Animation & Entertainment
Case Studies

Lecture 12
October 5, 2015
NBA 6120
Prof. Donald P. Greenberg
Complete Computer Animation
## Computer Animation Theater Gross Revenues (U.S.) September 2015

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title (click to view)</th>
<th>Studio</th>
<th>Lifetime Gross / Theaters</th>
<th>Opening / Theaters</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shrek 2 (CG)</td>
<td>DW</td>
<td>$411,226,247</td>
<td>4,223</td>
<td>5/19/04</td>
</tr>
<tr>
<td>2</td>
<td>The Lion King</td>
<td>BV</td>
<td>$422,783,777</td>
<td>2,624</td>
<td>6/15/94</td>
</tr>
<tr>
<td>3</td>
<td>Toy Story 3 (CG)</td>
<td>BV</td>
<td>$415,004,880</td>
<td>4,028</td>
<td>6/18/10</td>
</tr>
<tr>
<td>4</td>
<td>Frozen</td>
<td>BV</td>
<td>$400,738,009</td>
<td>3,742</td>
<td>11/22/13</td>
</tr>
<tr>
<td>5</td>
<td>Finding Nemo (CG)</td>
<td>BV</td>
<td>$380,843,261</td>
<td>3,425</td>
<td>5/30/03</td>
</tr>
<tr>
<td>6</td>
<td>Despicable Me 2</td>
<td>Uni.</td>
<td>$368,061,265</td>
<td>4,003</td>
<td>7/3/13</td>
</tr>
<tr>
<td>7</td>
<td>Inside Out</td>
<td>BV</td>
<td>$352,976,903</td>
<td>4,158</td>
<td>6/19/15</td>
</tr>
<tr>
<td>8</td>
<td>Minions</td>
<td>Uni.</td>
<td>$332,952,765</td>
<td>4,311</td>
<td>7/10/15</td>
</tr>
<tr>
<td>9</td>
<td>Shrek the Third (CG)</td>
<td>P/DW</td>
<td>$322,719,944</td>
<td>4,172</td>
<td>5/18/07</td>
</tr>
<tr>
<td>10</td>
<td>Up (CG)</td>
<td>BV</td>
<td>$293,004,164</td>
<td>3,886</td>
<td>5/29/09</td>
</tr>
</tbody>
</table>
Movies with Special Effects
Special Effects Bring in $$$$ (U.S. only) 2015

Of top 10 grossing movies ever, 2 nominated for Oscars, 2 won, 3 won Best Visual Effects

1. Avatar ($760M) - 2009 nominated for 9 Oscars, including 3 wins
2. Titanic ($660M) – 1997 Best Visual Effects winner
3. Jurassic World ($649M)
4. Marvel’s The Avengers ($623M) - 2013 nominated for Oscar, Best Achievement in Visual Effects
5. The Dark Knight ($535M) - 2008 nominated for 8 Oscars, including 2 wins
8. Avengers: Age of Ultron ($458M)
9. The Dark Knight Rises ($448M) – 2013 AFI Award Movie of the Year
10. Shrek 2 ($441M) – 2004 Nominee for Best Animated Feature Film of the Year
Advantage: the blue screen

Advanced blue screen algorithm can produce fantastic results. Observe in the image below that important details, such as the reflections in the window, and the fine edges of the hair are maintained.

A naïve observer would have a hard time identifying that the above image was not an original photograph.
Compositing: Putting it all together, “A Perfect Storm”

The boat is computer generated.

base geometry

textured model

Final Composite

“The Perfect Storm” (2000)
Compositing: Putting it all together, “A Perfect Storm”

These simple techniques are used in production situations, only on a much larger scale. “The Perfect Storm” in an excellent example.

Is this a real image, or a composite?
Pixar Image Computer (mid-1986)

Pixar’s first production, the ill-fated Pixar Image Computer.
Live Action With Computer Simulated Characters
Avatar 2009
Avatar 2009

James Cameron
## Worldwide Gross Theater Revenues as of September 2015

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title</th>
<th>Studio</th>
<th>Worldwide</th>
<th>Domestic / %</th>
<th>Overseas / %</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Avatar</td>
<td>Fox</td>
<td>$2,768.0</td>
<td>$760.5</td>
<td>$2,027.5</td>
<td>2009</td>
</tr>
<tr>
<td>2</td>
<td>Titanic</td>
<td>Par.</td>
<td>$2,186.8</td>
<td>$658.7</td>
<td>$1,528.1</td>
<td>1997</td>
</tr>
<tr>
<td>3</td>
<td>Jurassic World</td>
<td>Uni.</td>
<td>$1,659.4</td>
<td>$650.0</td>
<td>$1,009.5</td>
<td>2015</td>
</tr>
<tr>
<td>4</td>
<td>Marvel's The Avengers</td>
<td>BV</td>
<td>$1,519.6</td>
<td>$623.4</td>
<td>$896.2</td>
<td>2012</td>
</tr>
<tr>
<td>5</td>
<td>Furious 7</td>
<td>Uni.</td>
<td>$1,511.7</td>
<td>$351.0</td>
<td>$1,160.7</td>
<td>2015</td>
</tr>
<tr>
<td>6</td>
<td>Avengers: Age of Ultron</td>
<td>BV</td>
<td>$1,402.6</td>
<td>$458.8</td>
<td>$943.8</td>
<td>2015</td>
</tr>
<tr>
<td>7</td>
<td>Harry Potter and the Deathly Hallows Part 2</td>
<td>WB</td>
<td>$1,341.5</td>
<td>$381.0</td>
<td>$960.5</td>
<td>2011</td>
</tr>
<tr>
<td>8</td>
<td>Frozen</td>
<td>BV</td>
<td>$1,274.2</td>
<td>$400.7</td>
<td>$873.5</td>
<td>2013</td>
</tr>
<tr>
<td>9</td>
<td>Iron Man 3</td>
<td>BV</td>
<td>$1,215.4</td>
<td>$400.0</td>
<td>$806.4</td>
<td>2013</td>
</tr>
<tr>
<td>10</td>
<td>Transformers: Dark of the Moon</td>
<td>P/DW</td>
<td>$1,123.8</td>
<td>$352.4</td>
<td>$771.4</td>
<td>2011</td>
</tr>
</tbody>
</table>
# Worldwide Gross Theater Revenues as of September 2015

<table>
<thead>
<tr>
<th>Rank</th>
<th>Title</th>
<th>Studio</th>
<th>Worldwide Gross</th>
<th>US Gross</th>
<th>Overseas Gross</th>
<th>US %</th>
<th>Overseas %</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>The Lord of the Rings: The Return of the King</td>
<td>NL</td>
<td>$1,119.9</td>
<td>$377.8</td>
<td>$742.1</td>
<td>33.7%</td>
<td>66.3%</td>
<td>2003^</td>
</tr>
<tr>
<td>12</td>
<td>Minions</td>
<td>Uni.</td>
<td>$1,118.9</td>
<td>$333.0</td>
<td>$785.9</td>
<td>29.8%</td>
<td>70.2%</td>
<td>2015</td>
</tr>
<tr>
<td>13</td>
<td>Skyfall</td>
<td>Sony</td>
<td>$1,108.6</td>
<td>$304.4</td>
<td>$804.2</td>
<td>27.5%</td>
<td>72.5%</td>
<td>2012</td>
</tr>
<tr>
<td>14</td>
<td>Transformers: Age of Extinction</td>
<td>Par.</td>
<td>$1,104.0</td>
<td>$245.4</td>
<td>$858.6</td>
<td>22.2%</td>
<td>77.8%</td>
<td>2014</td>
</tr>
<tr>
<td>15</td>
<td>The Dark Knight Rises</td>
<td>WB</td>
<td>$1,084.9</td>
<td>$448.1</td>
<td>$636.8</td>
<td>41.3%</td>
<td>58.7%</td>
<td>2012</td>
</tr>
<tr>
<td>16</td>
<td>Pirates of the Caribbean: Dead Man's Chest</td>
<td>BV</td>
<td>$1,066.2</td>
<td>$423.3</td>
<td>$642.9</td>
<td>39.7%</td>
<td>60.3%</td>
<td>2006</td>
</tr>
<tr>
<td>17</td>
<td>Toy Story 3</td>
<td>BV</td>
<td>$1,063.2</td>
<td>$415.0</td>
<td>$648.2</td>
<td>39.0%</td>
<td>61.0%</td>
<td>2010</td>
</tr>
<tr>
<td>18</td>
<td>Pirates of the Caribbean: On Stranger Tides</td>
<td>BV</td>
<td>$1,045.7</td>
<td>$241.1</td>
<td>$804.6</td>
<td>23.1%</td>
<td>76.9%</td>
<td>2011</td>
</tr>
<tr>
<td>19</td>
<td>Jurassic Park</td>
<td>Uni.</td>
<td>$1,029.2</td>
<td>$402.5</td>
<td>$626.7</td>
<td>39.1%</td>
<td>60.9%</td>
<td>1993^</td>
</tr>
<tr>
<td>20</td>
<td>Star Wars: Episode I - The Phantom Menace</td>
<td>Fox</td>
<td>$1,027.0</td>
<td>$474.5</td>
<td>$552.5</td>
<td>46.2%</td>
<td>53.8%</td>
<td>1999^</td>
</tr>
</tbody>
</table>
Digital Video Film Production
Motion Picture Film Pipeline

Traditional Analog Distribution

1. Original Camera Negative
2. Master Positive (Archival)
3. Internegative
4. Release Print

Cineon Digital Film Scanner

Digital Effects / Compositing

Archival Digital Master

Standard Movie Theaters
Digital Movie Projection (DLP)
DVDs

Modern Digital Effects Pipeline
New Digital Methods for Movie Production

Film on high definition digital video cameras

Use of post-production digital software
  Special effects creation
  Editing software

Earliest adopters were low budget filmmakers

Cost can be cheap (Less than $10K)
Advantages of Digital Moviemaking Methods

Digital playback allows for immediate “reshooting”

Can take advantage of real world scenes

(Video camera is not obtrusive)

Can use multiple cameras

Can use the Internet as a distribution medium
Digital Filming: The Real Advantages

• With physical film, the camera is rolling a small percentage of time. Much time is required to light and set-up each shot. ∴ Very expensive.

• For film:

\[
\frac{\text{footage shot}}{\text{footage used}} \approx \frac{3}{1}
\]

• For digital:

\[
\frac{\text{footage shot}}{\text{footage used}} \approx \frac{50}{1}
\]

∴ Many more choices
Hollywood East
Red One

- Records motion at 4096 x 2304 resolution (Note HDTV is 1920 x 1080)
- This is roughly equivalent to 35mm stock film
- The Red One engineers built a lossless compression codec – “Redcode Raw”
- It allows control of depth of field
- The price is $17,500
Red One – The Analog Advantage

Analog film lets moviemakers control the depth of field.

Most 2K and HD cameras force everything into focus. Red One mimics analog film.

Peter Jackson shot a 12 minute featurette “Crossing The Line” (WWI) including shots from helicopter, crawling on the ground, etc.
Reducing the cost of Theater Distribution

Christie’s AccessIT
DMD Structure

Digital Micromirror Device (DMD™)
A True Microelectromechanical System
Christie CP4230 Digital Cinema Projector

- 4K DLP
- Screen size up to 105ft (32m)
- 4096 x 2160 resolution
- 30720 pixel updates / sec
- 2100:1 contrast
Digital Cinema projectors/servers -- $60^k$-$80^k$/Theaters

Distribution costs -- approx. $2000 for standard film and canisters, limited reuse

- - *A digital copy costs less than $200*
Advantage To Theater Operators

Theater operators do not have to be limited to “one film” showing

Can have multiple screenings

Content can include:

- Movies
- Live sports events
- Broadway shows
How can digital cinema equipment be made more affordable to the theater owner?

AccessIT (now Cinedigm) pioneered strategy that subsidized the cost of digital cinema equipment with savings from distribution costs. The system that many use is called the Virtual Print Fee (VPF).

AccessIT’s Digital Cinema Business Strategy

Provides turnkey operations, the funding, installation, support, and administration (Phase I)

Provides networked, turnkey Digital Cinema systems

- Library Management Server
- Theater Command Software
Digital Cinema

Digital Cinema

Distributors pay fee to VPF managing company. Fee is less than difference between film & digital

VPF money used to finance digital cinema equipment installation
- Exhibitors still pay maintenance fees

VPF pays cash for systems & support

Over time, the need for VPF goes away and industry is saturated with digital cinema

TI boasts that half of worldwide movie screens (>50,000) are using DLP Cinema digital technology.

The Asia-Pacific region had 92% growth last year followed by Europe with 91%.

According to industry estimates, all worldwide cinema screens will convert to digital technology in four years.
By February 2013, DLP Cinema screens numbered 79,152 screens worldwide of which 42,120 are 3D enabled

In addition, they provide projectors for 552 IMAX screens

Christie is now expanding into sports (ESPN), the Metropolitan Opera, outdoor signage and other display segments
Reducing the cost of Content Distribution
Hollywood vs. Technology Changes

Technology changes dramatically affect Hollywood’s strategies

WHY IS HOLLYWOOD SO AFRAID OF TECHNOLOGICAL CHANGE?

Paranoia?
In the 1940’s studios feared TV because they thought it would destroy box office revenues.

- When video tape recorders were introduced they had the same reactions.
- Video sales soon became a revenue stream which was greater than box office revenues.
Sony Corp. of America vs. Universal City Studios - “Betamax Case” 1984

Media type: Video recording
Media: Encoding magnetic tape
Developed by: Sony
Usage: Video storage
History of Hollywood vs. New Technologies

When DVDs were introduced their resistance was because they did not want to erode their video revenues.
US consumer spending on DVDs, $bn

Deleted scenes?
US consumer spending on DVDs, $bn

Source: Digital Entertainment Group
When DVDs were introduced their resistance was because they did not want to erode their video revenues

- Then Blu-ray
- Next the Internet
- Recently, the Ipad
- Next will be smart devices
- What should they do now?
Netflix

- 2005 Netflix is “not a sustainable business” - Michael Pachter: Wedbush Morgan Securities
  - Stock price ≈ $11/share
  - Too much time to download
  - Engineers modify bar-code sorting machines to handle DVD’s odd shaped envelopes. Stock price ≈ $300.
- 2011 Increased price and lost 800,000 customers. With increased broadband, Netflix now offers streaming option.
  - Stock price ≈ $459 (as of October 6, 2014)
Download times for DVD-quality film (1GB), 2007

![Diagram](image.png)

**Clicks for flicks**
Download times for DVD-quality film (1GB), 2007

*Average broadband speeds* in:

- Western Europe
- South Korea
- Japan

**Broadband speed** (megabits/second)

Minutes

Sources: OECD; Screen Digest; The Economist

*Based on half of advertised speed, Oct 2007

Hollywood’s Aftermarket Strategy

DVDs, Cable, Netflix
Revenues From Movie Production

- **Box Office Revenues**: $10.0 Billion
- **Video/DVD Sales &Rentals**: $23.8 Billion
- **Cable Pay Per View**: $2.2 Billion
- **Premium Cable Channels**: $10.4 Billion

*BusinessWeek/July 2003*
Box Office take falls dramatically each week

Release Windows

Special Effects Companies
FX Business Models

- The business model is to charge a fixed fee for developing effects for a specified number of “shots.” (Service model)

Problems:
- Margins are low since there are an excess number of FX firms
- Labor is cheaper off-shore (e.g., India, Asia)
- Foreign governments offer generous tax incentives to make movies (Canada, UK)
Rhythm & Hues

- Rhythm & Hues, one of the best special effects companies (1987) employed more than 700 people by 2013.
- At the Academy Awards show in 2013, they won an Oscar for their superb visual effects in *Life of Pi*.
- The Awards ceremony occurred two weeks after the company filed for bankruptcy.
Digital Domain bought by Galloping Horse/Reliant Mediaworks
The current business model is obviously broken.

Should foreign VFX companies be charged a tariff?
Stereo 3D Theater
IMAX Widescreens 2010

Box office sales 3x, shares rose 10x, screens generate 5x when compared to regular cinema

Why?
Large screens, immersive, unique and patented projection technology, demand > supply, large margins (1/3)

Finally good content, e.g., The Matrix Reloaded, Avatar, Tron: Legacy

Small percent of total revenue – but free marketing – social networks, “You should see what I saw!” on Twitter, Facebook
Motorola: Spotlight Stories
Virtual Reality, Glen Keane
Glen Keane
Complete Computer Animation Companies
3D Animation
Pixar Approximate Employee Distribution

Creative
- Story: 60
- Art: 70
- Layout: 40

170

Production
- Layout: 40
- Anim: 150
- TD: 150
- GT/FX: 100
- Lighting: 120
- Editorial: 30
- Post: 60

650

Technology
- Research/Tools: 170
- Renderman: 25

195
Pixar Closes Vancouver Studios 3 Years After Opening

- Vancouver’s tax incentives and local talent had lured Pixar to Vancouver, Canada
- The October 2013 closing resulted in a lay-off of 80 highly talented employees.
Pixar

- Pixar undergoes lay-offs due to the delay of “The Good Dinosaur.”
- The Lay-offs effect less than 5 percent of their Emeryville’s 1,200-person workforce
- The delay leaves Pixar without a movie for 2014

Is this an early signal that Pixar & Walt Disney’s Animation Studios might merge?
Dreamworks 2013

- Dreamwork Animation’s recent film, “The Rise of the Guardians (W.W. Gross = $302M) could not cover production & marketing costs
- Impact was $83M loss in Q4 of 2012 and a lay-off of 350 employees (+/- 15%)
Layoffs Continue at Dreamworks

• “How to Train Your Dragon 2” continued to struggle at the box office.
• The studio didn’t have enough feature films to justify keeping employees at the front end of the production process.
• Dreamworks’ stock plummeted approximately 34% in 2014 to date.
End.