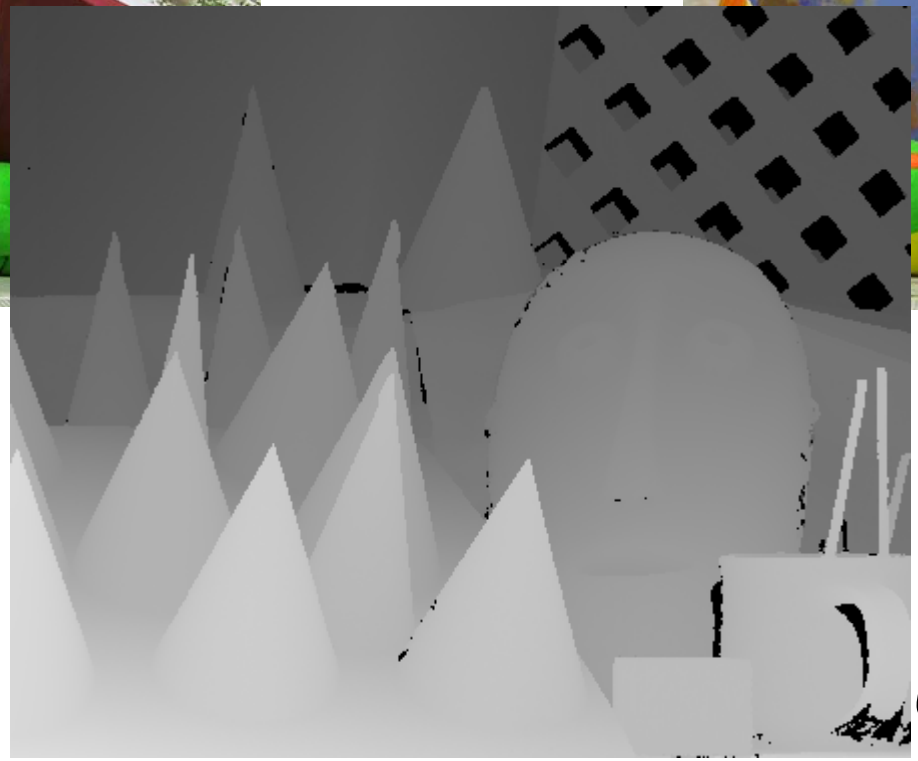


*Photometric stereo*

# 3D photography (passive)

*left*

*right*



*depth*

*Stereo*

# Image-based rendering

*Surface lightfield*

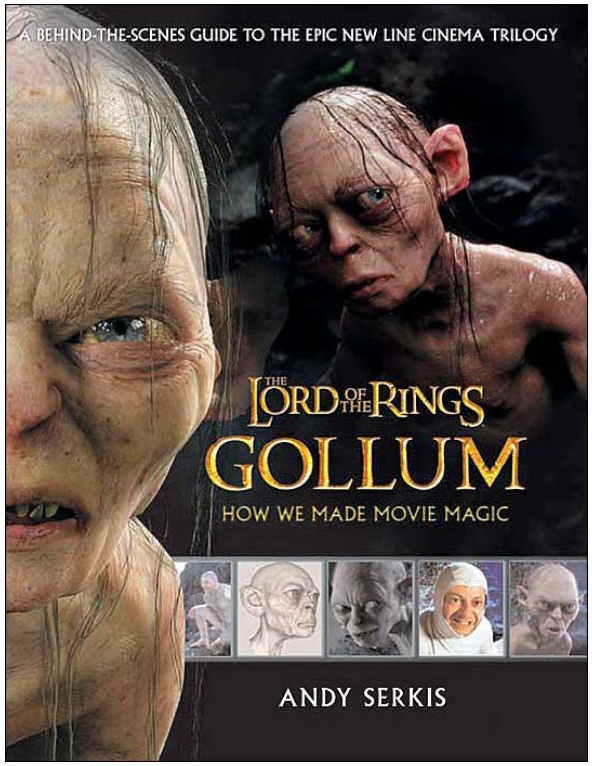
# View interpolation

Bullet time video

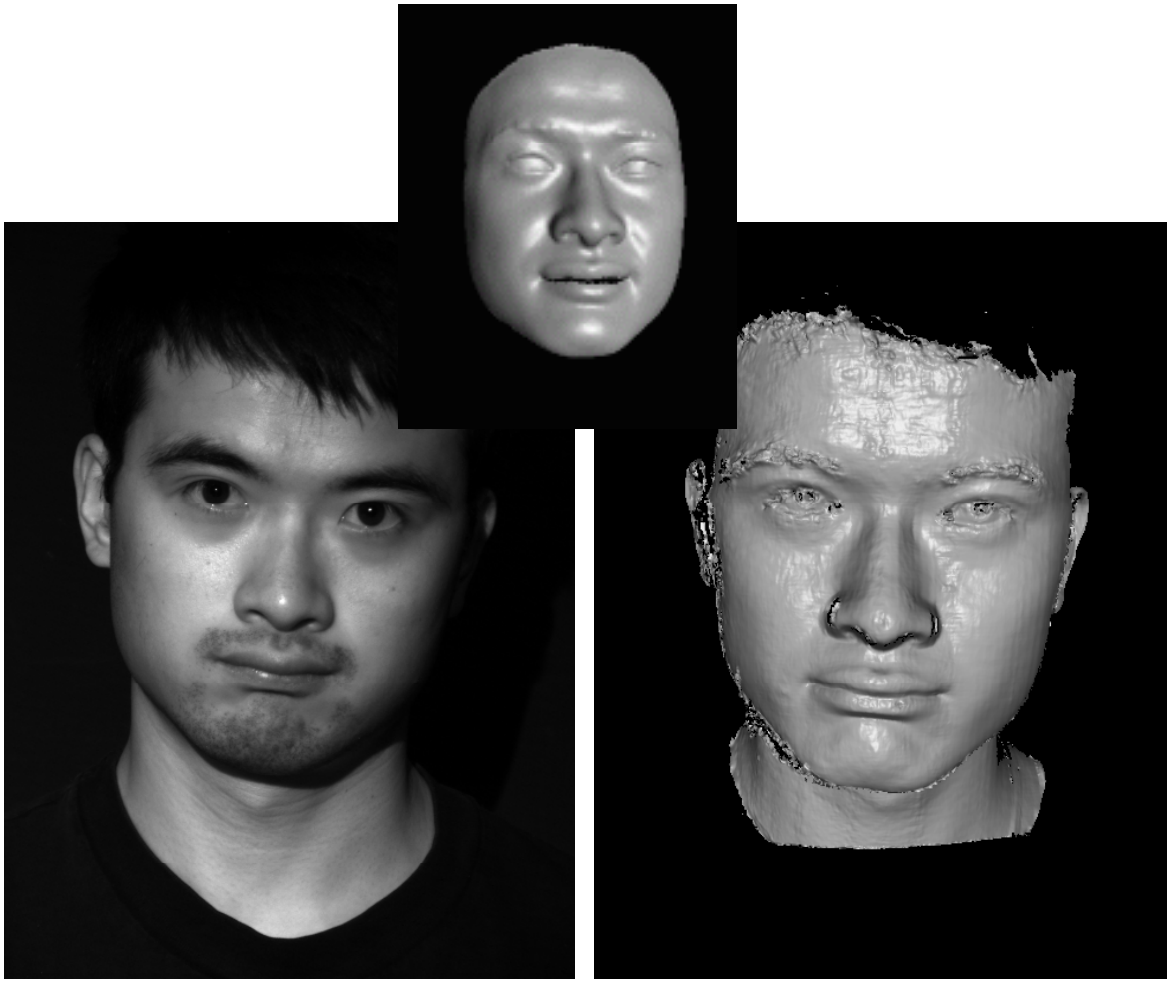
# View interpolation

High-Quality Video View Interpolation

# Making face




Gollum



Spacetime face

# Video rewrite

Trainable videorealistic speech animation

# Inpainting (wire removal)

*Inpainting*

# Texture synthesis/replacement

*Texture replacement*

# Semi-automatic matting painting

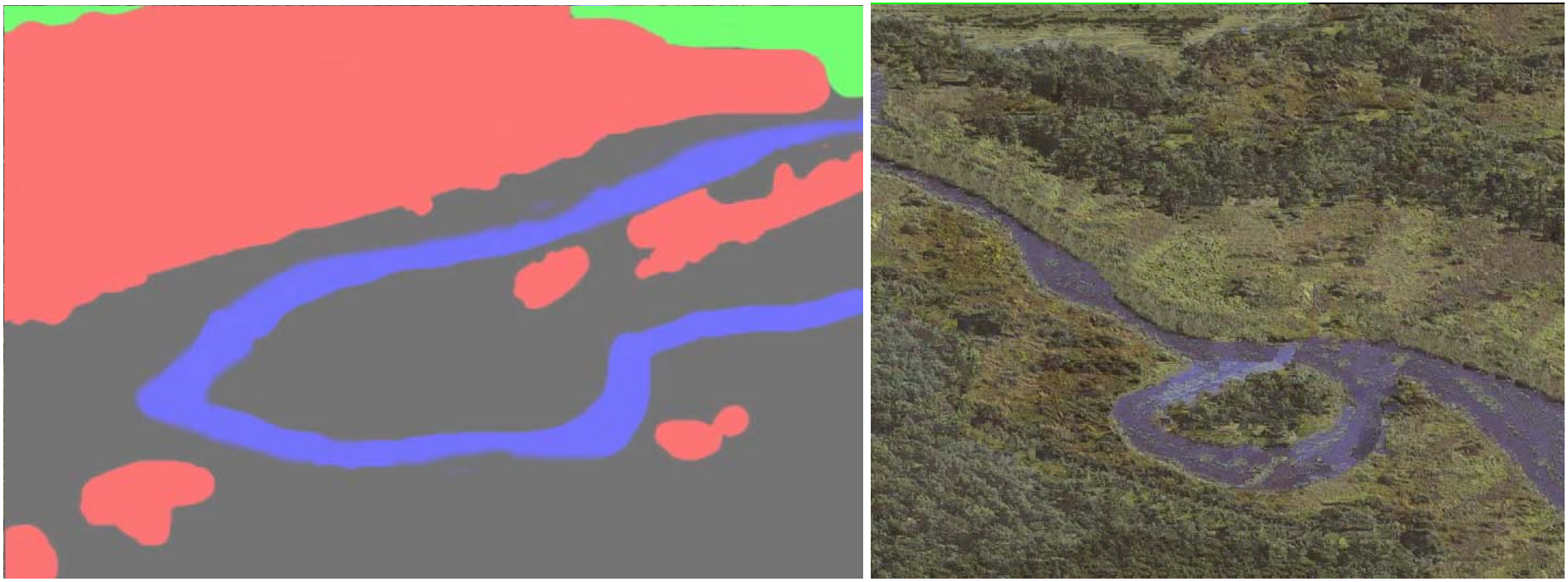
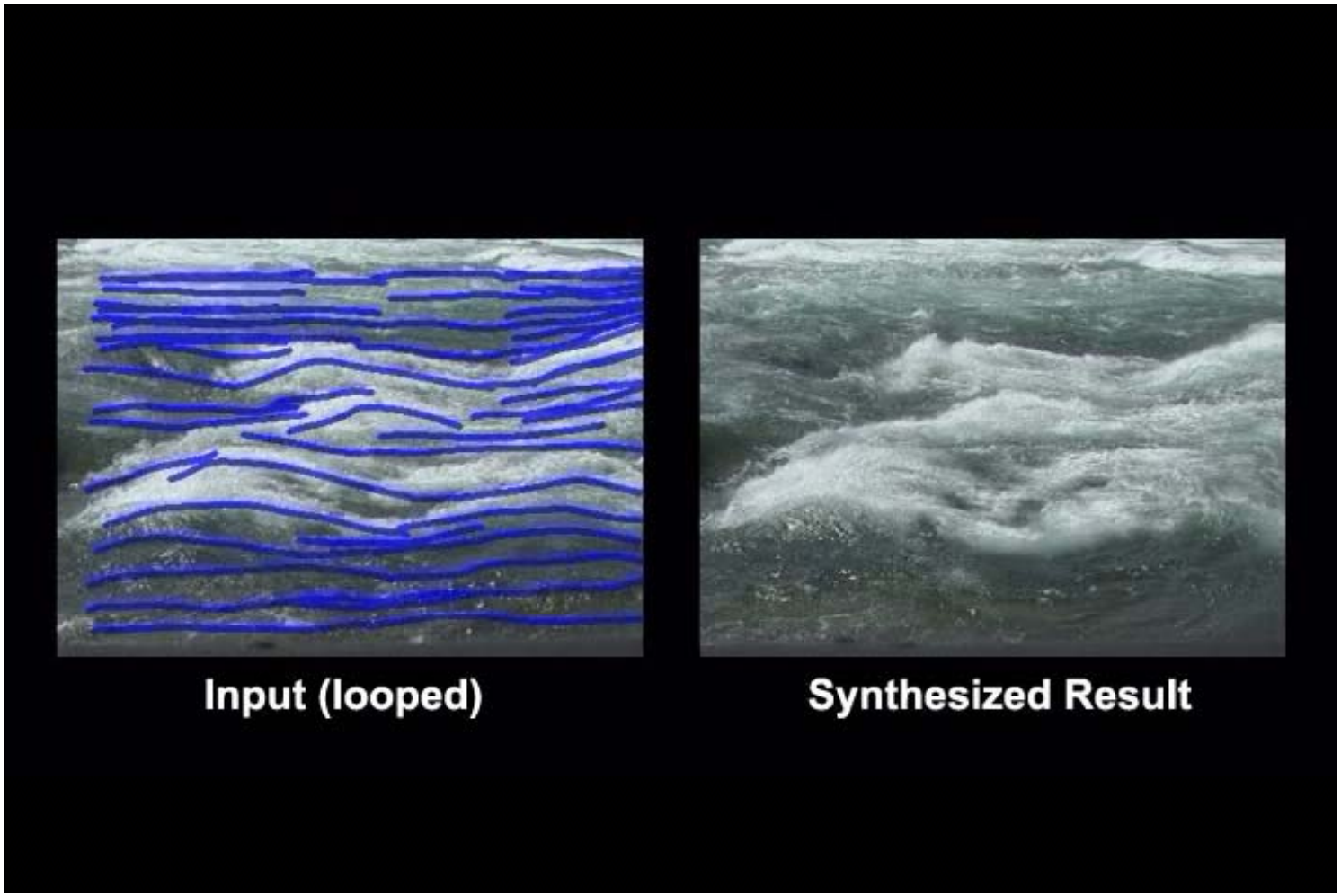


*Image analogies*

# Video editing



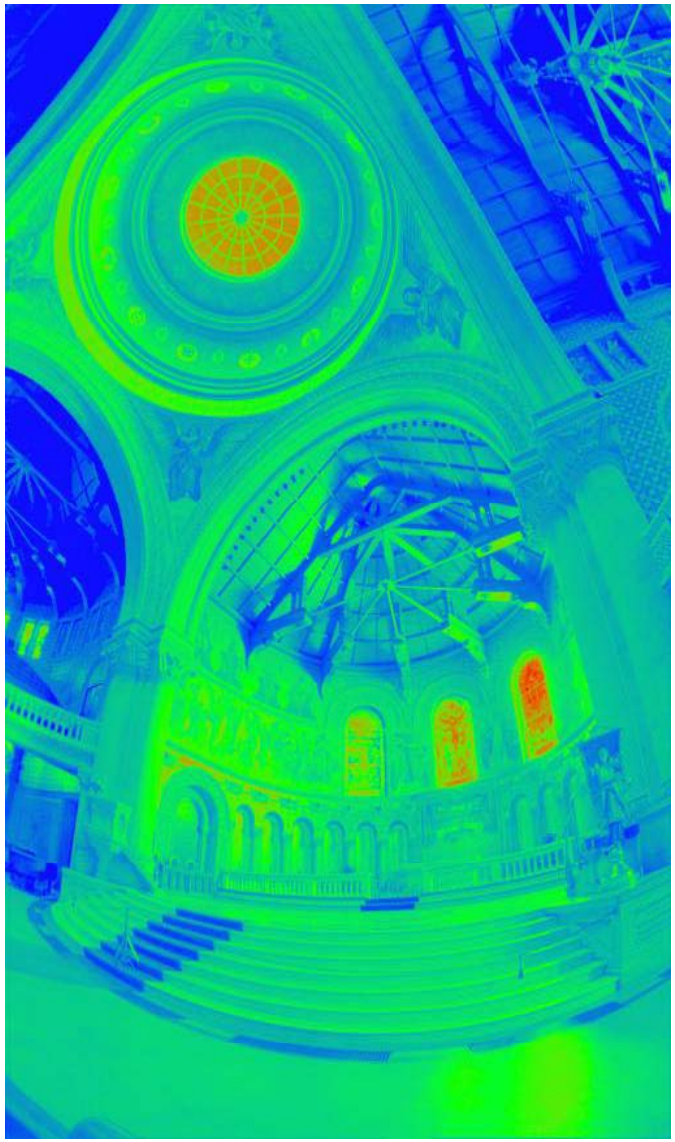

*Flow-based video editing*

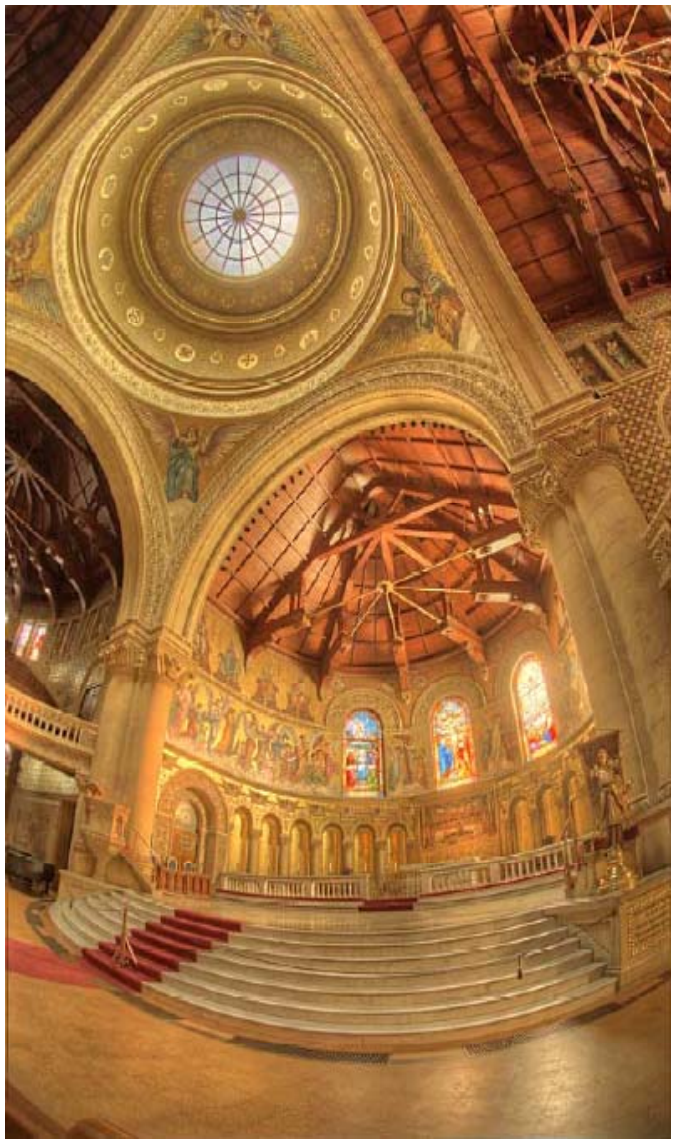
# Grading

DigiVFX

- 3 programming assignments (60%)
  - HDR Imaging (18%)
  - AutoStitch (24%)
  - MatchMove (18%)
- Class participation (5%)
- Final project (35%)
  - Research
  - System
  - Film

# High dynamic range imaging





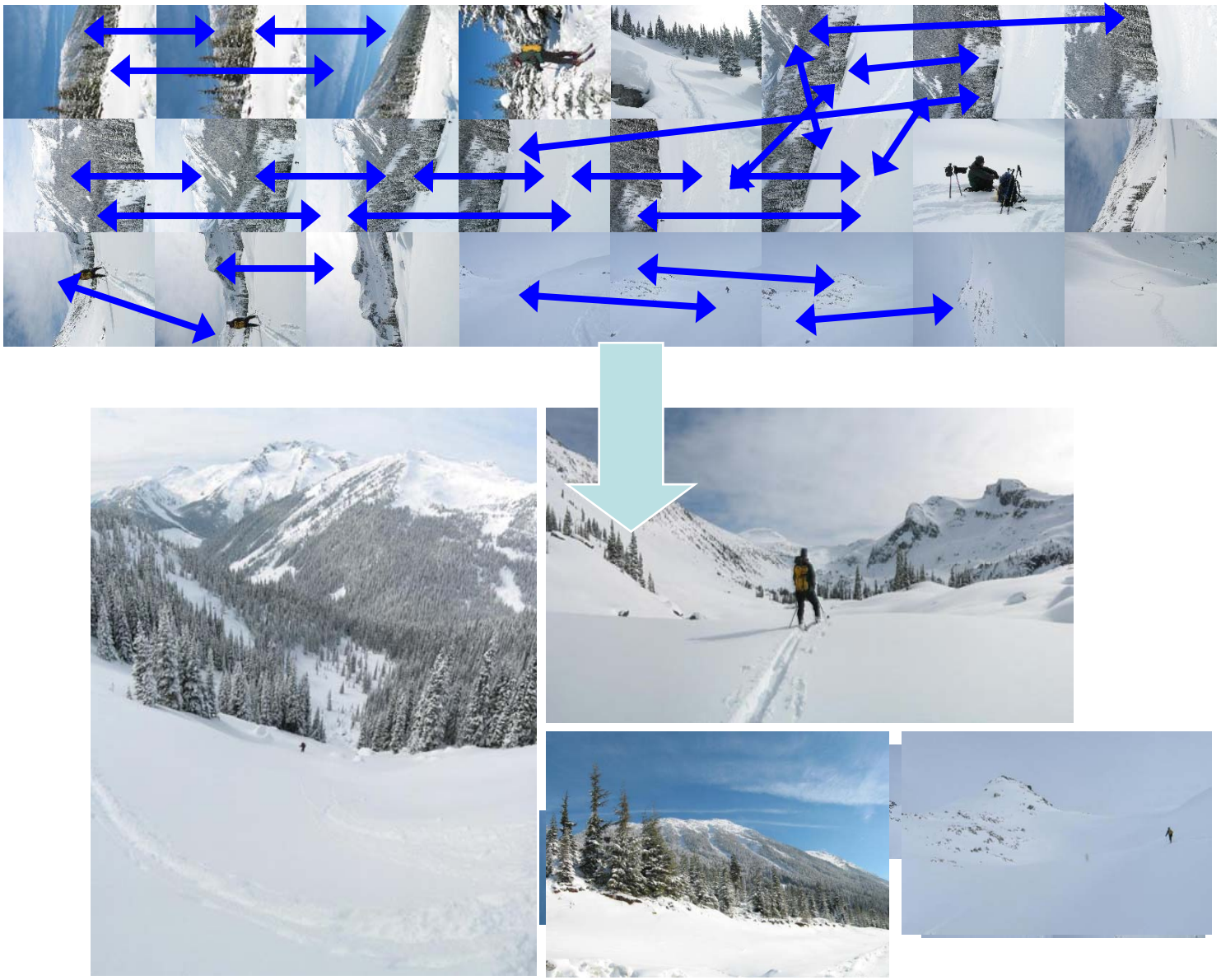
# From past semesters (鄭逸廷 陳柏叡)

# From past semesters (吳侑親, 張書瑋)

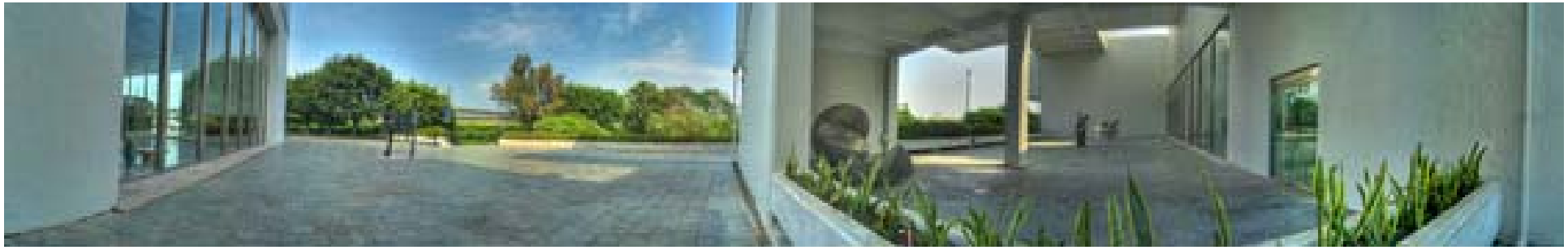
# From past semesters (王瑋馥, 余雁雲)

# AutoStitch

DigiVFX



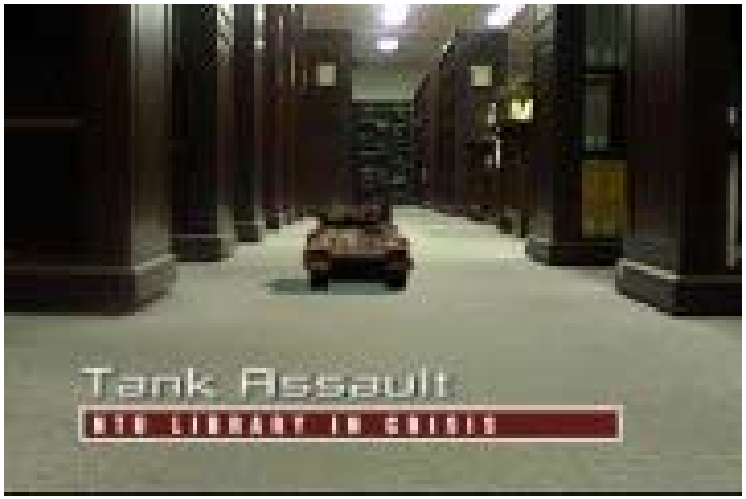
# From past semesters



鄭逸廷 陳柏叡

李佳燕 黃政基

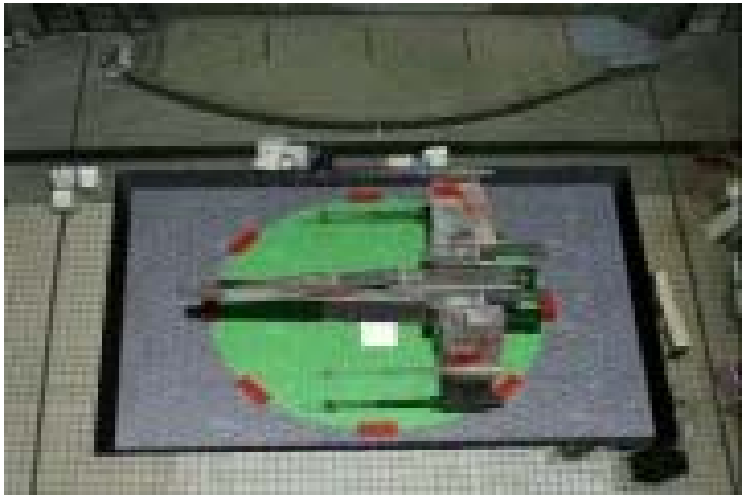
# MathMove




梁家愷 鐘志遠

姜任遠 林立峯

楊宗碩 林柏劭



翁憲政 洪韶憶

# Final projects from a similar course in Georgia Tech.

# Life in Paints

*Life in Paints*, GaTech DVFX 2003

# Tour into pictures

DigiVFX

Making of *Life in Paints*

# In Your Face

*In Your Face*, GaTech DVFX 2002

# Stop action

Making of *In Your Face*

# Tennis

DigiVFX

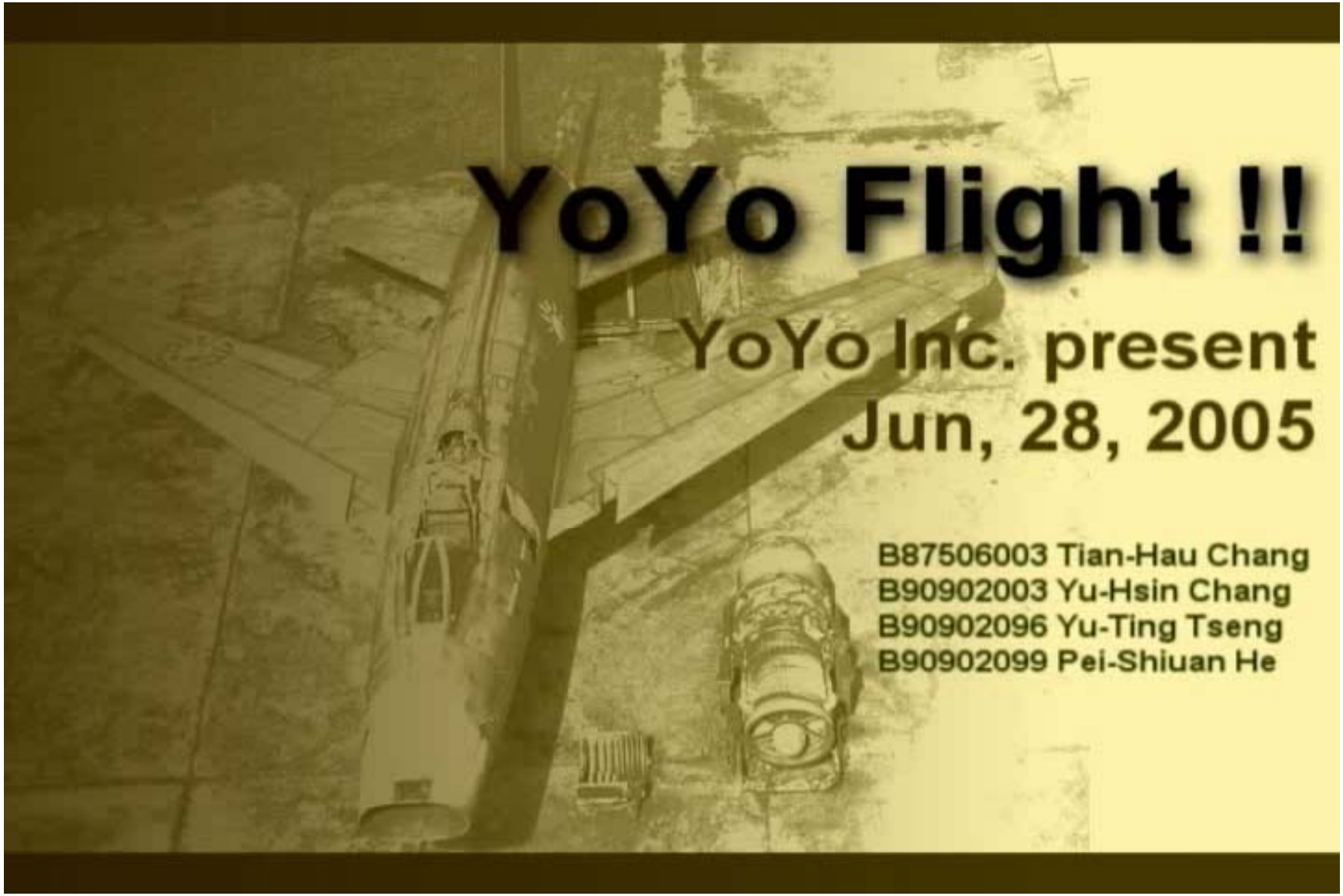
*Tennis*, GaTech DVFX 2007

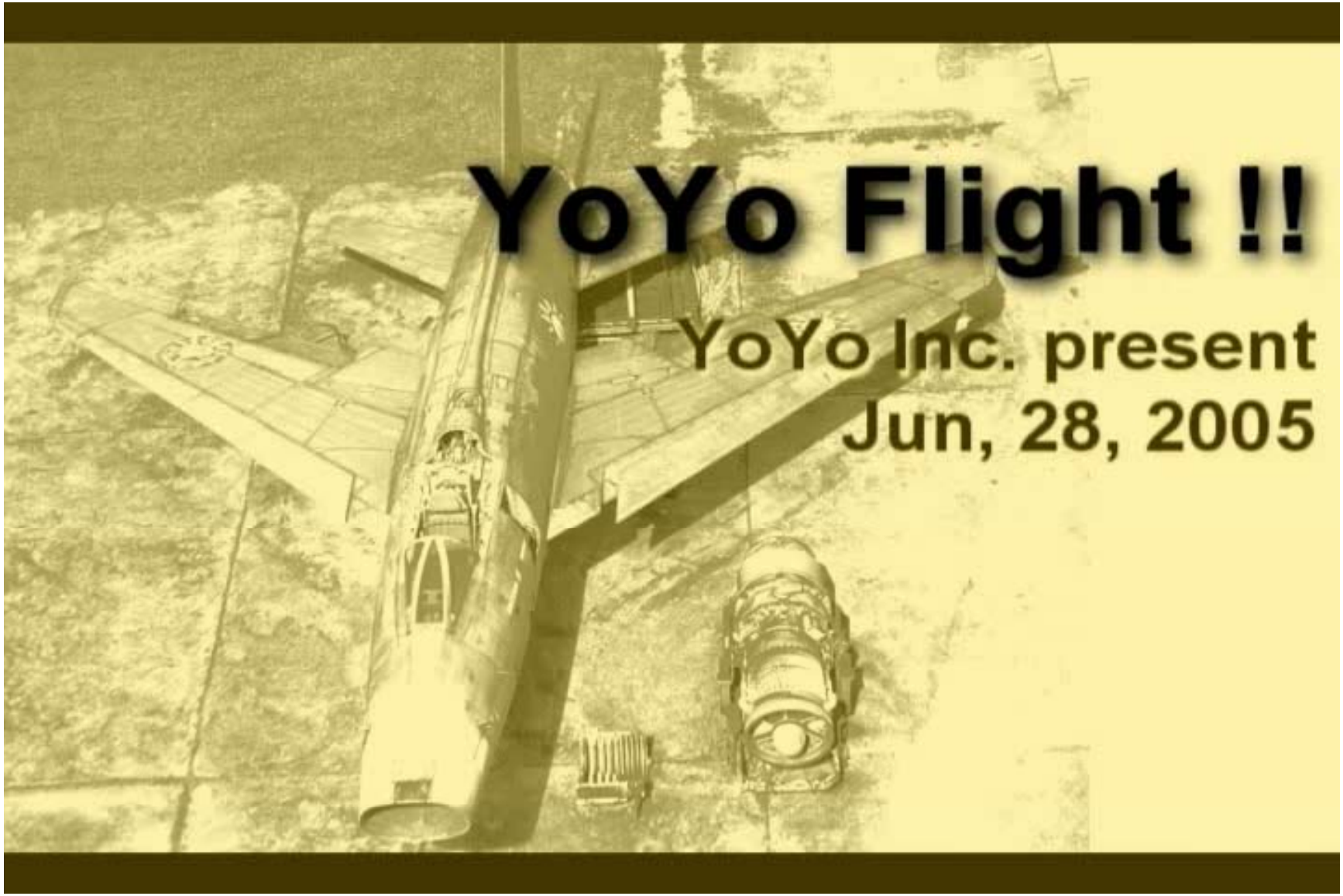
# MatchMove/CGI

*Making of Tennis*

# Final projects from the past.

# YoYo Flight


YoYo Flight !!
YoYo Inc. present
Jun, 28, 2005
B87506003 Tian-Hau Chang
B90902003 Yu-Hsin Chang
B90902096 Yu-Ting Tseng
B90902099 Pei-Shiuan He

# Making of YoYo Flight

DigiVFX