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)
- **Teaching assistants:** 沈林承、陳育聖
- **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/

It isn’t about photography

This course is **NOT** about …
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

**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 …

Deadpool

Deadpool
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。這真的很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！
Bush campaign’s TV AD, 2004

Texture synthesis and inpainting

Iraq War, LA Times, April 2003

Domestic example
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)

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

Production pipeline

Preproduction

Storyboard
Preproduction

Artwork

Preproduction

Reference & Research

Production

Shooting

Post-production
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)]
- 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>128</td>
</tr>
<tr>
<td>04</td>
<td>LA Freeway from Onleway</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>149</td>
</tr>
<tr>
<td>06</td>
<td>Pan From Freeway - 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>35</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 on rear view mirror - remove traffic</td>
<td>X</td>
<td></td>
<td>33</td>
</tr>
<tr>
<td>15</td>
<td>Plane reaches Car toward camera</td>
<td>X</td>
<td>X</td>
<td>77</td>
</tr>
</tbody>
</table>

Step 1: shooting
two days with a Canon Optura DV camera with progressive mode.
⇒ a 70-minute raw footage

initial editing
⇒ pickup shots

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

Making of 405

Step 3: traffic clearing

clean plate

close-up shots

Making of 405

Step 4: compositing

shot with the vehicle standing still in a backyard

inpainting
Making of 405

Step 5: fine touchup

3D hat                compositing and inpainting

Step 6: music and delivery

Bloody Omaha
Breakdown (Wolf of Wall Street)  

Topics we plan to cover

Camera

High dynamic range imaging/display

Canon 10D
Image warping/morphing

someone not that famous

someone very famous

Video

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)

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

Tour into a picture

3D photography (active)

Cyberware whole body scanner

3D photography (active)

Photometric stereo
3D photography (passive)

Image-based rendering

View interpolation

View interpolation

left  right

Stereo
depth

Surface lightfield

Bullet time video

High-Quality Video View Interpolation
Image manipulation

GraphCut Texture

Image manipulation

Poisson blending

Stereoscopic films

Making face

Gollum Spacetime face
Virtual human

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
Final projects from the past.
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.