

Course overview

Digital Visual Effects

Yung-Yu Chuang

Logistics

- **Instructor:** Yung-Yu Chuang (cyy@csie.ntu.edu.tw)
- **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



It isn't about 3D animations



It isn't about watching movies

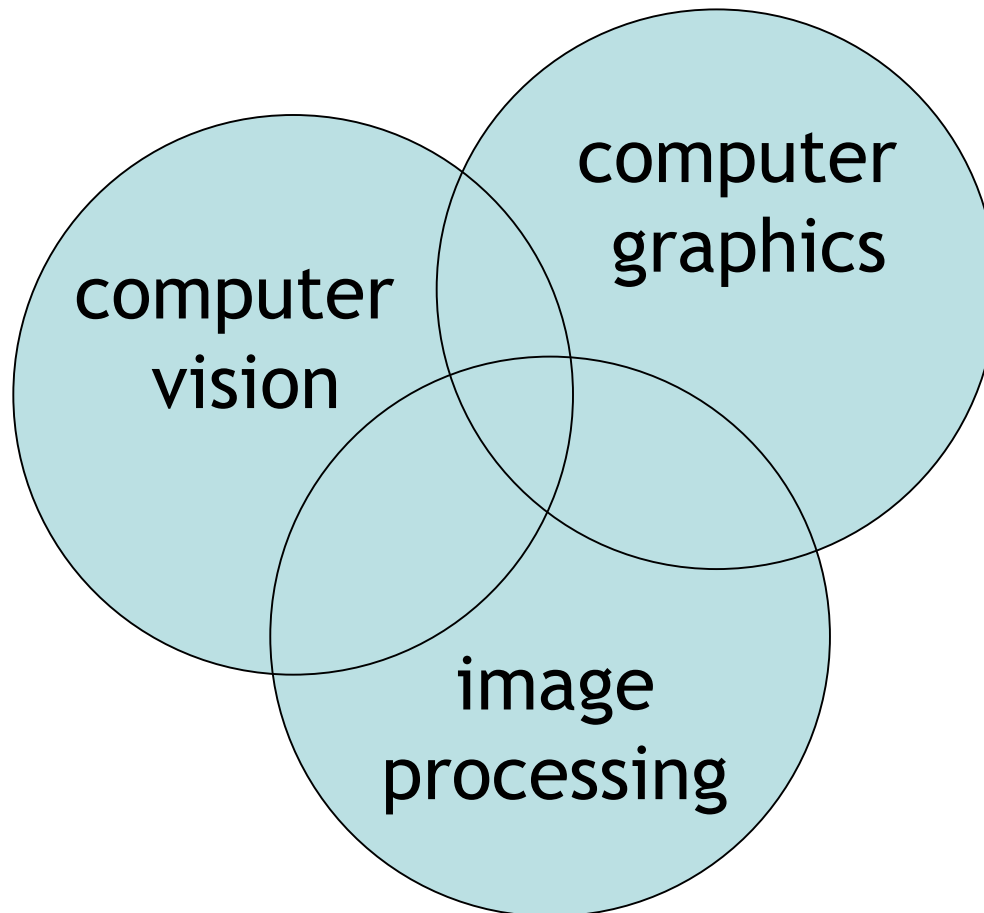


It isn't about physical effects



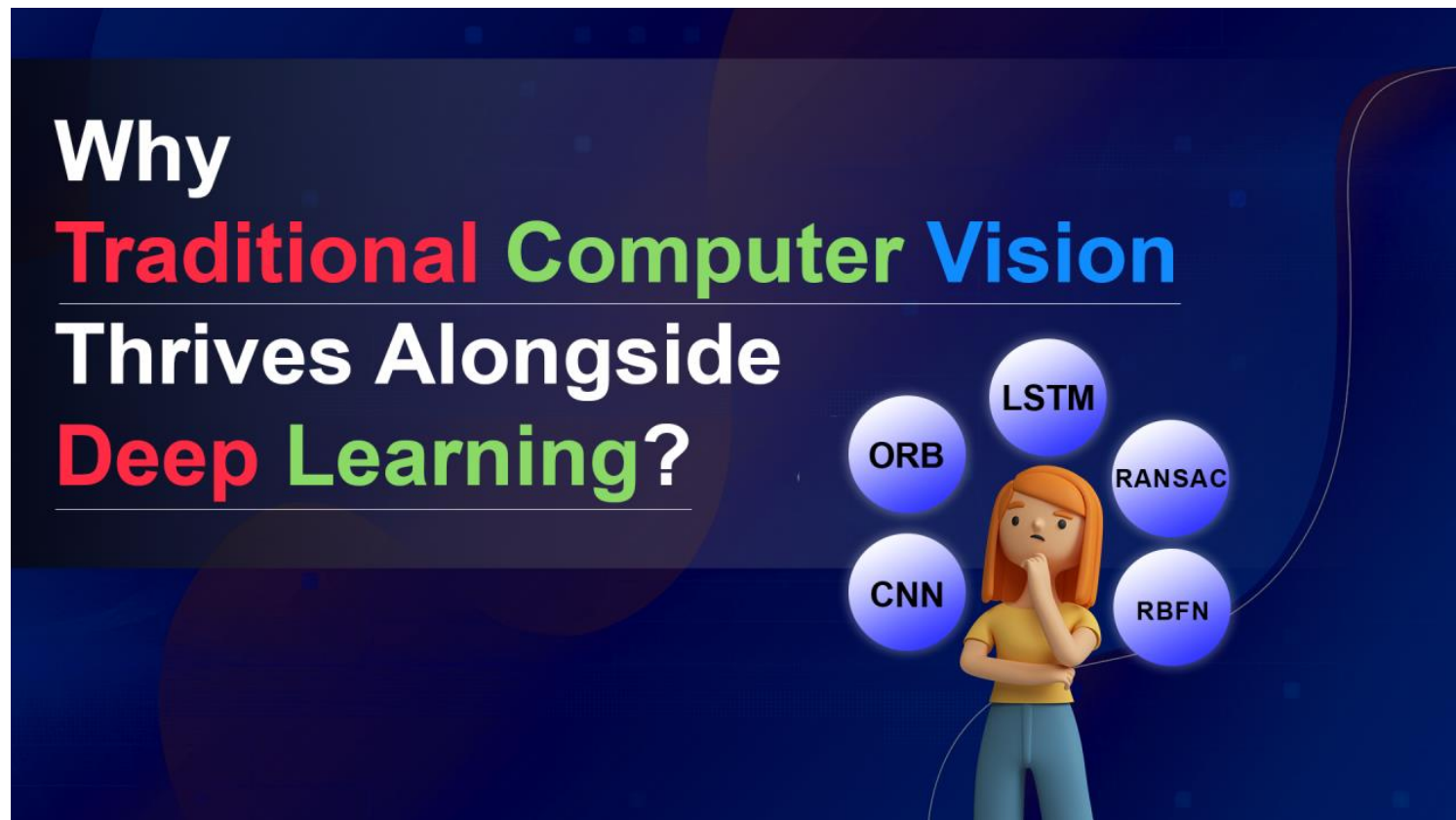
It's not about industrial tricks

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.



It's not about deep learning

- Although some of the discussed problems have better deep learning solutions, we mostly cover the classical approaches.



Prerequisites

- 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.

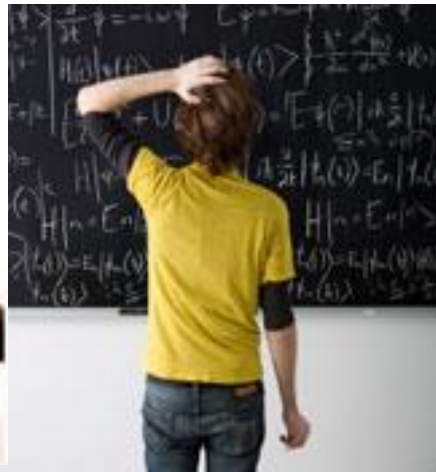
The vfx course



what other professors
think you do

what other students
think you do

what you thought
you will do



what you actually do

Be cautious!



This course is about ...

Digital Visual Effects



Digital Visual Effects



Deadpool



Deadpool



Life of Pi



Life of Pi



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?



Retouching



Retouching



Retouching



Bush campaign's TV AD, 2004



Texture synthesis and inpainting

This section shows a sampling of the duplication of soldiers.



Iraq War, LA Times, April 2003



Digital photomontage

Domestic example



The Liberty Times
2007.12.17



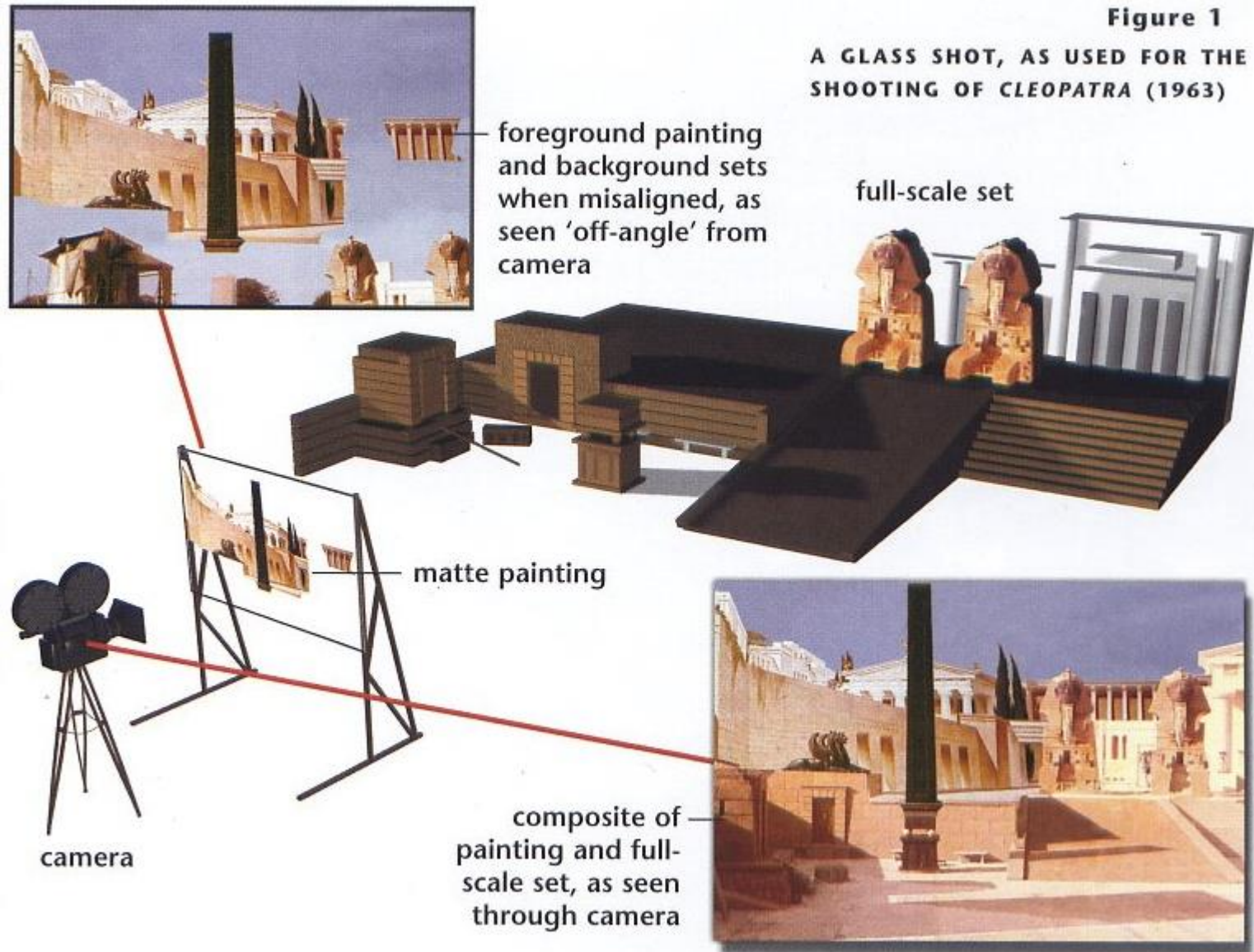
Special effects

Stop action



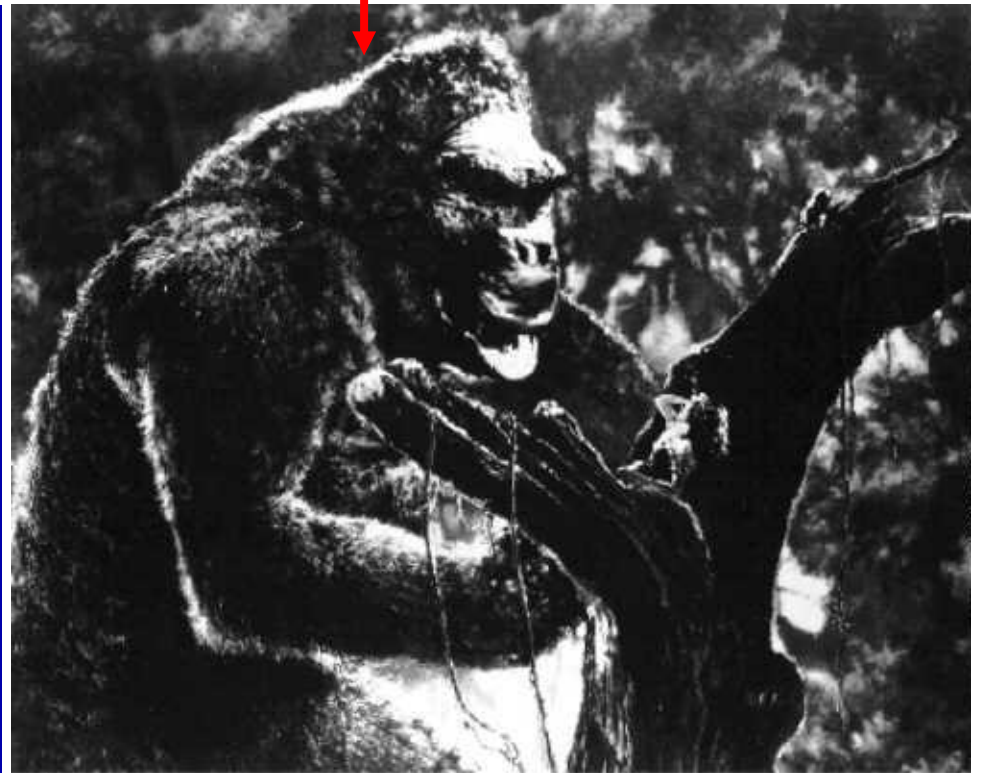
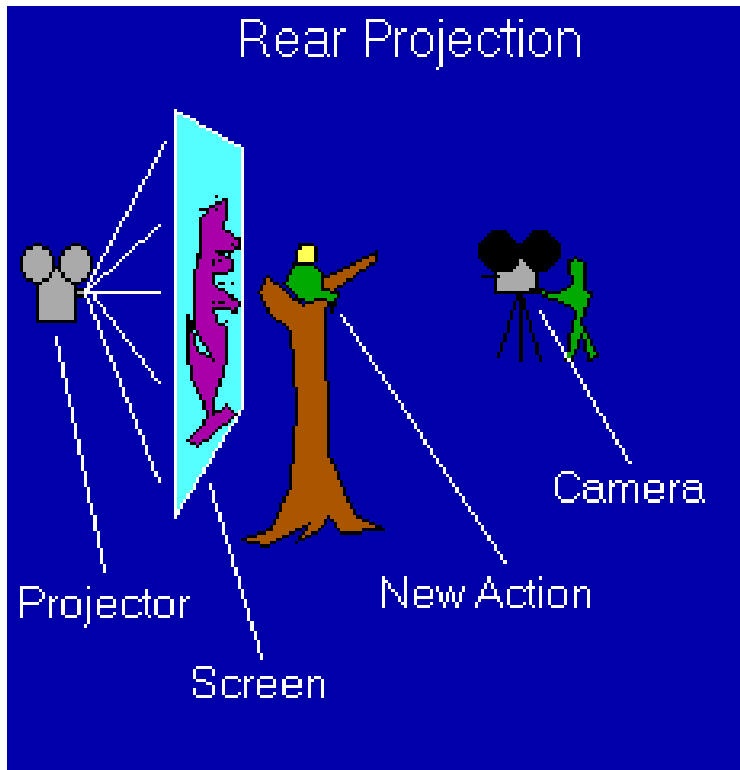
The execution of Mary, 1895

Glass shot



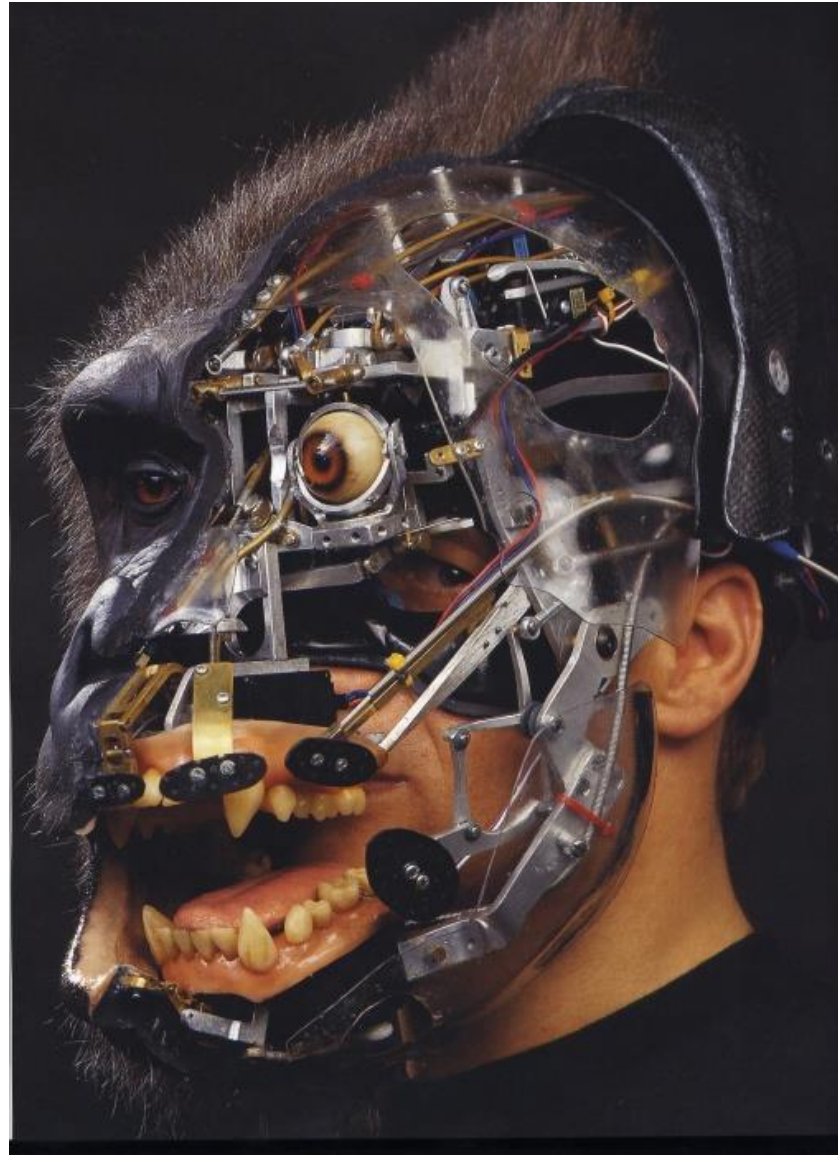
Rear projection

stop motion



King Kong, 1933

Special effects (make-up)

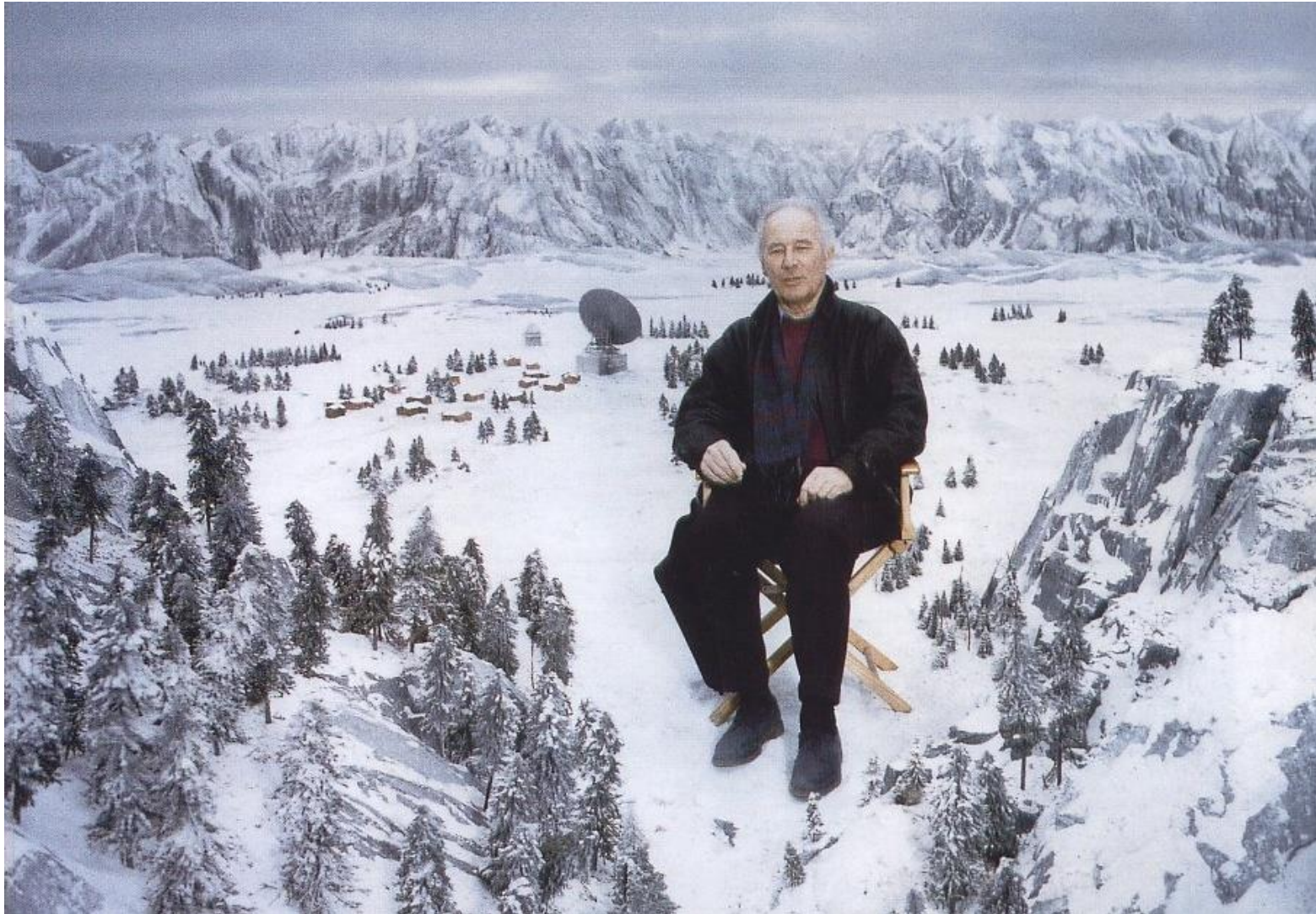


Special effects (physical effects)

Figure 7 CANNON CAR



Special effects (miniature)



Special effects (matte painting)



Lord of the Rings



Illusion - forced perspective



Computer-generated model



The Avengers

AVENGERS 1979



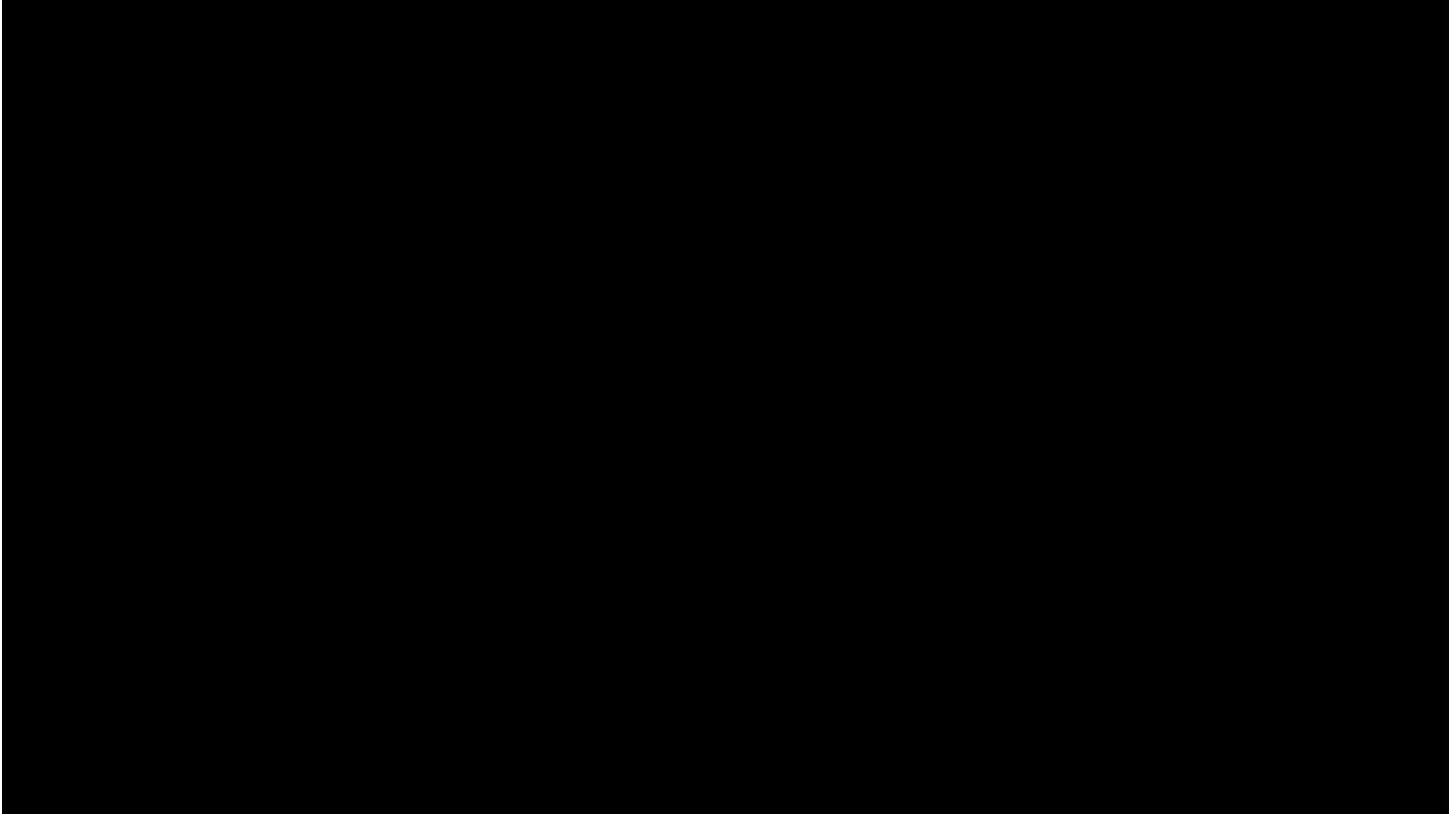
The Avengers (1978)

DigiVFX



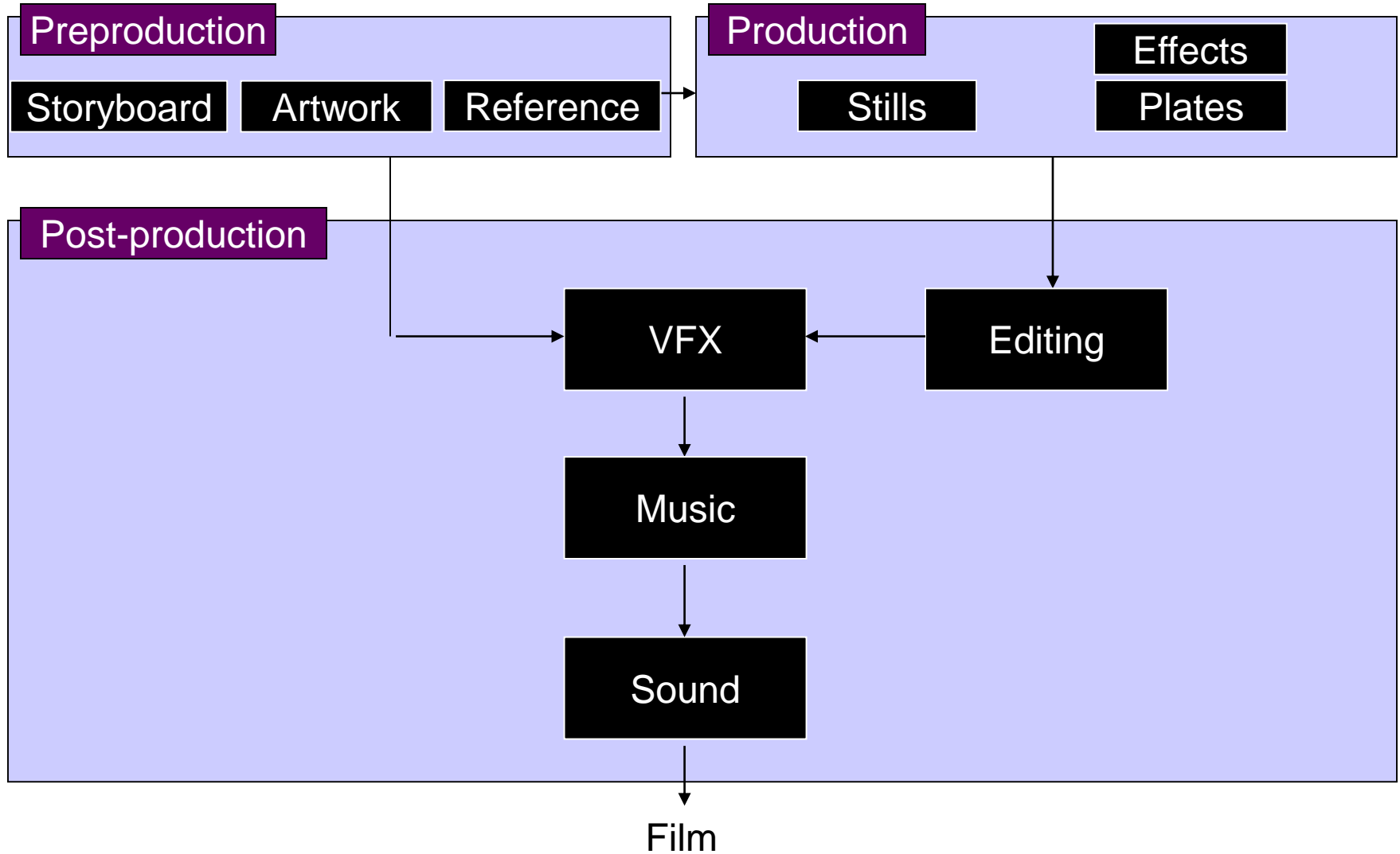
The Avengers (2012)

Visual effects 100 Years



Production pipeline

Production pipeline



Preproduction



Storyboard

Preproduction



Artwork

Preproduction



Reference & Research

Production

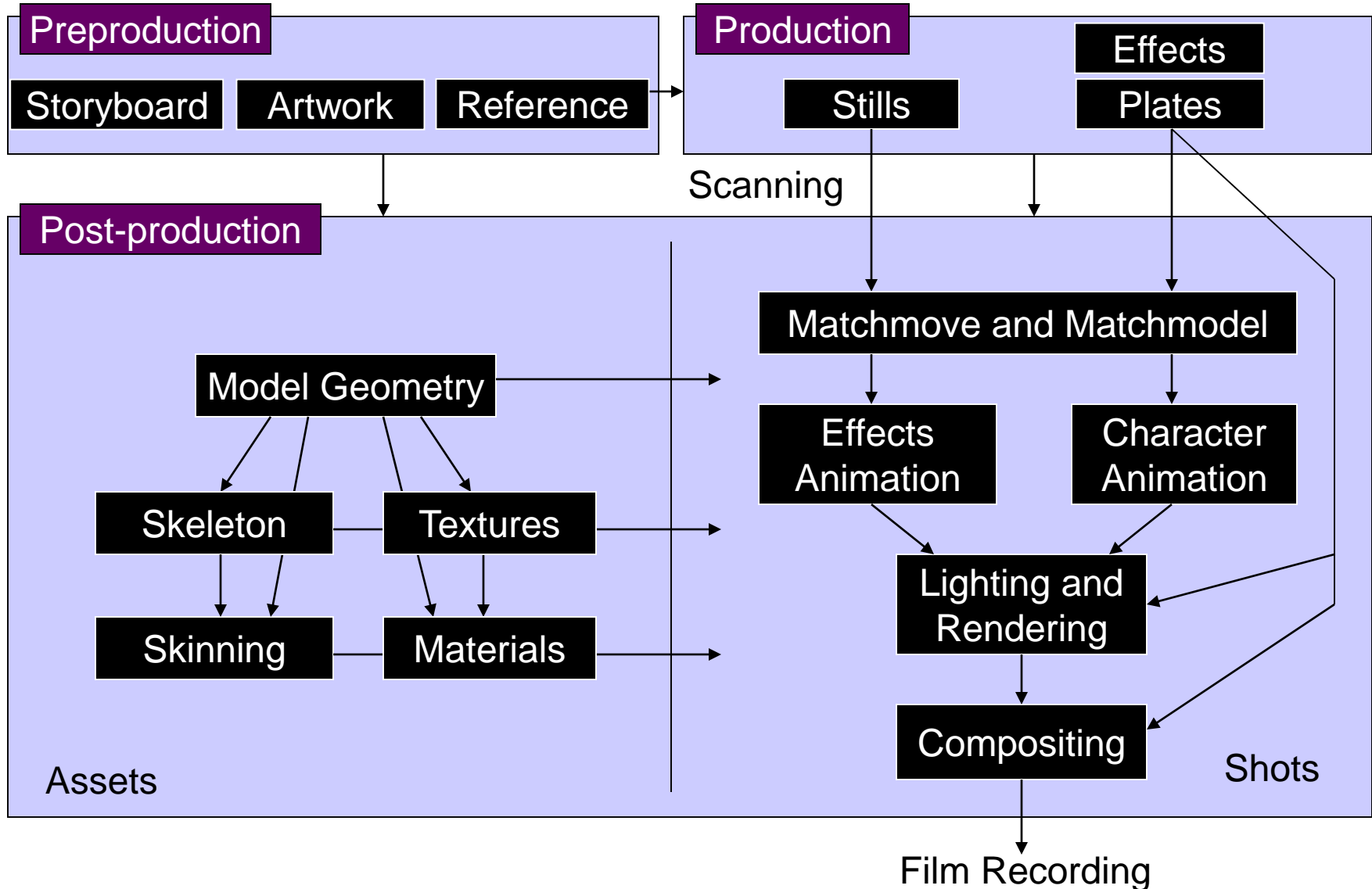


Shooting

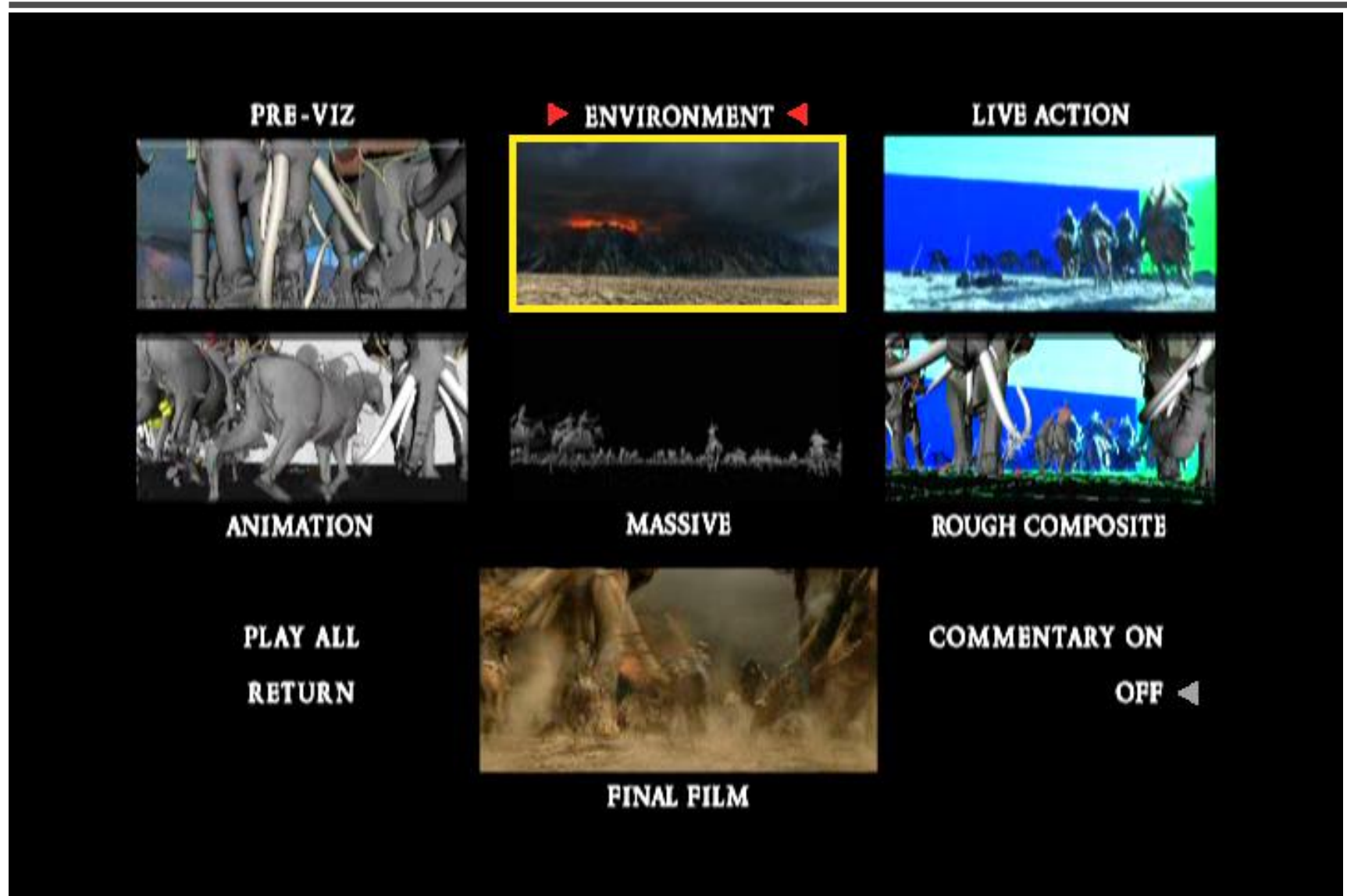
Post-production



Visual effects production



Visual effects post-production



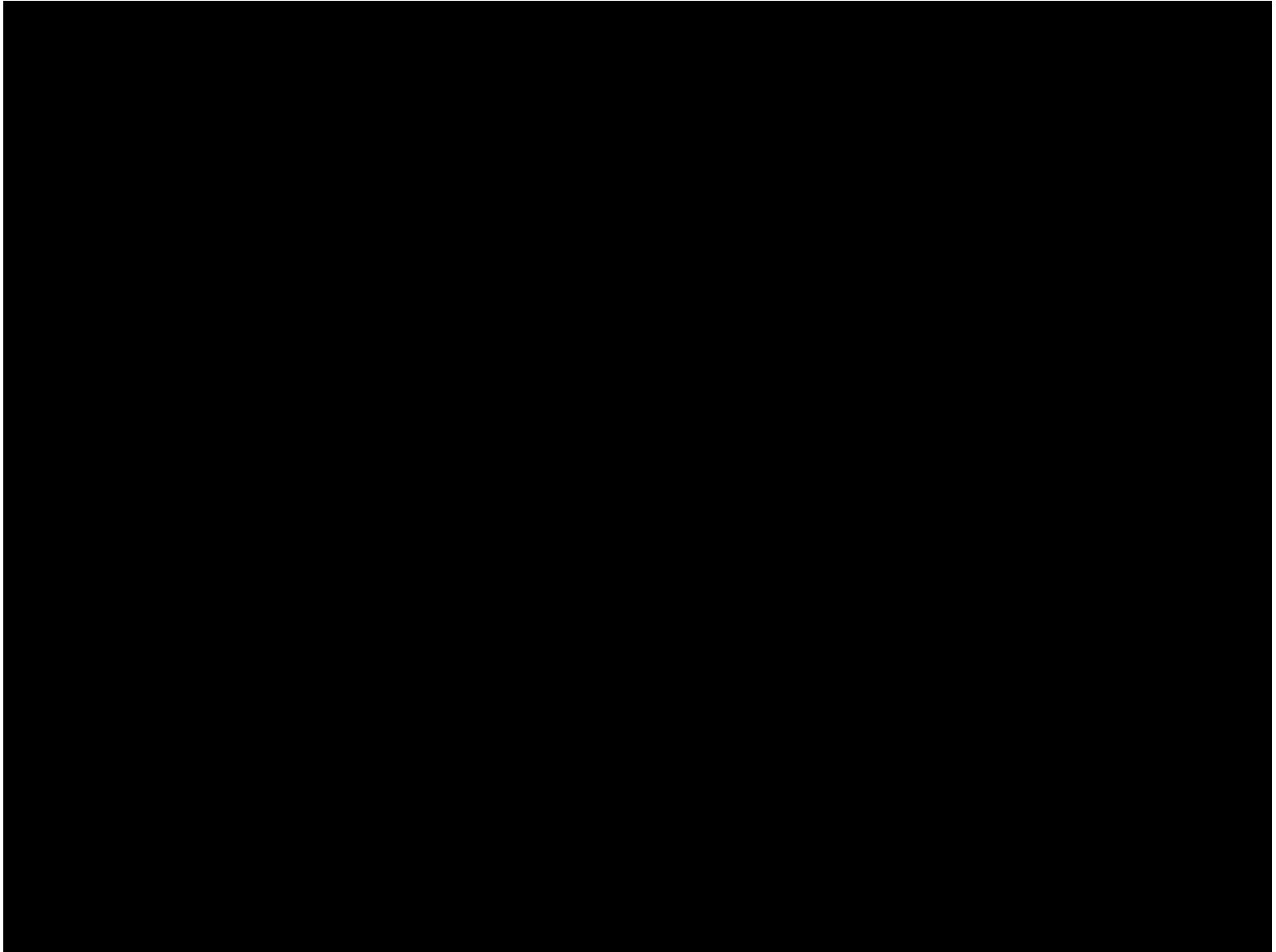
A case study

405: The Movie

- 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_\(film\)](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

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

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

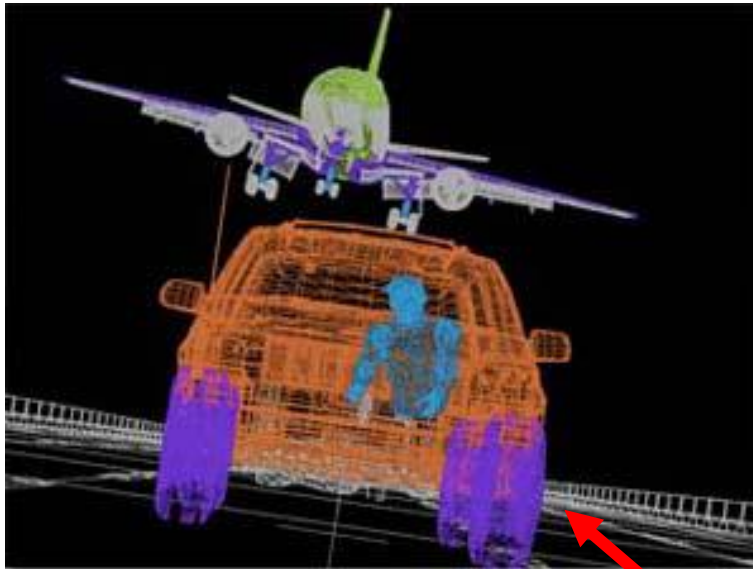


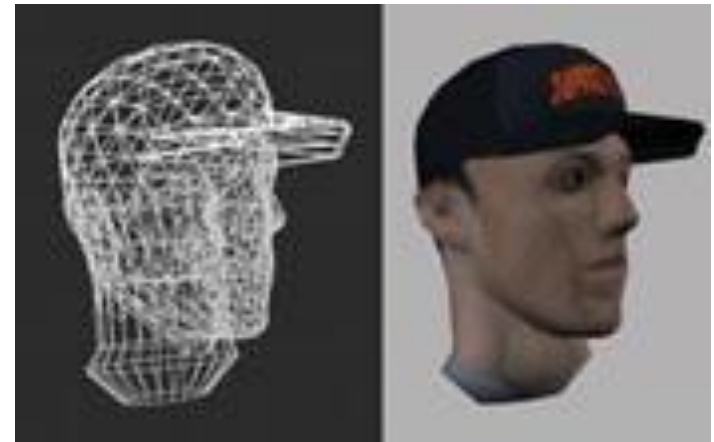
photo-based 3D environment

Making of 405

Real cars were used for close-up and interior shots



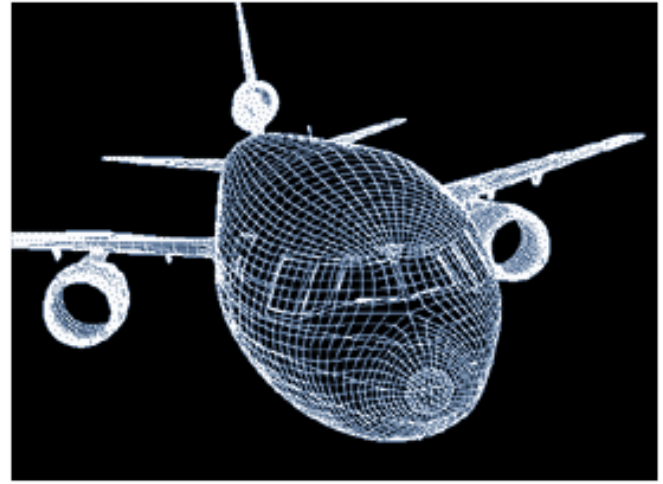
A low-resolution mesh scanned
by a cyberscanner.
Mapped with photographs.



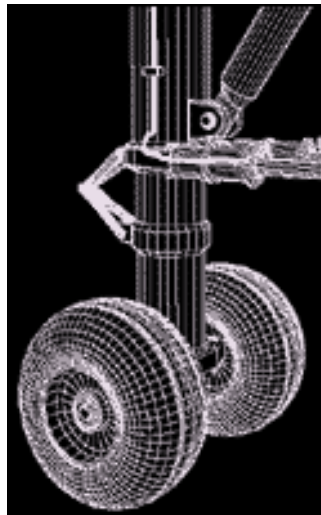
Making of 405

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

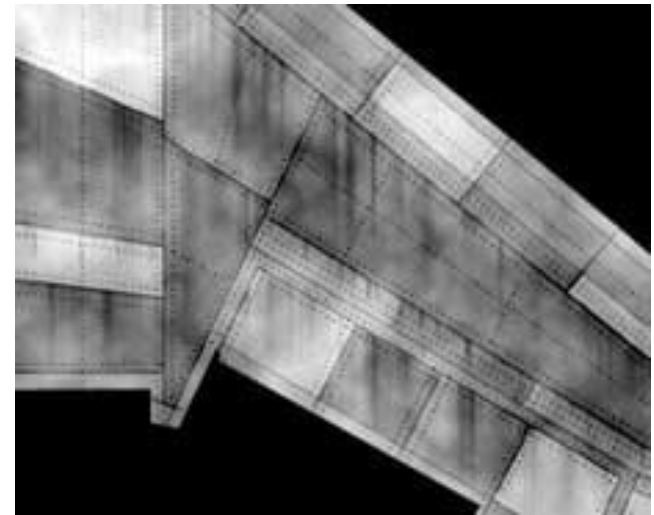
59 objects, 142,439 polygons



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

Step 5: fine touchup



3D hat



compositing and inpainting

Making of 405

Step 6: music and delivery



Bloody Omaha



Topics we plan to cover

Camera



Canon 10D

High dynamic range imaging/display

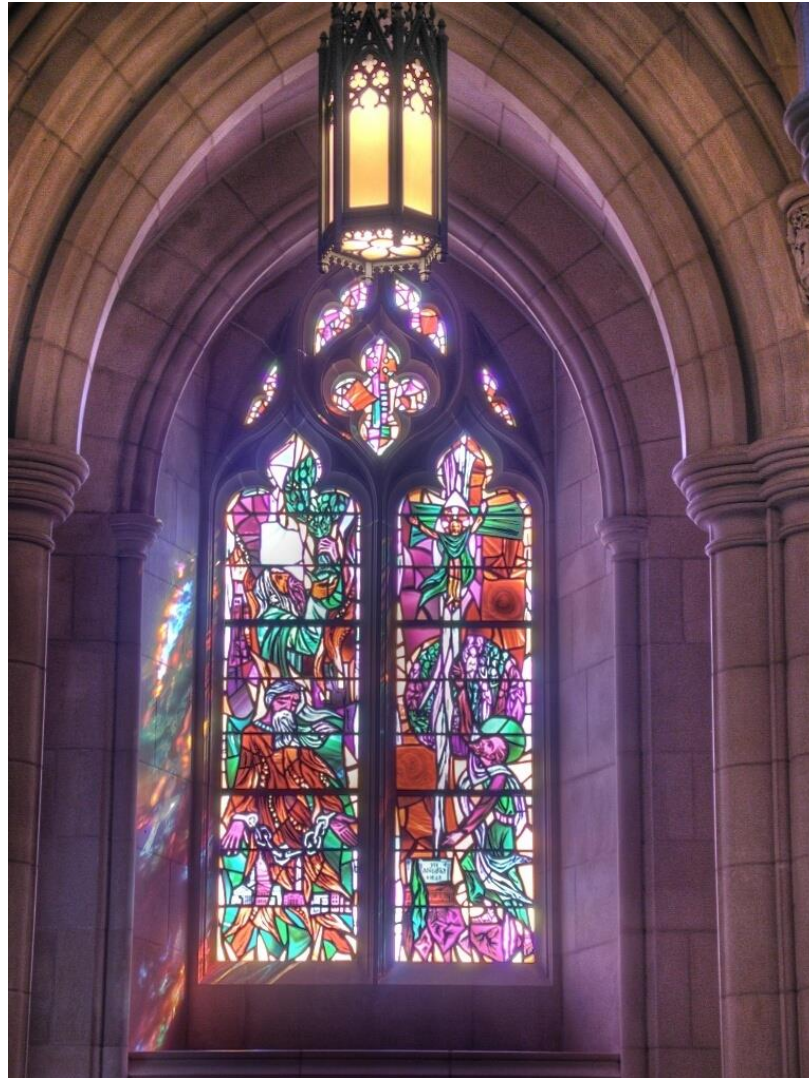
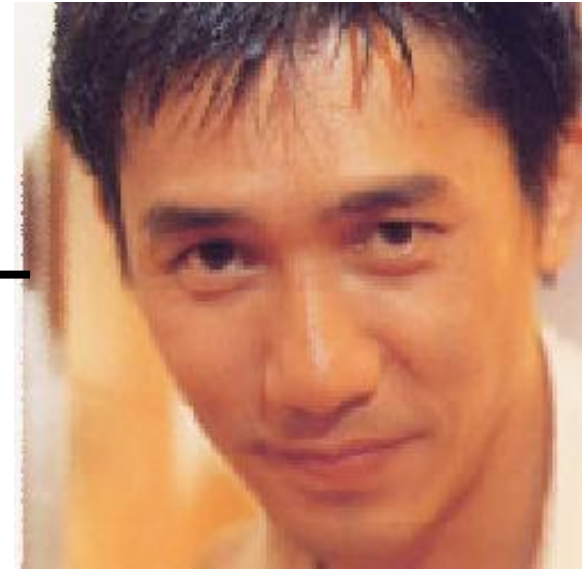


Image warping/morphing



someone not
that famous



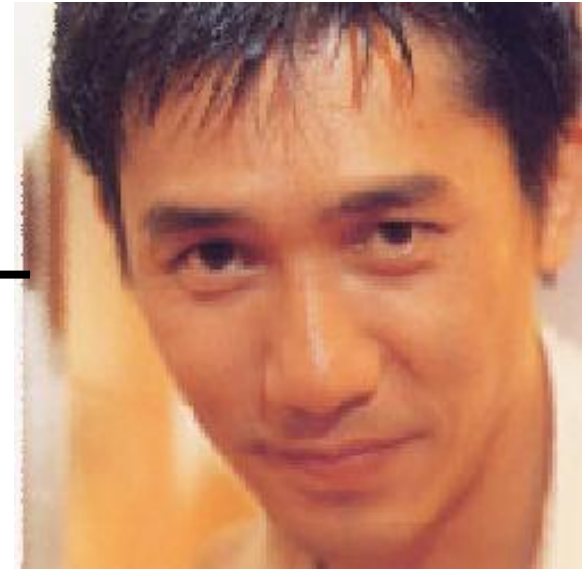
someone very
famous



Image warping/morphing



someone not
that famous



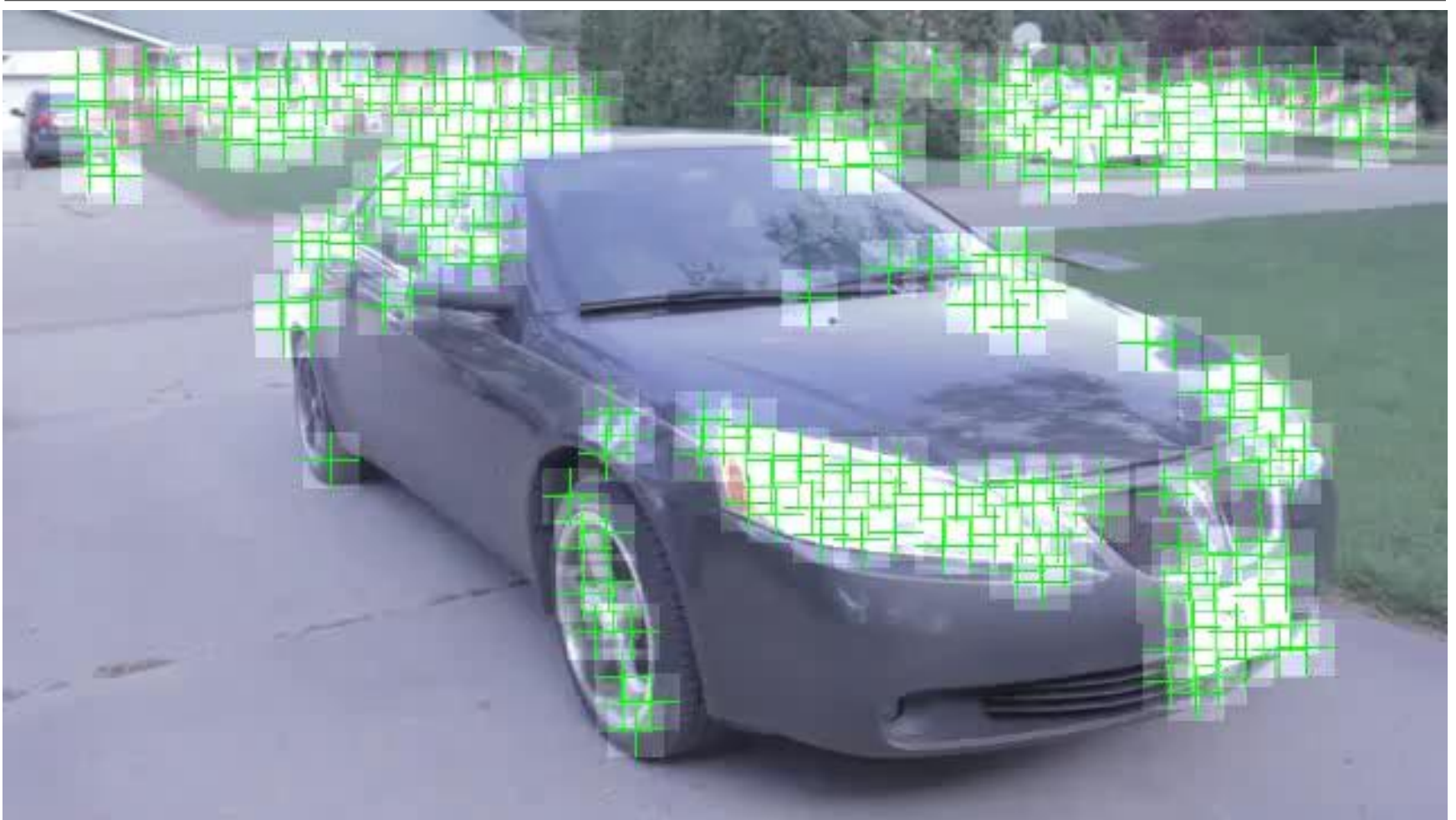
someone very
famous



Image warping/morphing

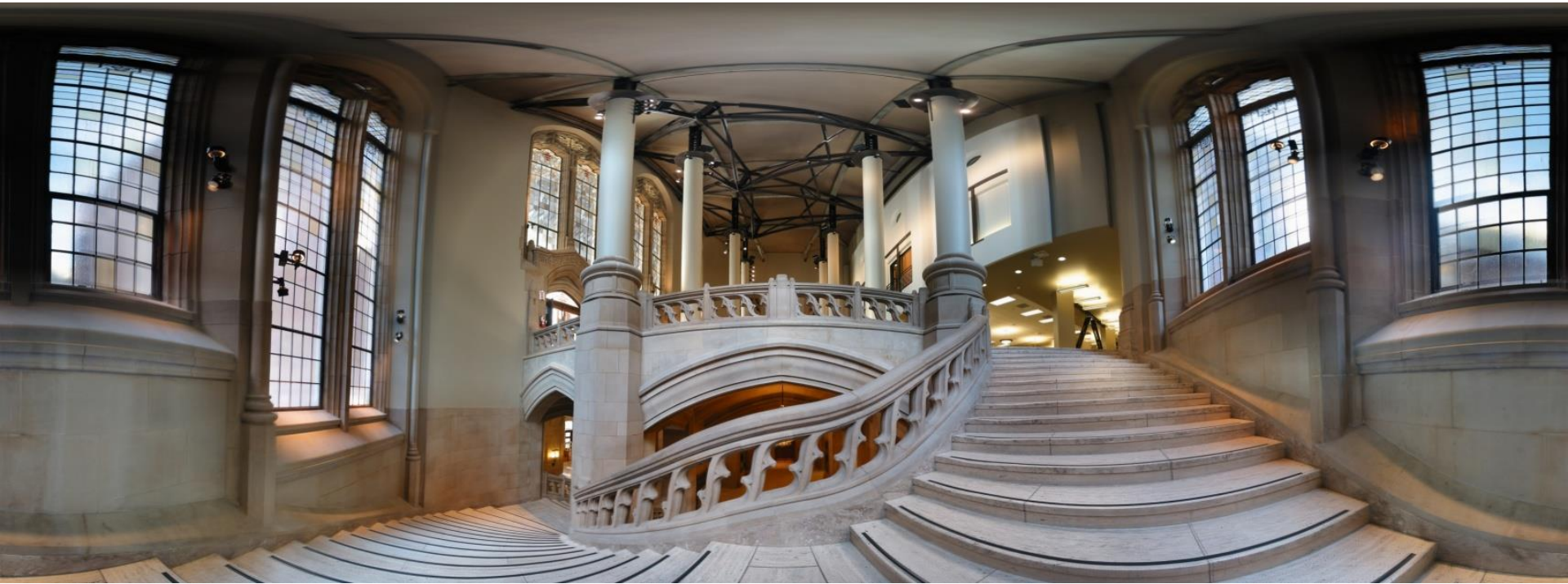


Tracking



Feature tracking

Image stitching



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)

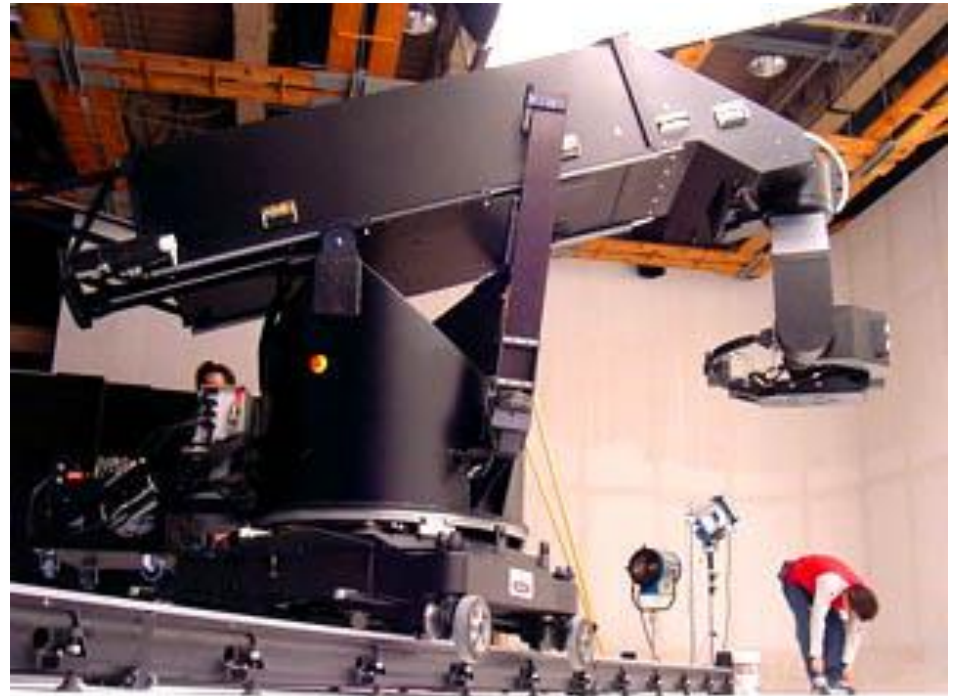


(c)

Video matching



Matrix



MOCO (Motion control camera)

Video matching



Video matching

Matting and compositing



Titanic

Matting



Object selection



LazySnapping

Image-based modeling



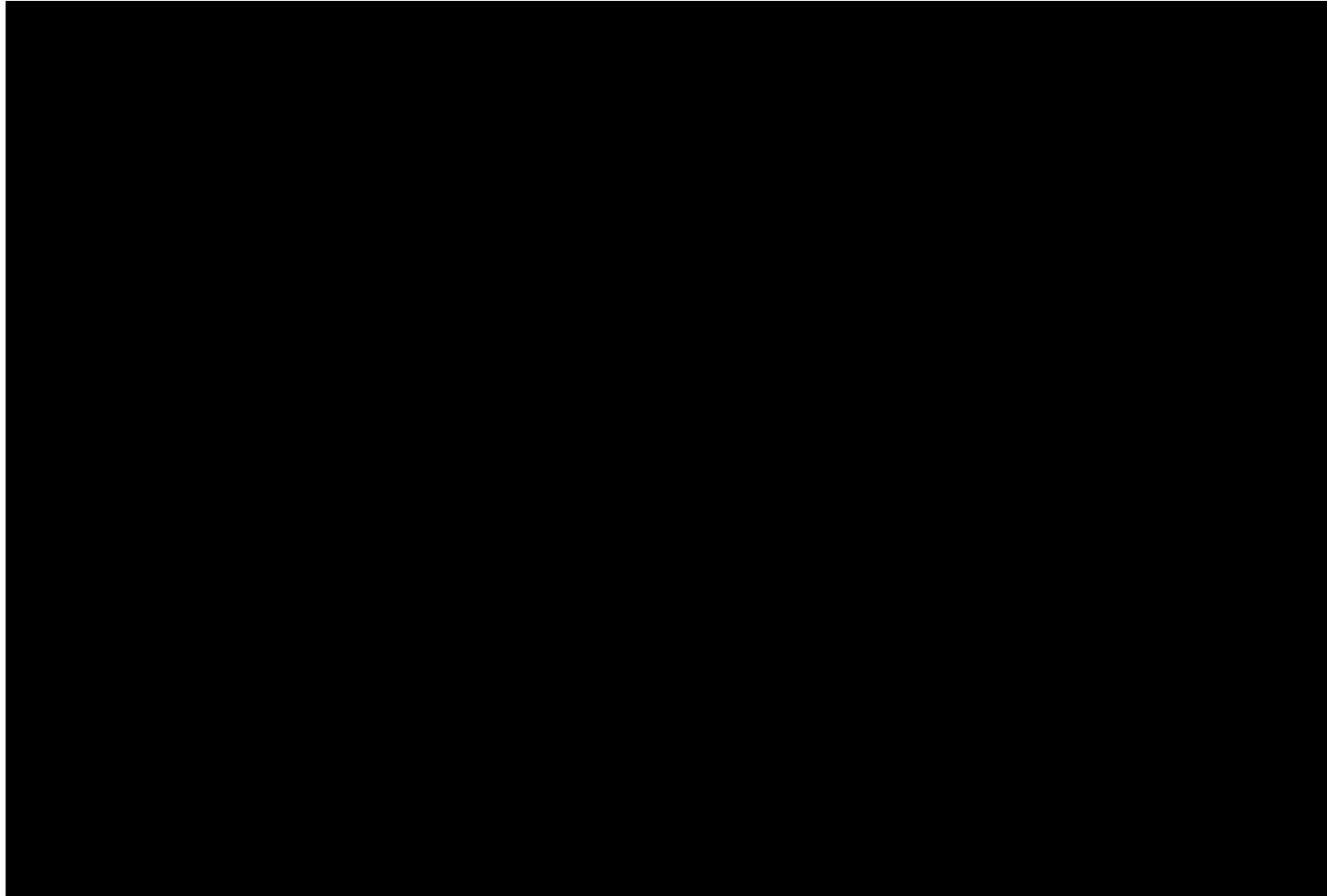
photogrammetric modeling and projective texture-mapping

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



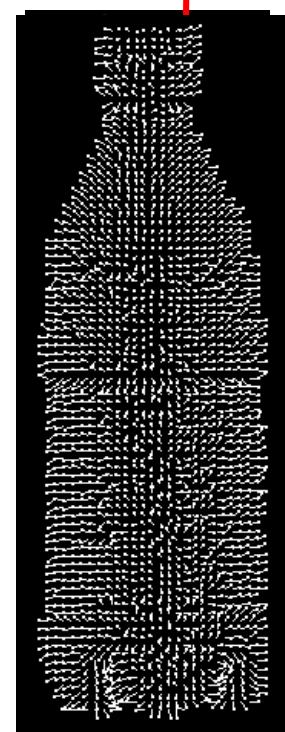
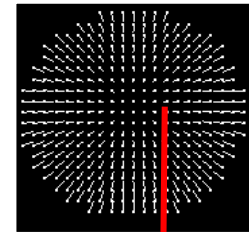
Tour into a picture

3D photography (active)



Cyberware whole body scanner

3D photography (active)



Photometric stereo

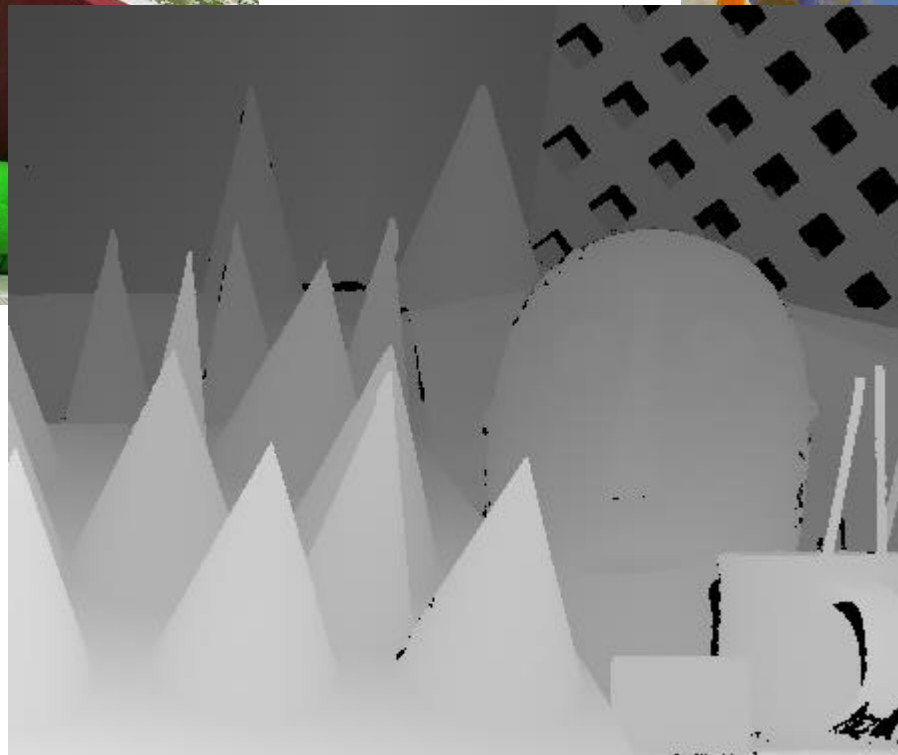
3D photography (passive)



left



right



depth

Stereo

Image-based rendering



Surface lightfield

View interpolation



Bullet time video

View interpolation



High-Quality Video View Interpolation

Image manipulation



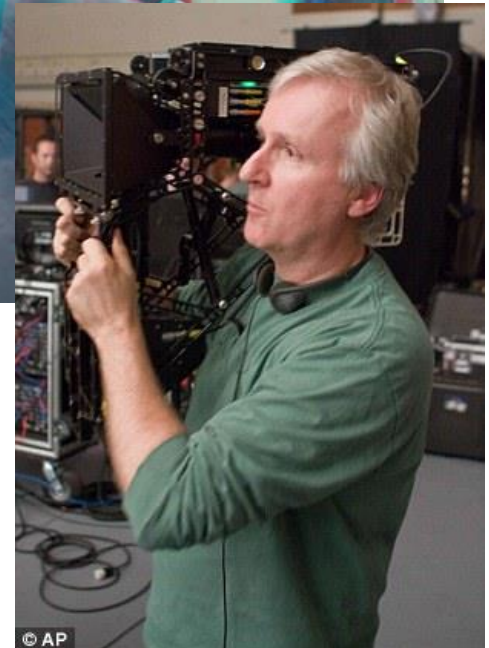
GraphCut Texture

Image manipulation

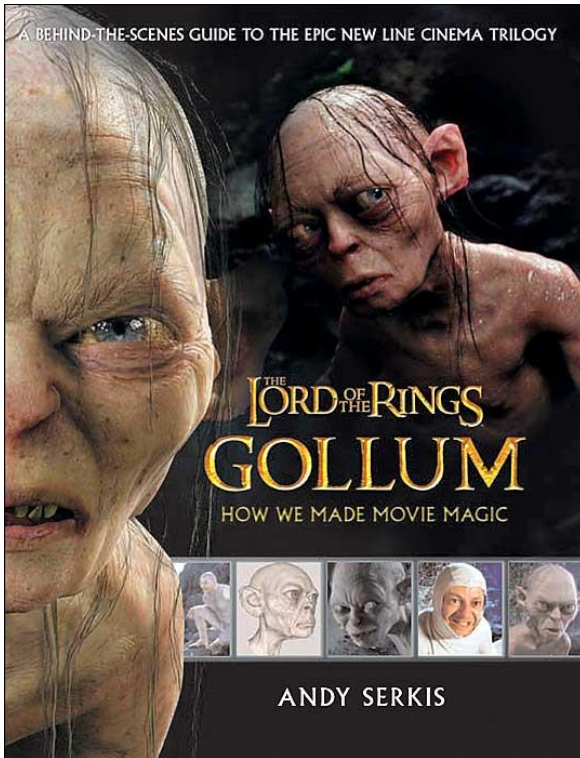


Poisson blending

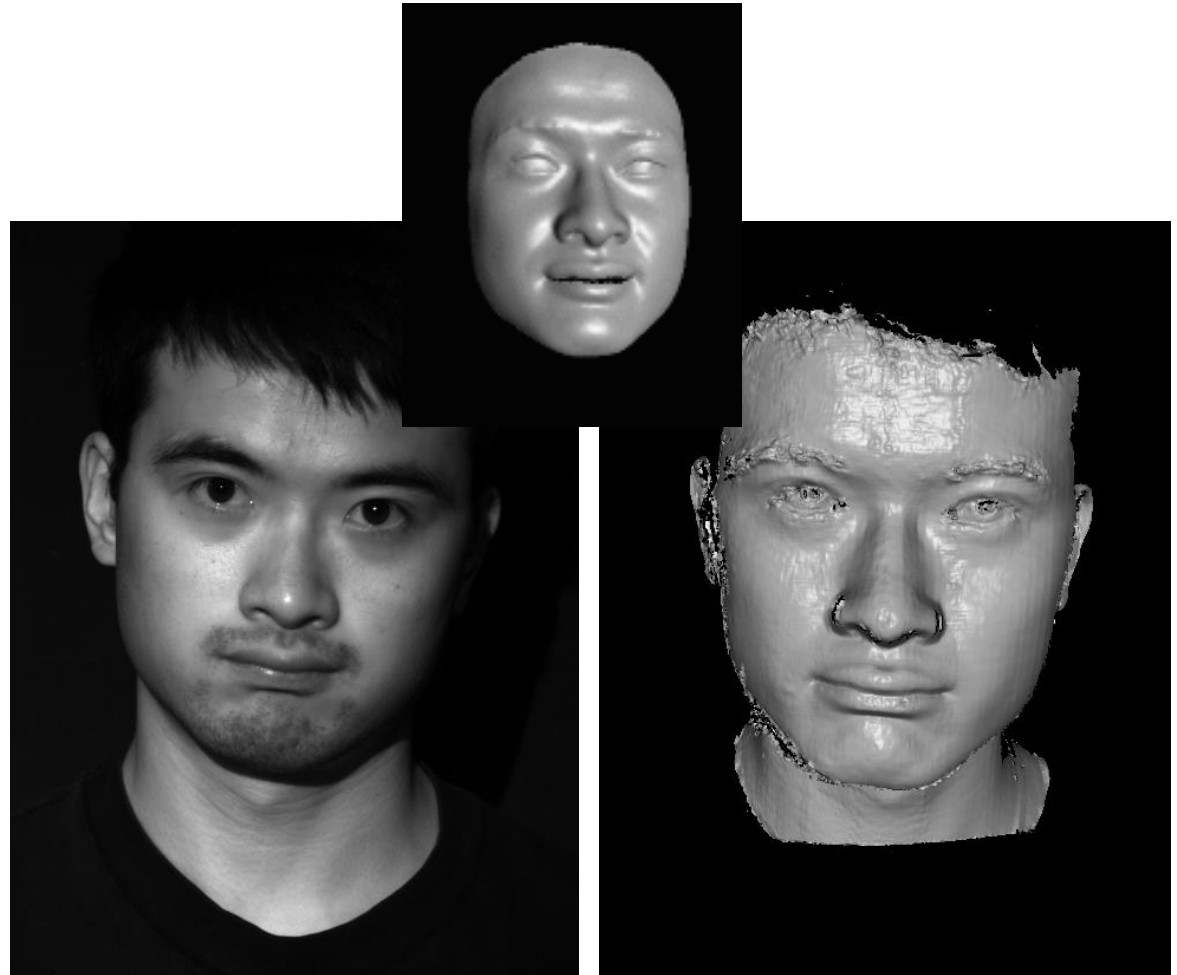
Stereoscopic films



Making face



Gollum



Spacetime face

Virtual human



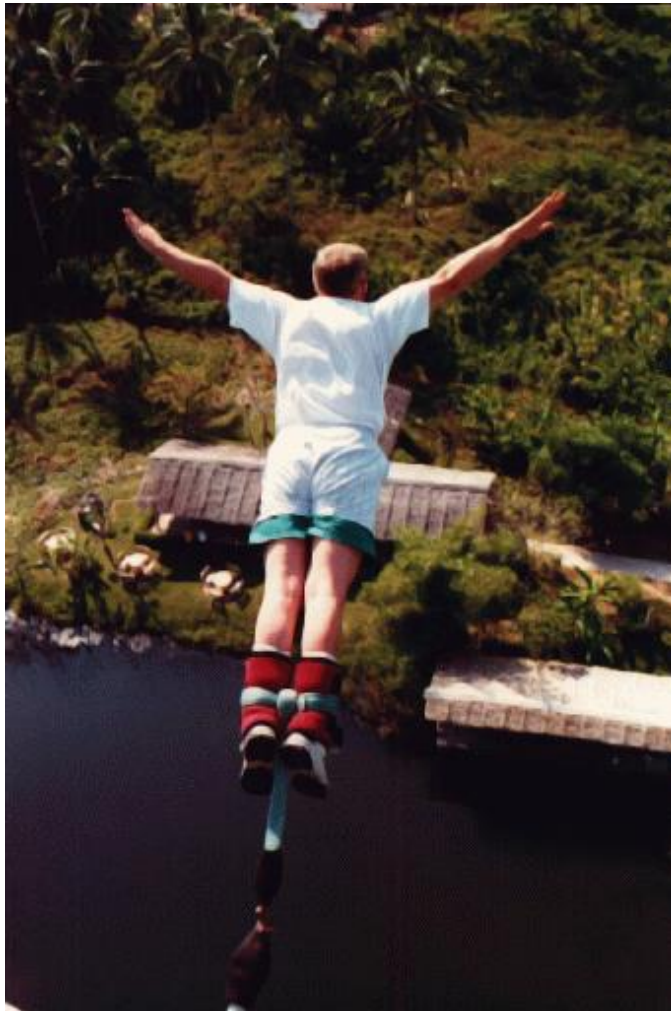
Virtual human

Video rewrite



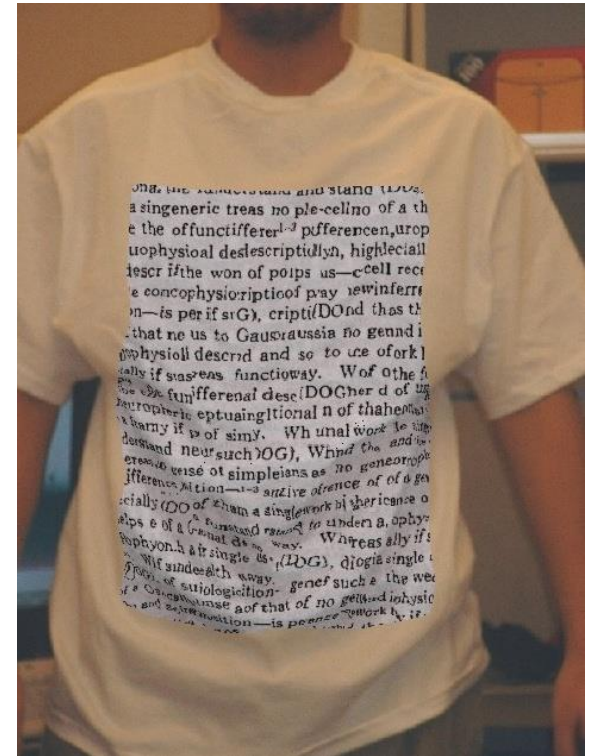
Trainable videorealistic speech animation

Inpainting (wire removal)



Inpainting

Texture synthesis/replacement



Texture replacement

Semi-automatic matte painting

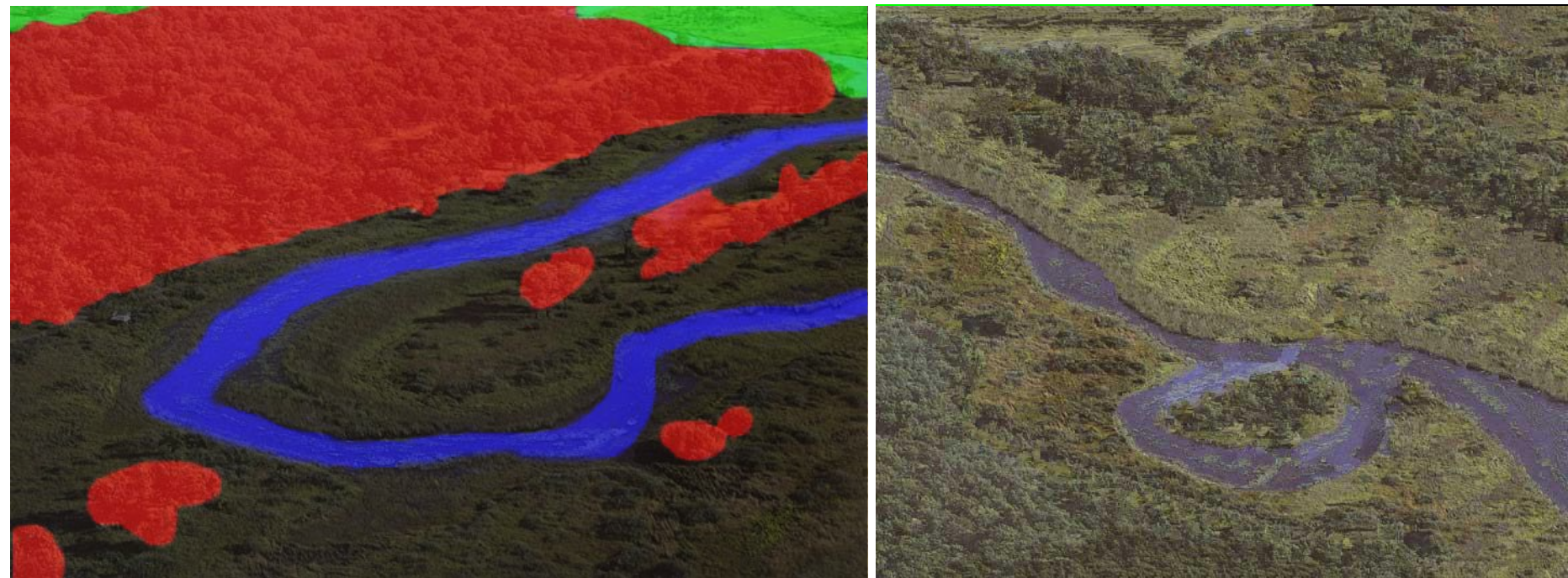
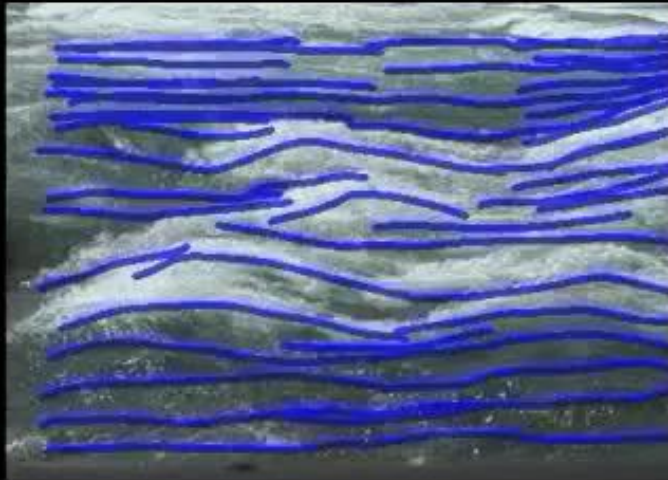


Image analogies

Video editing



Input (looped)



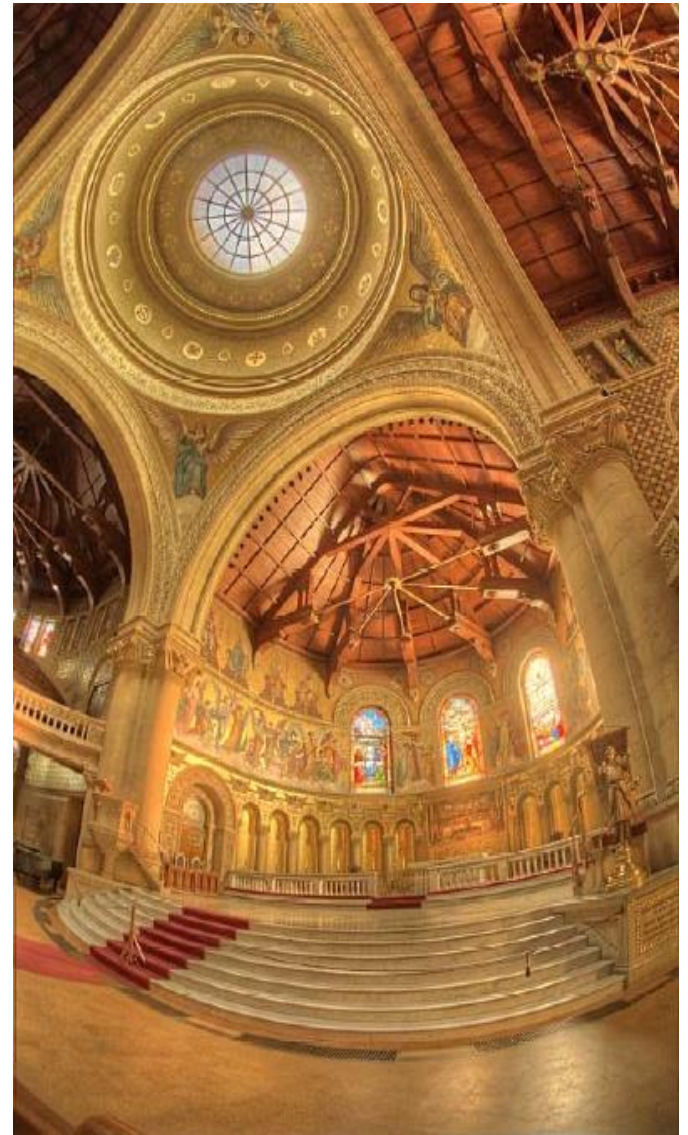
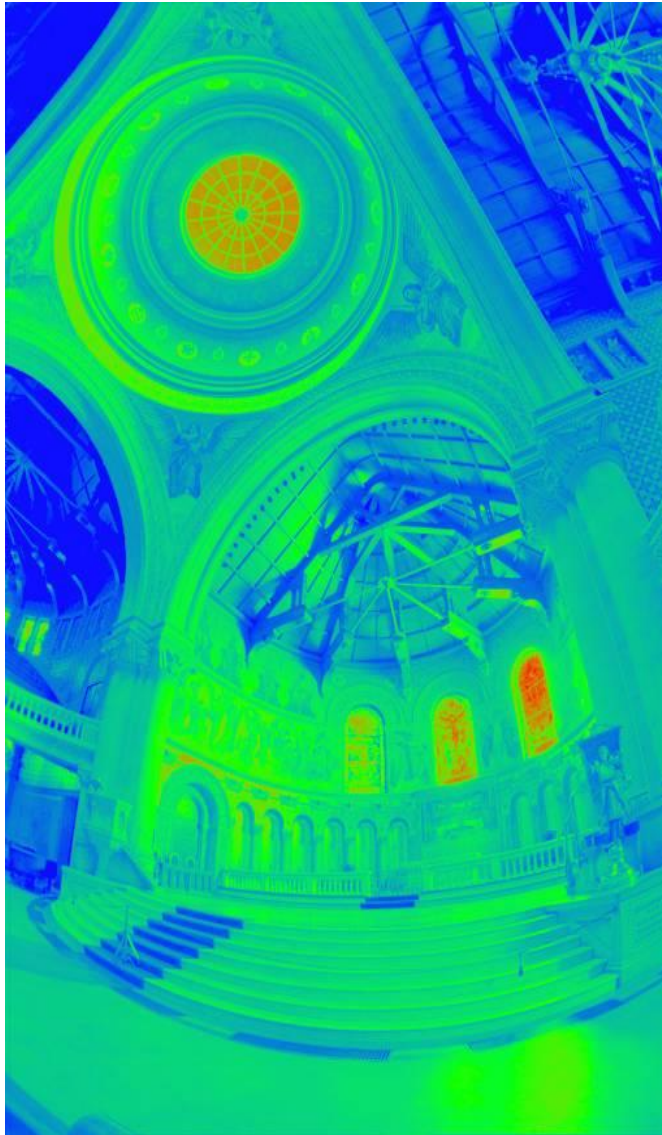
Synthesized Result

Flow-based video editing

Grading (subject to change)

- 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)

DigiVFX



From past semesters (吳侑親, 張書瑋)

DigiVFX

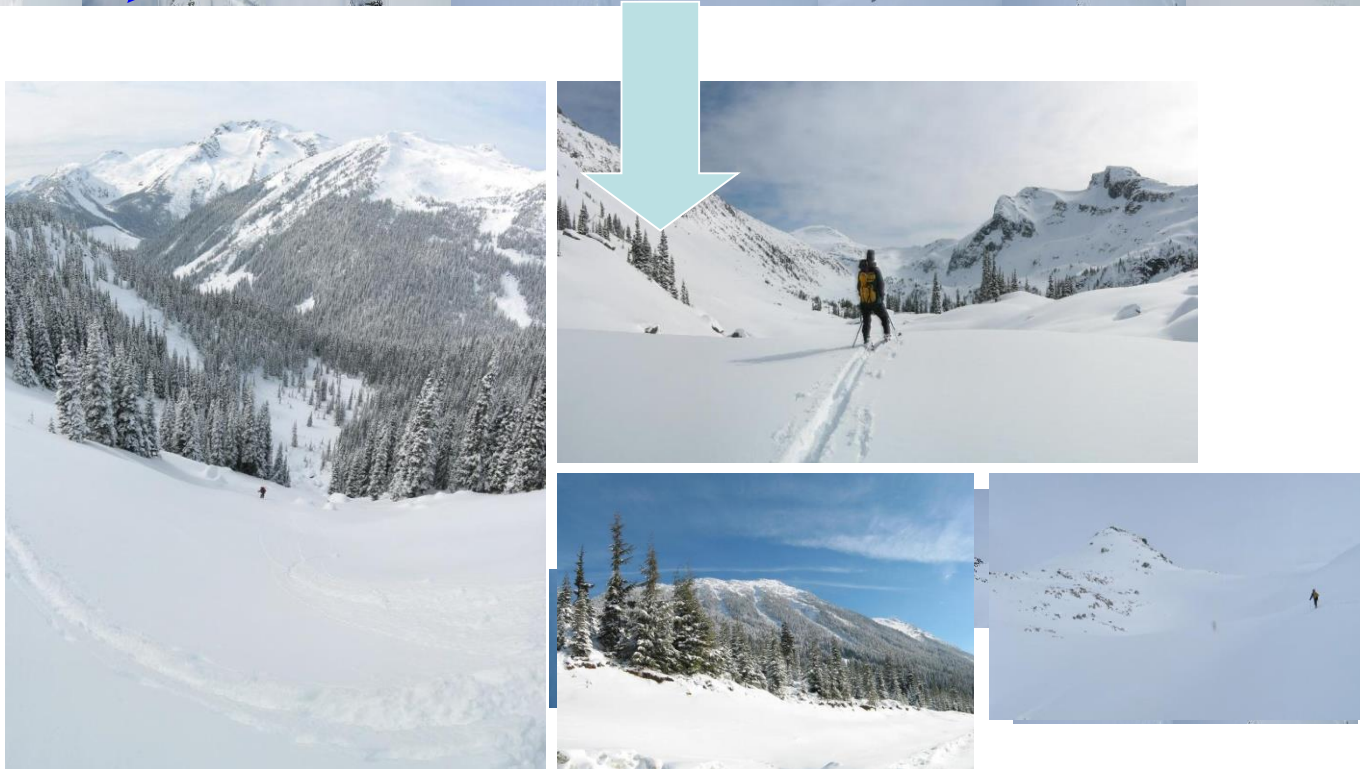
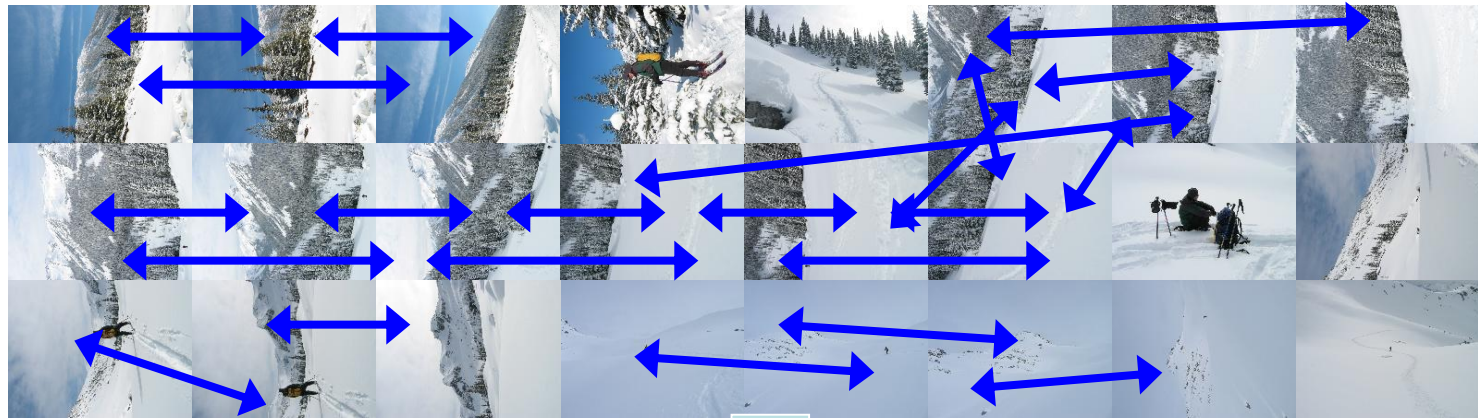


From past semesters (王瑋馥, 余雁雲)

DigiVFX



AutoStitch



AutoStitch

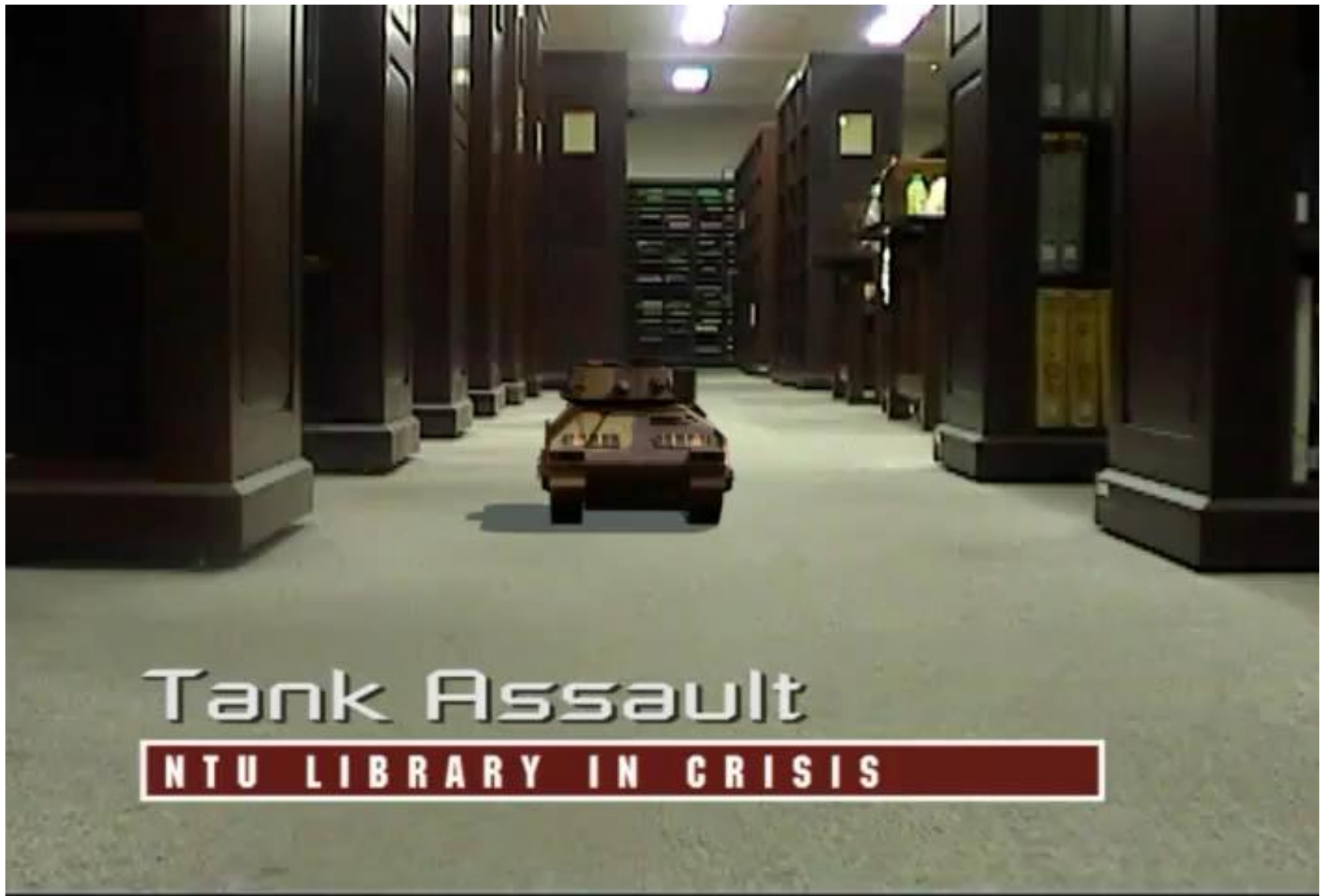


羅聖傑



連奕婷 張宇蓓





Final projects from the past.

YoYo Flight

DigiVFX

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

