

# Course overview

Digital Visual Effects

*Yung-Yu Chuang*

# Logistics

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- Meeting time: 2:20pm-5:20pm, Wednesday
- Classroom: CSIE Room 104
- Instructor: Yung-Yu Chuang ([cyy@csie.ntu.edu.tw](mailto:cyy@csie.ntu.edu.tw))
- Teaching assistants: TBA
- Textbook: Readings from books, journals and proceedings. Richard Szeliski's [Computer Vision: Algorithms and Applications](#).
- .Webpage: (user name/password)  
<http://www.csie.ntu.edu.tw/~cyy/vfx>
- Mailing list: [vfx@cmlab.csie.ntu.edu.tw](mailto: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

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# It isn't about 3D animations

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# It isn't about watching movies

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# It isn't about physical effects

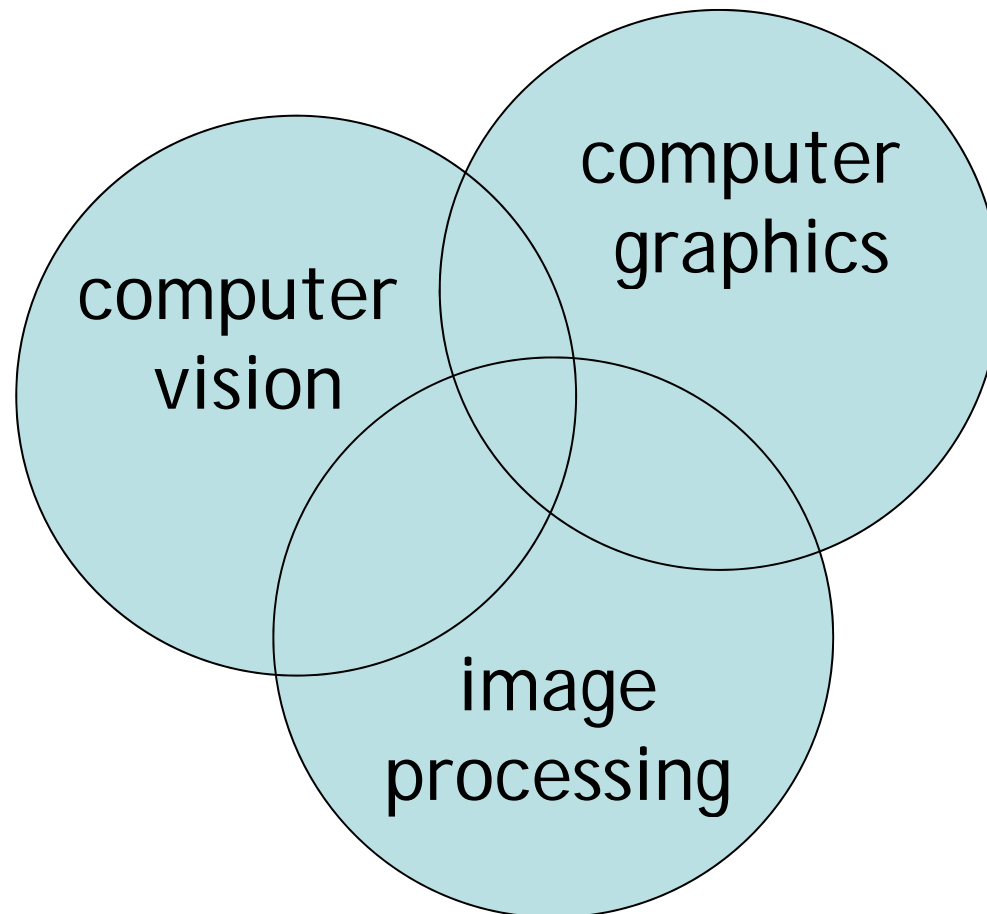
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# It's not about industrial tricks

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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

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- 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.

# The vfx course



what other professors think you do

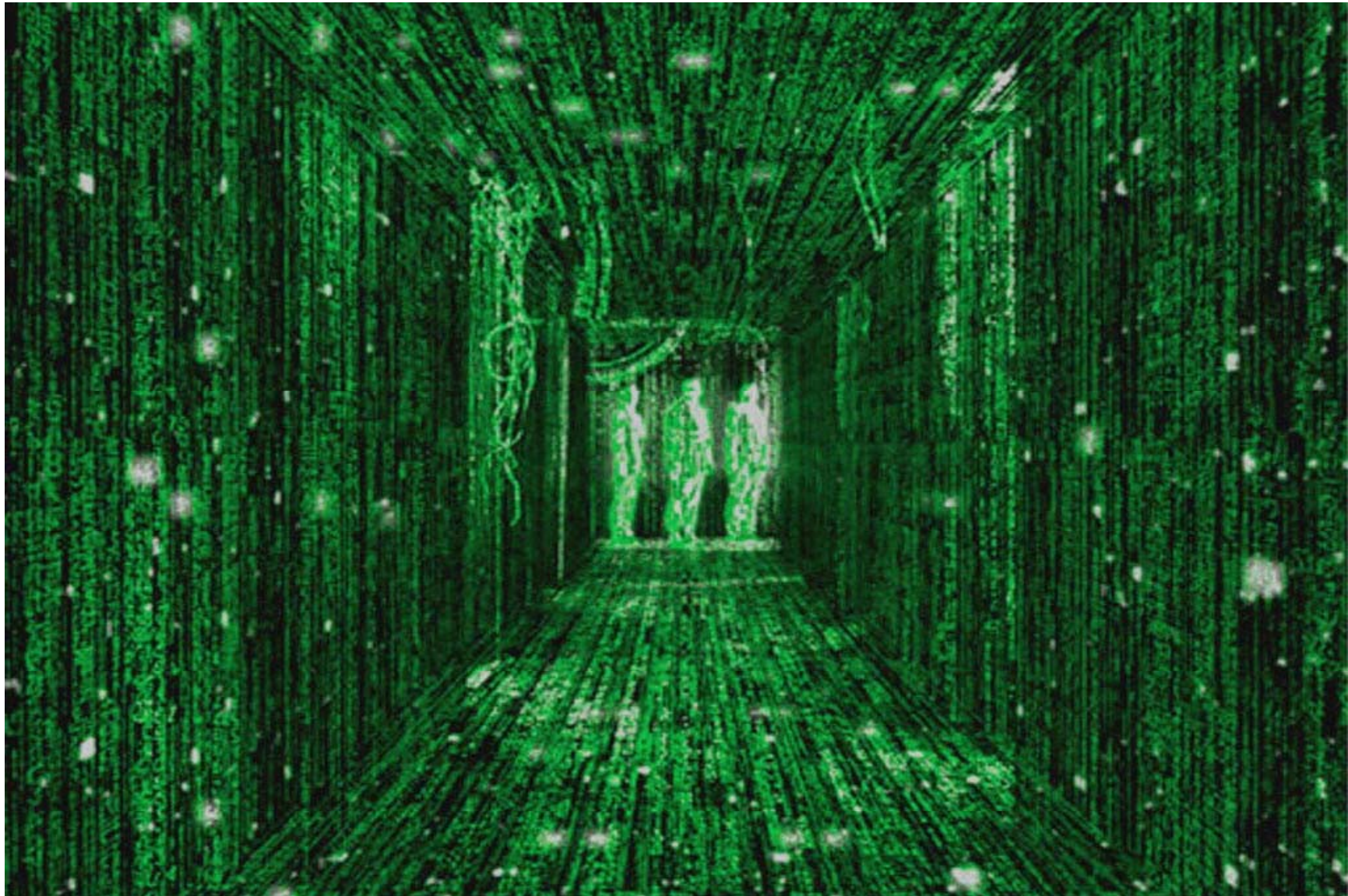
what other students think you do

what you thought you will do



what you actually do

# The vfx course



# Warning from previous students

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- 請學期初老師要多提醒這門課的困難度請興趣或實力不足同學勿修，否則就會像我一樣停修 XD

**This course is about ...**

# Digital Visual Effects



# Reality?

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# Retouching

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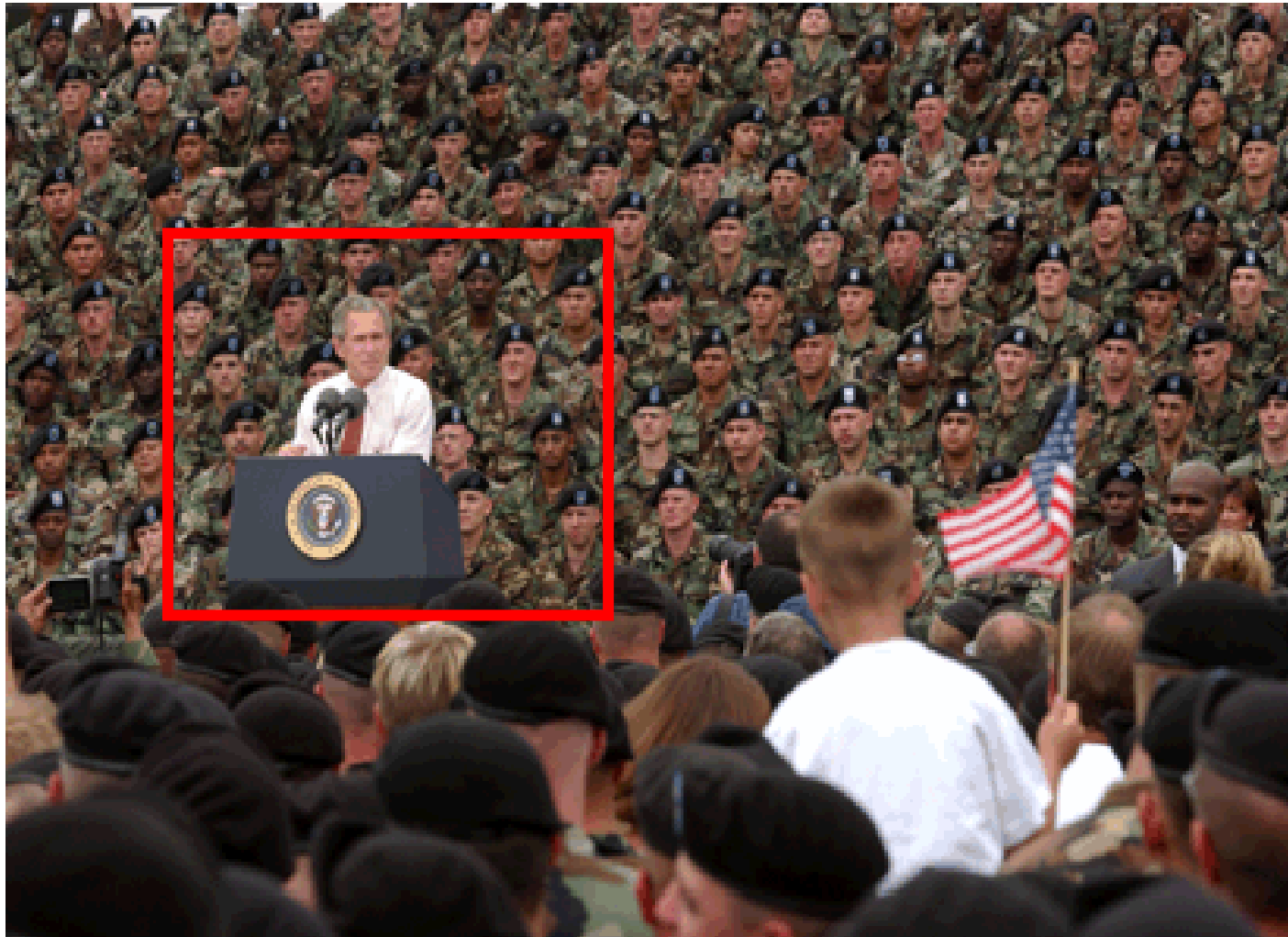
# Iraq War, LA Times, April 2003



Digital photo montage

# Bush campaign's TV AD, 2004

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# Texture synthesis and inpainting

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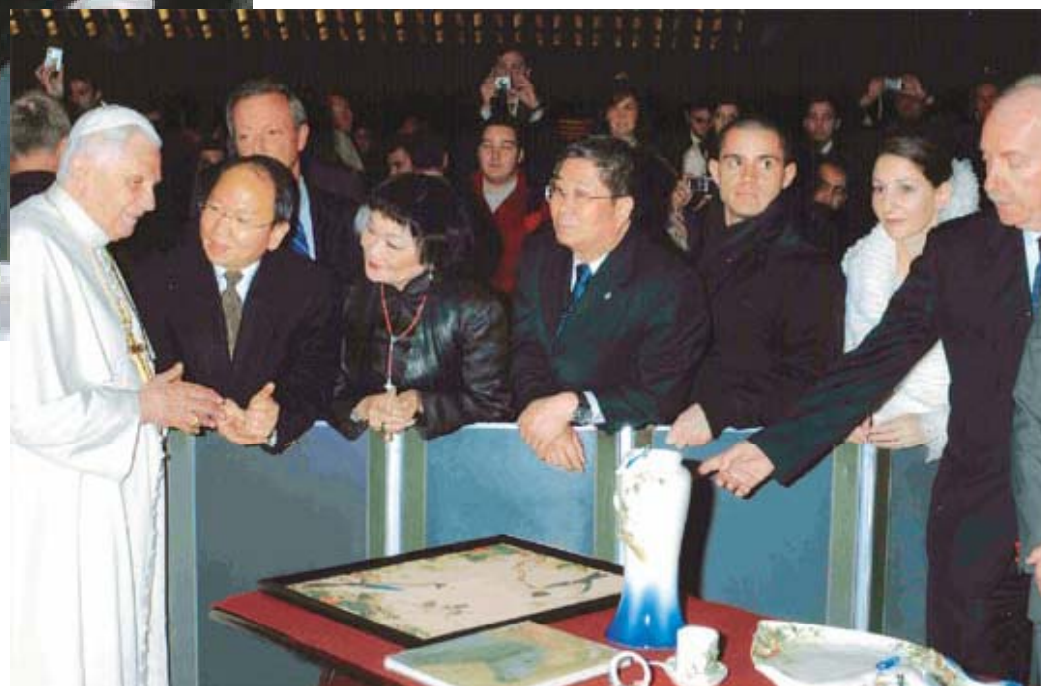
This section shows a sampling of the duplication of soldiers.



# Domestic example



The Liberty Times  
2007.12.17



# Special effects

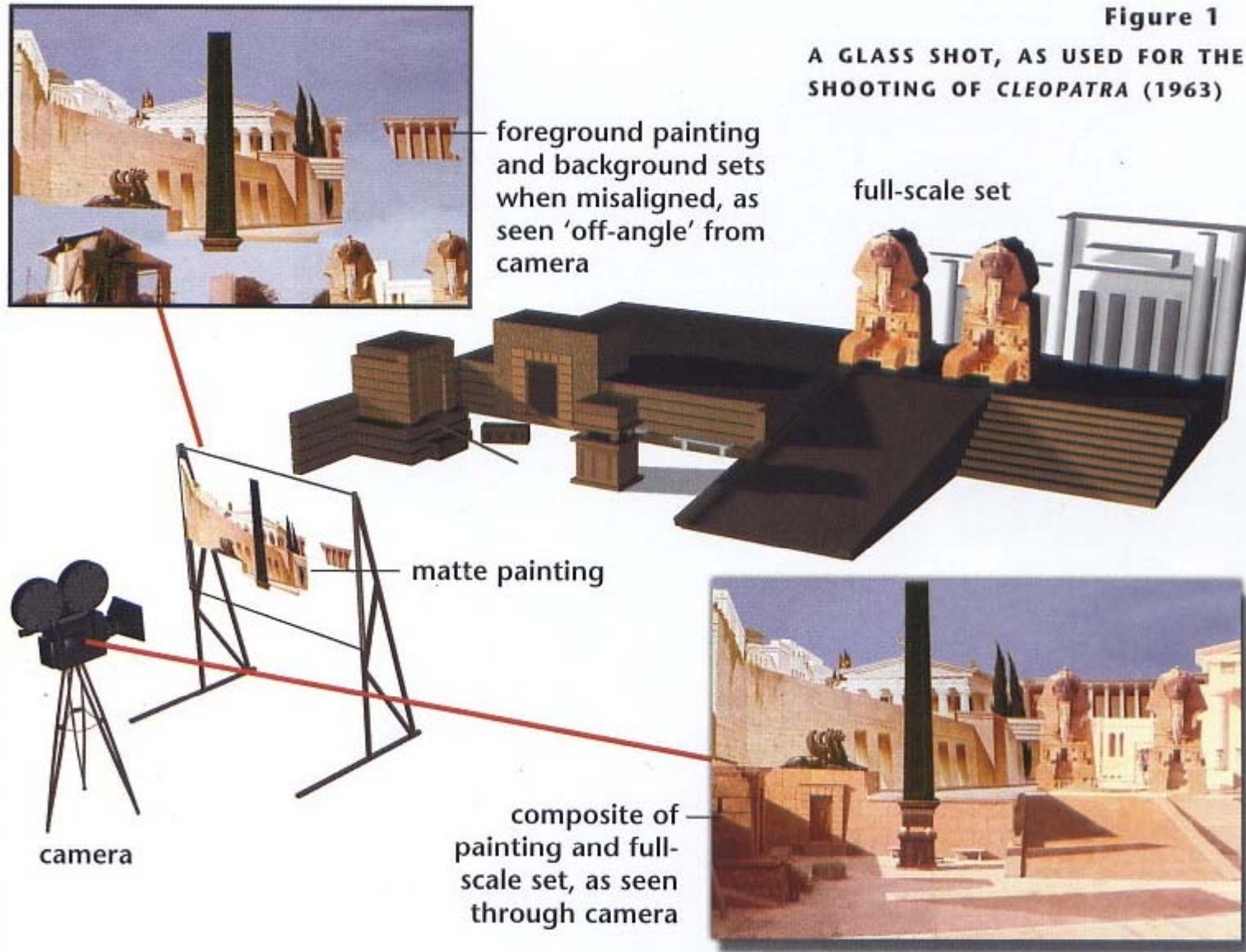
# Stop action

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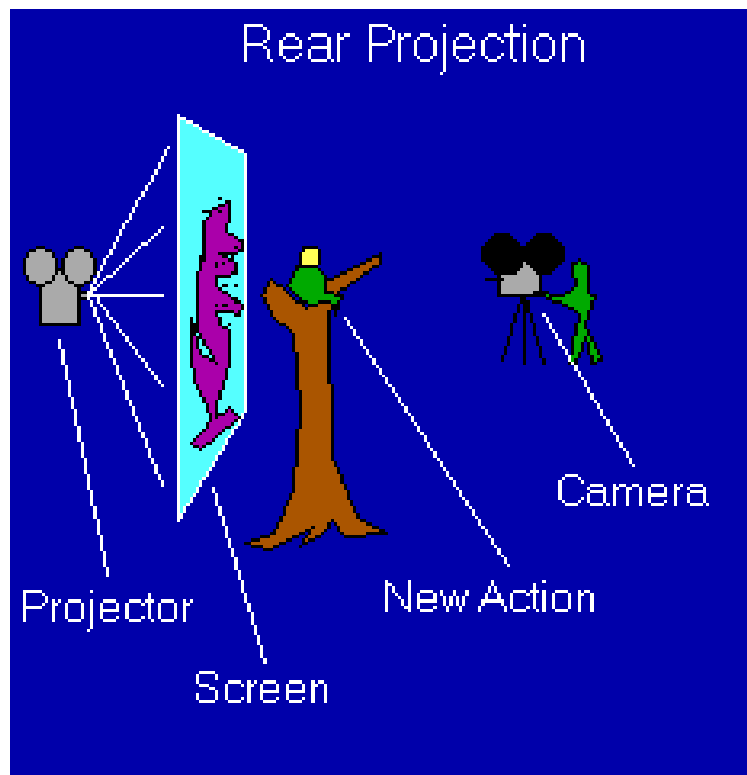
*The execution of Mary, 1895*

# Glass shot



# Rear projection

stop motion



*King Kong, 1933*



# Special effects (make-up)

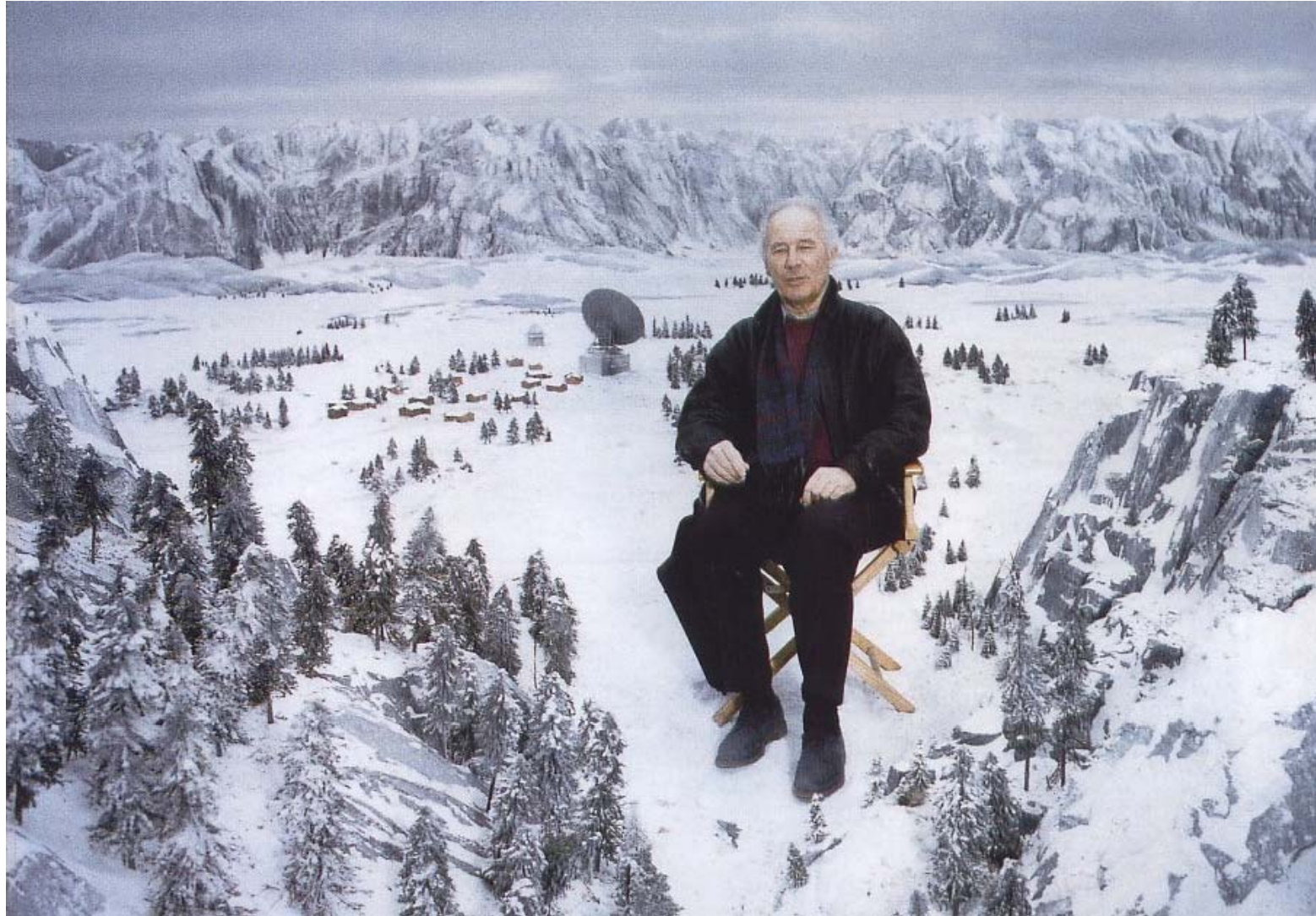
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# Special effects (physical effects)



# Special effects (miniature)



# Special effects (matte painting)



# Lord of the Rings

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# Illusion - forced perspective

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# Computer-generated model

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# Visual effects 100 Years

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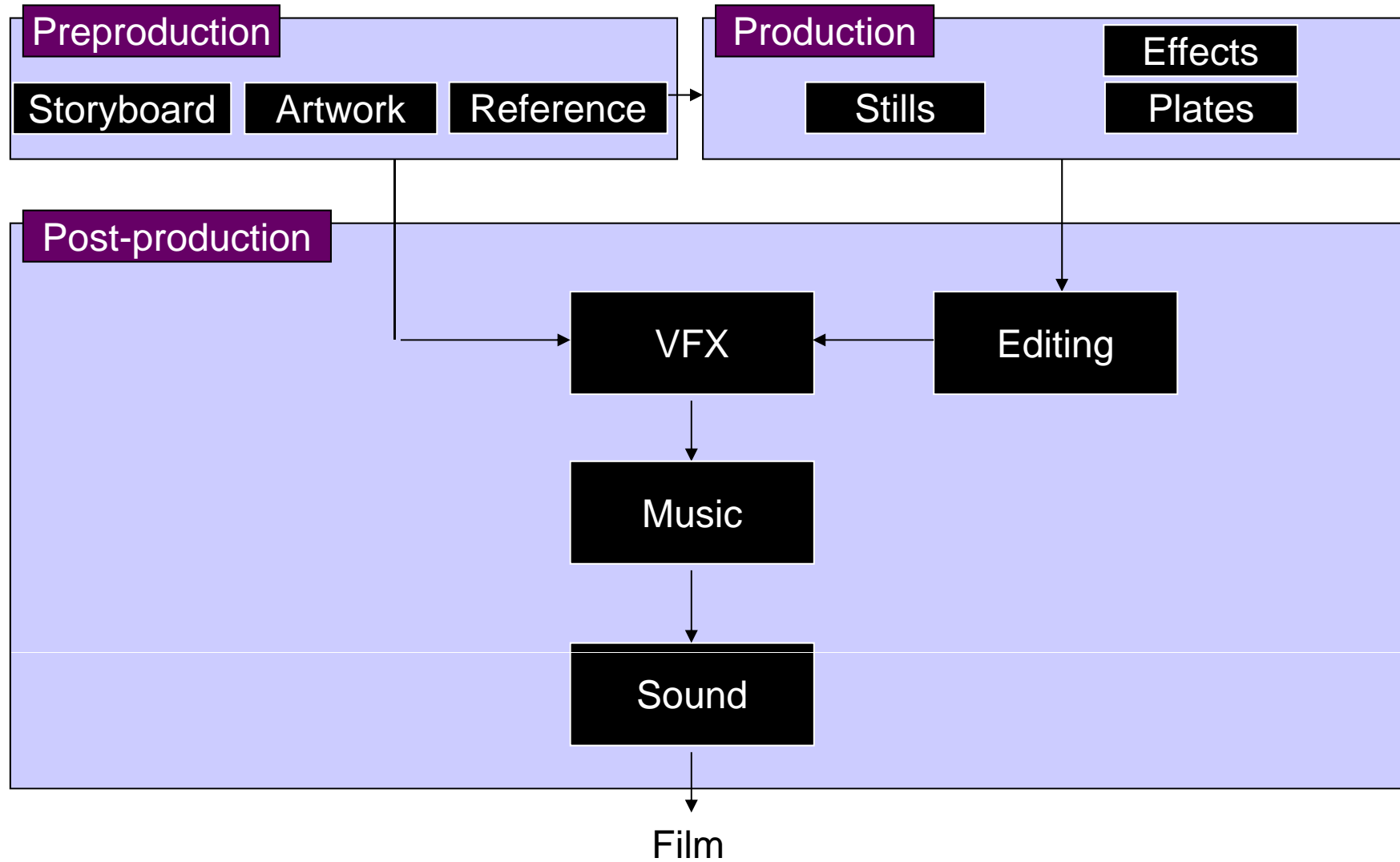


***VISUAL EFFECTS:  
100 YEARS OF INSPIRATION***



# Production pipeline

# Production pipeline



# Preproduction

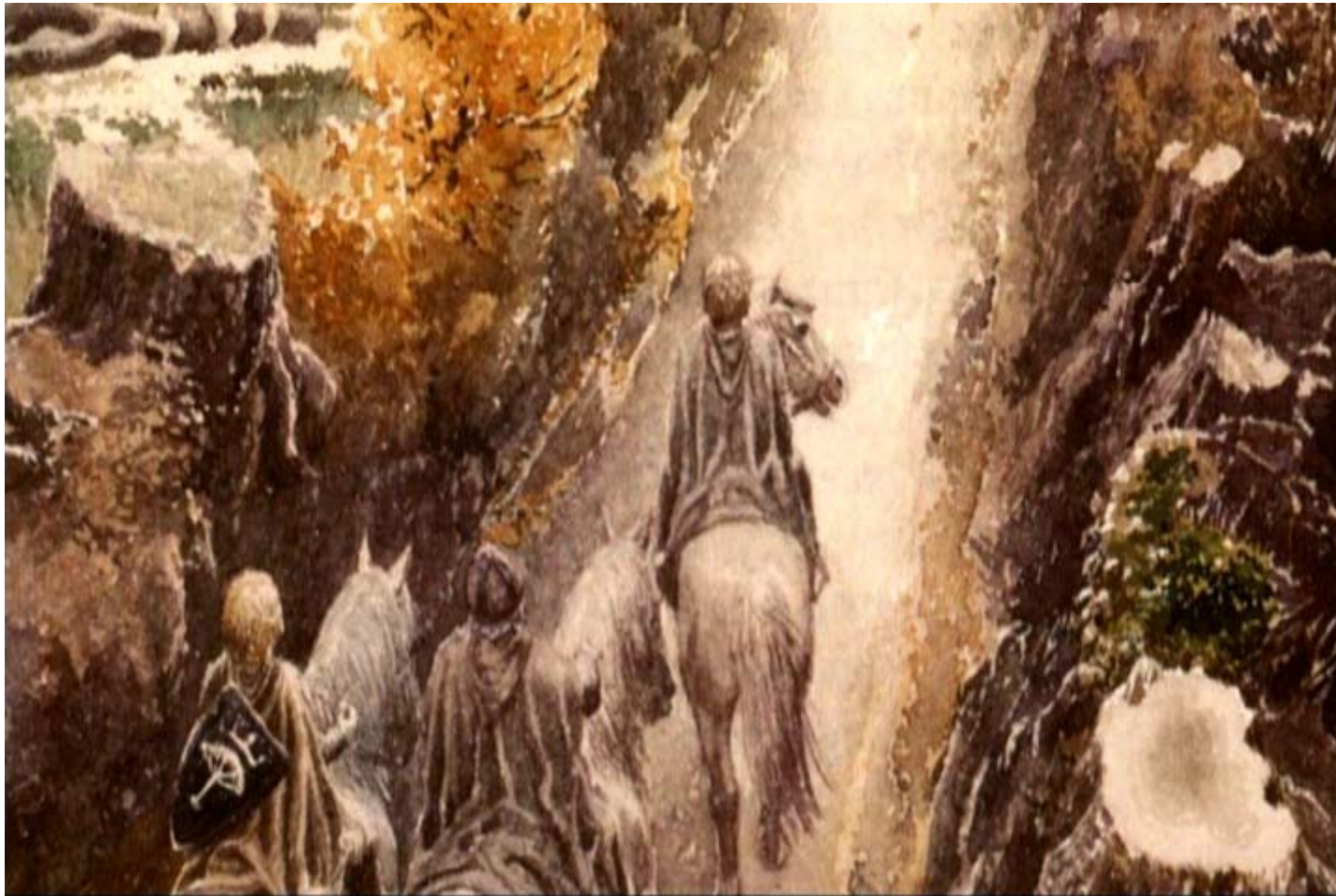
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Storyboard

# Preproduction

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Artwork

# Preproduction

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Reference & Research

# Production

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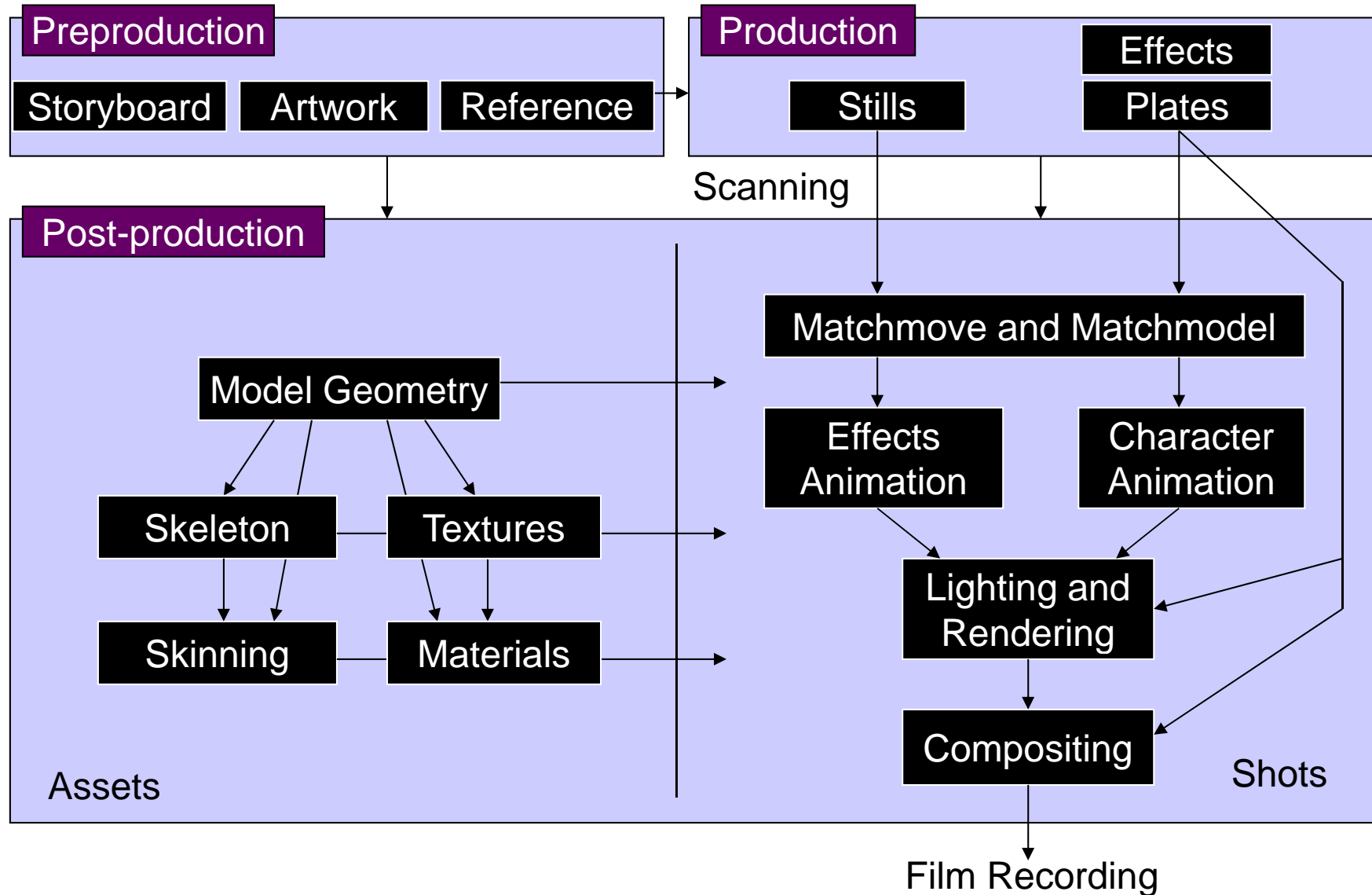
Shooting

# Post-production

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# Visual effects production





# Visual effects post-production

The interface displays a grid of visual effects stages for a mammoth scene. The stages are arranged as follows:

- PRE-VIZ**: Shows a close-up of a mammoth's legs and tusks.
- ENVIRONMENT**: Shows a landscape with a volcano in the background, highlighted with a yellow border and red arrowheads.
- LIVE ACTION**: Shows a scene with a blue and green background, featuring a mammoth and a rider.
- ANIMATION**: Shows a close-up of a mammoth's head and tusks.
- MASSIVE**: Shows a wide shot of a herd of mammoths in a landscape.
- ROUGH COMPOSITE**: Shows a scene with a blue and green background, featuring a mammoth and a rider.
- FINAL FILM**: Shows a close-up of a mammoth's legs and tusks.

Navigation and control elements include:

- PLAY ALL** and **RETURN** buttons on the left.
- COMMENTARY ON** and **OFF** buttons on the right, with a left-pointing arrowhead next to "OFF".

# **A case study**

# 405: The Movie

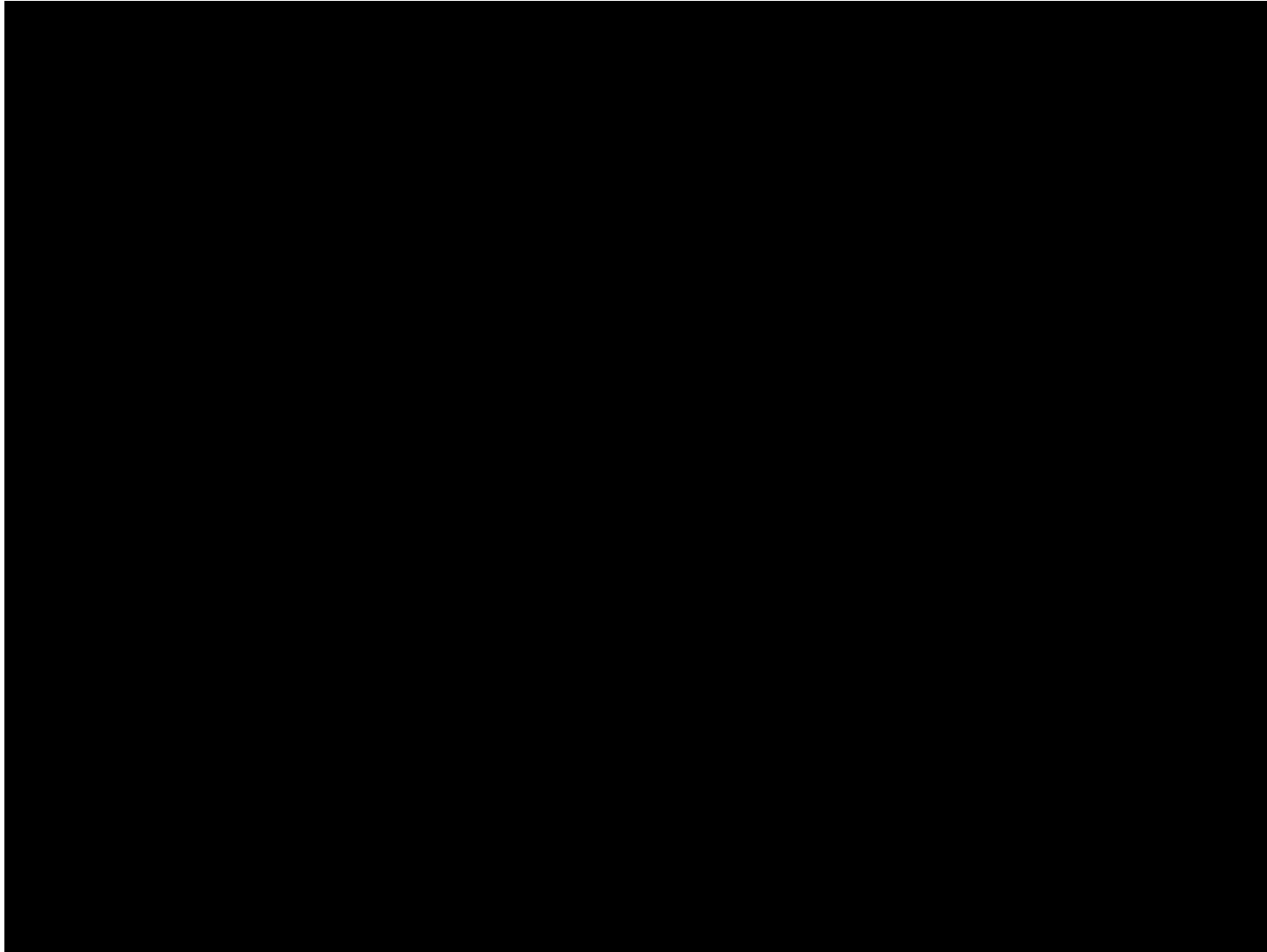
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- This movie were created solely by two visual effects artists in the year of 2000. It was a process that took over three months of nights, weekends and any spare moments that they could find.
- <http://www.405themovie.com/>



# 405: The Movie

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# Making of 405

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## 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

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

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## 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

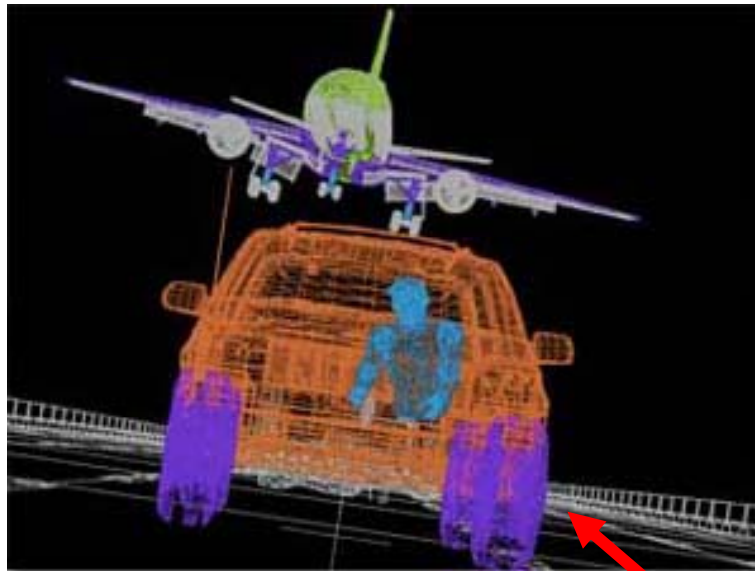


photo-based 3D environment

# Making of 405

Real cars were used for close-up and interior shots



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

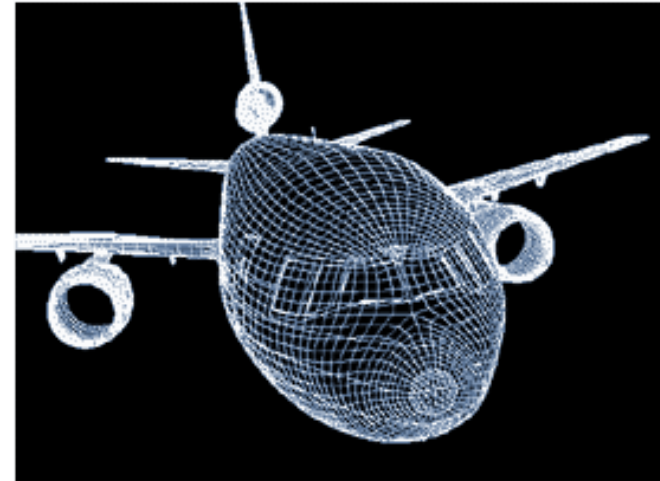




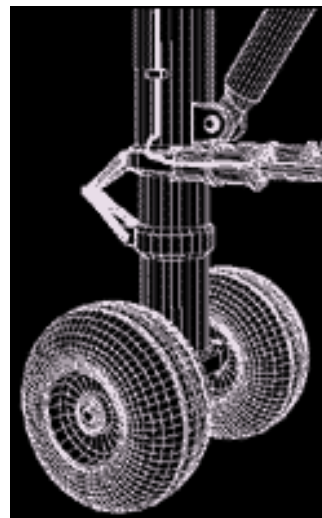
# Making of 405

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

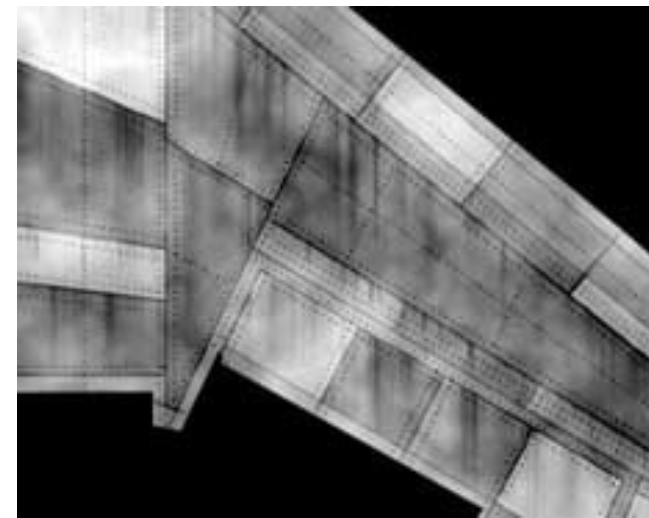
59 objects, 142,439 polygons



reference



modeling



material painting

# Making of 405

Step 3: traffic clearing

clean plate



close-up shots



inpainting

# Making of 405

## Step 4: compositing



shot with the vehicle standing still in a backyard



# Making of 405



# Making of 405

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## Step 5: fine touchup



3D hat



compositing and inpainting

# Making of 405

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## Step 6: music and delivery



# Bloody Omaha



**Topics we plan to cover**



# Camera

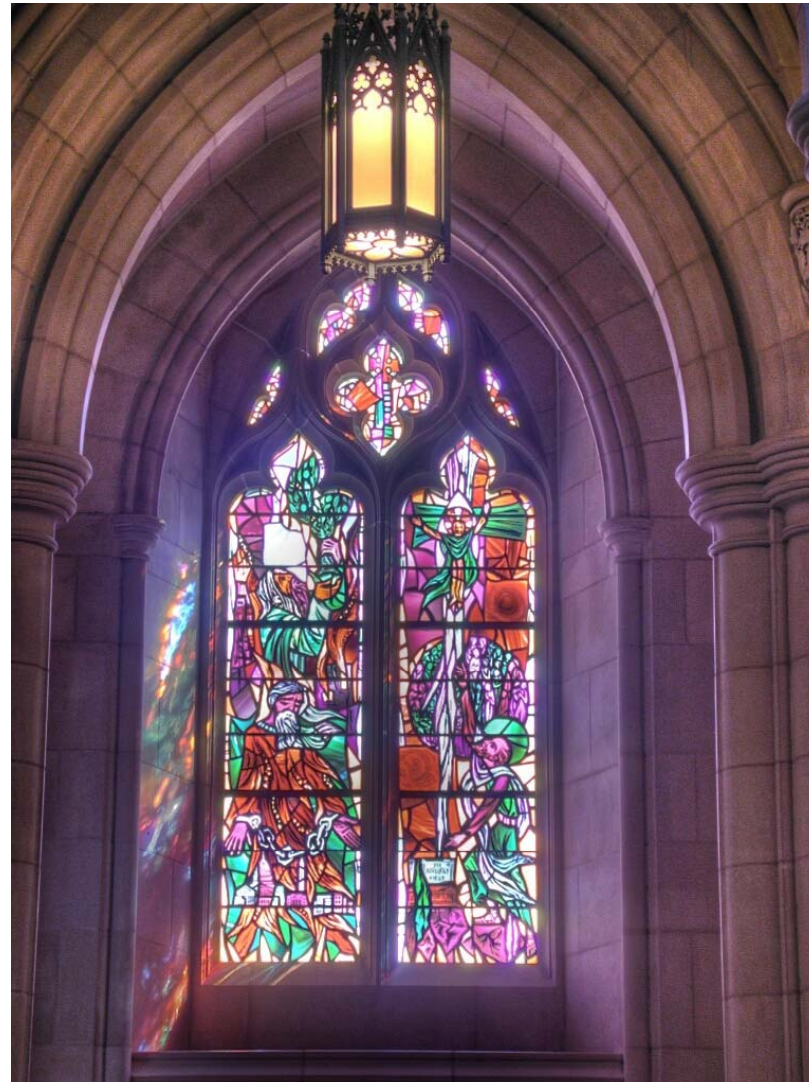
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Canon 10D

# High dynamic range imaging/display

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# Image warping/morphing

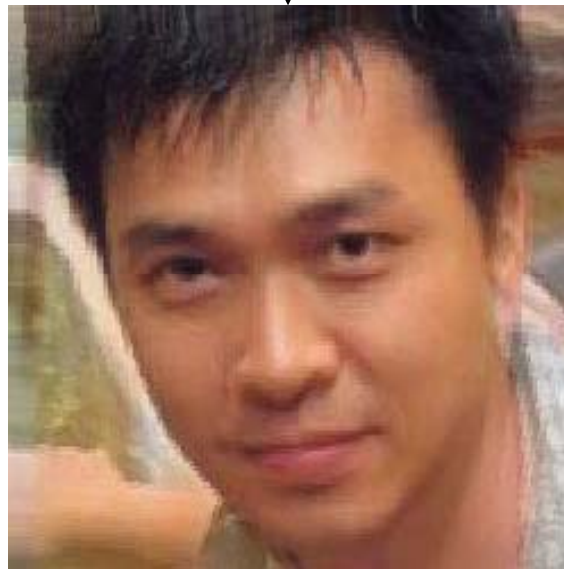
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someone not  
that famous



someone very  
famous



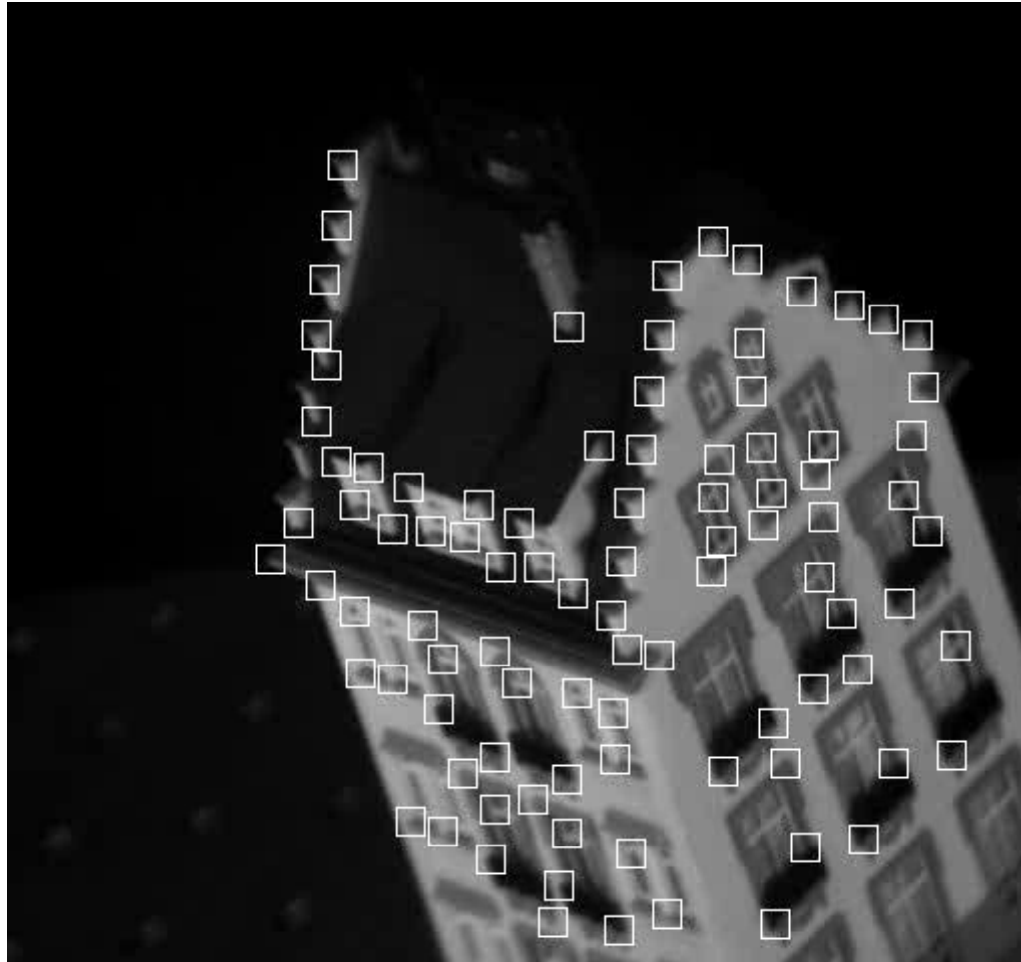
[video](#)

# Image warping/morphing



# Tracking

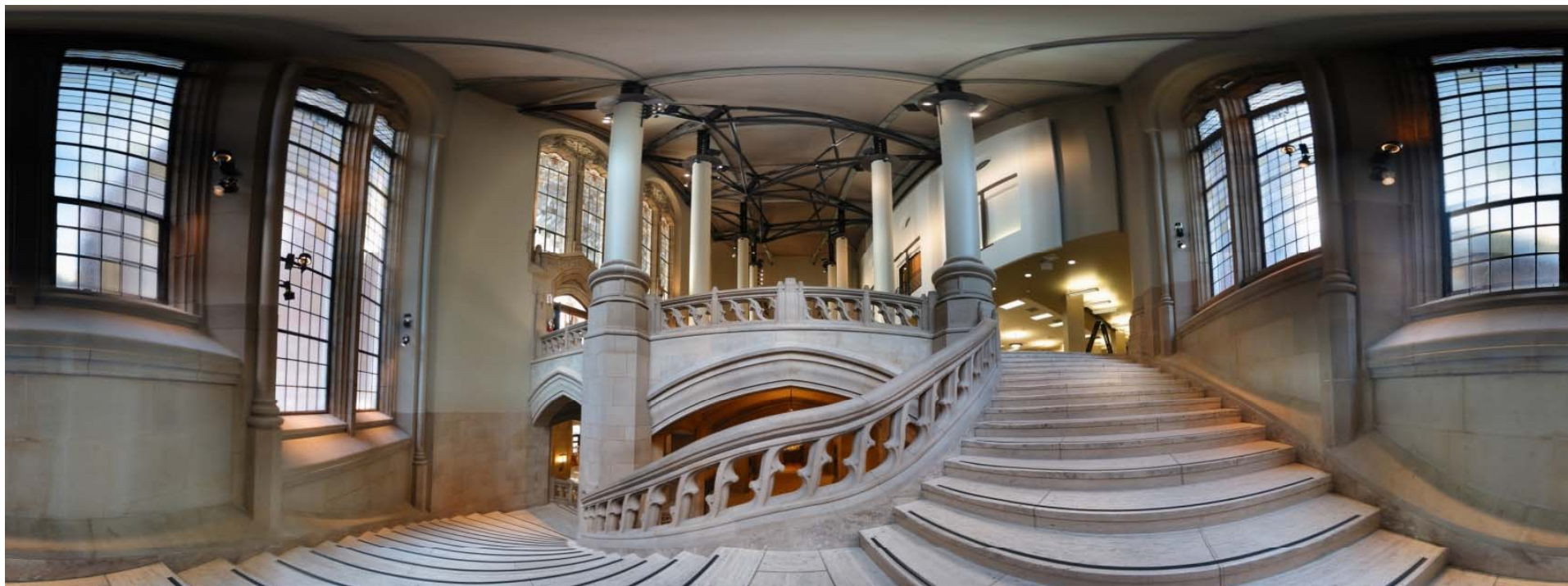
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Feature tracking

# Image stitching

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# MatchMove



*Move matching using scene planes*

# Matchmove



*Move matching using scene planes*



# Matchmove



*Move matching using scene planes*

# Photo tourism



## Photo Tourism

Exploring photo collections in 3D



(a)



(b)



(c)

# Video matching

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*Matrix*



*MOCO (Motion control camera)*

# Video matching



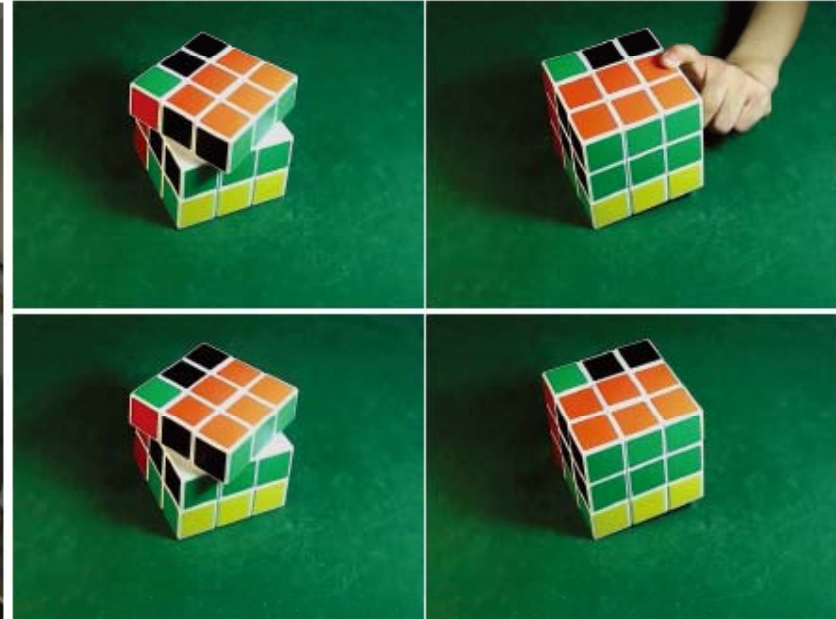
*Video matching*

# Stop motion



# Stop motion

---



# Matting and compositing



*Titanic*

# Matting

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# Object selection



*LazySnapping*

# Image-based modeling

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*photogrammetric modeling and projective texture-mapping*

# Image-based modeling



*photogrammetric modeling and projective texture-mapping*

# Image-based modeling

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*photogrammetric modeling and projective texture-mapping*

# Image-based modeling

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*Tour into a picture*

# Image-based modeling

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*Tour into a picture*

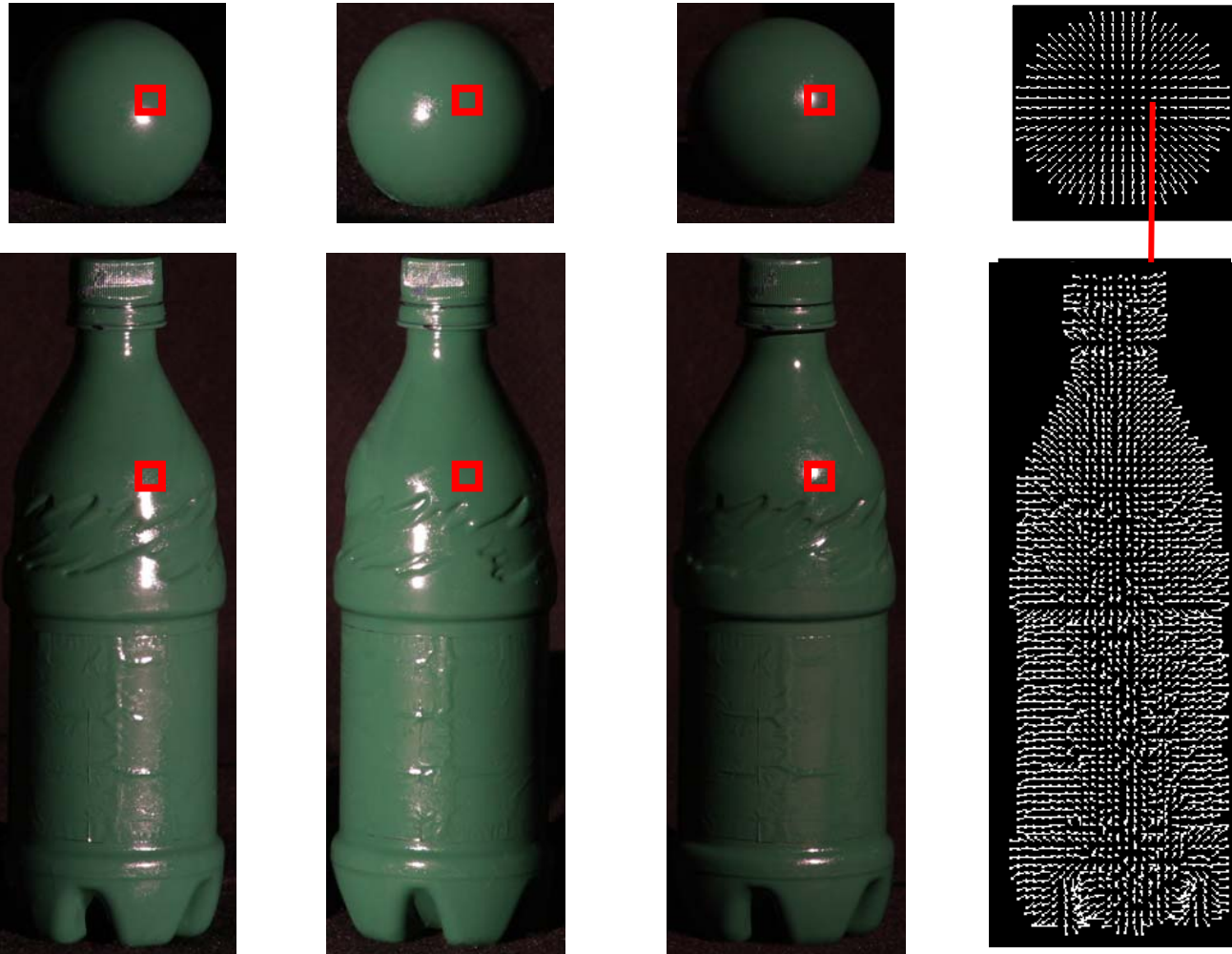
# 3D photography (active)

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*Cyberware whole body scanner*

# 3D photography (active)



*Photometric stereo*



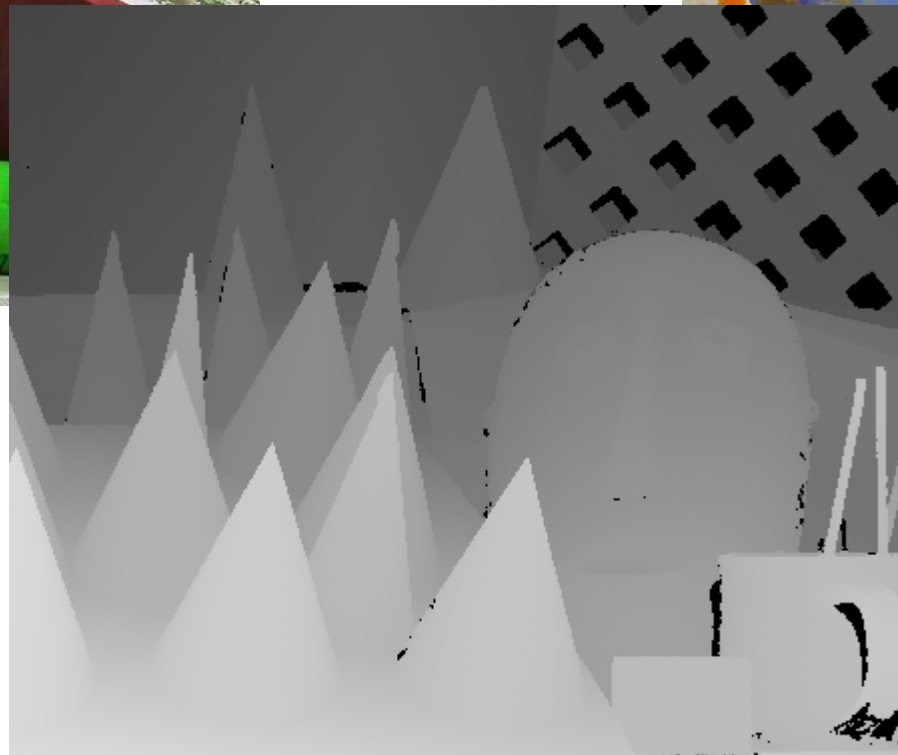
# 3D photography (passive)



*left*



*right*

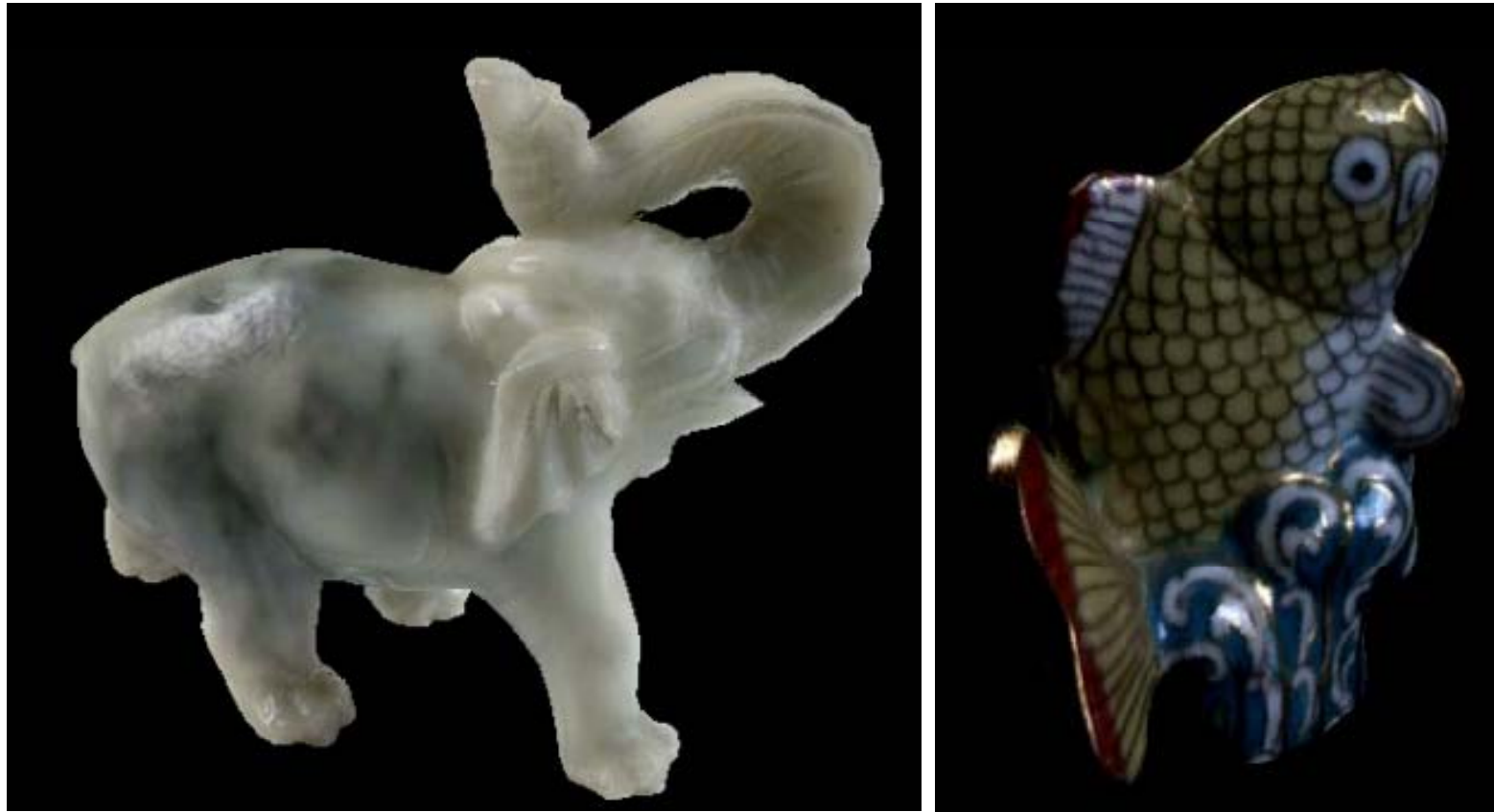


*depth*

*Stereo*

# Image-based rendering

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*Surface lightfield*

# View interpolation

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Bullet time video

# View interpolation

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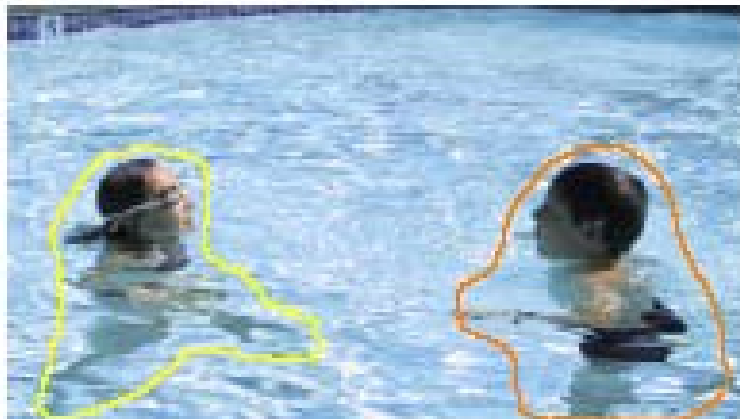
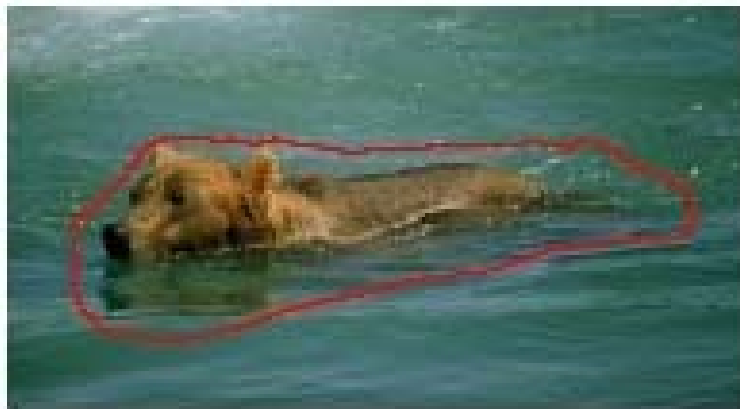
High-Quality Video View Interpolation

# Image manipulation



*GraphCut Texture*

# Image manipulation

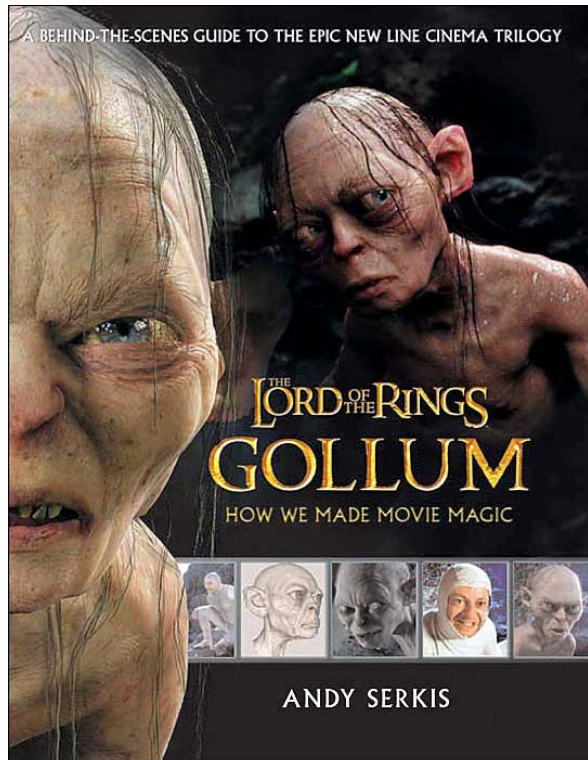


*Poisson blending*

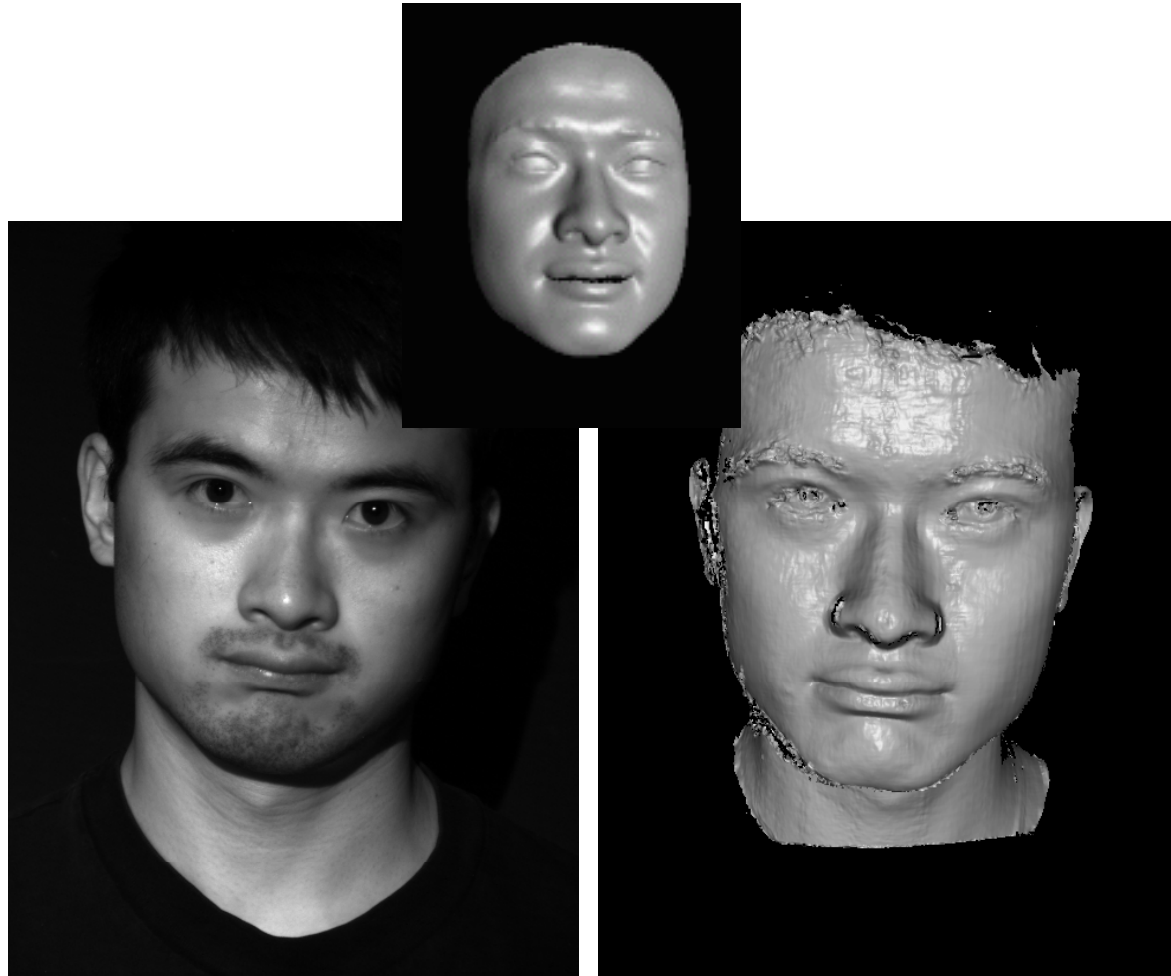
# Stereoscopic films



# Making face



*Gollum*



*Spacetime face*



# Virtual human



# Video rewrite

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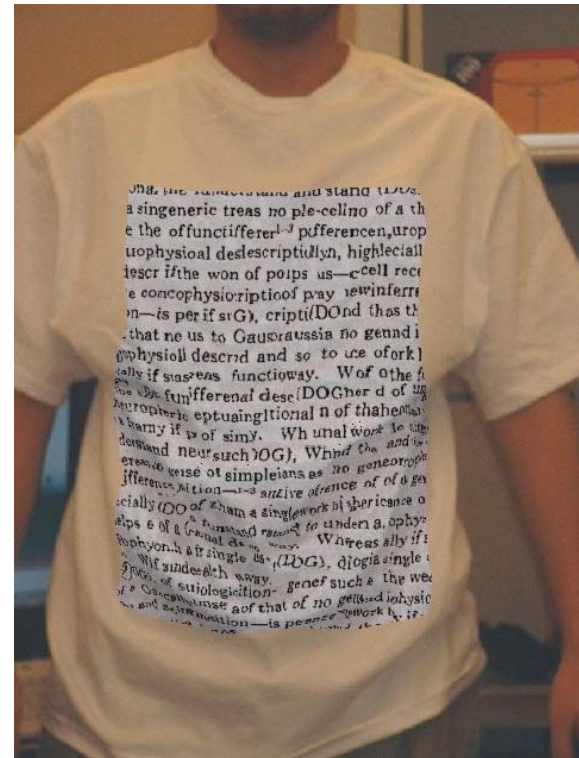
Trainable videorealistic speech animation

# Inpainting (wire removal)



*Inpainting*

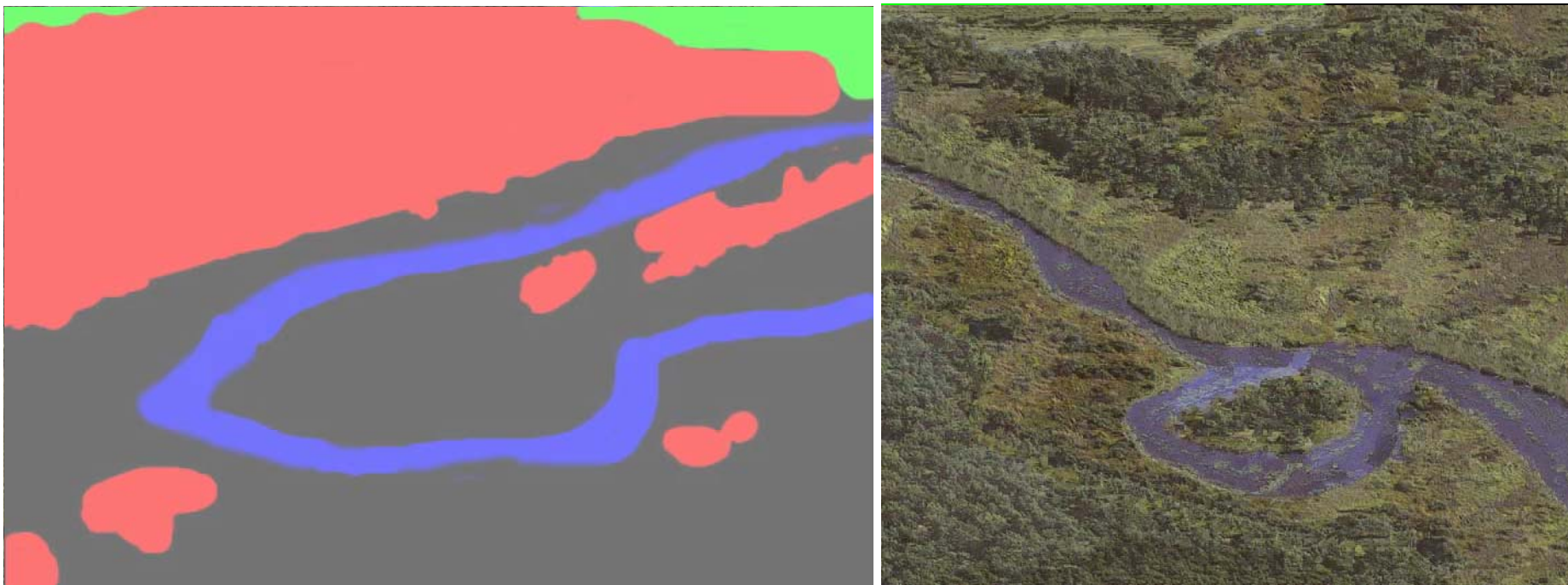
# Texture synthesis/replacement



*Texture replacement*

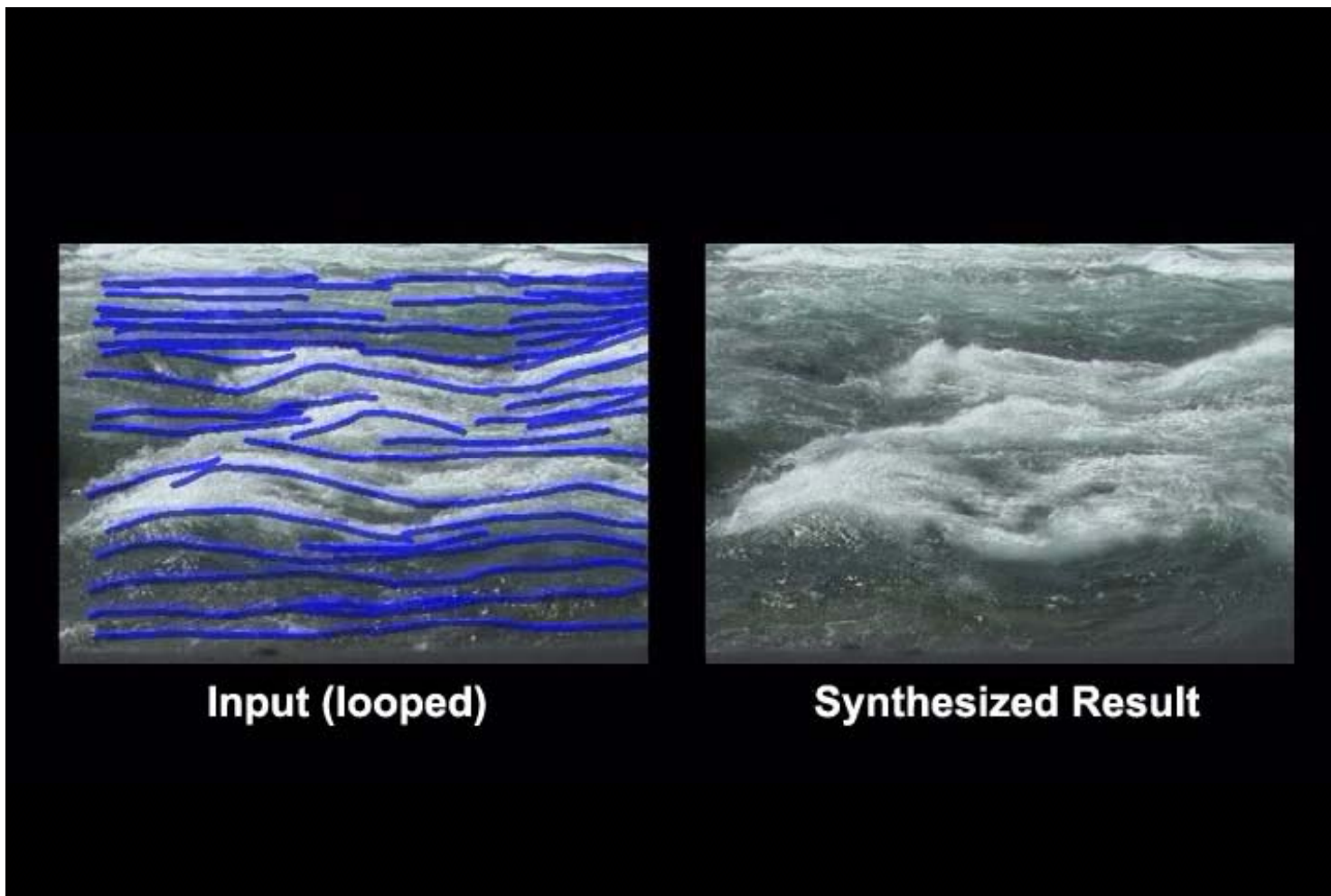
# Semi-automatic matte painting

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*Image analogies*

# Video editing



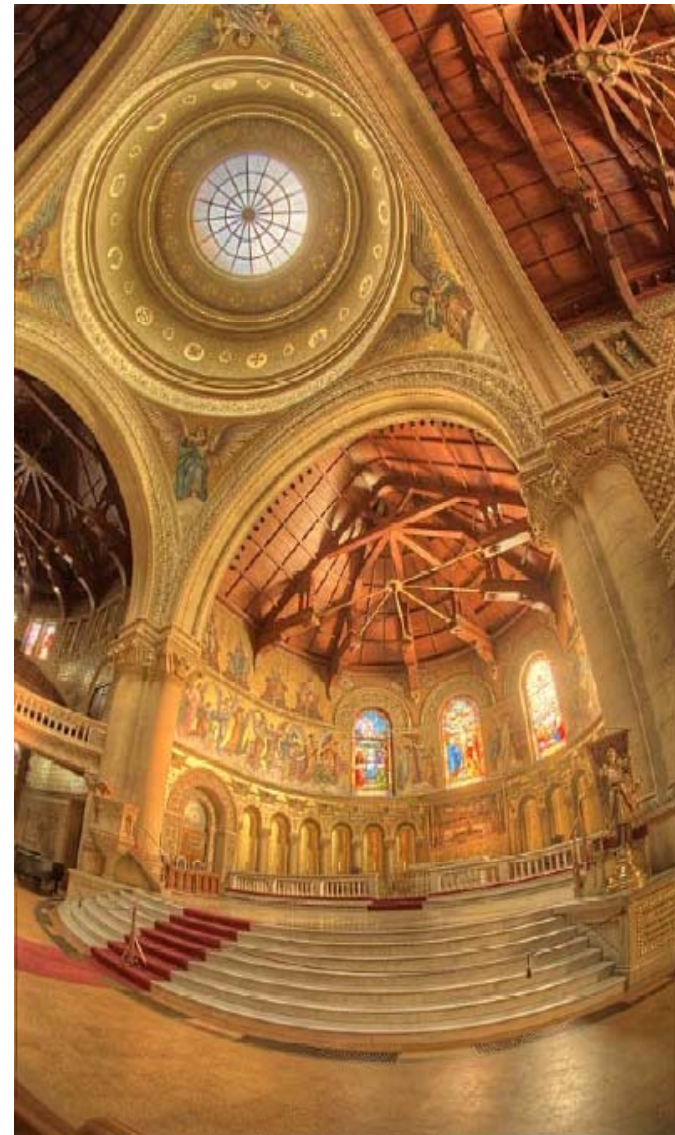
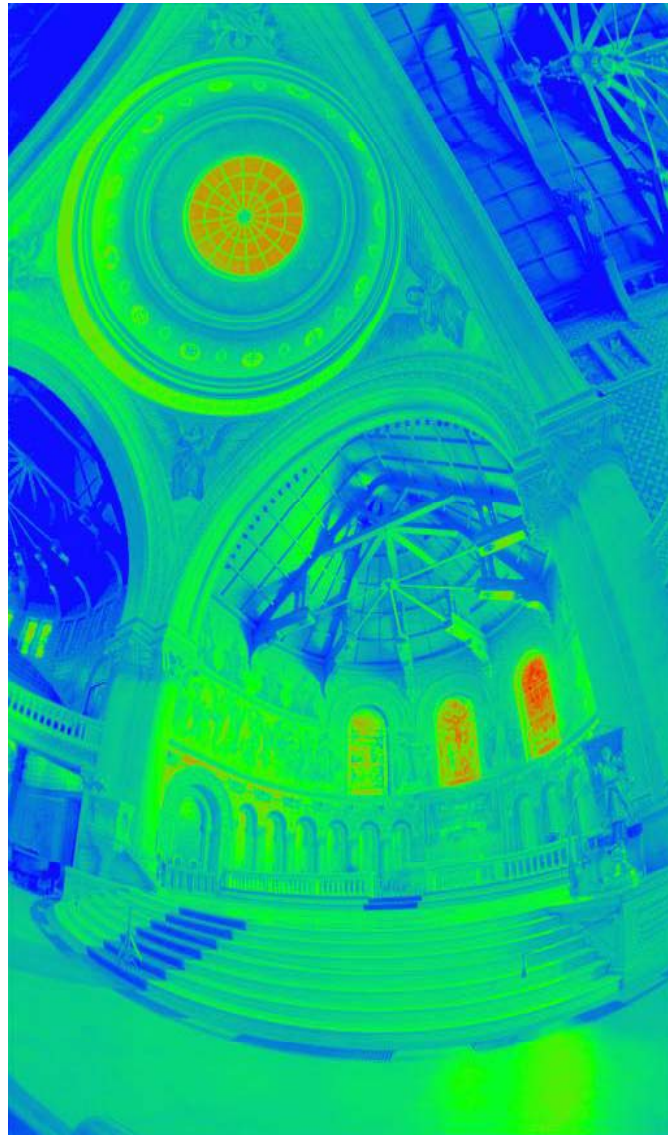
*Flow-based video editing*

# Grading (subject to change)

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- 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)

DigiVFX

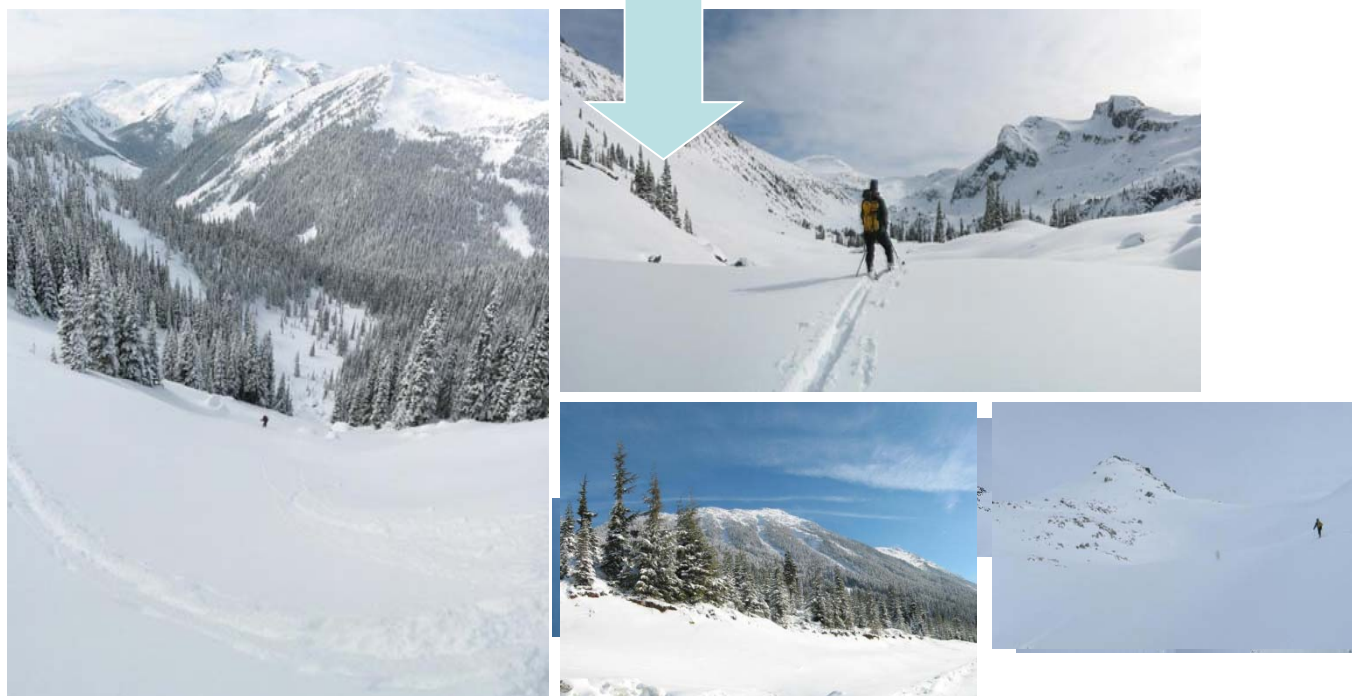
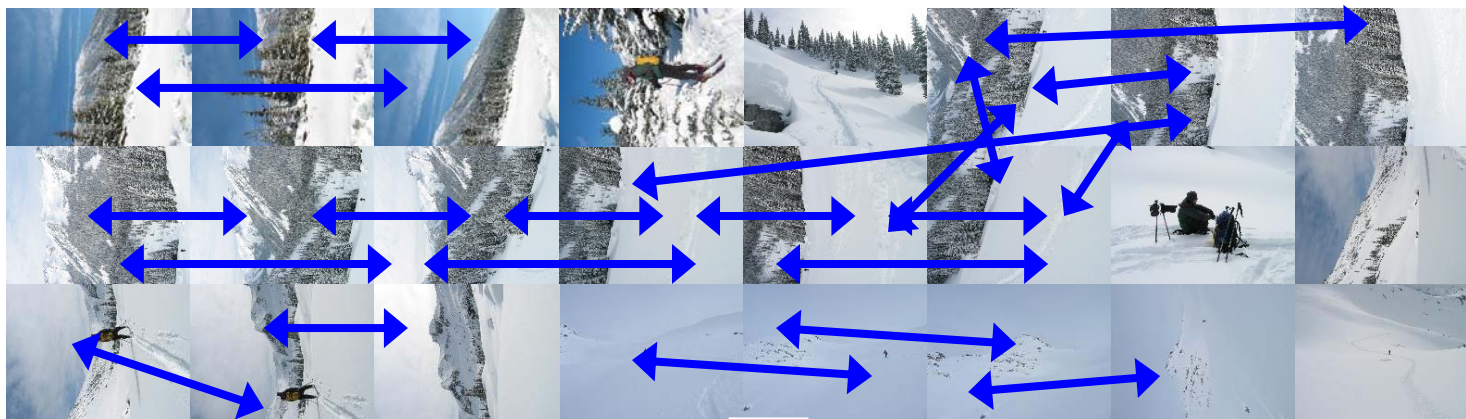


# From past semesters (王瑋馥, 余雁雲)

DigiVFX



# AutoStitch



# AutoStitch

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羅聖傑



連奕婷 張宇蓓

# MathMove



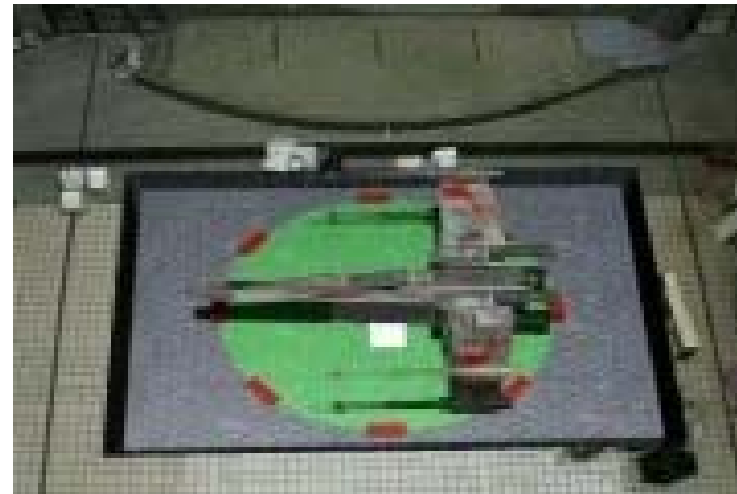
梁家愷 鐘志遠



姜任遠 林立峯



楊宗碩 林柏劭

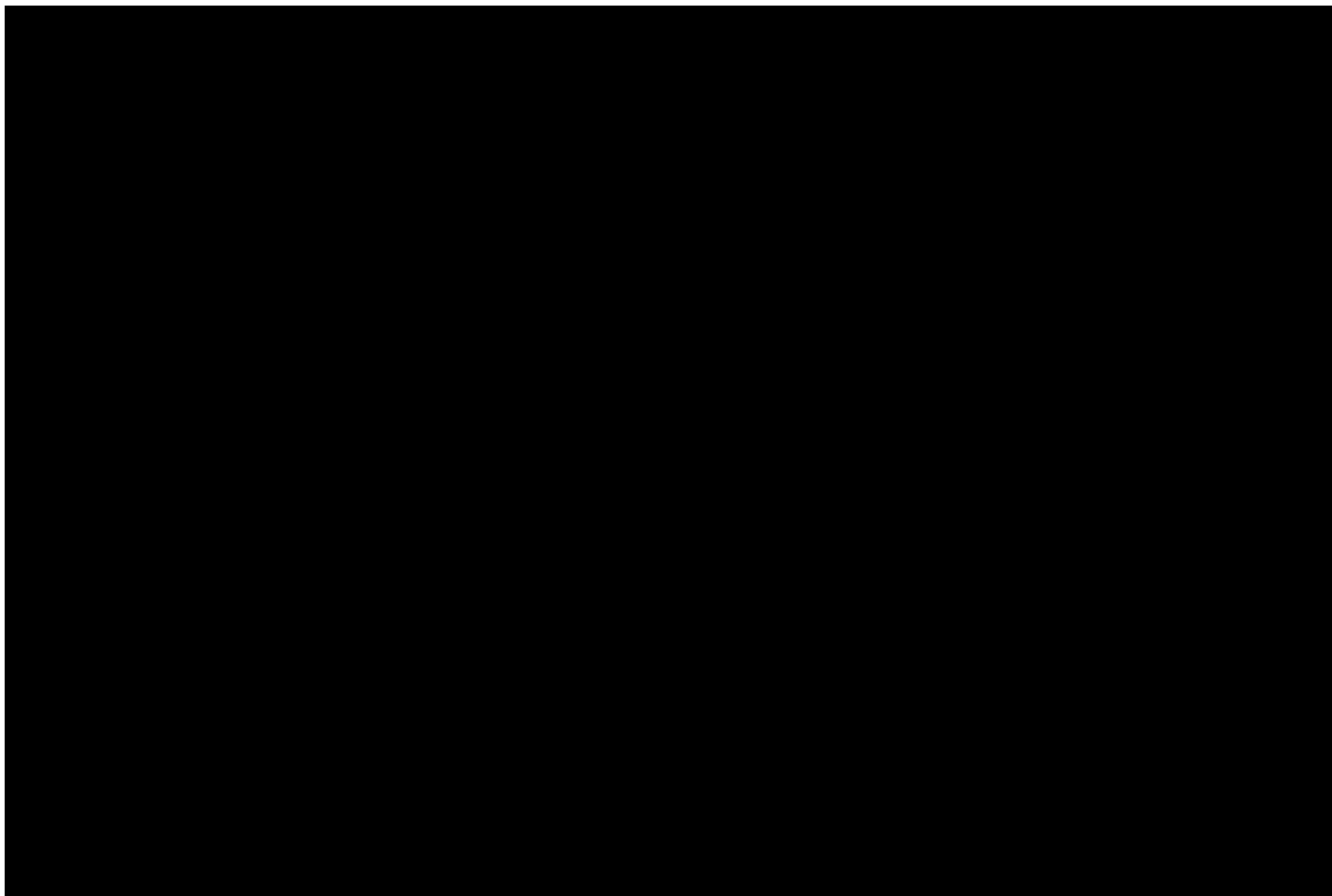


翁憲政 洪韶憶

**Final projects from a similar course  
in Georgia Tech.**

# Life in Paints

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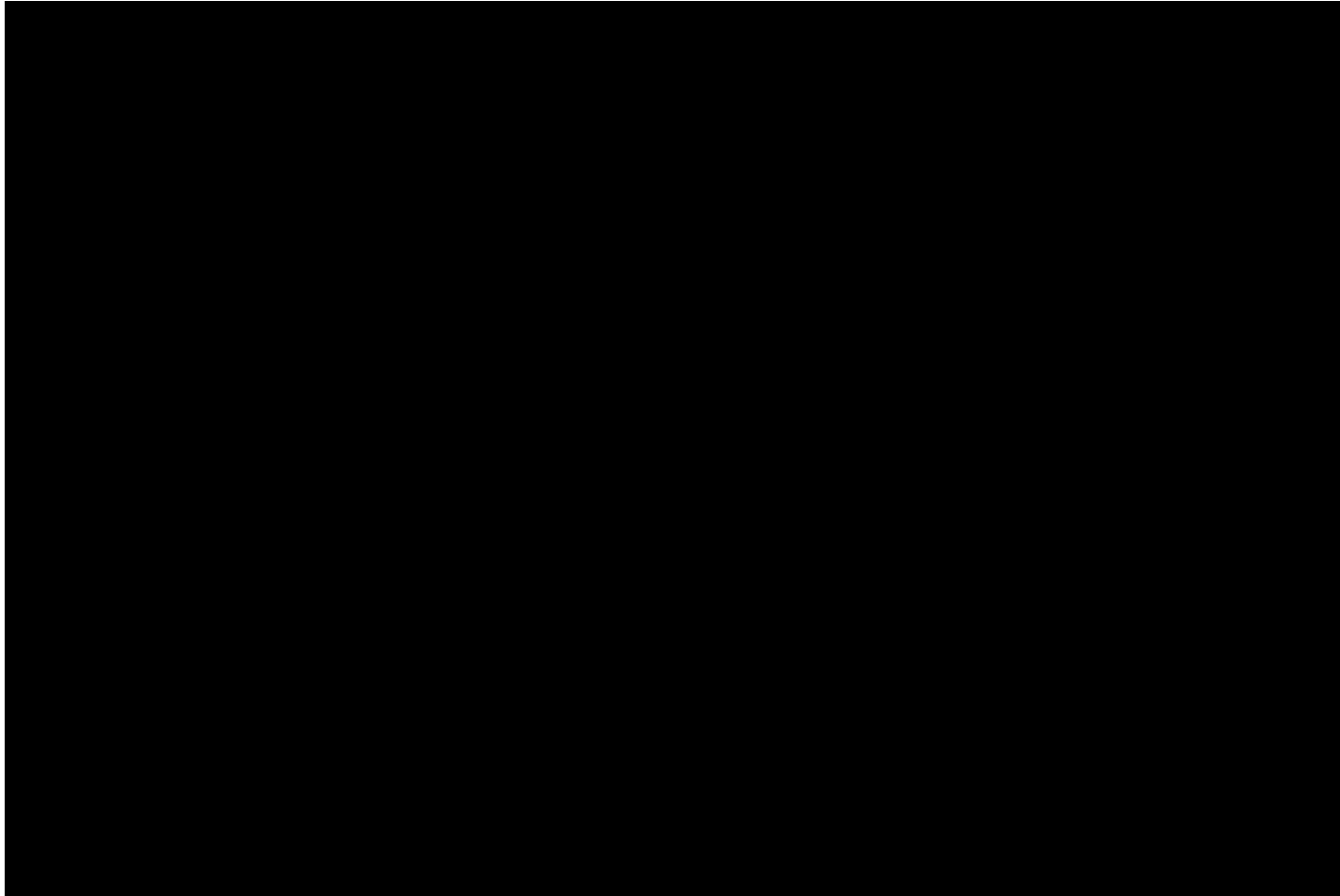


*Life in Paints*, GaTech DVFX 2003



# Tour into pictures

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Making of *Life in Paints*

# In Your Face

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*In Your Face*, GaTech DVFX 2002

# Stop action

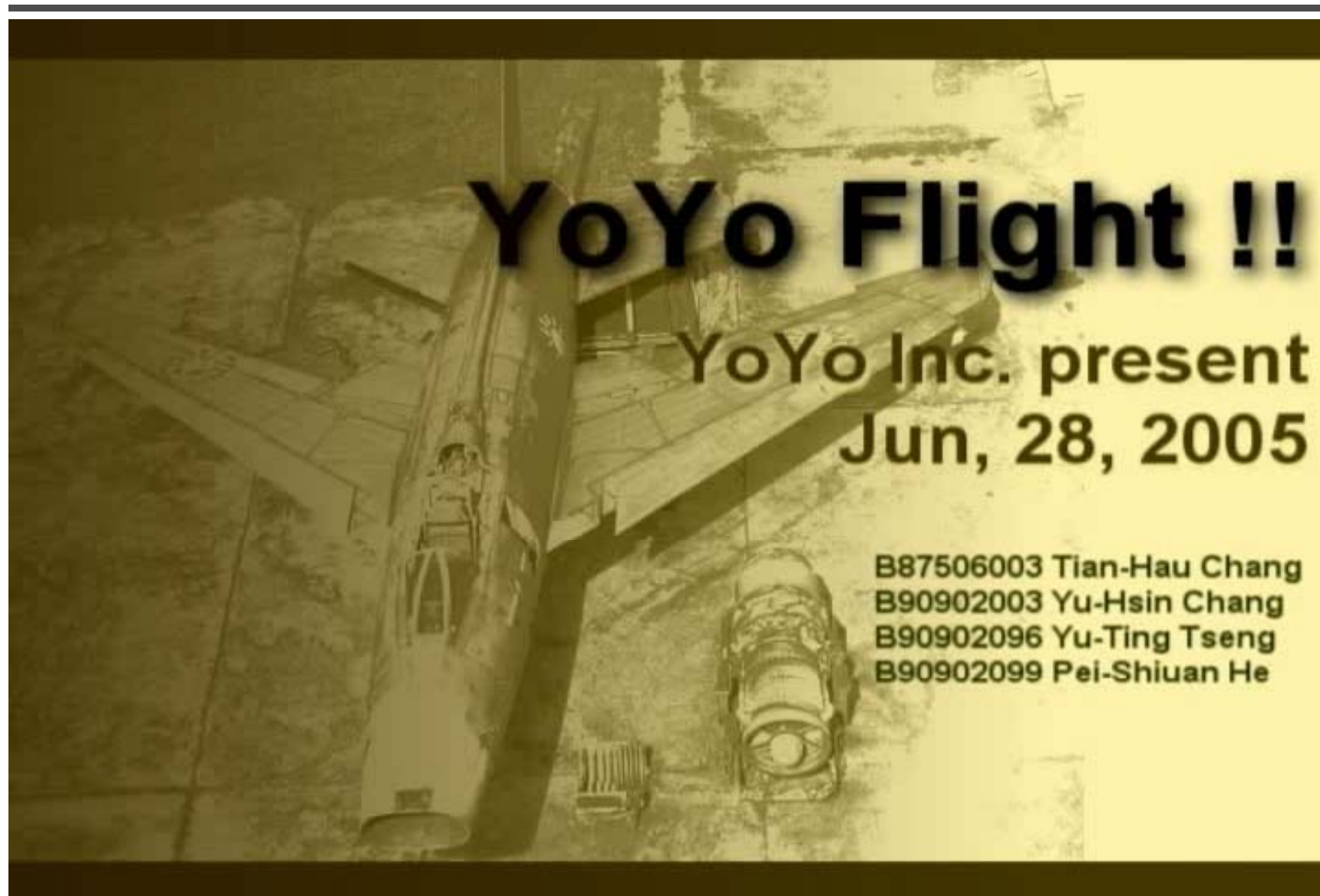
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The Making Of  
In Your Face

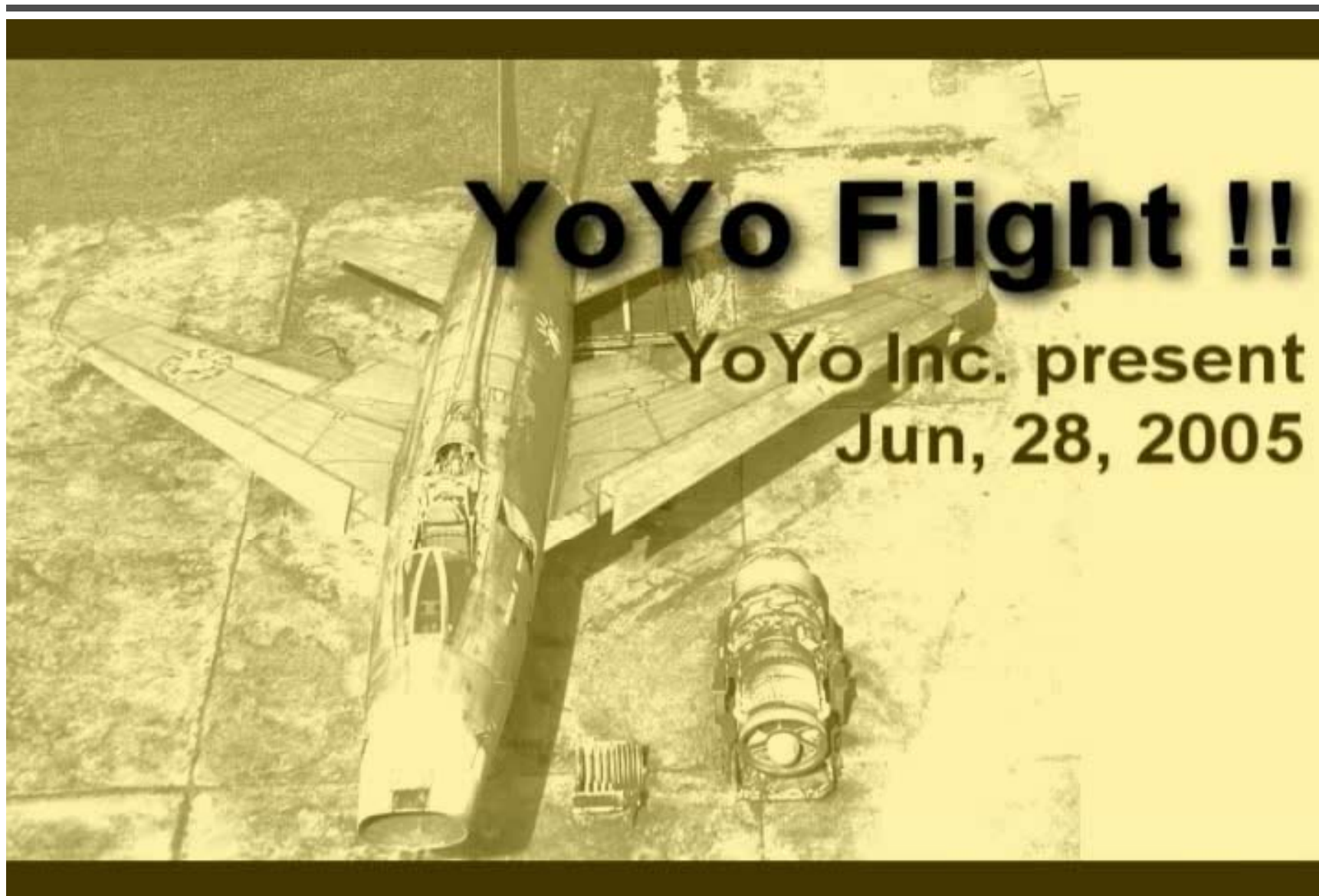
Making of *In Your Face*

**Final projects from the past.**

# YoYo Flight



# Making of YoYo Flight



# That's it for today!

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- Don't forget to subscribe the mailing list.
- Check out the course website.