Course overview

Digital Visual Effects

Yung-Yu Chuang

Logistics

DigiVFX

- **Meeting time:** 2:20pm-5:20pm, Wednesday
- **Classroom:** CSIE Room 104
- **Instructor:** Yung-Yu Chuang (cyy@csie.ntu.edu.tw)
- **Teaching assistants:**
- **Textbook:** Readings from books, journals and proceedings. Richard Szeliski's Computer Vision: Algorithms and Applications. Richard Radke's Computer Vision for Visual Effects.
- **Webpage:** http://www.csie.ntu.edu.tw/~cyy/vfx

This course is NOT about …

It isn’t about photography

DigiVFX

It isn’t about 3D animations

It isn’t about watching movies

DigiVFX

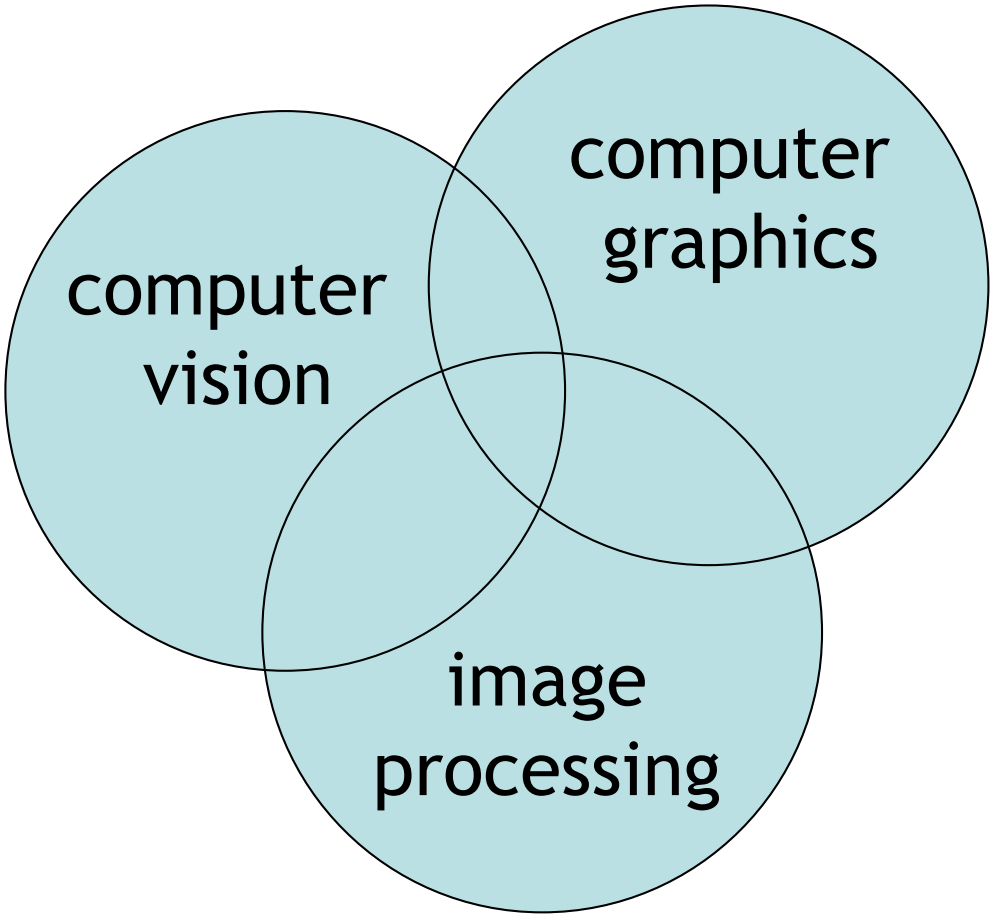
It isn’t about physical effects

DigiVFX

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

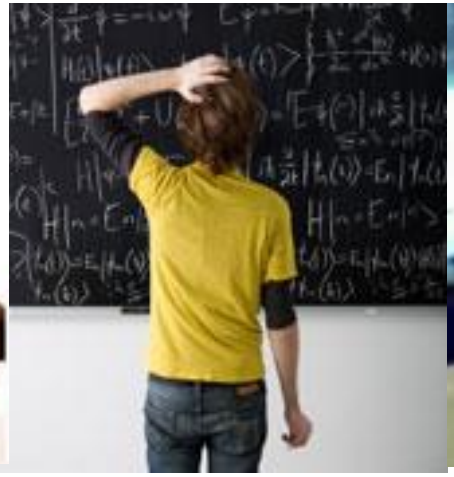
- It is a ***must*** that you have programming experiences.
- It is a ***must*** that you have basic knowledge on linear algebra and probability.
- It is a *plus* if you have background knowledge on computer vision, image processing and computer graphics.
- It is a *plus* if you have access to digital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

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

Be cautious!

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Warning from previous students

DigiVFX

- 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的同學勿修，否則就會像我一樣停修 XD

This course is about …

Digital Visual Effects

DigiVFX

Digital Visual Effects

DigiVFX

Deadpool

DigiVFX

Deadpool

Life of Pi

Life of Pi

DigiVFX

獨自一人拍和十三人的戲

要把身材高大的甘道夫和小矮人們拍攝在一起，我們是沒法在同一個片場的。和我一起拍攝的只有柱子上貼著的13張他們的照片，後面還有一個小燈，哪個角色說話了燈就亮起來。想像一下你在拍一場和13個人一起演的戲，但你卻只有獨自一人。這真的會把你的演技推到極限。我哭了，真的，我當時真的哭了。然後我還說出了聲：我認真演了一輩子不是為了跟這些照片對戲啊！

VFX of the Hobbit

Reality?

DigiVFX

Retouching

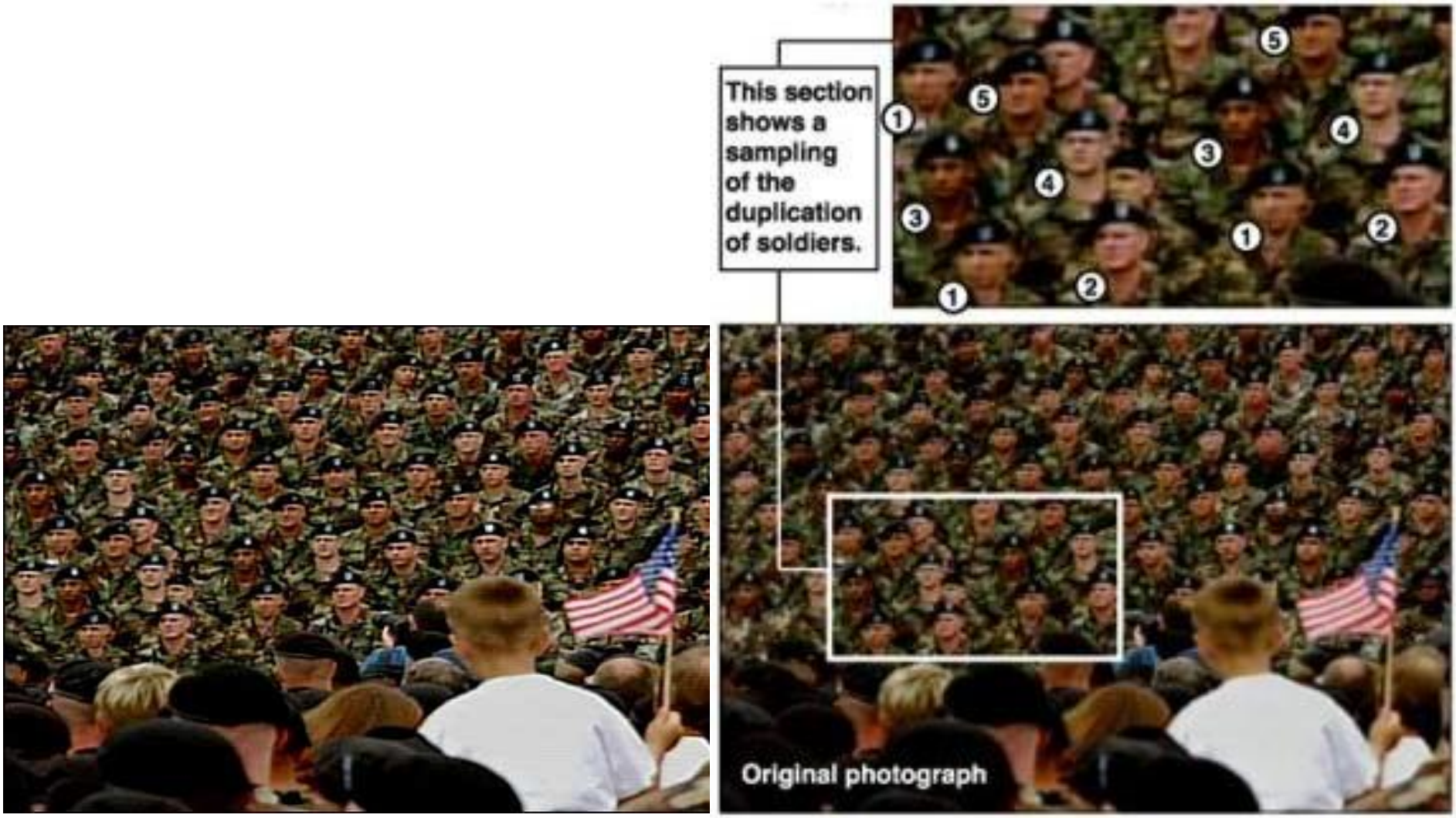
Retouching

Retouching

DigiVFX

Bush campaign's TV AD, 2004

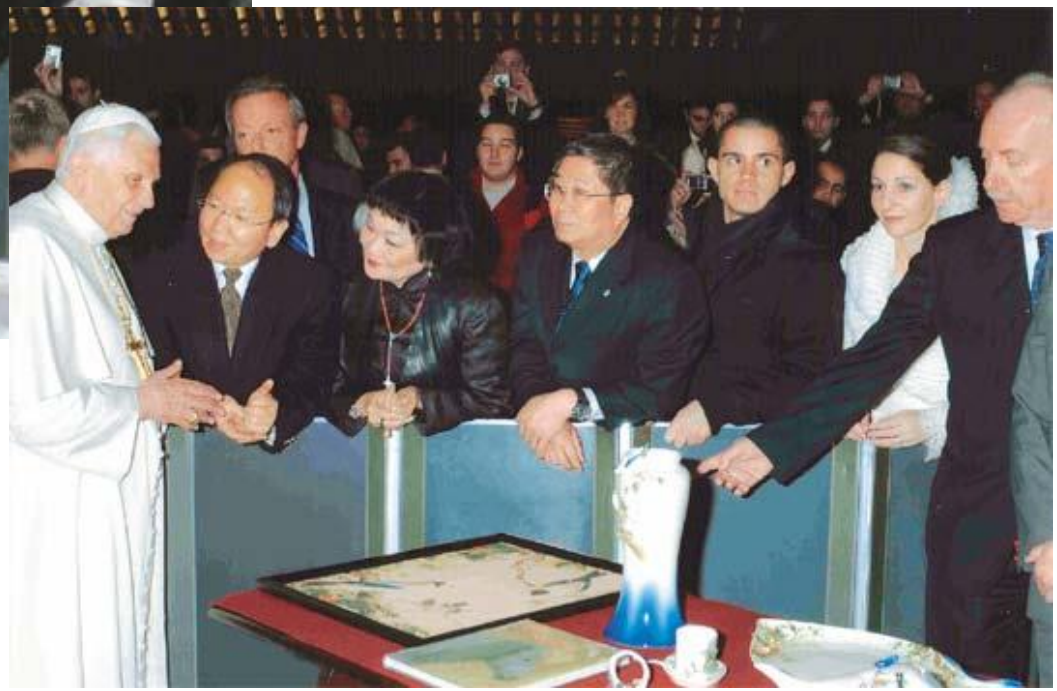
Texture synthesis and inpainting



Iraq War, LA Times, April 2003

Domestic example

The Liberty Times
2007.12.17



Special effects

Stop action

The execution of Mary, 1895

Glass shot

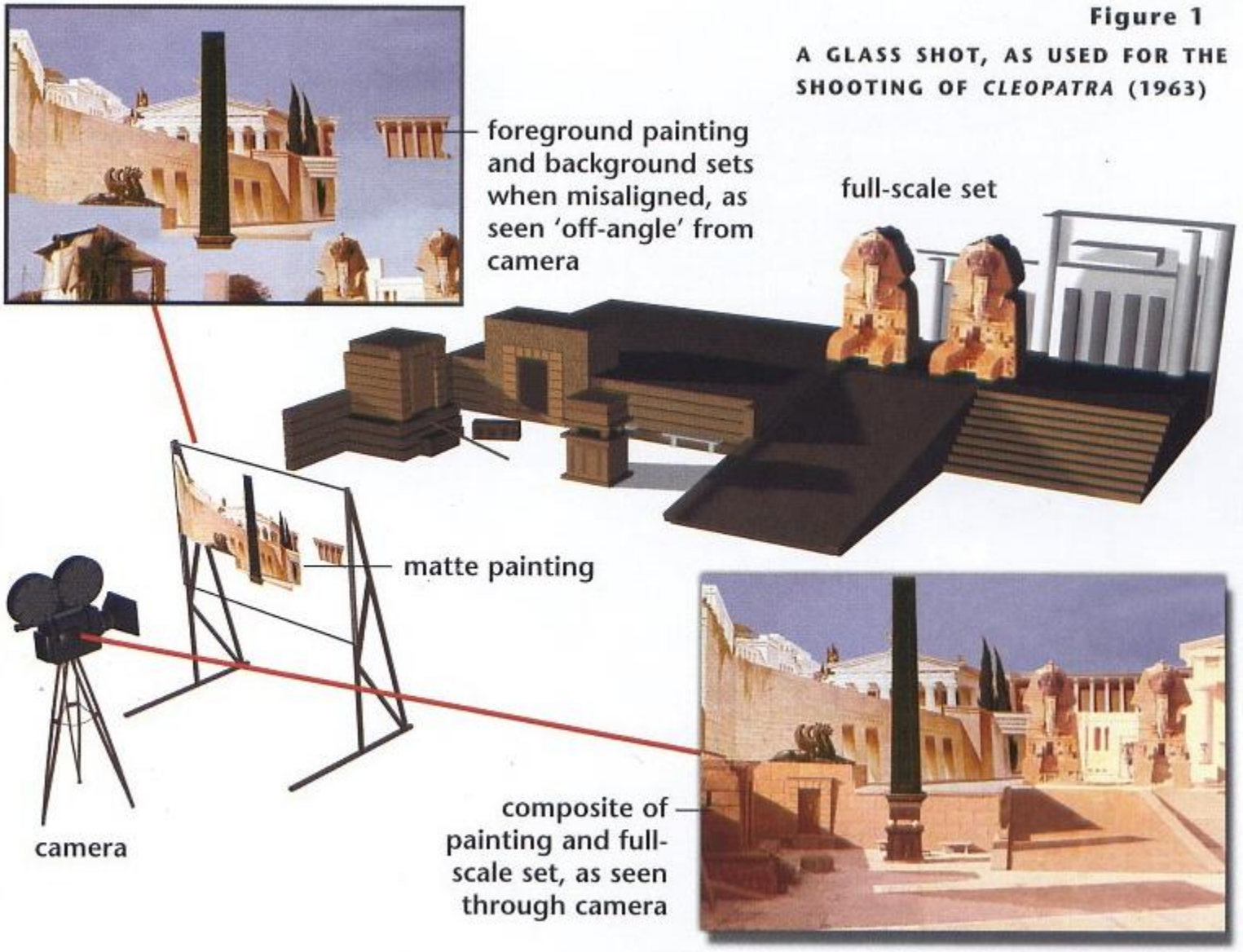
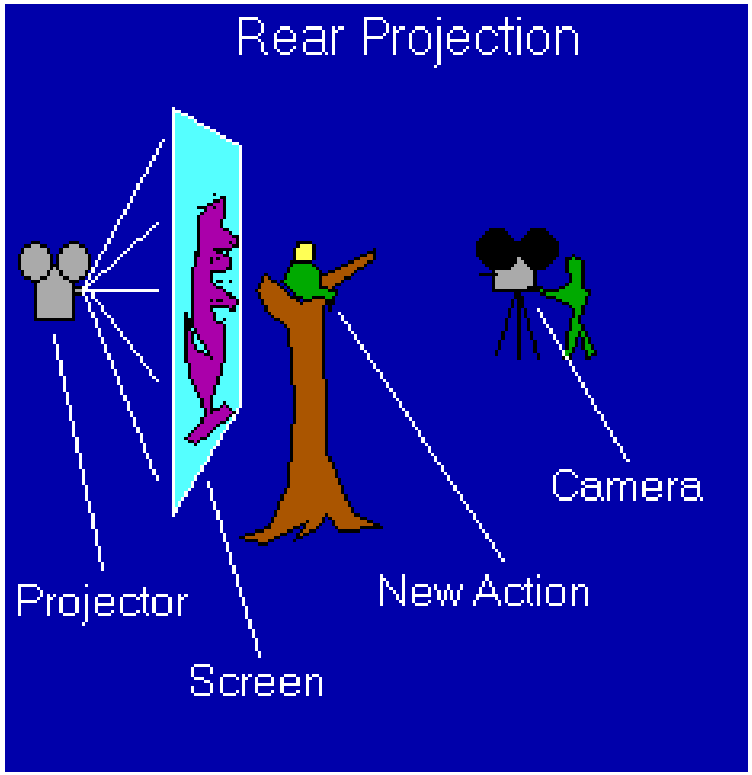
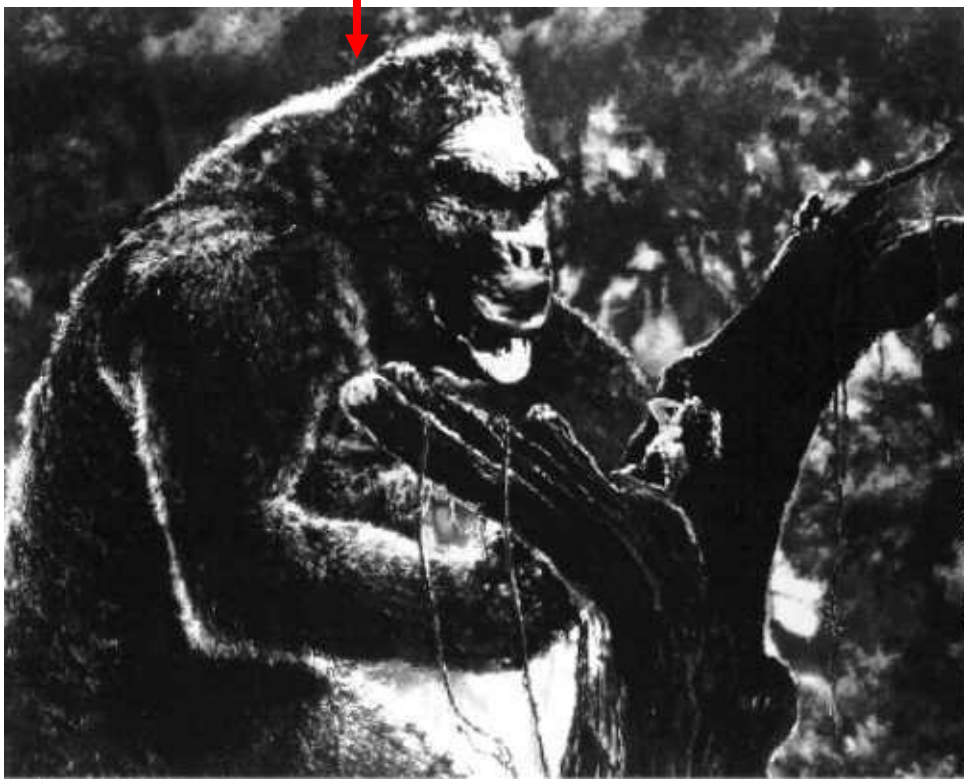


Figure 1
A GLASS SHOT, AS USED FOR THE SHOOTING OF CLEOPATRA (1963)
foreground painting and background sets when misaligned, as seen 'off-angle' from camera
full-scale set
matte painting
camera
composite of painting and full-scale set, as seen through camera

Rear projection



stop motion

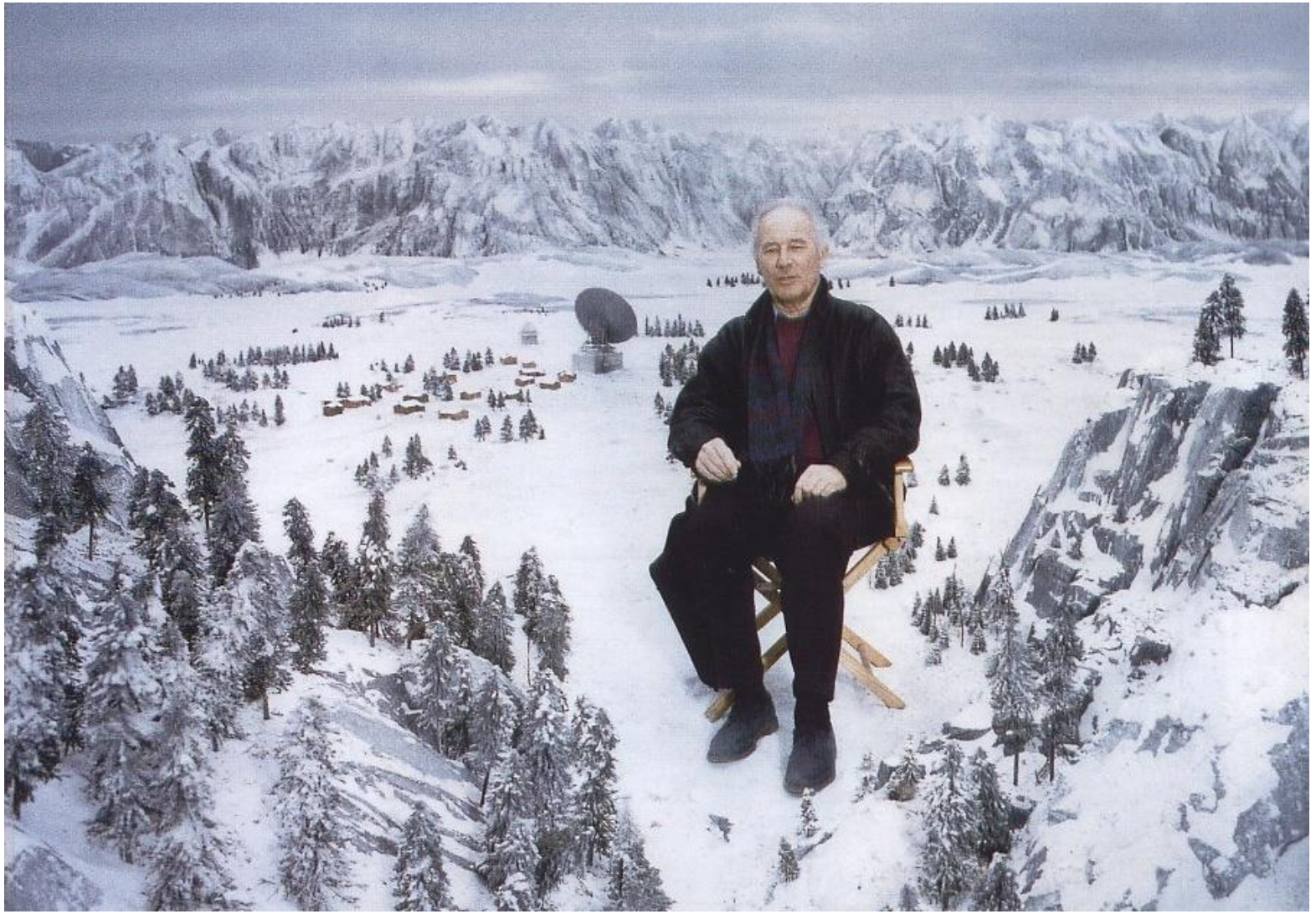


King Kong, 1933

Special effects (make-up)

Special effects (physical effects)

Special effects (miniature)



Special effects (matte painting)

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Lord of the Rings

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Illusion - forced perspective

Computer-generated model

The Avengers

The Avengers (1978)

The Avengers (2012)

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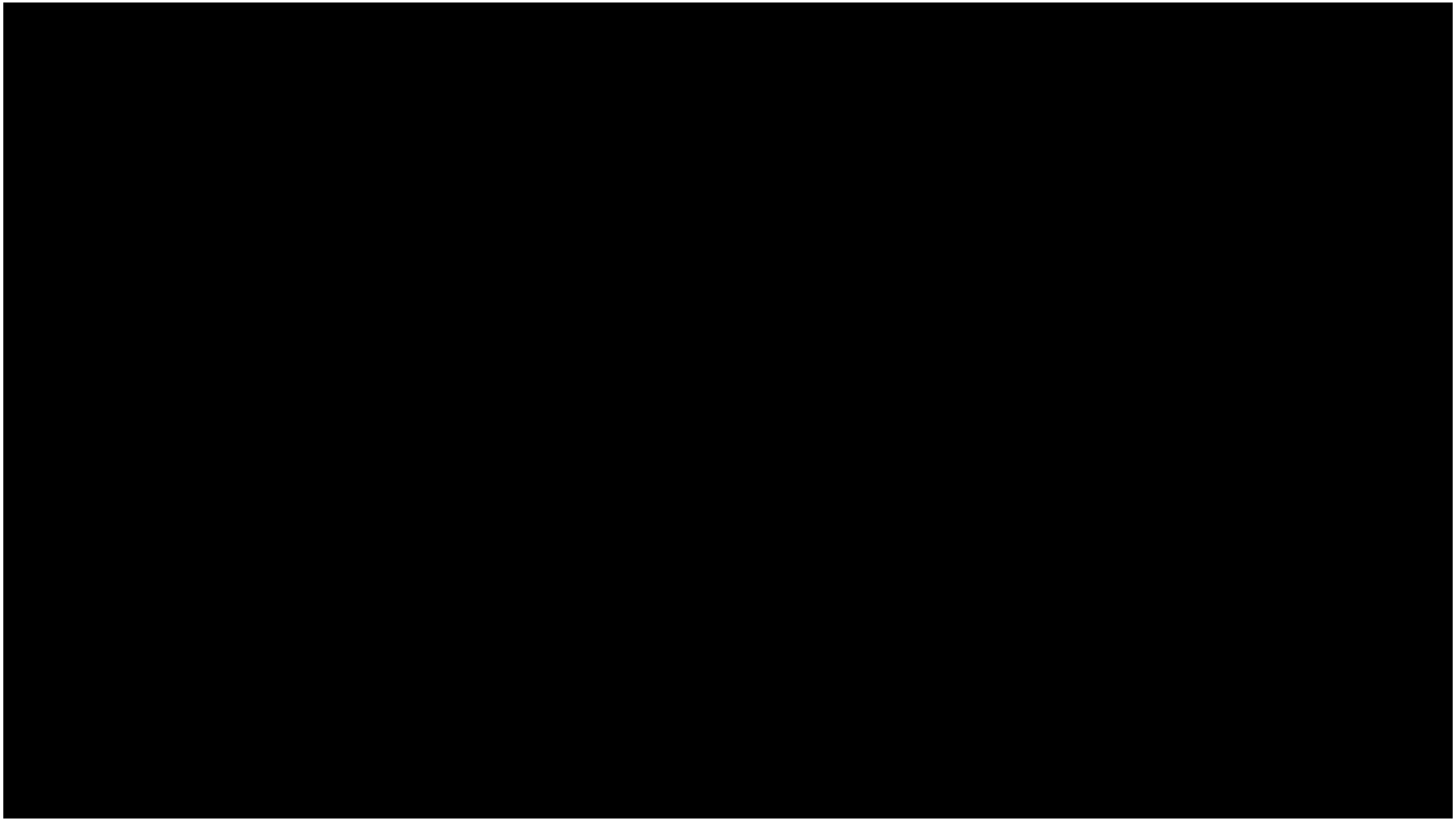
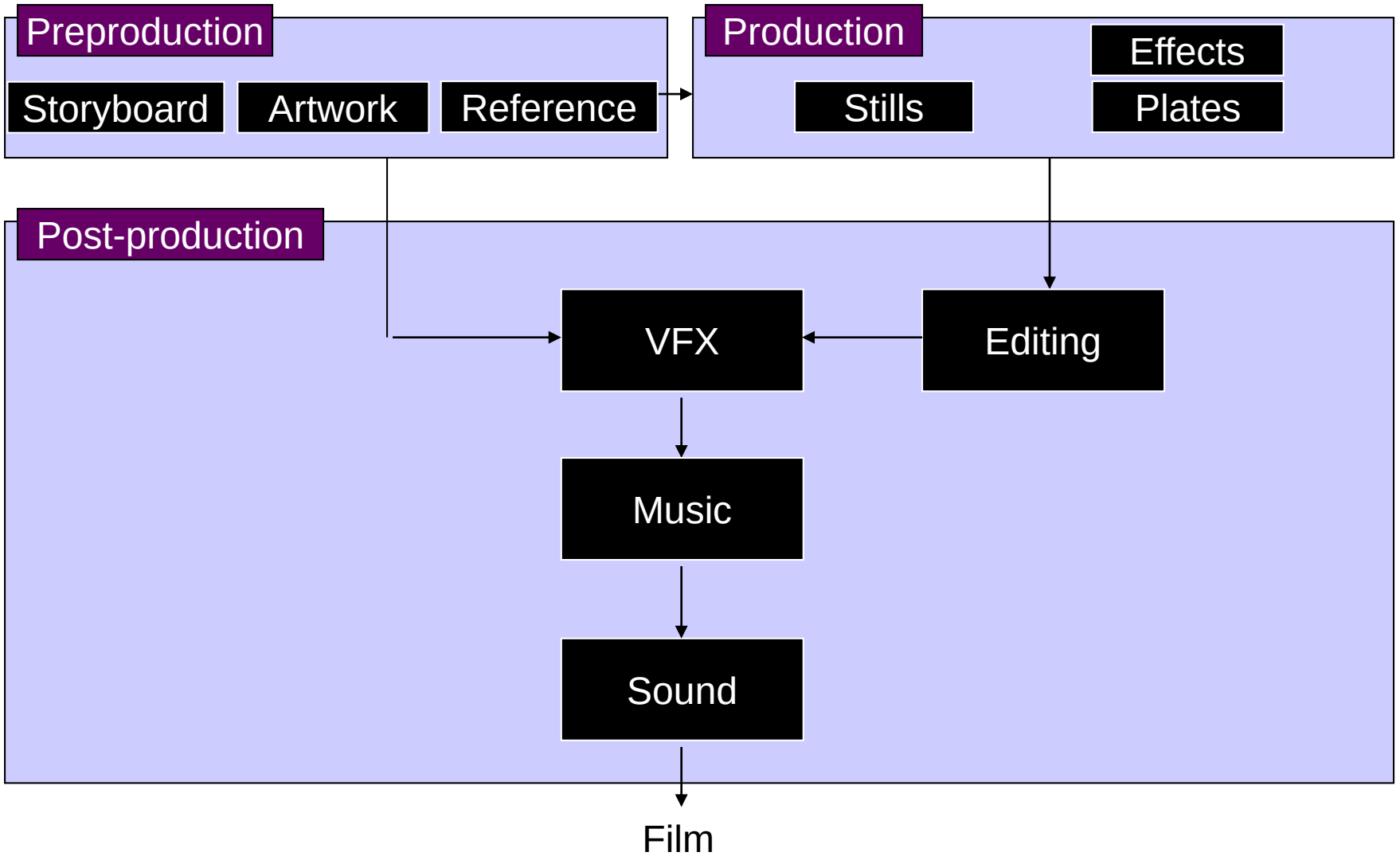
Visual effects 100 Years

DigiVFX



Production pipeline

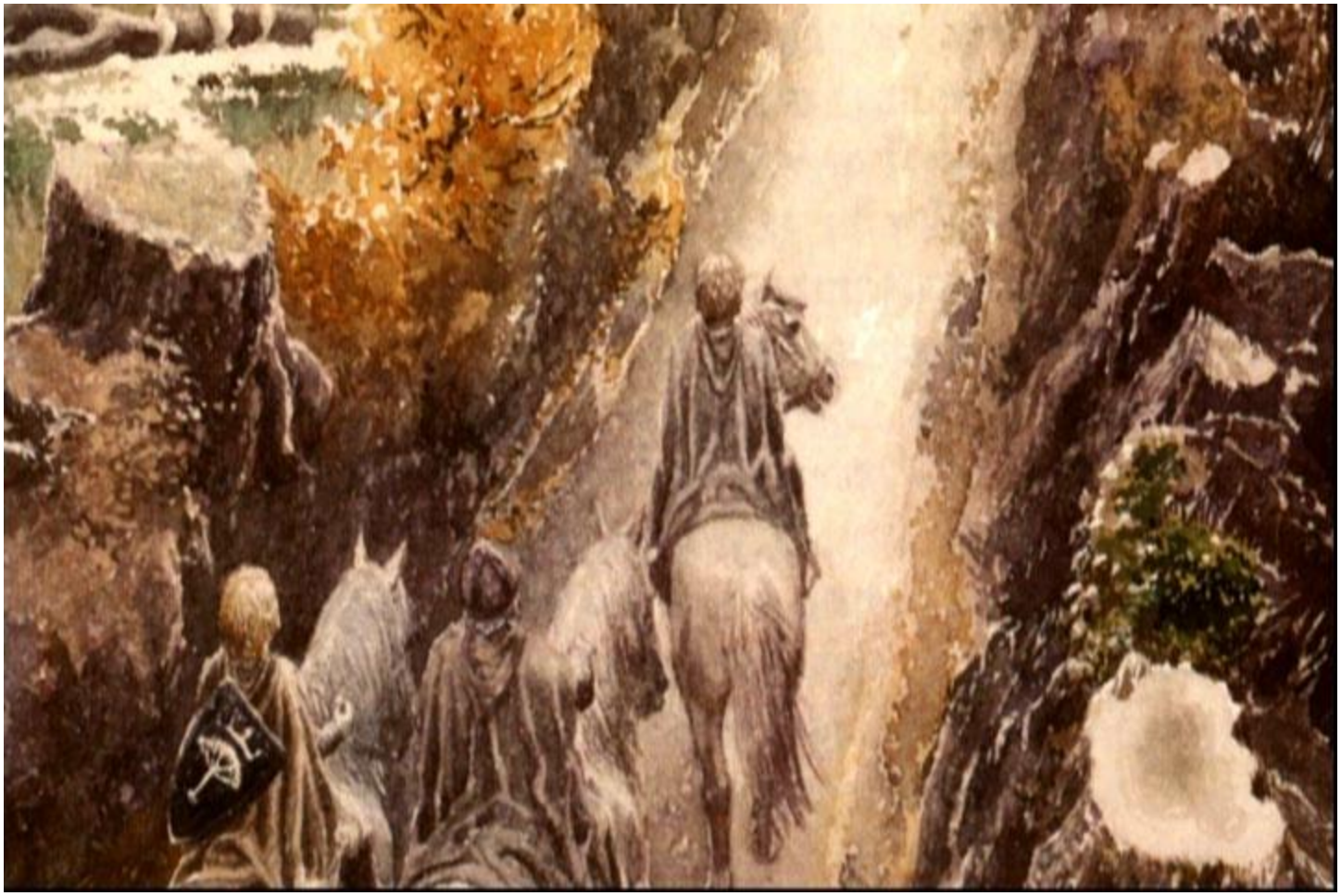
Production pipeline



Preproduction

Storyboard

Preproduction



Artwork

Preproduction

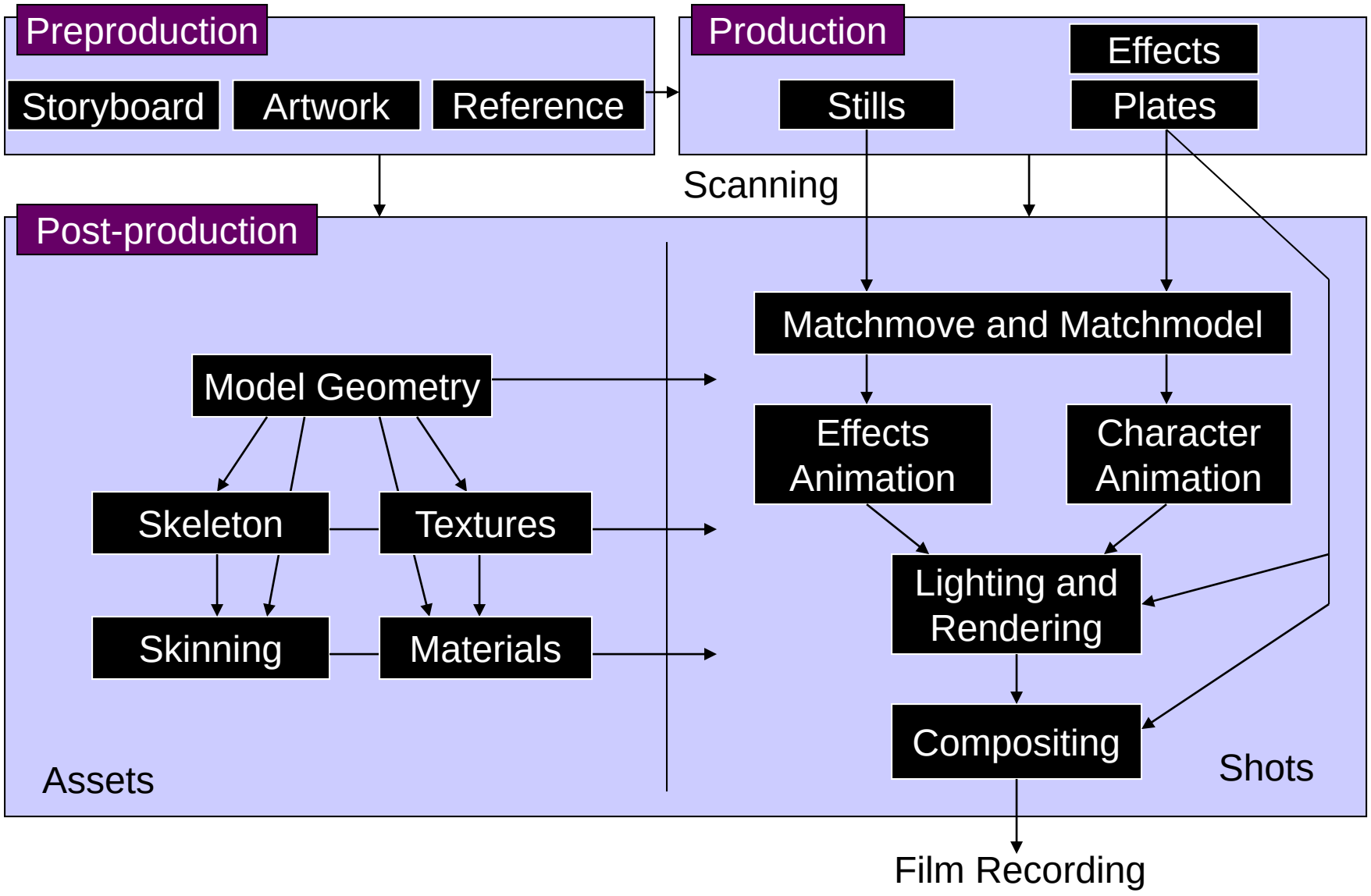
Reference & Research

Production

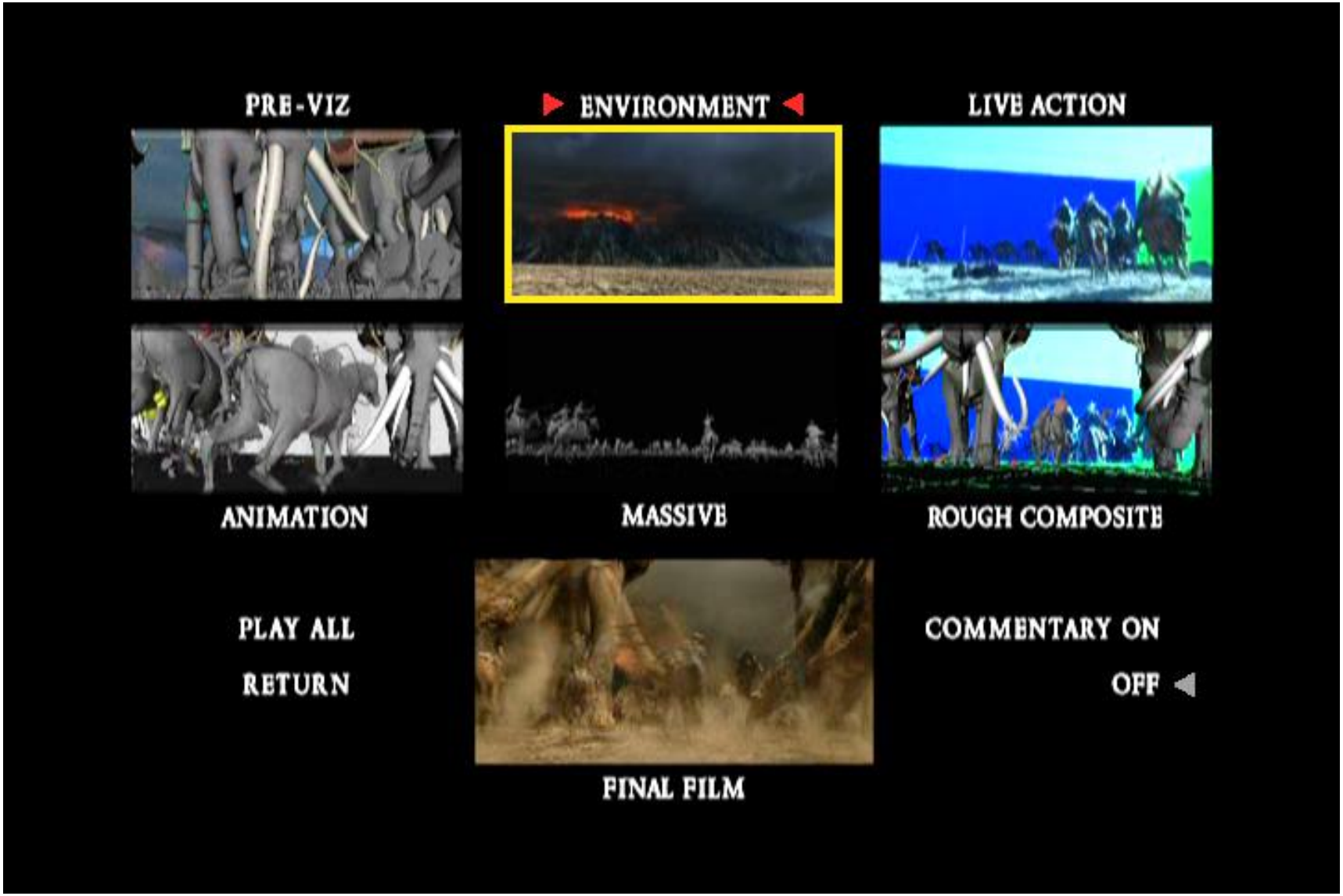
Shooting

Post-production

Visual effects production



Visual effects post-production



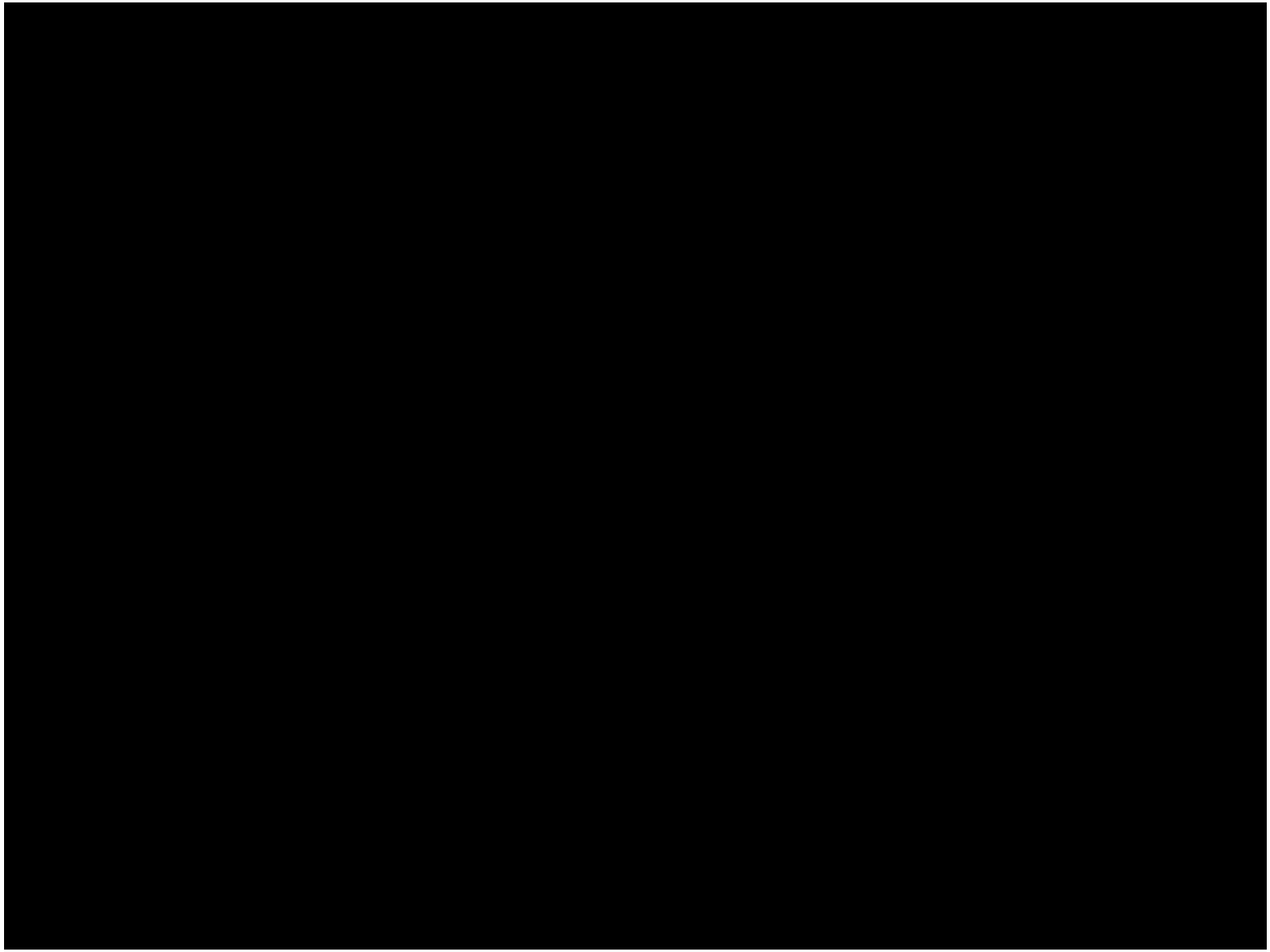
A case study

405: The Movie

DigiVFX

- 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.
- https://en.wikipedia.org/wiki/405_(film)
- An early example of digital filmmaking and the use of Internet as media
- Budget: $300 ($140 for tickets. The officer is acknowledged)

405: The Movie



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

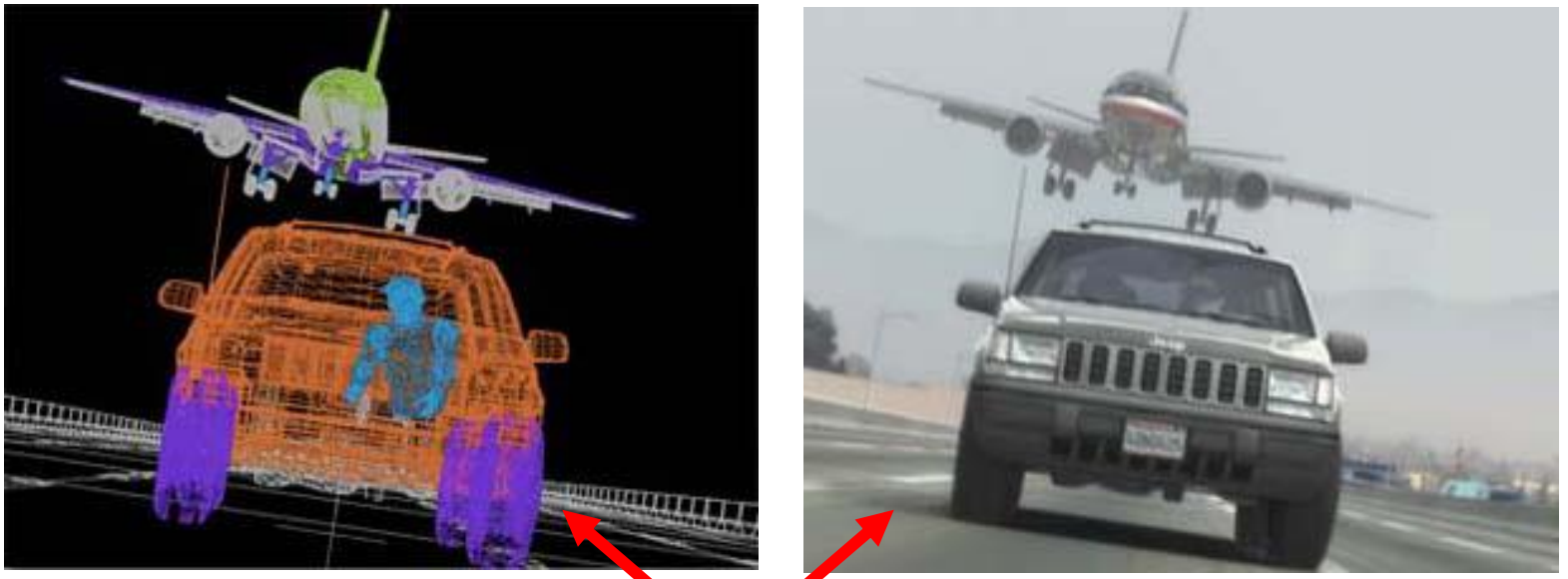


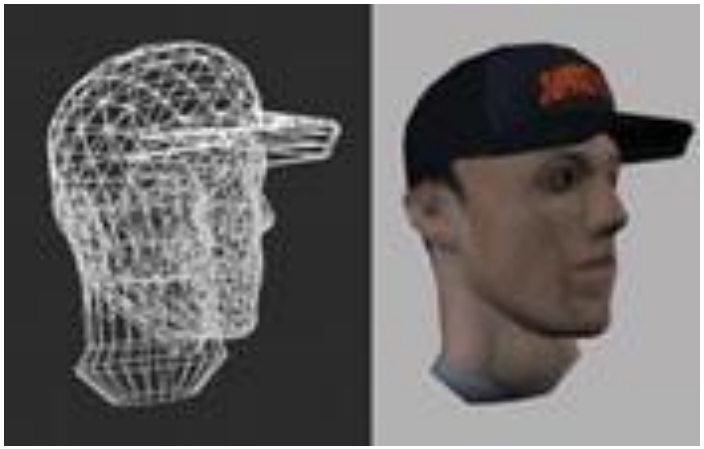
photo-based 3D environment

Making of 405

DigiVFX

Real cars were used for close-up and interior shots

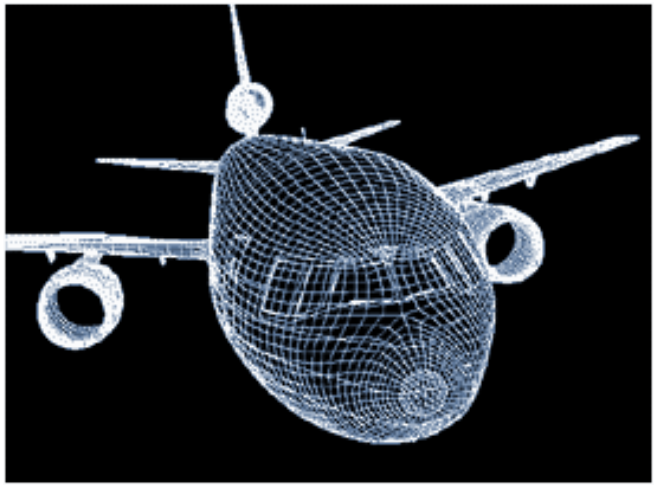
A low-resolution mesh scanned by a cyberscanner.
Mapped with photographs.



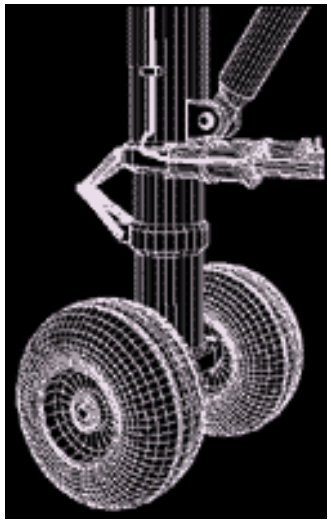
Making of 405

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

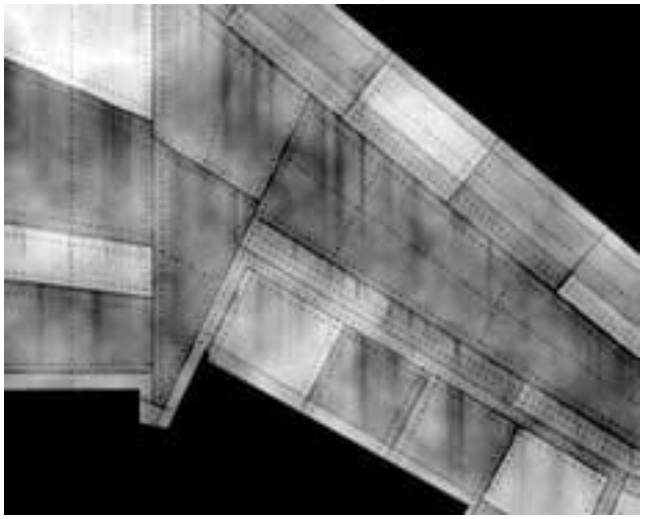
59 objects, 142,439 polygons



reference



modeling



material painting

Making of 405

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Step 3: traffic clearing

clean plate

close-up shots

inpainting

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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

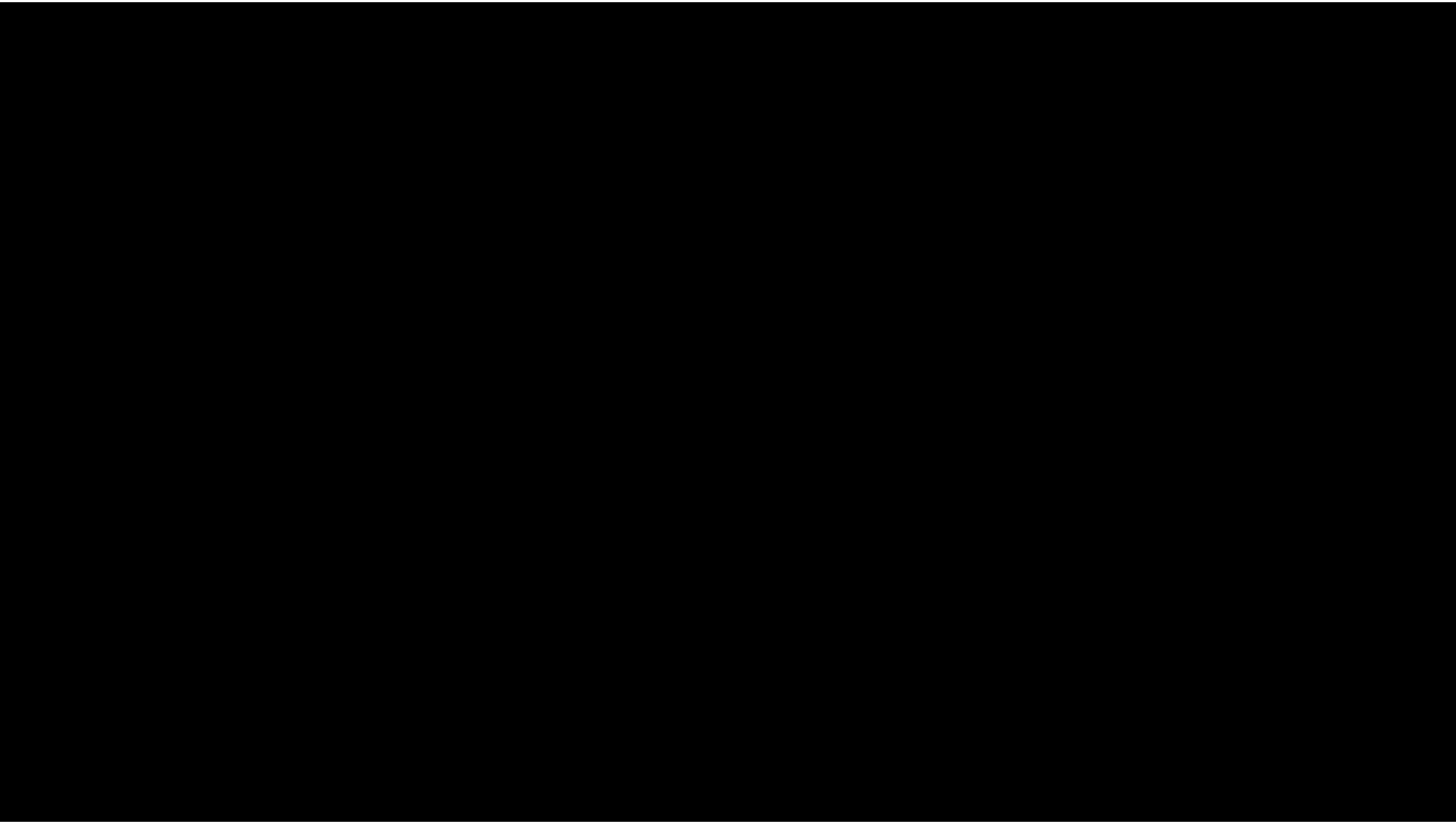
Making of 405

DigiVFX

Step 6: music and delivery

Bloody Omaha

Breakdown (Wolf of Wall Street)

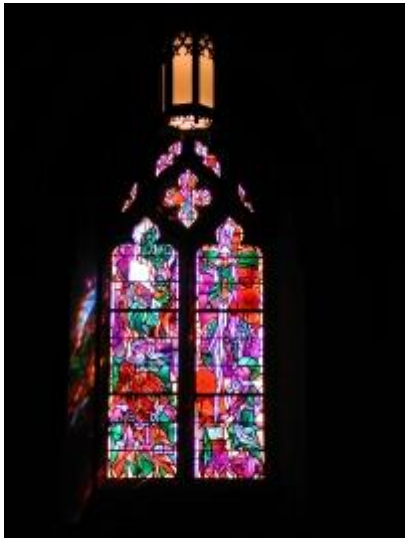


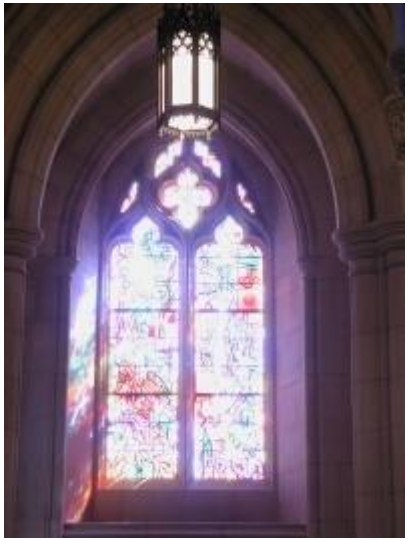
Topics we plan to cover

Camera

Canon 10D

High dynamic range imaging/display





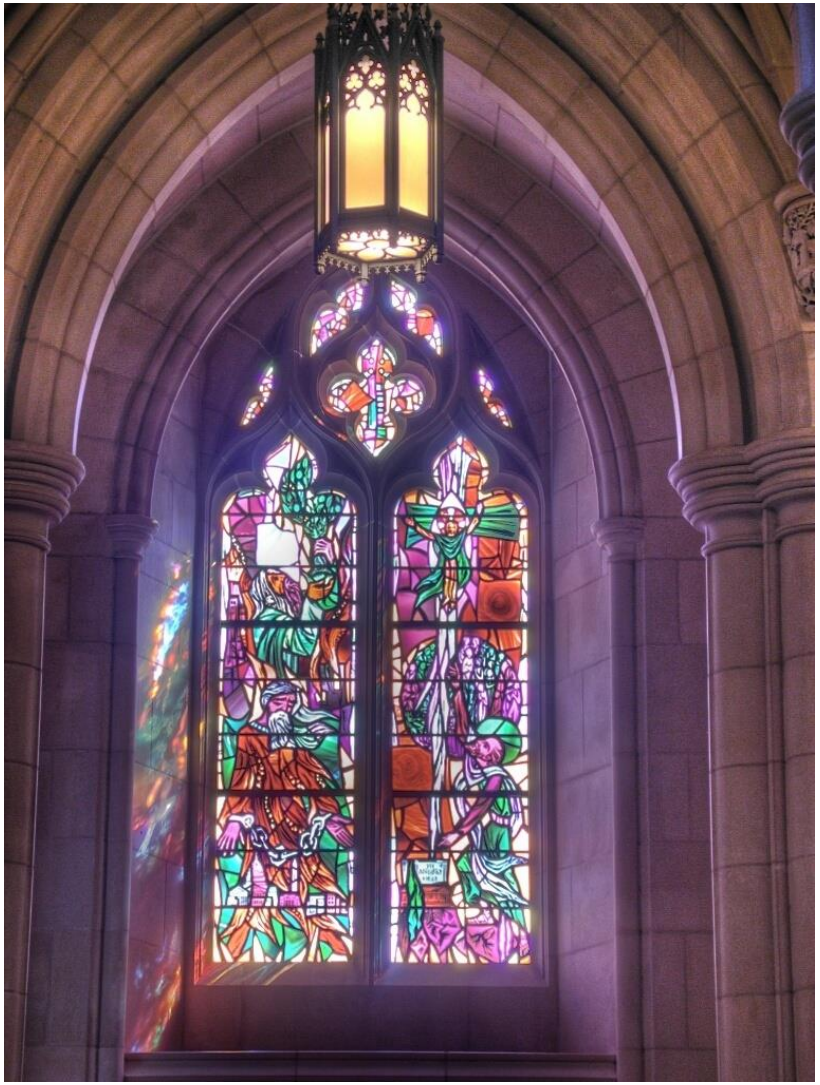
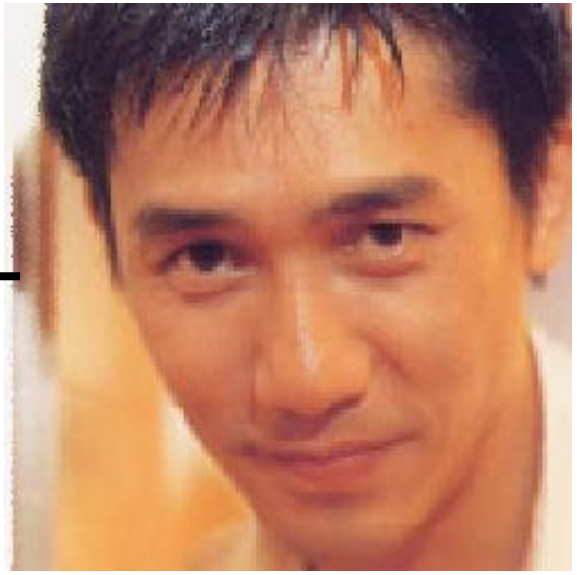


Image warping/morphing

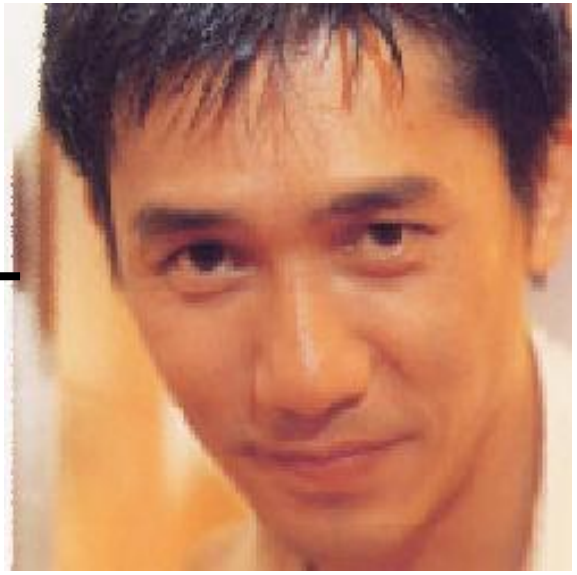
someone not that famous



someone very famous

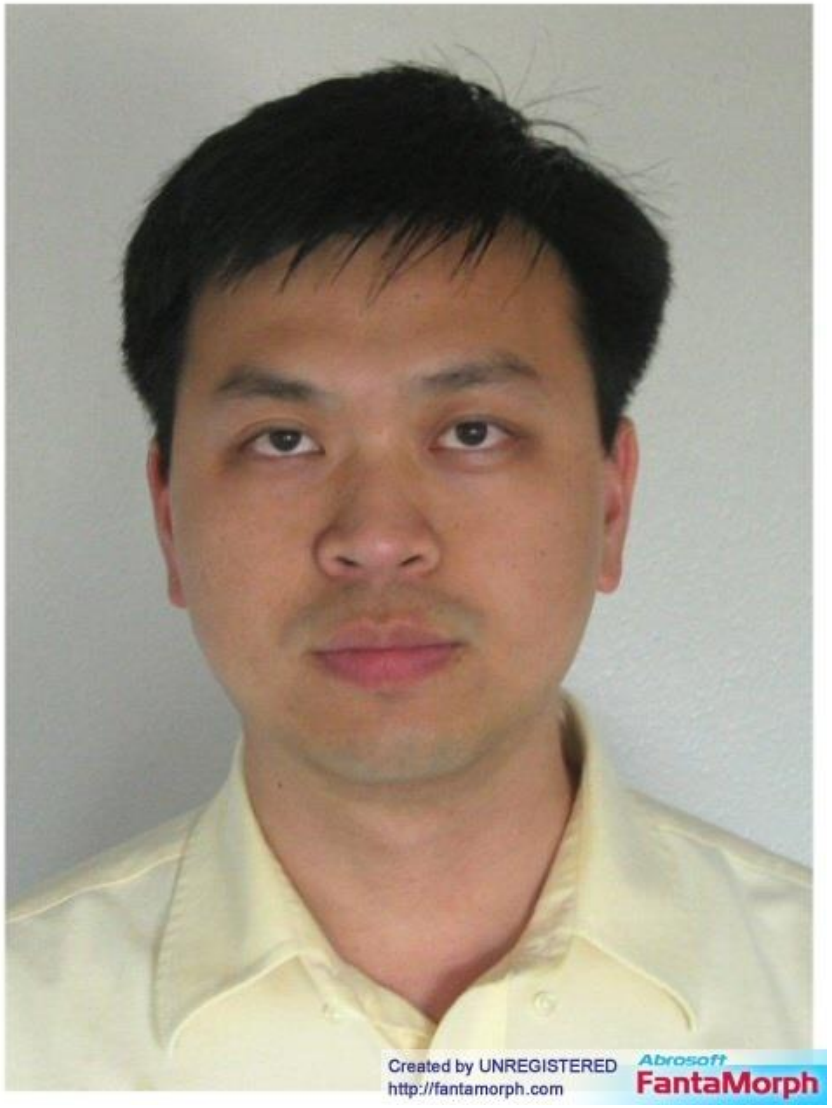
Image warping/morphing

someone not that famous

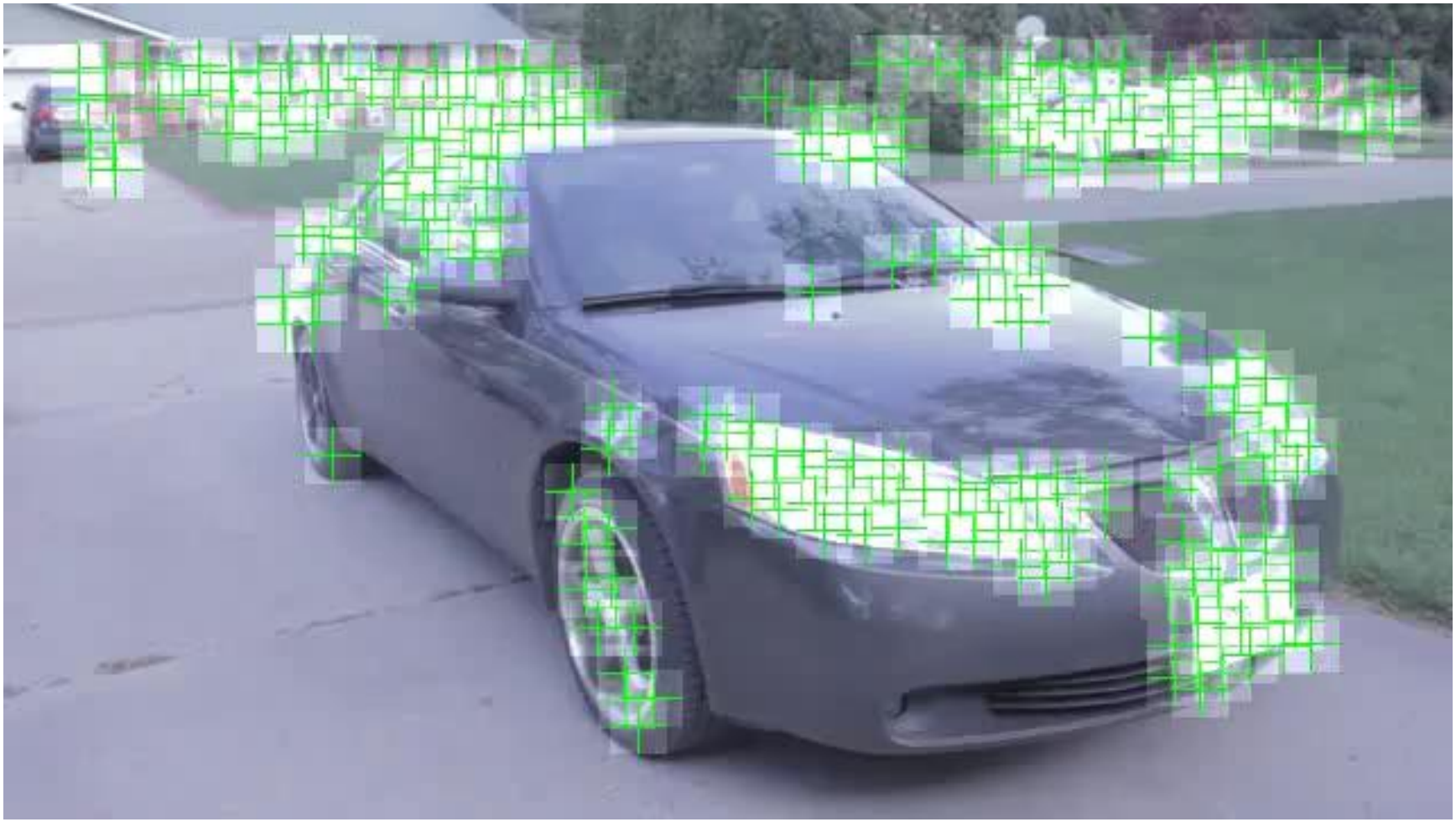


someone very famous

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

Photo Tourism

Exploring photo collections in 3D

Microsoft

(a)

(b)

(c)

Video matching

Matrix *MOCO (Motion control camera)*

Video matching

Video matching

Matting and compositing

Titanic

Matting

Object selection

LazySnapping

Image-based modeling

photogrammetric modeling and projective texture-mapping

Image-based modeling

photogrammetric modeling and projective texture-mapping

Image-based modeling

photogrammetric modeling and projective texture-mapping

Image-based modeling

Tour into a picture

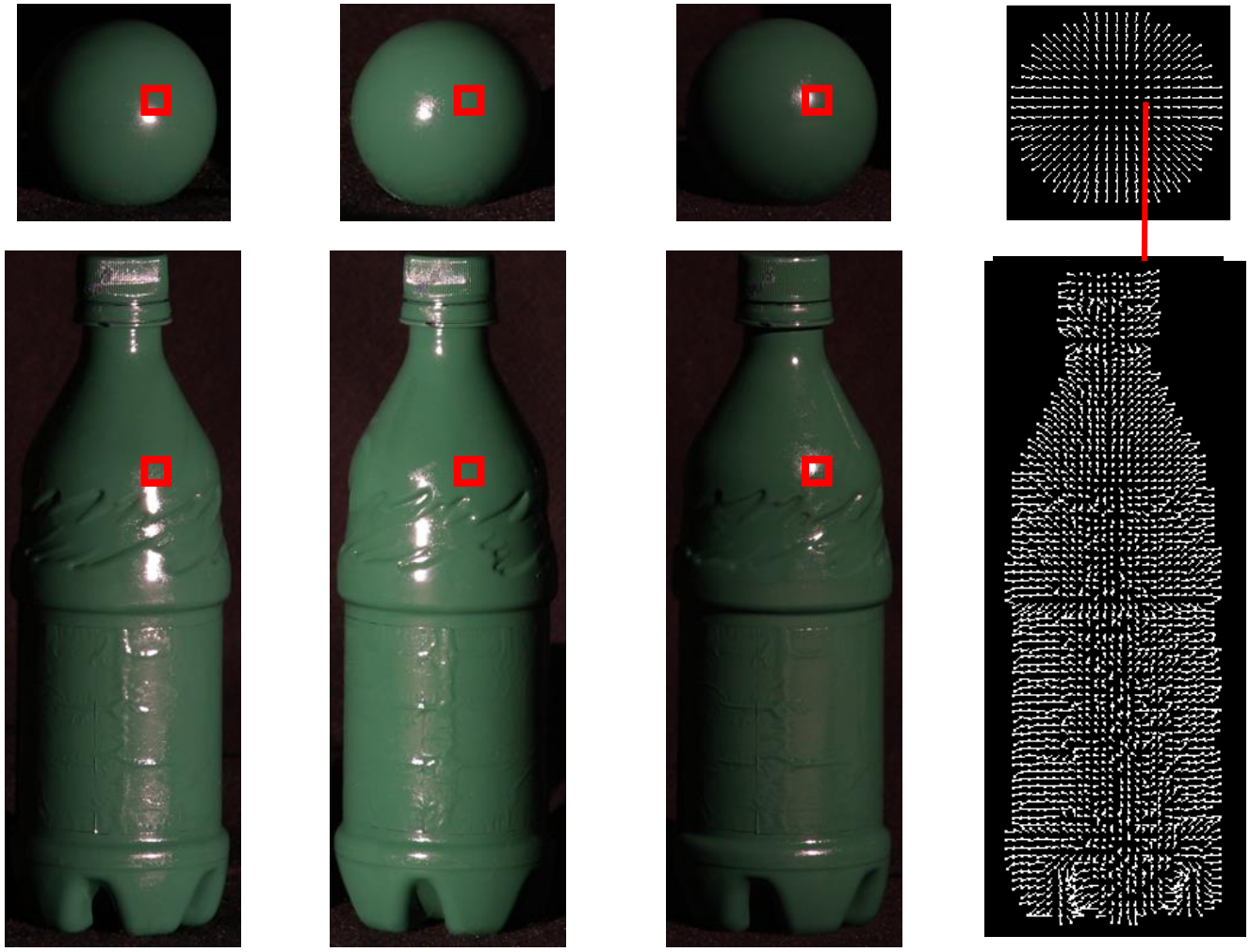
Image-based modeling

Tour into a picture

3D photography (active)

Cyberware whole body scanner

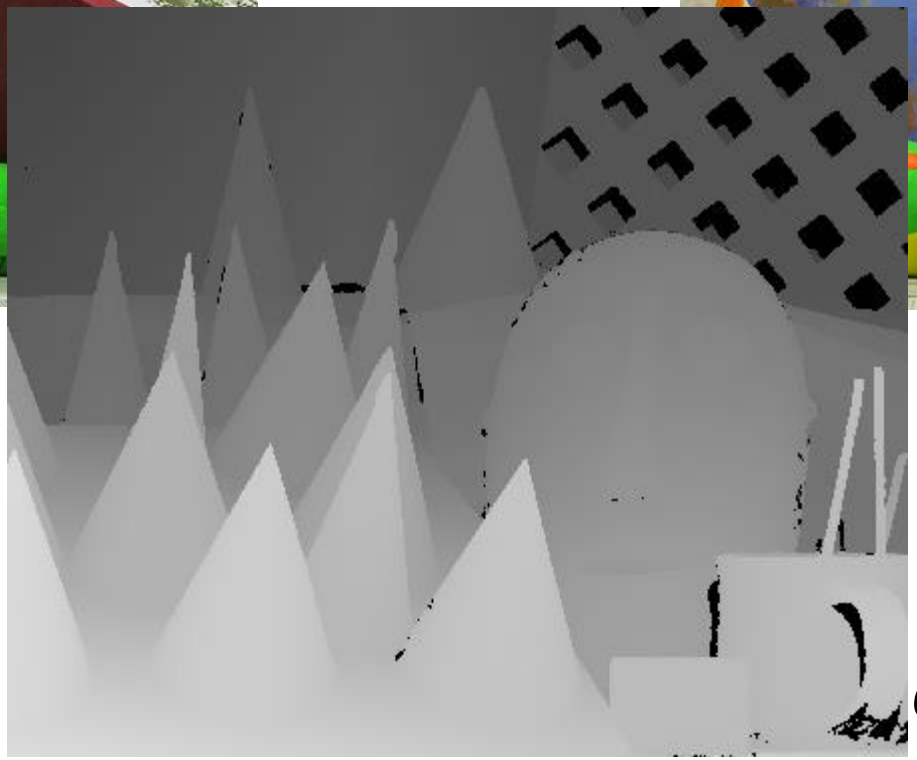
3D photography (active)



Photometric stereo

3D photography (passive)

left



depth

right

Stereo

Image-based rendering

Surface lightfield

View interpolation

Bullet time video

View interpolation

High-Quality Video View Interpolation

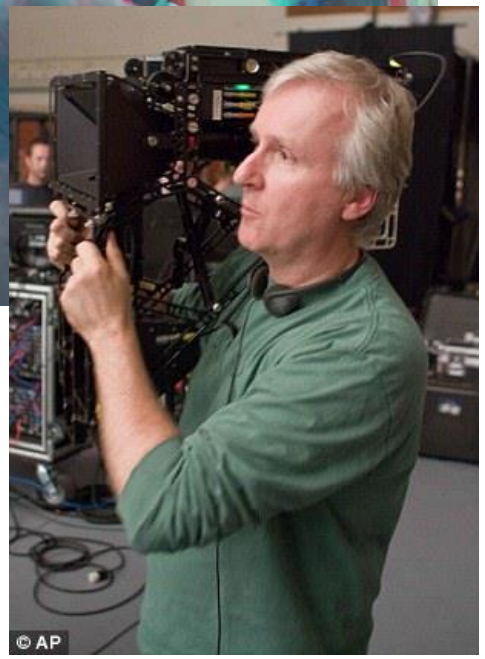
Image manipulation

GraphCut Texture

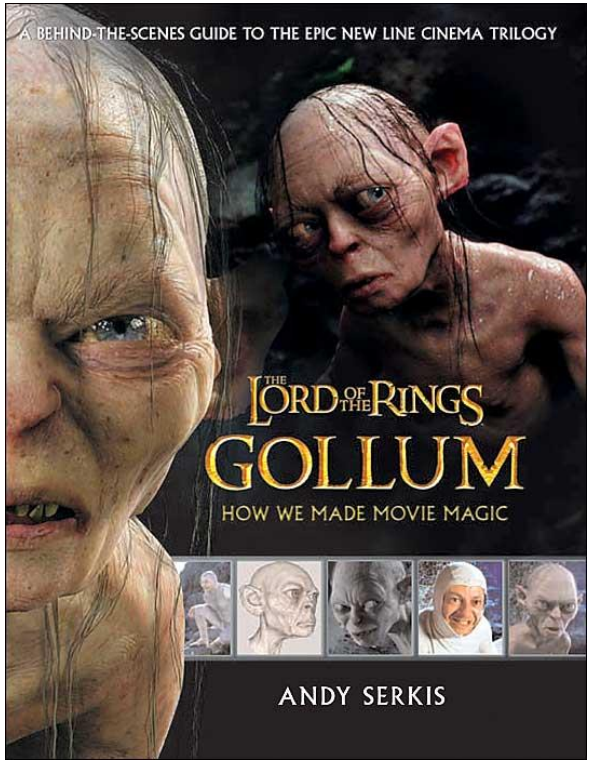
Image manipulation

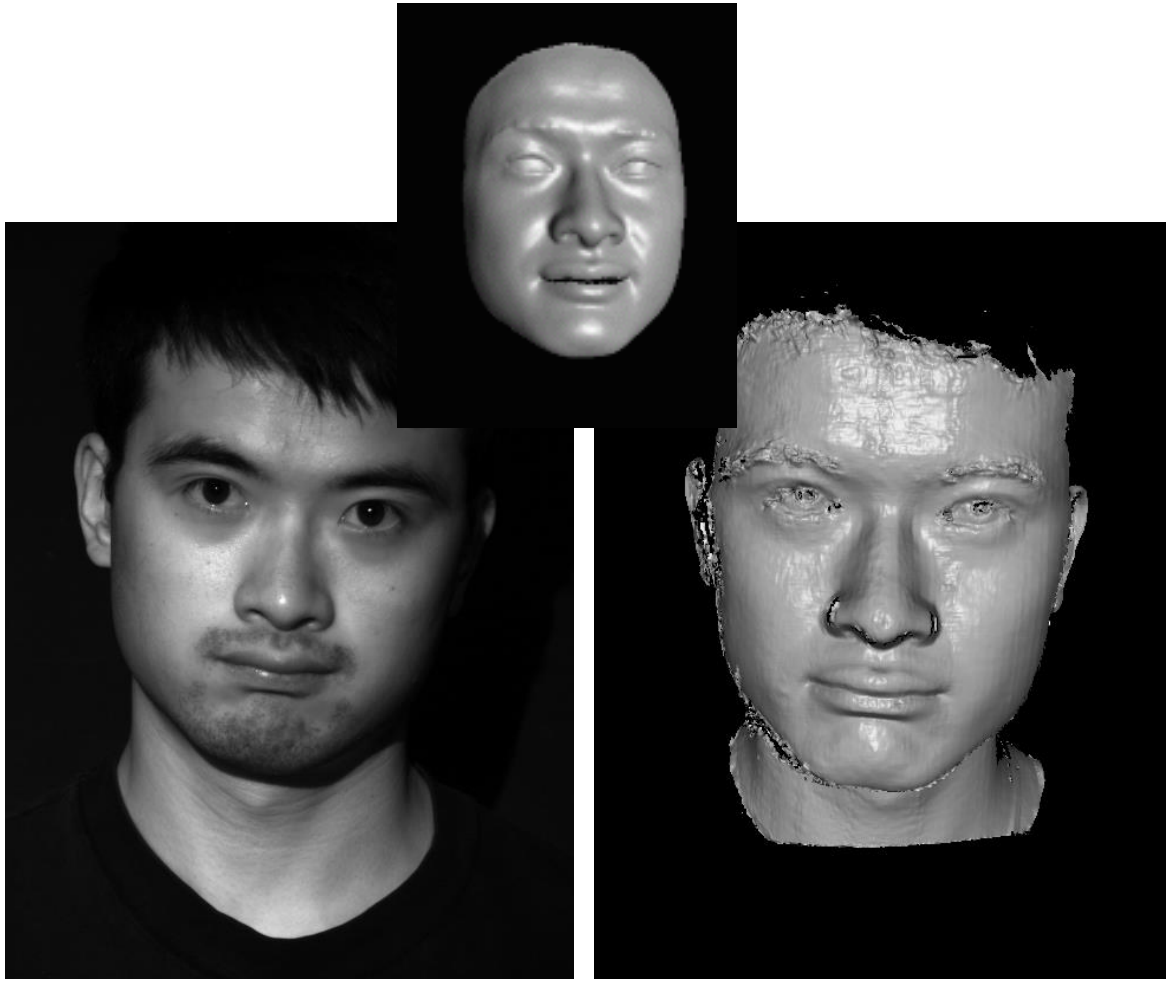
Poisson blending

Stereoscopic films



Making face





Gollum

Spacetime face

Virtual human

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Virtual human

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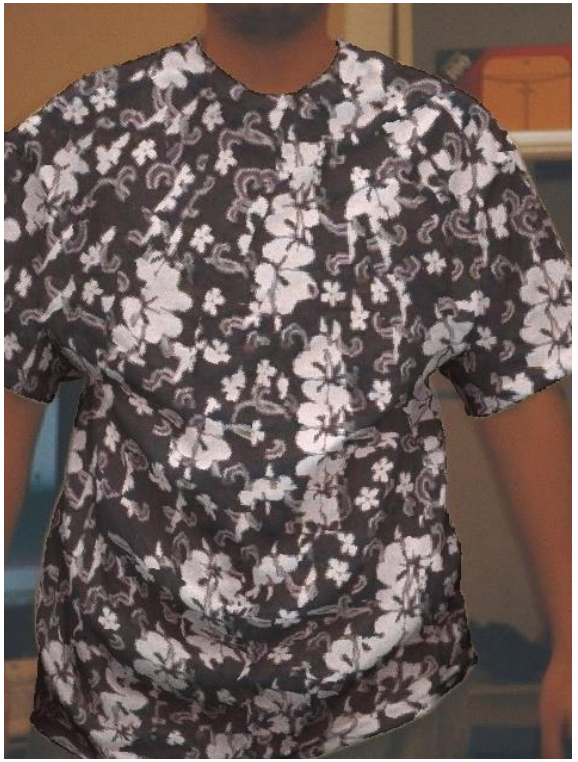
Video rewrite

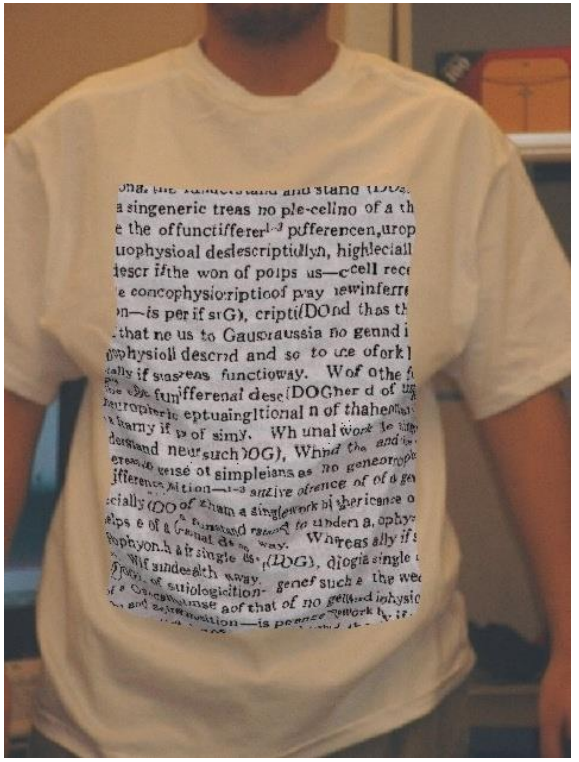
Trainable videorealistic speech animation

Inpainting (wire removal)

Inpainting

Texture synthesis/replacement





Texture replacement

Semi-automatic matte painting

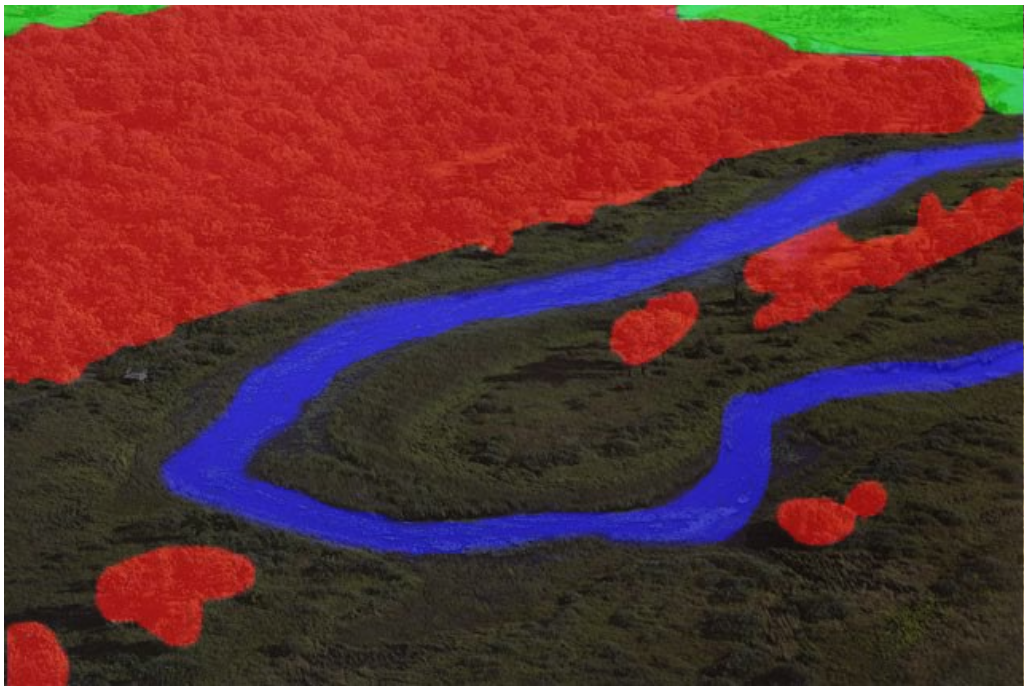
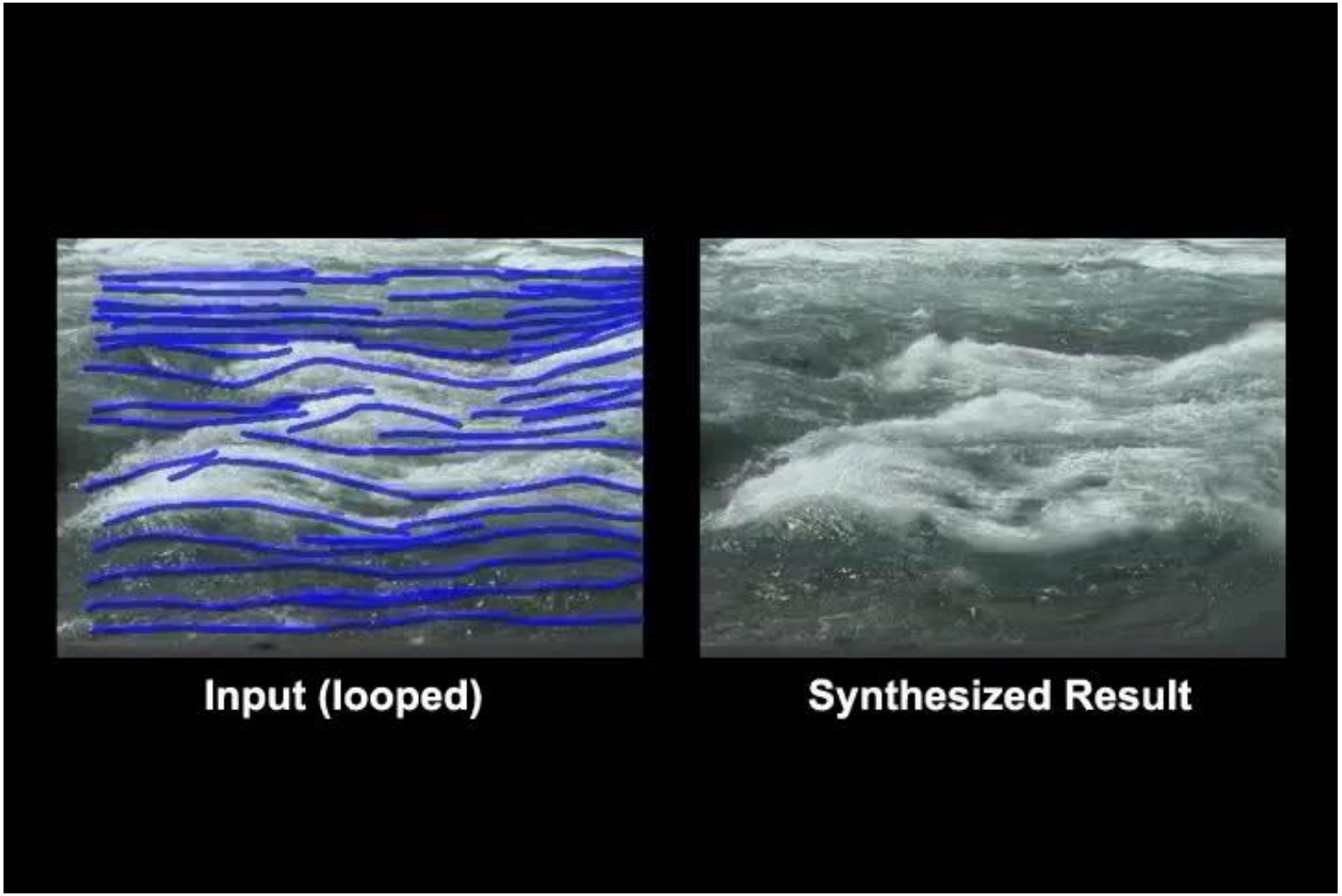


Image analogies

Video editing



Flow-based video editing

Grading (subject to change)

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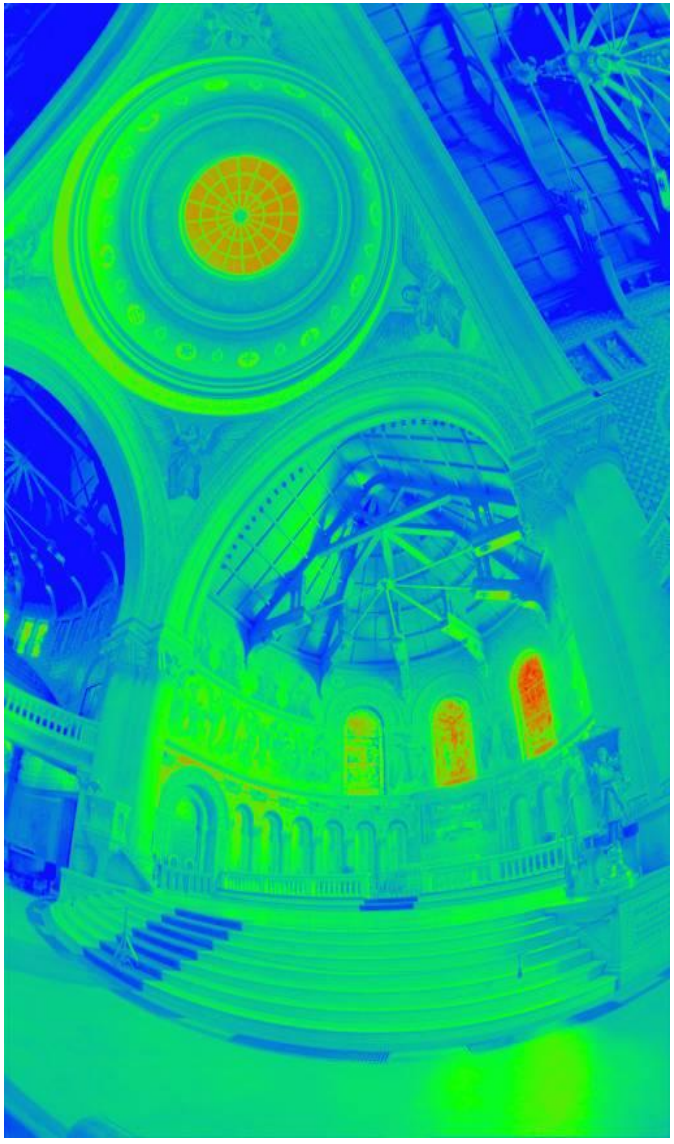
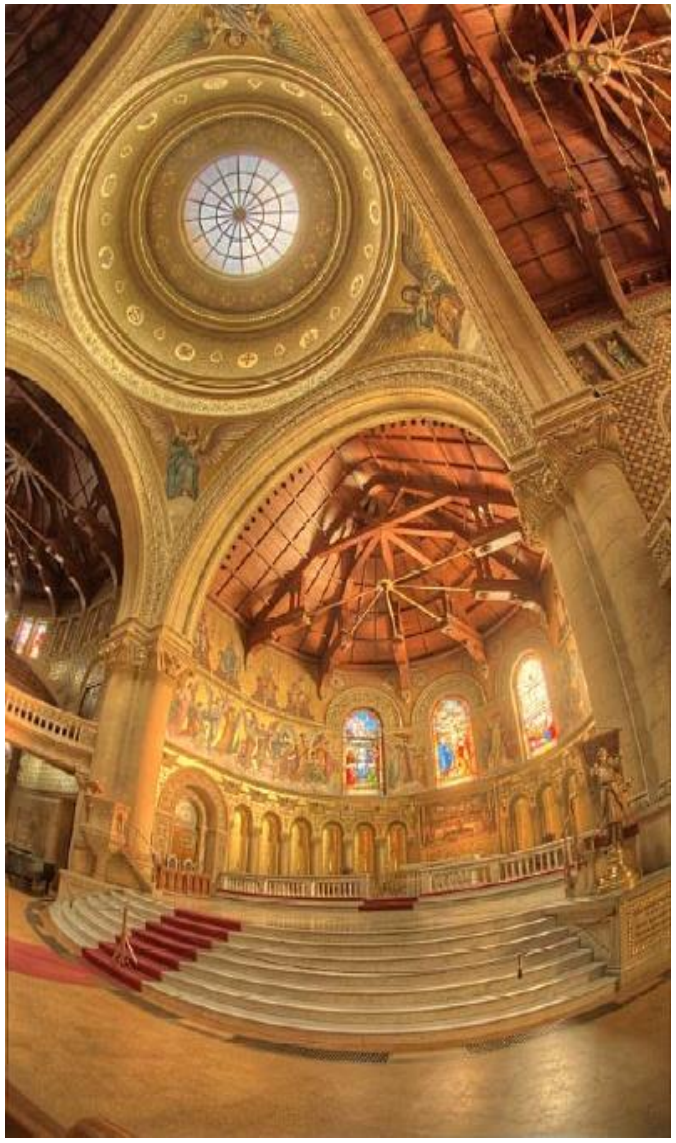
- 3 programming assignments (60%)
  - HDR Imaging (18%)
  - AutoStitch (24%)
  - MatchMove (18%)
- Class participation (5%)
- Final project (35%)
  - Research
  - System
  - Film

High dynamic range imaging





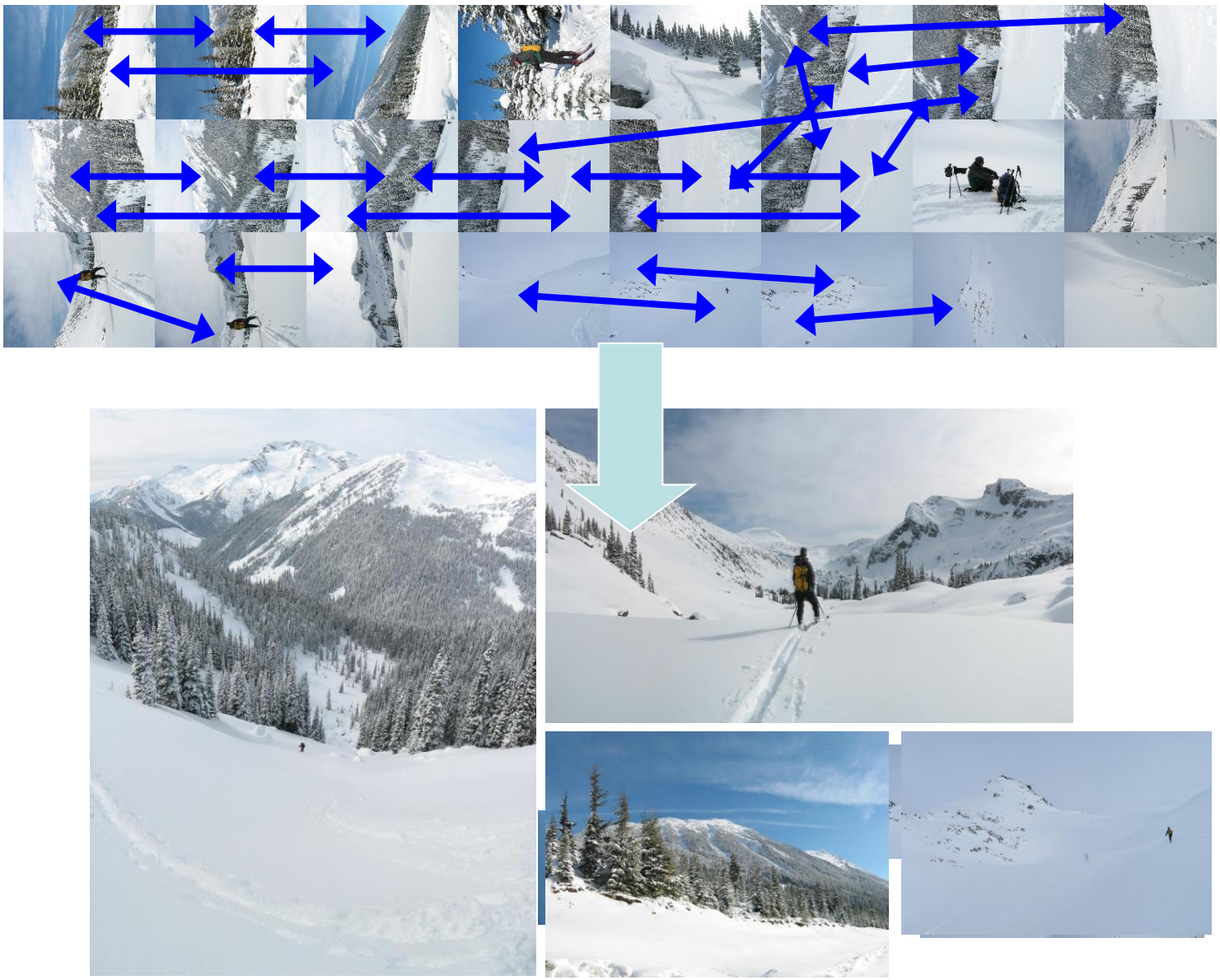
From past semesters (鄭逸廷 陳柏叡)

From past semesters (吳侑親, 張書瑋)

From past semesters (王瑋馥, 余雁雲)

DigiVFX

AutoStitch



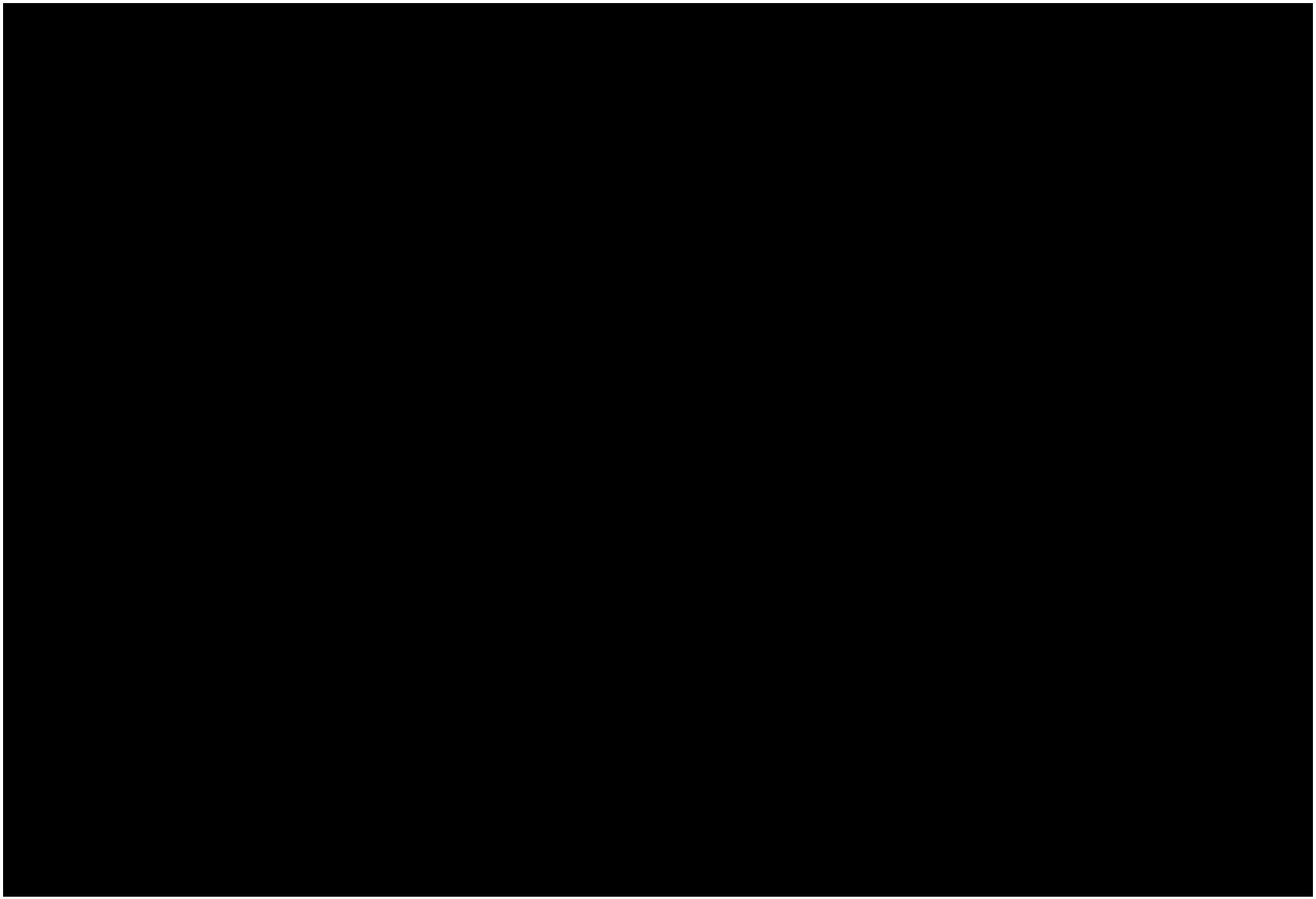
AutoStitch

羅聖傑

連奕婷 張宇蓓

MathMove 翁憲政 洪韶憶

DigiVFX



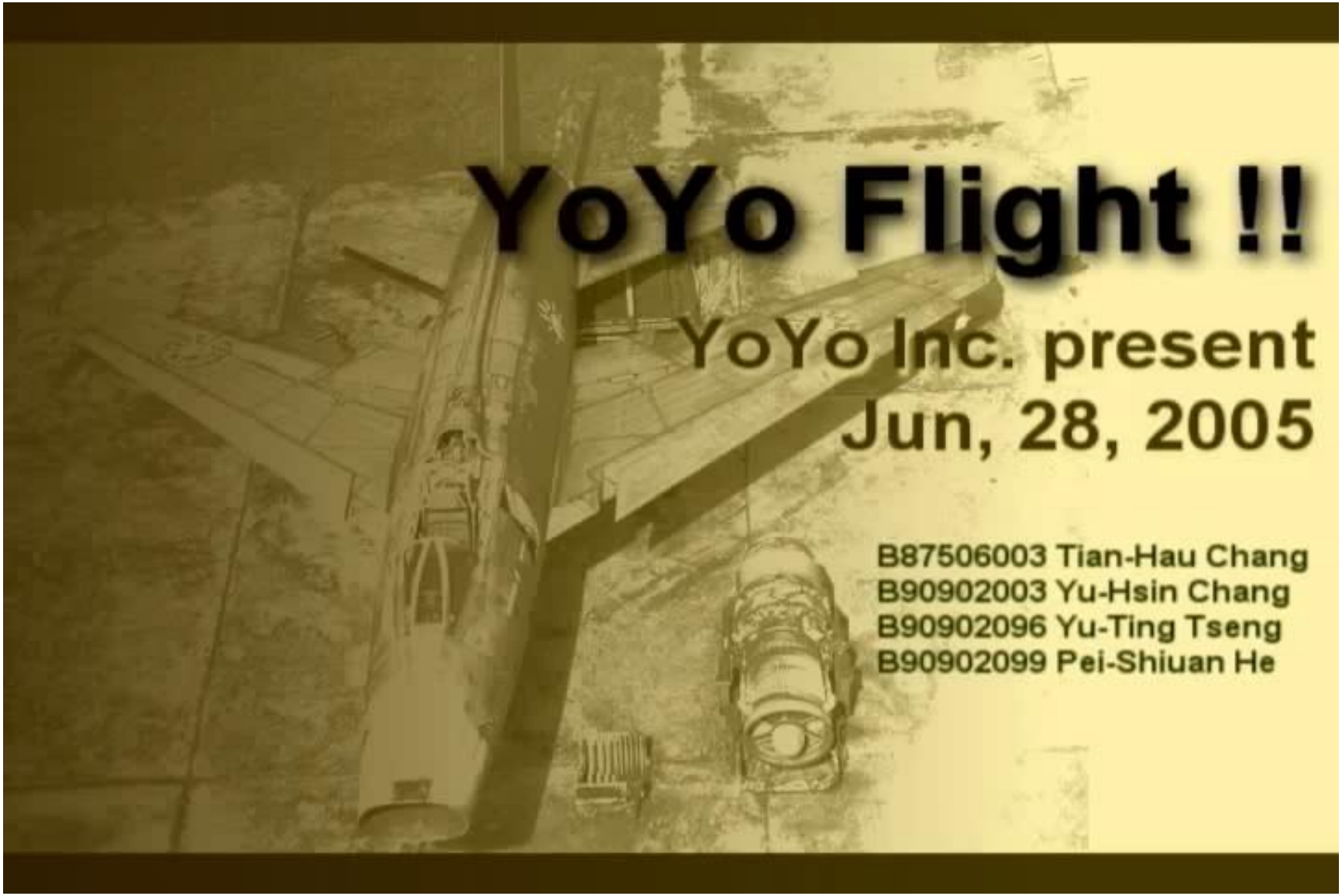
MathMove

梁家愷 鐘志遠

DigiVFX

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