Course overview

Digital Visual Effects

Yung-Yu Chuang
Logistics

- **Meeting time:** 2:20pm-5:20pm, Wednesday
- **Classroom:** CSIE Room 102
- **Instructor:** Yung-Yu Chuang ([cyy@csie.ntu.edu.tw](mailto:cyy@csie.ntu.edu.tw))
- **Teaching assistants:** 沈林承、陳育聖
- **Webpage:** (user name/password)
  [http://www.csie.ntu.edu.tw/~cyy/vfx](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/](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
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.
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 you actually do

What you thought you will do

What other professors think you do

What other students think you do

What you actually do
Be cautious!
Warning from previous students

• 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
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
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

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

composite of painting and full-scale set, as seen through camera
Rear projection

King Kong, 1933

stop motion
Special effects (make-up)
Special effects (physical effects)
Special effects (miniature)
Special effects (matte painting)
Lord of the Rings
Illusion - forced perspective
Computer-generated model
The Avengers (1978 vs 2012)
Visual effects 100 Years

VISUAL EFFECTS: 100 YEARS OF INSPIRATION
Production pipeline
Preproduction

Storyboard

THE RETURN OF THE KING
Book Six - Chapter III
"Mount Doom"
Preproduction

Artwork
Preproduction

Reference & Research
Production

Shooting
Post-production
Visual effects production

Preproduction
- Storyboard
- Artwork
- Reference

Production
- Stills
- Plates

Effects
- Matchmove and Matchmodel
- Effects Animation
- Character Animation
- Lighting and Rendering
- Compositing

Post-production
- Model Geometry
  - Skeleton
  - Textures
  - Skinning
  - Materials

Scanning

Assets

Film Recording
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.
- An early example of digital filmmaking and the use of Internet as media
- Budget: $300 ($140 for tickets. The officer is acknowledged)
## Making of 405

### Step 0: script and shooting plan

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

close-up shots

inpainting

clean plate
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
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

video

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
Video matching

Matrix  MOCO (Motion control camera)
Video matching

Primary Video
Matting and compositing

Titanic
Matting
Object selection

Lazy Snapping
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)
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
Video rewrite

Trainable videorealistic speech animation
Inpainting (wire removal)
Texture synthesis/replacement

Texture replacement
Semi-automatic matte painting

Image analogies
Video editing

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)
From past semesters (吳侑親, 張書瑋)
From past semesters (王瑋馥, 余雁雲)
AutoStitch
MathMove

梁家愷 鍾志遠

姜任遠 林立峯

楊宗碩 林柏劭

翁憲政 洪韶憶
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

YoYo Flight !!
YoYo Inc. present
Jun, 28, 2005
That’s it for today!

• Don’t forget to subscribe the mailing list.
• Check out the course website.