

Course overview

Digital Visual Effects

Yung-Yu Chuang

DigiVFX

Logistics

- Meeting time: 2:20pm-5:20pm, Tuesday
- Classroom: CSIE Room 102
- Instructor: Yung-Yu Chuang (cyy@csie.ntu.edu.tw)
- Teaching assistants: TBA
- Textbook: Readings from books, journals and proceedings. Richard Szeliski's [Computer Vision: Algorithms and Applications](#). Richard Radke's [Computer Vision for Visual Effects](#).
- 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/>

DigiVFX

It isn't about photography



This course is **NOT** about ...

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

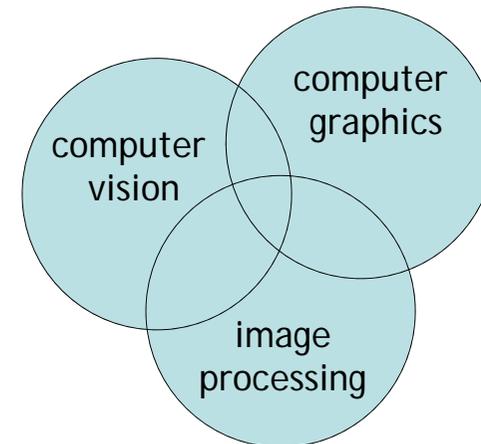
DigiVFX



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

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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

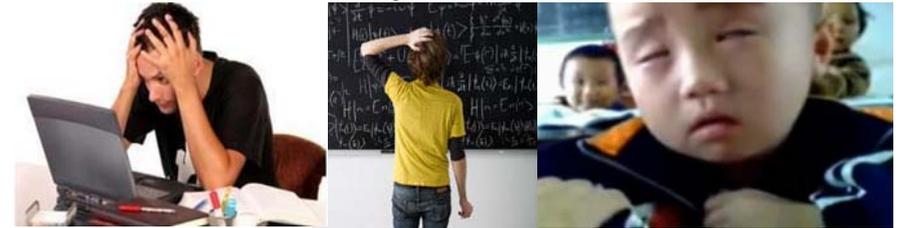
DigiVFX



what other professors think you do

what other students think you do

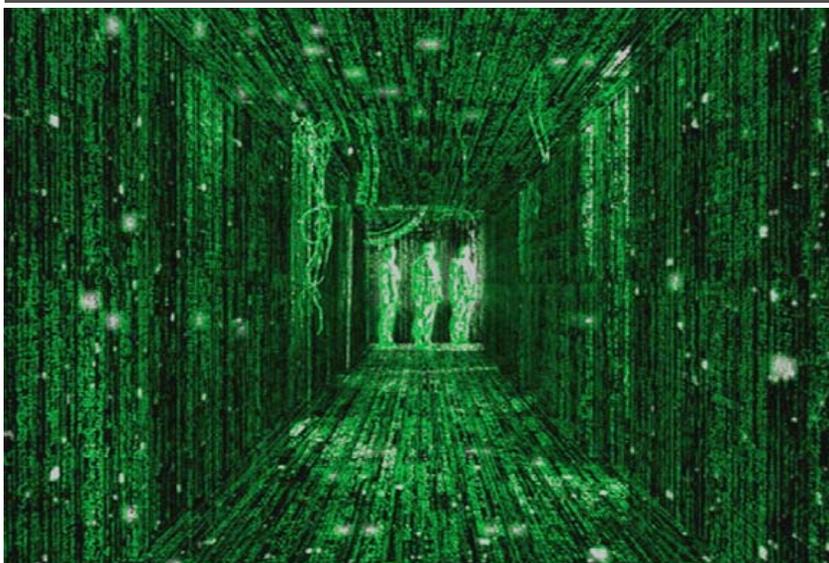
what you thought you will do



what you actually do

Be cautious!

DigiVFX



Warning from previous students

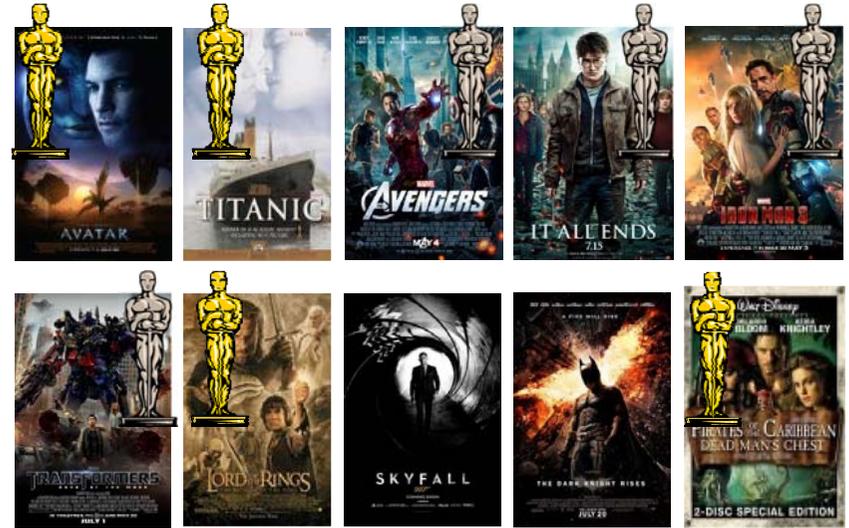
DigiVFX

- 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同學勿修，否則就會像我一樣停修 XD

This course is about ...

Digital Visual Effects

DigiVFX



Life of Pi

DigiVFX



Life of Pi

DigiVFX



獨自一人拍和十三人的戲

DigiVFX



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！

Reality?

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Retouching

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Retouching

DigiVFX



Retouching

DigiVFX



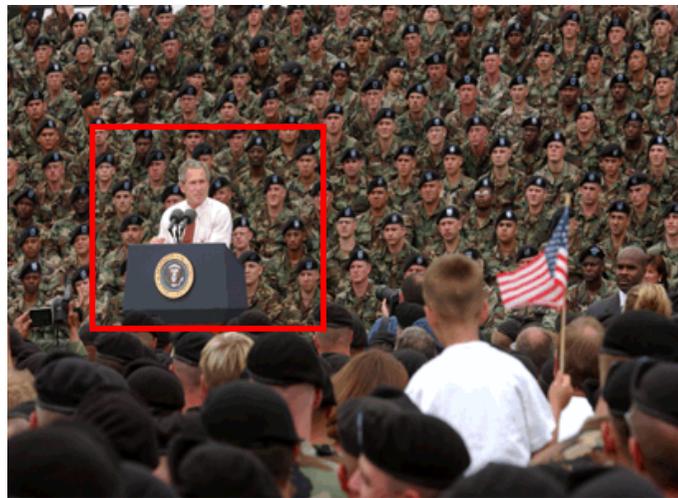
Iraq War, LA Times, April 2003

DigiVFX



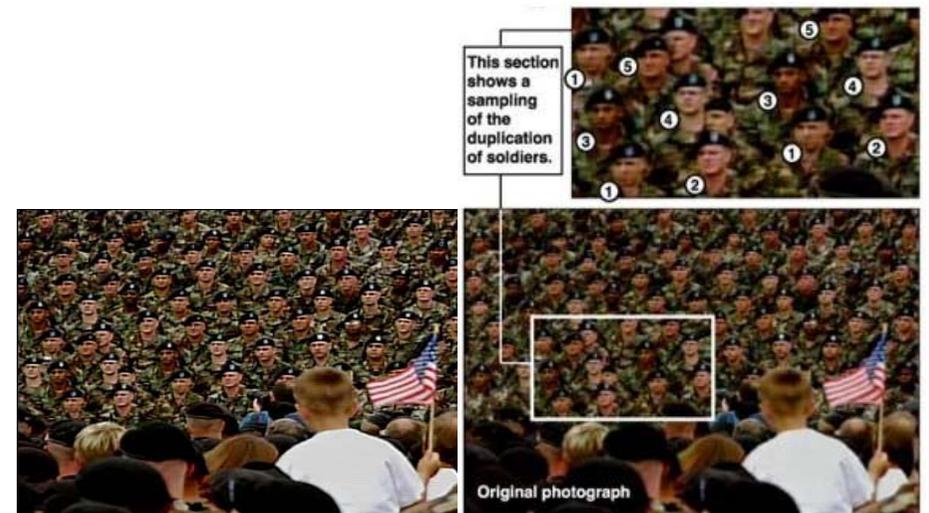
Bush campaign's TV AD, 2004

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Texture synthesis and inpainting

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Domestic example

DigiVFX



The Liberty Times
2007.12.17



Special effects

Stop action

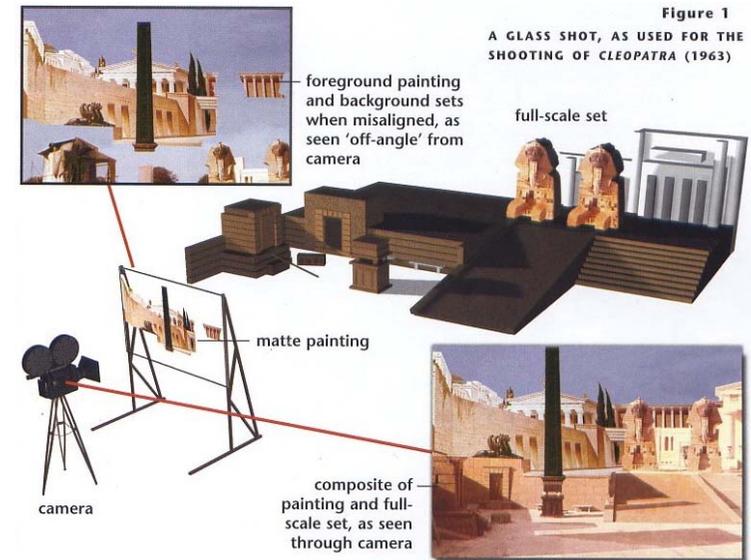
DigiVFX



The execution of Mary, 1895

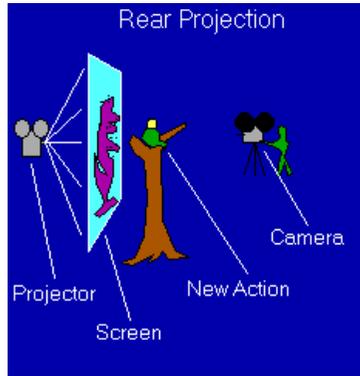
Glass shot

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Rear projection

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stop motion



King Kong, 1933

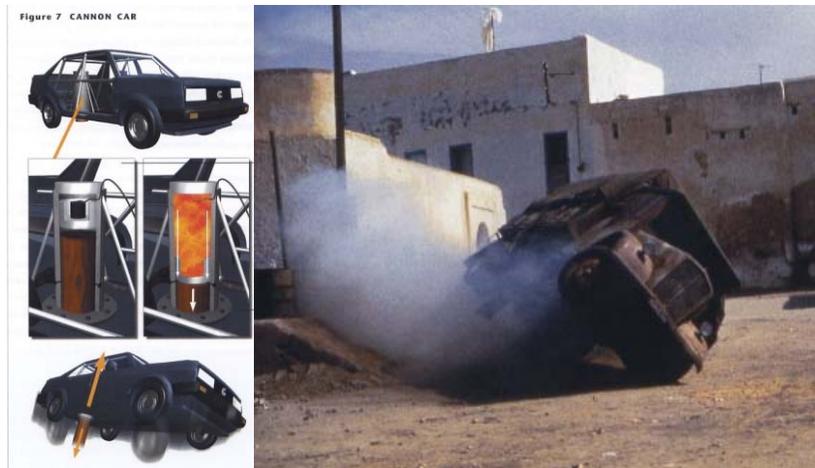
Special effects (make-up)

DigiVFX



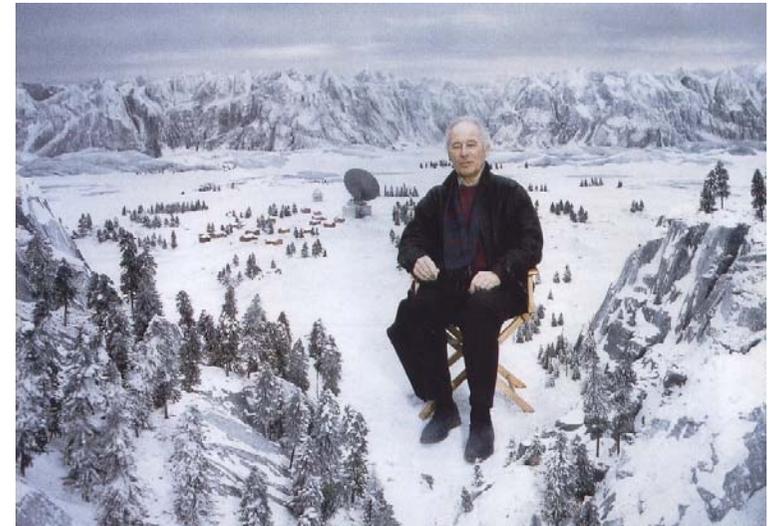
Special effects (physical effects)

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Special effects (miniature)

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Special effects (matte painting)

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Lord of the Rings

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Illusion - forced perspective

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Computer-generated model

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The Avengers (1978 vs 2012)

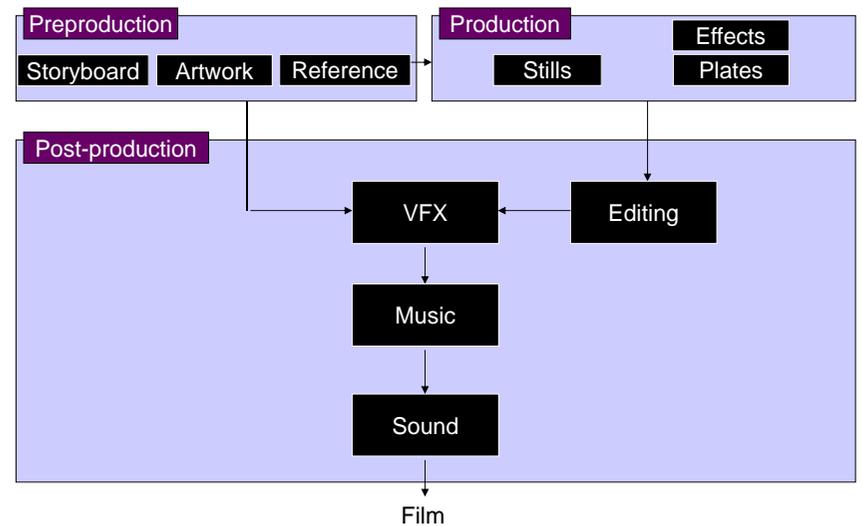


Visual effects 100 Years



Production pipeline

Production pipeline



Preproduction

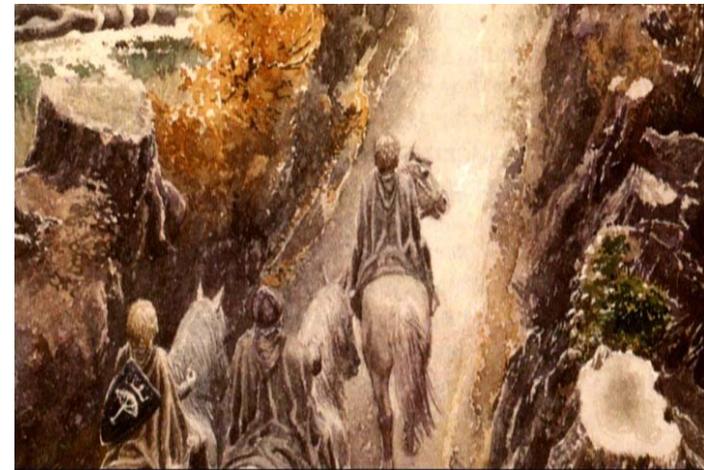
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Storyboard

Preproduction

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Artwork

Preproduction

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Reference & Research

Production

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Shooting

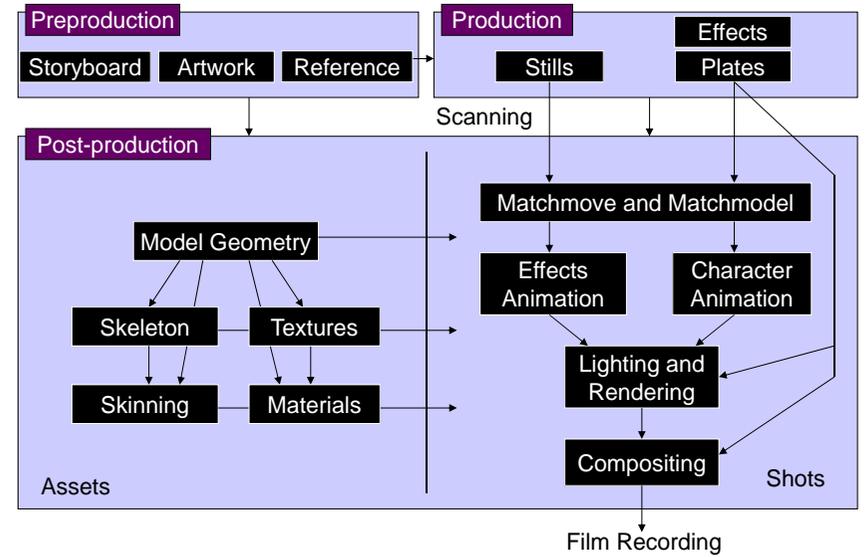
Post-production

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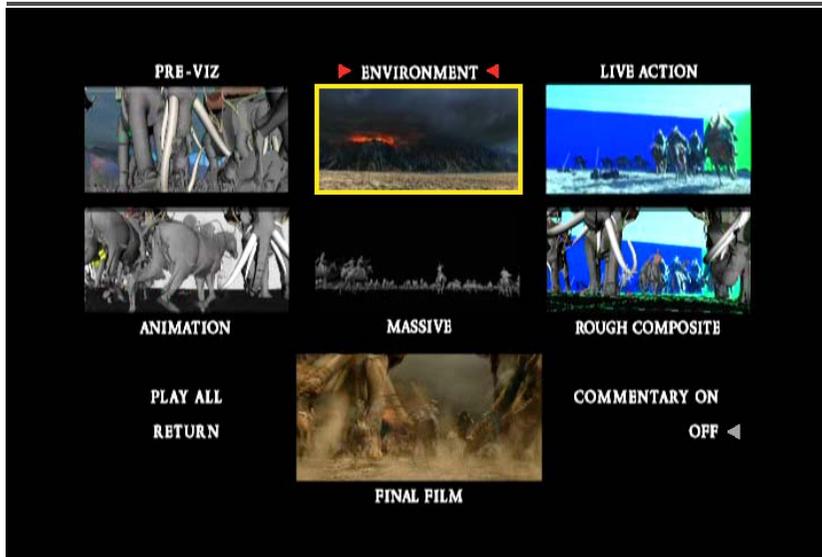
Visual effects production

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Visual effects post-production

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A case study

405: The Movie

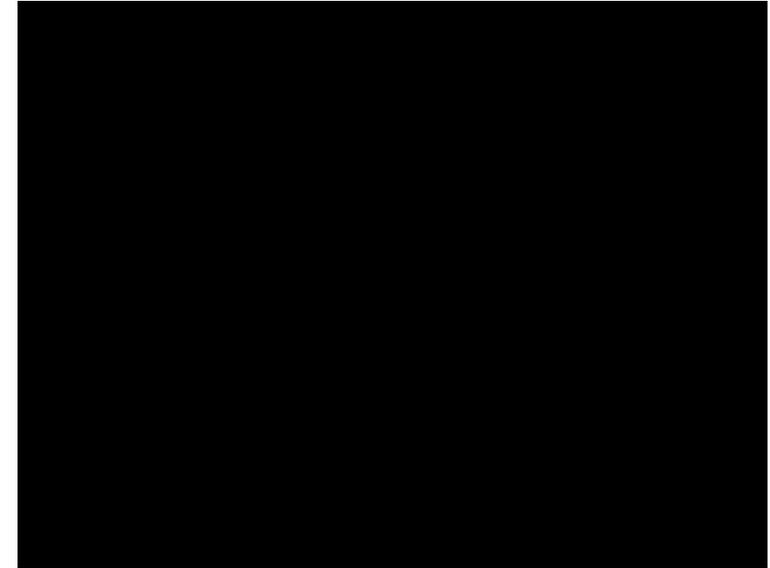
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- This movie were created solely by two visual effects artists in the year of 2000. It was a process that took over three months of nights, weekends and any spare moments that they could find.
- <http://www.405themovie.com/>



405: The Movie

DigiVFX



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

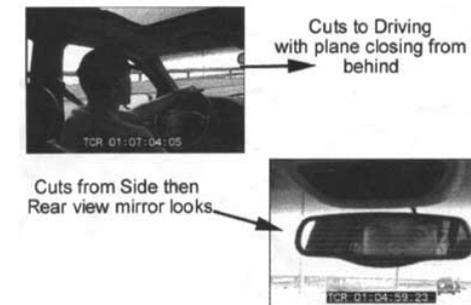
Making of 405

DigiVFX

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



initial editing
⇒ pickup shots



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

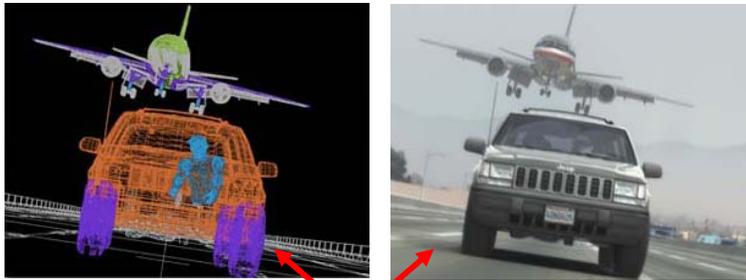


photo-based 3D environment

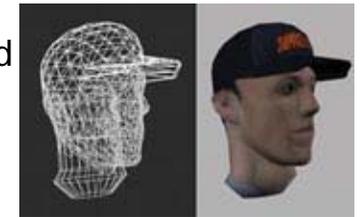
Making of 405

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Real cars were used for close-up and interior shots



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



Making of 405

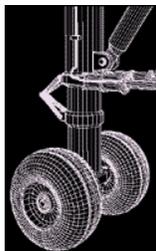
DigiVFX

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

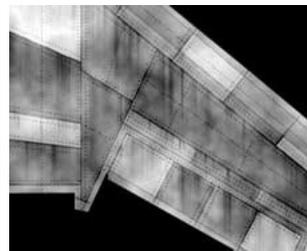
59 objects, 142,439 polygons



reference



modeling



material painting

Making of 405

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Step 3: traffic clearing

clean plate



close-up shots



inpainting



Making of 405

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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



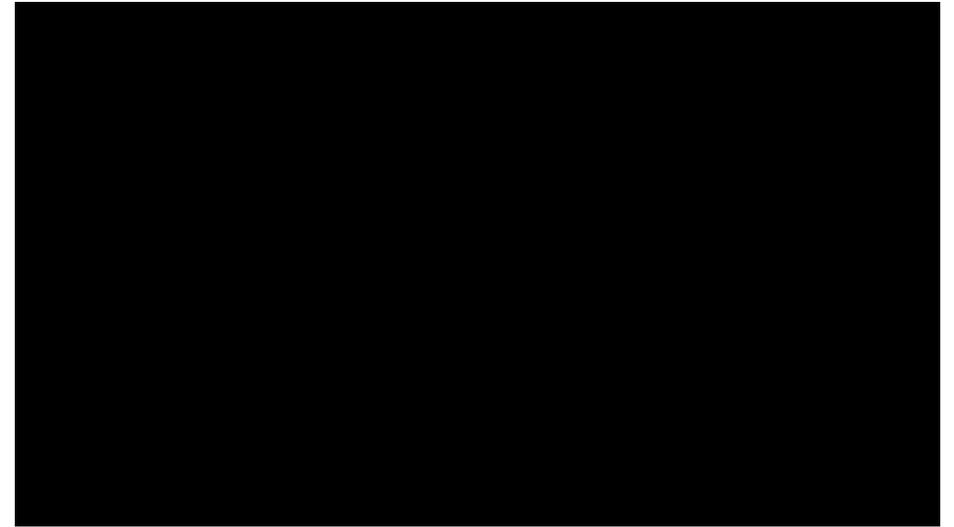
Bloody Omaha

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Breakdown (Wolf of Wall Street)

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Topics we plan to cover

Camera

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Canon 10D

High dynamic range imaging/display DigiVFX



Image warping/morphing DigiVFX

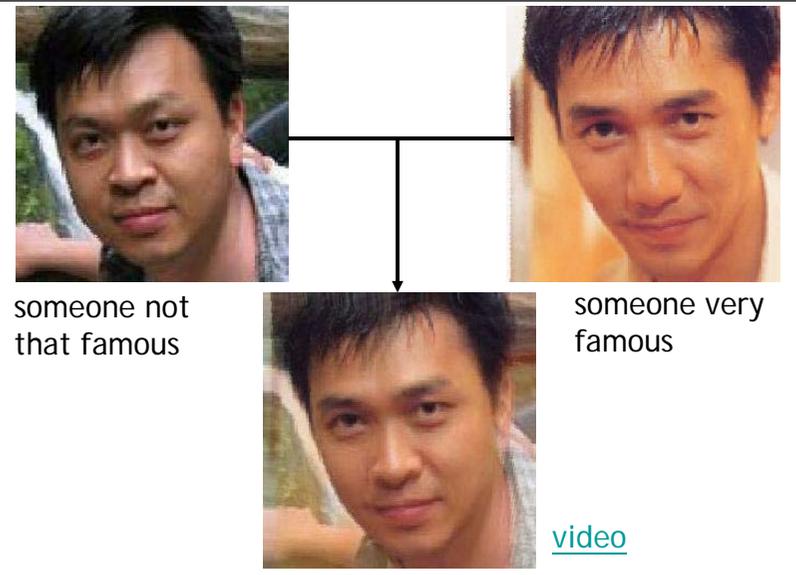
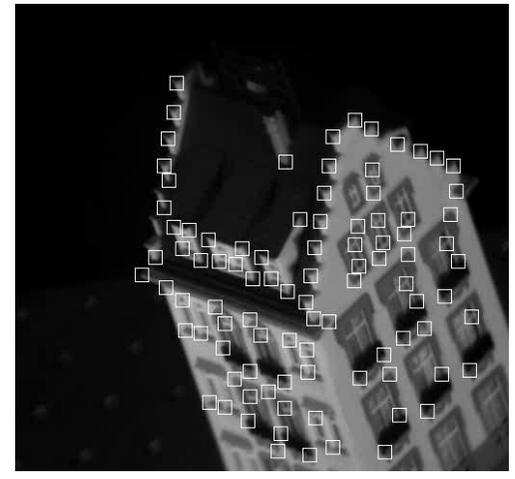


Image warping/morphing DigiVFX



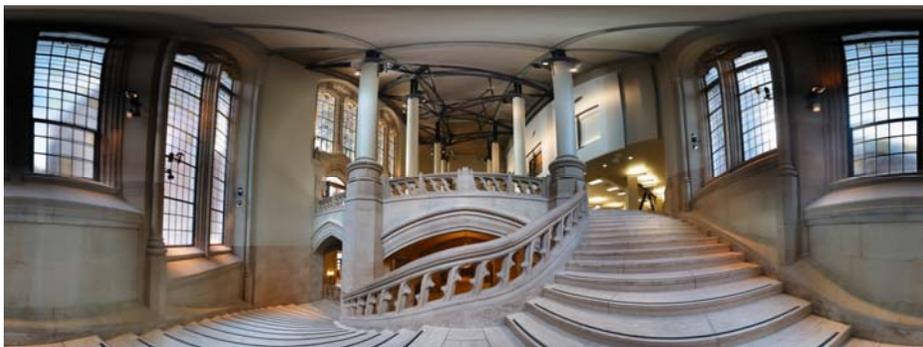
Tracking DigiVFX



Feature tracking

Image stitching

DigiVFX



MatchMove

DigiVFX



Move matching using scene planes

Matchmove

DigiVFX



Move matching using scene planes

Matchmove

DigiVFX



Move matching using scene planes

Photo tourism

DigiVFX



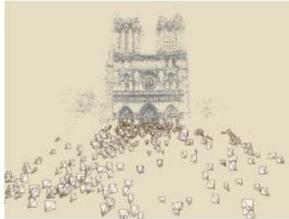
Photo Tourism

Exploring photo collections in 3D

Microsoft



(a)



(b)



(c)

Video matching

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Matrix



MOCO (Motion control camera)

Video matching

DigiVFX



Video matching

Stop motion

DigiVFX



Stop motion

DigiVFX



Matting and compositing

DigiVFX



Titanic

Matting

DigiVFX



Object selection

DigiVFX



LazySnapping

Image-based modeling

DigiVFX



photogrammetric modeling and projective texture-mapping

Image-based modeling

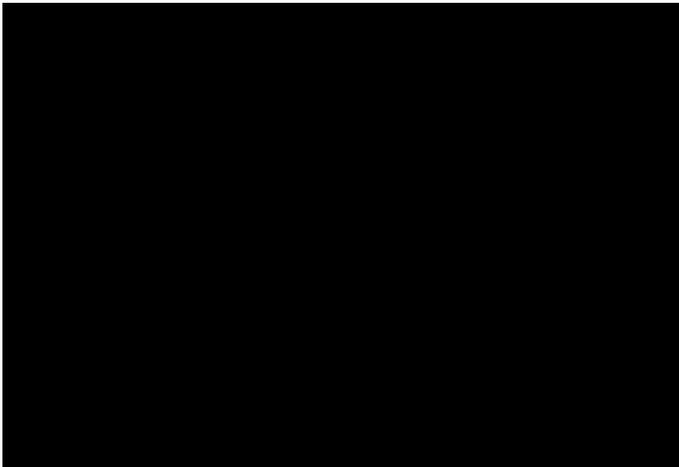
DigiVFX



photogrammetric modeling and projective texture-mapping

Image-based modeling

DigiVFX



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)

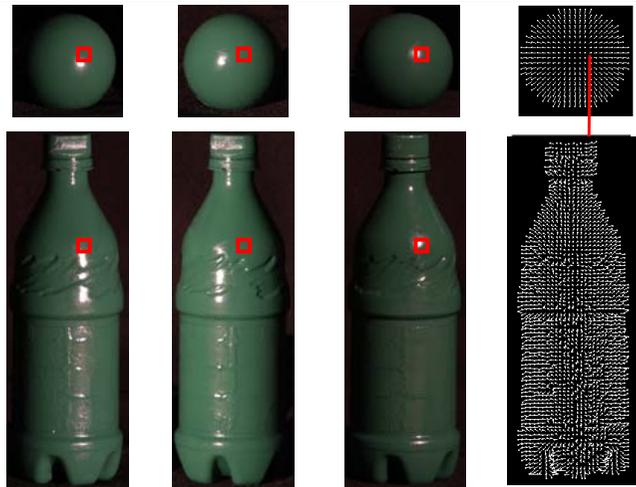
DigiVFX



Cyberware whole body scanner

3D photography (active)

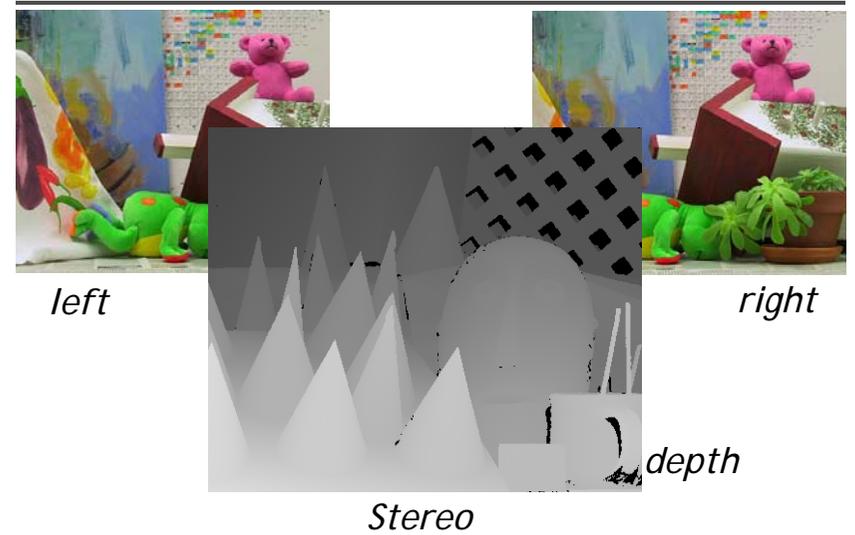
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Photometric stereo

3D photography (passive)

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left

right

depth

Stereo

Image-based rendering

DigiVFX



Surface lightfield

View interpolation

DigiVFX



Bullet time video

View interpolation

DigiVFX



High-Quality Video View Interpolation

Image manipulation

DigiVFX



GraphCut Texture

Image manipulation

DigiVFX



Poisson blending

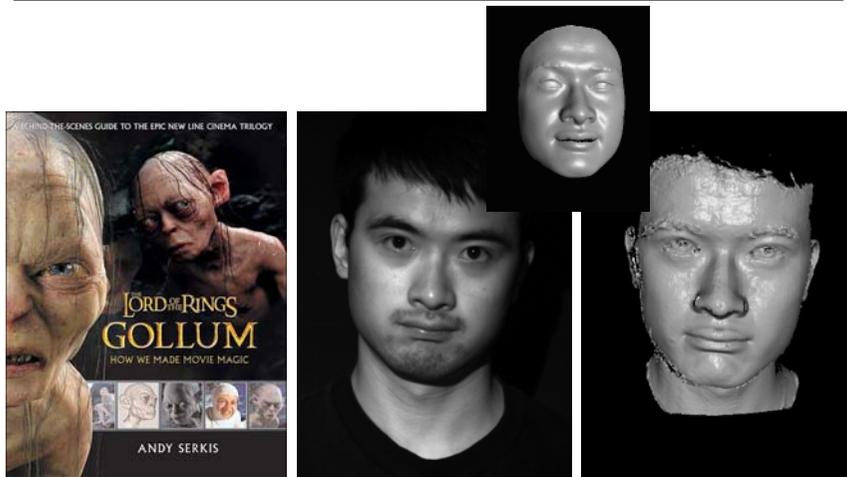
Stereoscopic films

DigiVFX



Making face

DigiVFX



Gollum

Spacetime face

Virtual human

DigiVFX



Video rewrite

DigiVFX



Trainable videorealistic speech animation

Inpainting (wire removal)

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Inpainting

Texture synthesis/replacement

DigiVFX



Texture replacement

Semi-automatic matte painting

DigiVFX

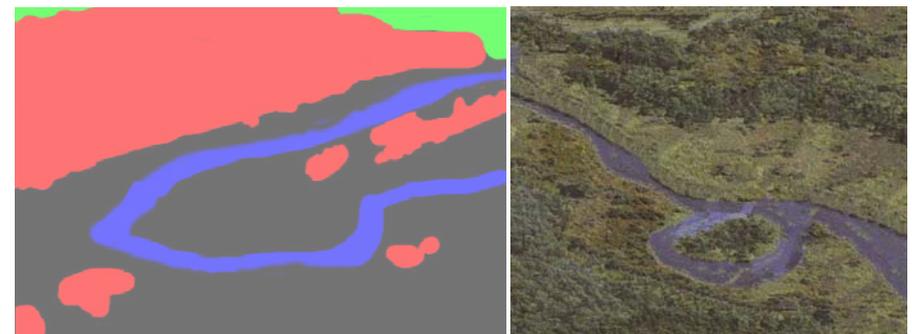
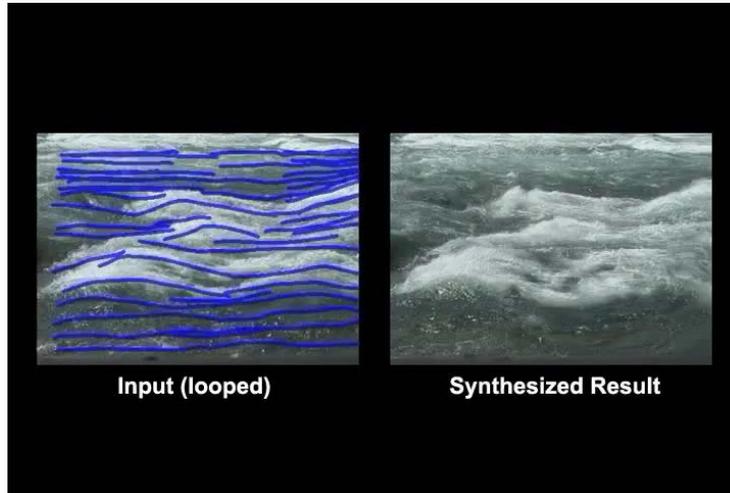


Image analogies

Video editing

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Flow-based video editing

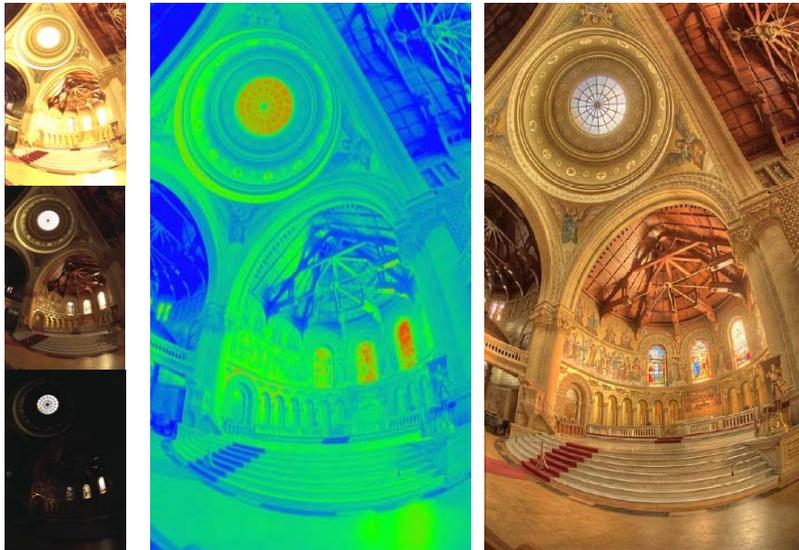
Grading (subject to change)

DigiVFX

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

High dynamic range imaging

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From past semesters (鄭逸廷 陳柏叡)

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From past semesters (吳侑親, 張書瑋) 

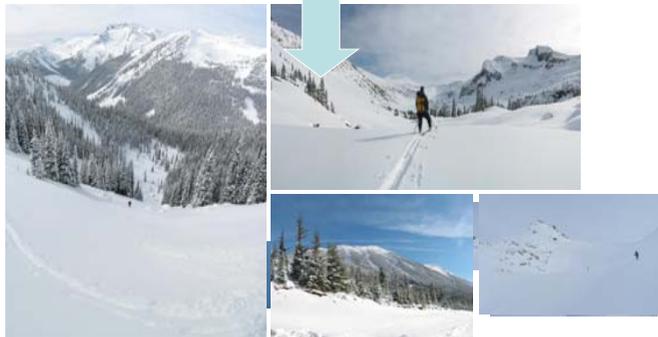
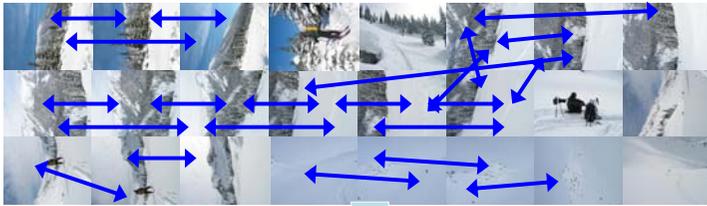


From past semesters (王瑋馥, 余雁雲) 



AutoStitch





AutoStitch





羅聖傑



連奕婷 張宇蓓

MathMove

DigiVFX



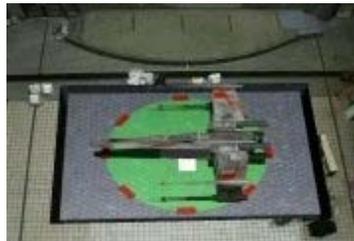
梁家愷 鐘志遠



姜任遠 林立峯



楊宗碩 林柏劭

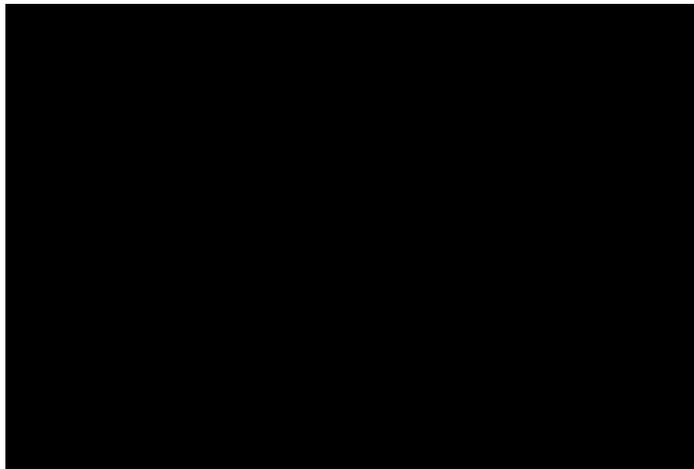


翁憲政 洪韶憶

Final projects from a similar course
in Georgia Tech.

Life in Paints

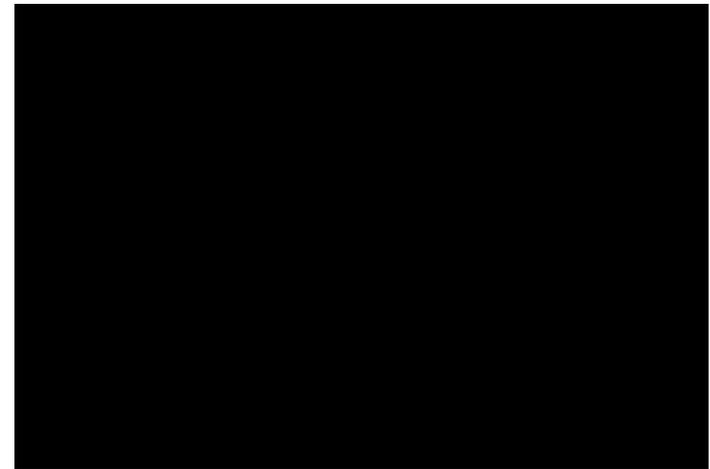
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Life in Paints, GaTech DVFX 2003

Tour into pictures

DigiVFX



Making of *Life in Paints*

In Your Face

DigiVFX



In Your Face, GaTech DVFX 2002

Stop action

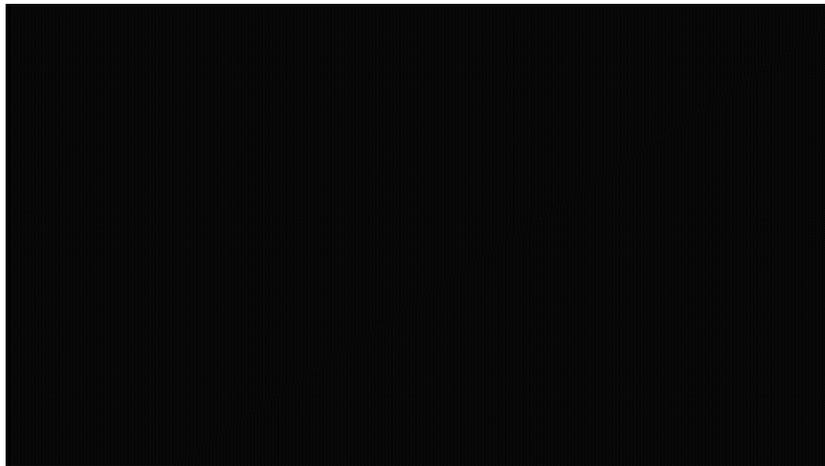
DigiVFX



Making of *In Your Face*

Tennis

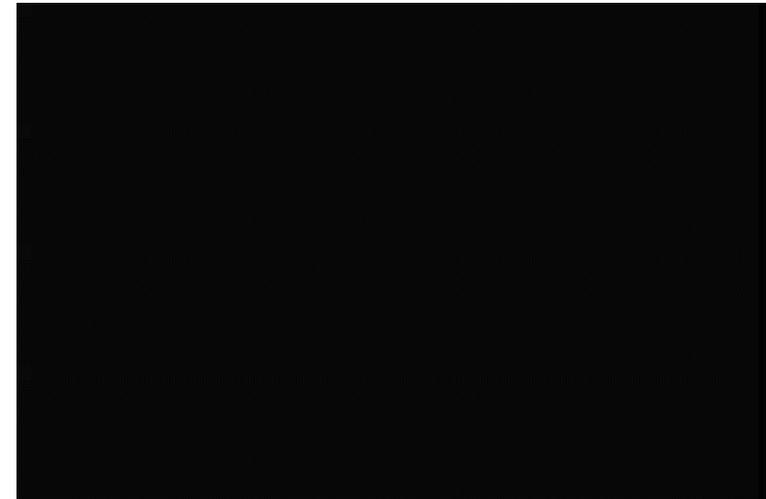
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Tennis, GaTech DVFX 2007

MatchMove/CGI

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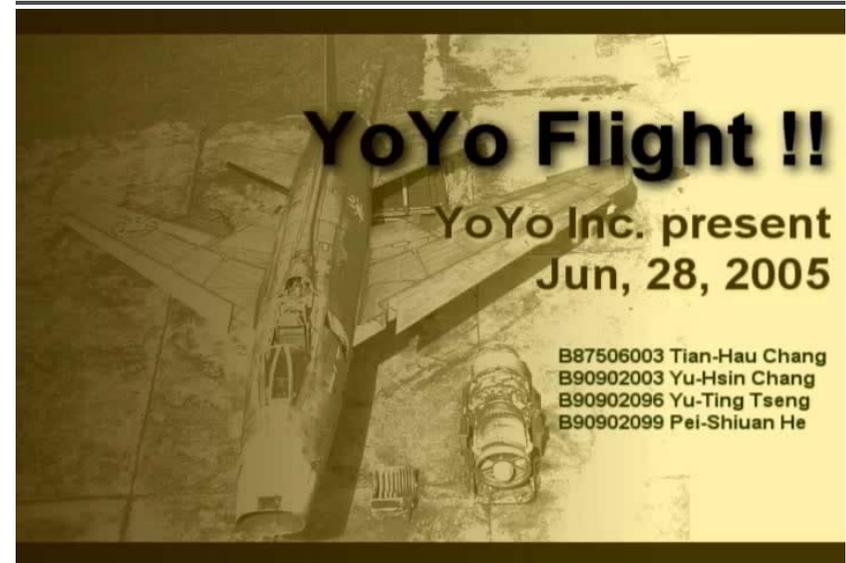


Making of *Tennis*

Final projects from the past.

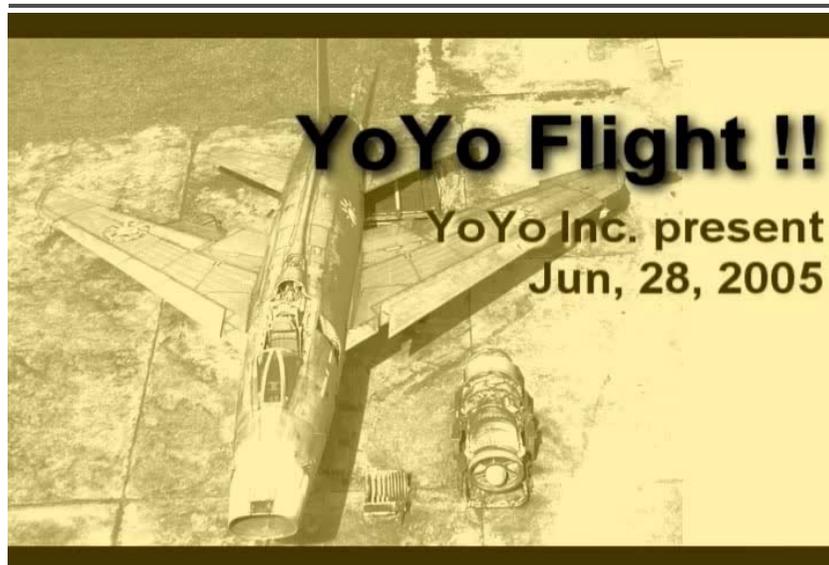
YoYo Flight

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Making of YoYo Flight

DigiVFX



That's it for today!

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