

Appendix 2

A Survey of the Development of Computer Graphics in Animation and Visual Effects

1971-Present

Terms

CG Computer Graphics

CGI Computer Generated Imagery

Is the application of the field of computer graphics or, more specifically, 3D computer graphics to special effects in art, video games, films, television programs, commercials, simulators and simulation generally, and printed media. The visual scenes may be either dynamic or static.

Terms

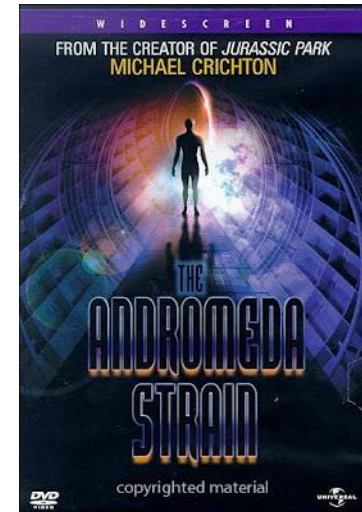
Computer animation refers to dynamic CGI rendered as a movie.

A virtual world is a simulated environment, which allows user to interact with animated characters, or interact with other users through the use of animated characters known as avatars.

Sketchpad

In 1959, the [TX-2](#) computer was developed at [MIT's Lincoln Laboratory](#). The TX-2 integrated a number of new man-machine interfaces. A light pen could be used to draw sketches on the computer using [Ivan Sutherland's](#) revolutionary [Sketchpad software](#).^[4] Using a light pen, Sketchpad allowed one to draw simple shapes on the computer screen, save them and even recall them later. The light pen itself had a small photoelectric cell in its tip. This cell emitted an electronic pulse whenever it was placed in front of a computer screen and the screen's electron gun fired directly at it. By simply timing the electronic pulse with the current location of the electron gun, it was easy to pinpoint exactly where the pen was on the screen at any given moment. Once that was determined, the computer could then draw a cursor at that location.

The Andromeda Strain (1971)



Arguably the **first movie ever to use computers to create a visual effect** (a 2D rotating structure on one level of the underground lab) was **The Andromeda Strain**, in 1971. The effect was extremely advanced for its time, with work by Douglas Trumbull (who also worked on “2001: A Space Odyssey”), James Shourt, and Albert Whitlock (who worked on the Alfred Hitchcock film “The Birds”).

Computers used to be large

It was the breakthrough of the Intel 4004 in 1971 that introduced the world to the microprocessor, a computer on a chip. No longer were computers accessible only to mega-corporations; in 1975 the Altair 8800 let you assemble your own personal computer while Apple and IBM provided pre-built PCs in 1977 and 1981 respectively.

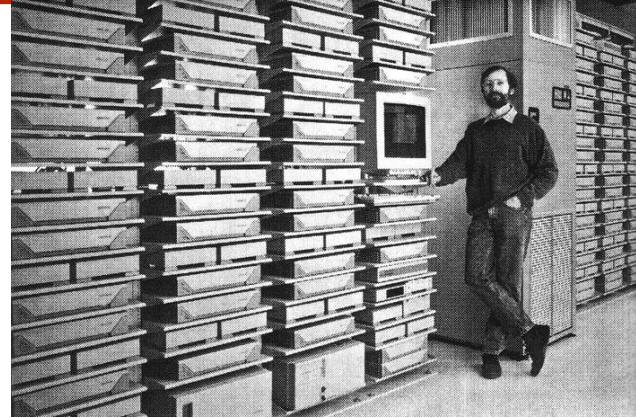


A Computer Animated Hand (1972)

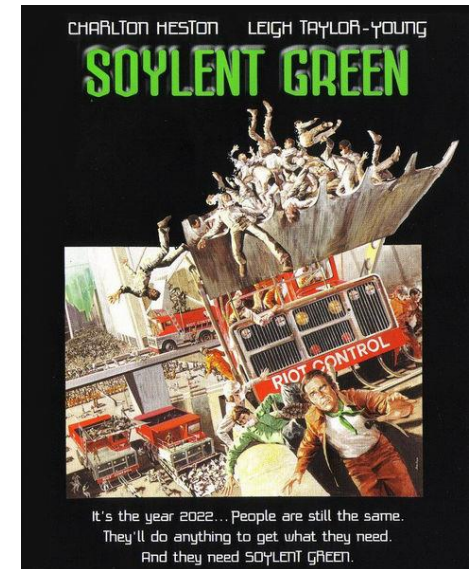
Ed Catmull, president of Pixar and Disney Animation is a computer science legend. The National Film Preservation Board placed Catmull's film *A Computer Animated Hand* in the National Film Registry in 2011.

Catmull made the film in 1972 while a student at University of Utah and it may very well be the world's first rendered 3D computer animated film. The film later appeared in the 1976 sci-fi movie *Futureworld*.

Catmull was co-founder of the original computer graphics and hardware group at Lucasfilm which was later bought by Steve Jobs and became Pixar Animation Studios.



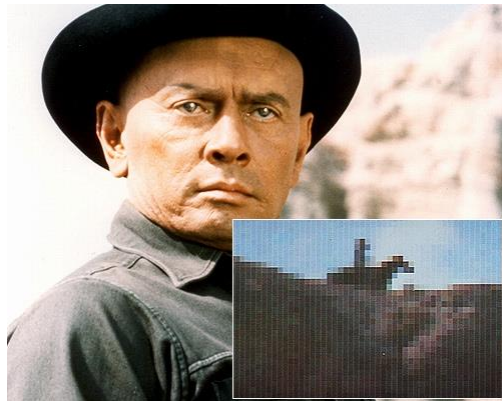
Soylent Green (1973)



Soylent Green

The first commercial arcade video game, *Computer Space*, makes an appearance. The game, created by Nolan Bushnell and Ted Dabney and published by Nutting Associates, appeared in 1971, a year before Atari's *Pong*. So technically, this is the first instance of CGI in a movie, though it's kinda cheating

Westworld (1973)



Westworld (1973)

The android Gunslinger's point-of-view shots (left) were achieved using 2D raster (or bitmap) graphics, provided by artists at Evans & Sutherland, pioneers of computer graphics. *Soylent Green* came out in May '73, some months ahead of *Westworld*, which was released in November '73 but we still reckon that means *Westworld* stakes the claim for the first ever *proper* use of computer generated imagery in the movies.

The Hunger (1974)

The short film **“The Hunger”** (1974) from the National Film Board Of Canada is notable as the first computer animation to be nominated for an Academy Award (as best short film). The 2 dimensional 11 minute feature about world hunger was the first to use computers to “fill in” the action between key cels drawn by a human artist. Because a computer actually “created” the animation depicted in the images, this is the **world’s first example of "true" computer animation.**



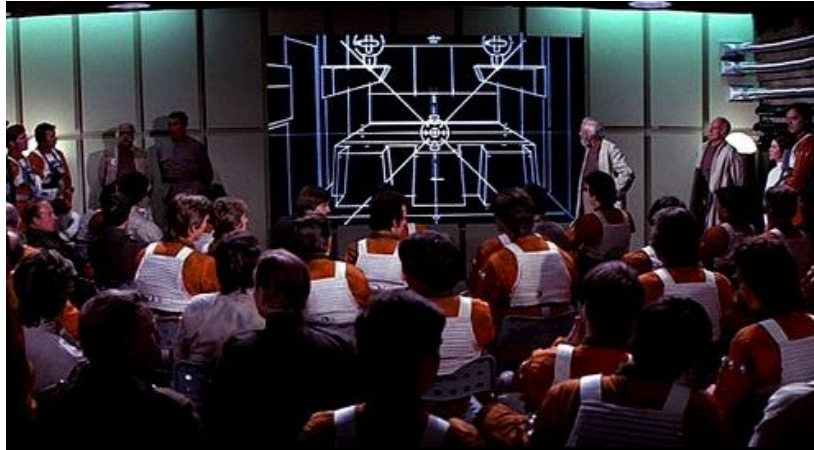
Futureworld (1976)

Futureworld (1976)

The sequel to *Westworld* (and Yul Brynner's final film), features the first use of animated 3D computer graphics. In the film, Peter Fonda's face and hand are digitized by computer and stored in its memory banks. In reality, Triple I (Information International Inc,) painstakingly scanned in Fonda's head and rendered his face using shaded polygons. However, the animated hand was from an animation created in 1972 by Ed Catmull and Fred Parke while at the University of Utah. A cast of Catmull's hand was digitized manually, point-by-point to generate the wireframe mesh.



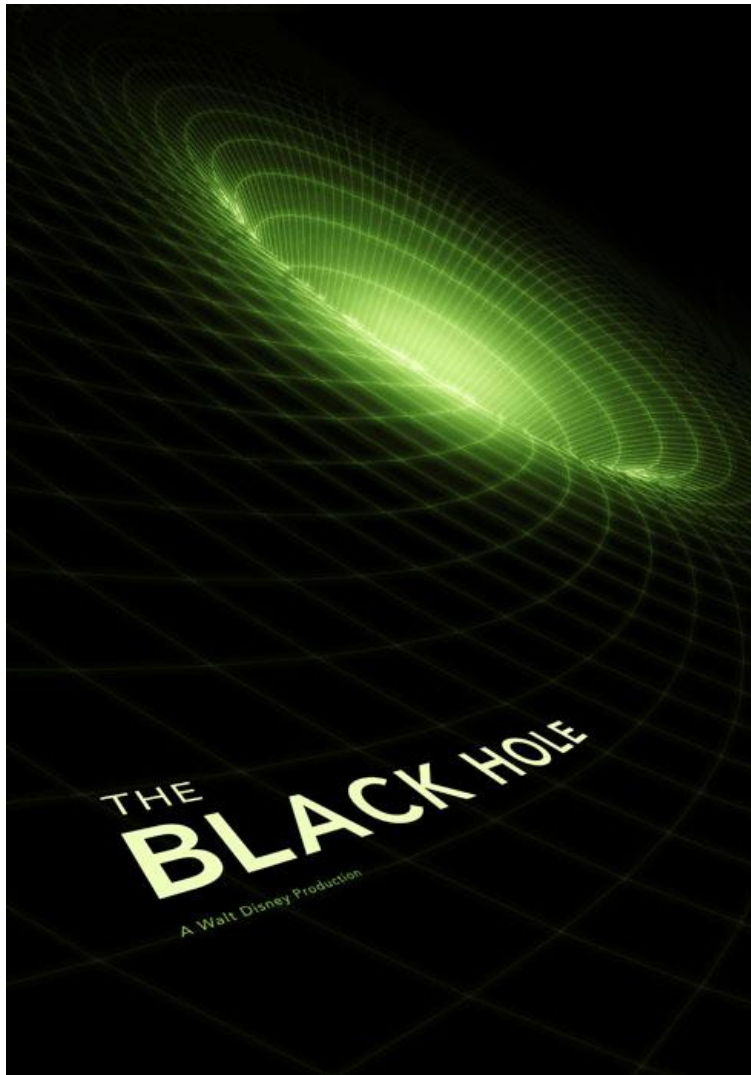
Star Wars (1977)



Star Wars Episode IV: A New Hope (1977)

The animated wireframe graphic that appears in the Rebel Alliance's briefing for the Death Star attack run is noteworthy for being the first substantial animated CG sequence (rather than the few fleeting seconds in previous movies). It was painstakingly hand-crafted by Larry Cuba, working in the Electronic Visualization Laboratory (EVL) at the University of Illinois.

The Black Hole (1979)



The Black Hole (1979)

The opening credit sequence, showing a wireframe representation of a black hole's gravity well, was, at the time, the longest computer-generated shot committed to film.

Tron (1982)

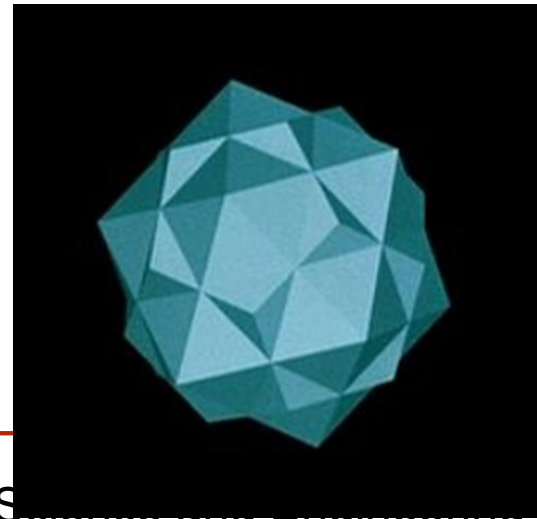
Steven Lisberger's fantasy inside-a-computer-video-game adventure/science-fiction film was one of the first films to be derived from the video-game craze. It was the first live-action film to use computer-generated imagery (CGI) to any large degree (about 20 minutes) - in this case, to create a full 3-D graphics world, in its most innovative sequence of the famed racing bike or Lightcycle sequence depicting computerized lightcycles in a high-speed race.



Tron (1982)



There is some debate as to who brought us the **first CGI “character.”** Some believe the polyhedron character “Bit” in **Tron** qualifies for this honor. But because of the character’s limited range of controls and animation, some insist that “Bit” does not qualify as a true “character.”



Where The Wild Things Are (1983)

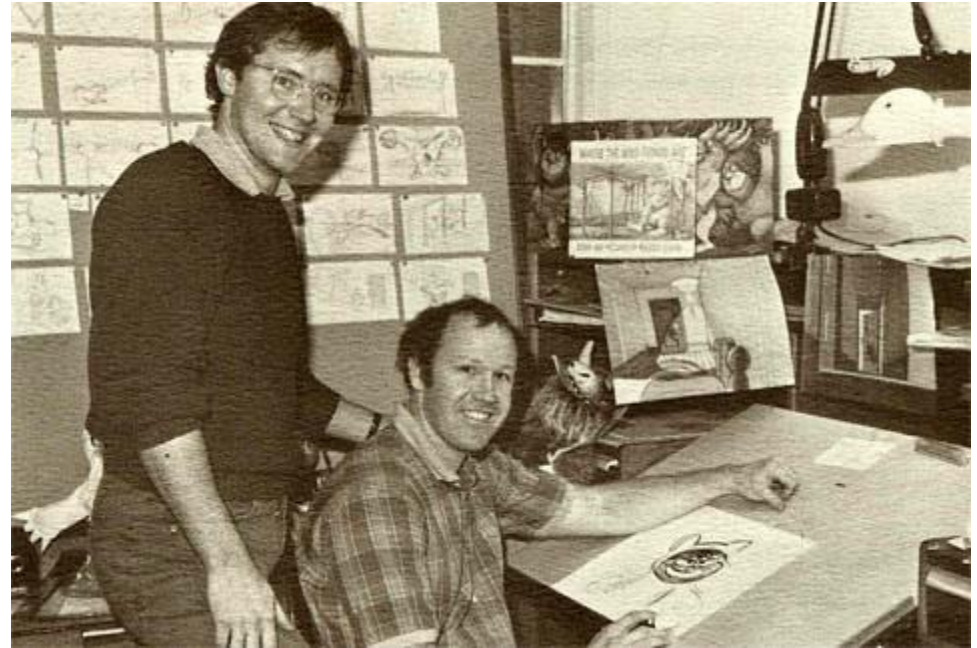
Where The Wild Things Are (1983)

Disney produced test footage, based on Maurice Sendak's classic children's novel, that combined traditional, hand-drawn character animation with computer generated backgrounds. It was directed by John Lasseter. When the project was shelved, due to budgetary issues Lasseter was fired. Shortly after he would join Lucasfilm's Graphics Group and the rest is history. Another member of *Wild Things* team was Chris Drew, who went on to direct the Blue Sky Studios movies *Ice Age* and *Robots*.



Where The Wild Things Are (1983)

“The combination of computer-generated graphics and Disney animation is in its very basic stages in terms of what it could eventually become. John reports that, “In five years these tests will seem so primitive, they’ll look like *Steamboat Willie* does today.” But just as *Steamboat Willie* gave Disney the recognition as a forerunner in animation technology some 50 years ago, *The Wild Things* test and *The Brave Little Toaster* have the potential to give Disney similar recognition in the future.”

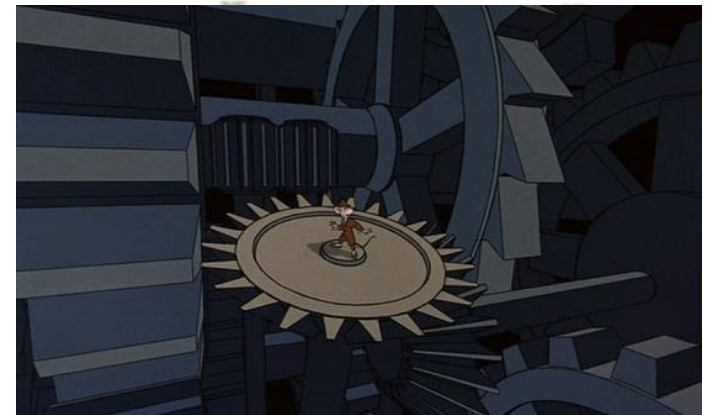


Quote and photo from a Disney in-house newsletter. Lasseter on left.

The Great Mouse Detective (1986)

The layouts were done on computers, and the use of video cameras made a digital version of pencil testing possible.

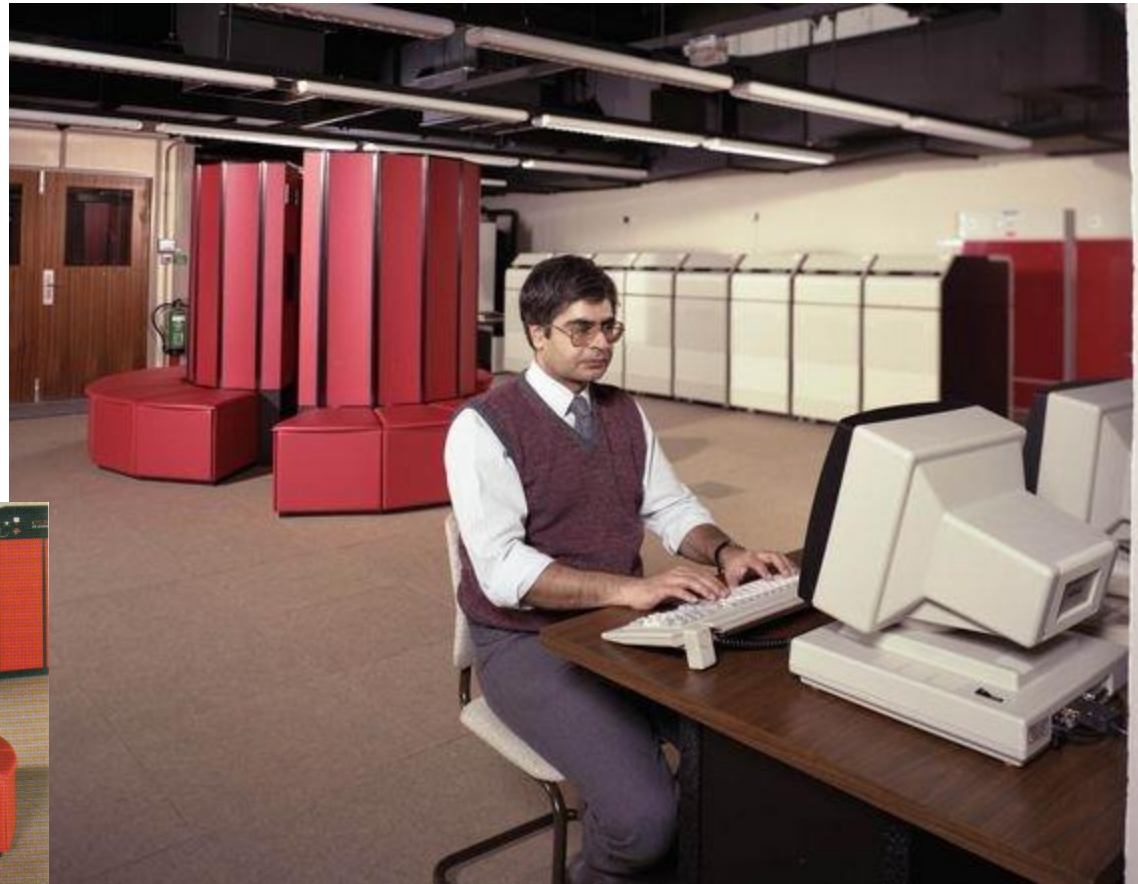
CGI chase scene takes place in the interior of Big Ben. The movements of the clock's gears were produced as wire-frame graphics on a computer, printed out and traced onto animation cells where colors and the characters were added.



Cray X-MP Supercomputer

1984 X-MP/48 cost
\$15 million plus the
cost of disks.

Included sofa



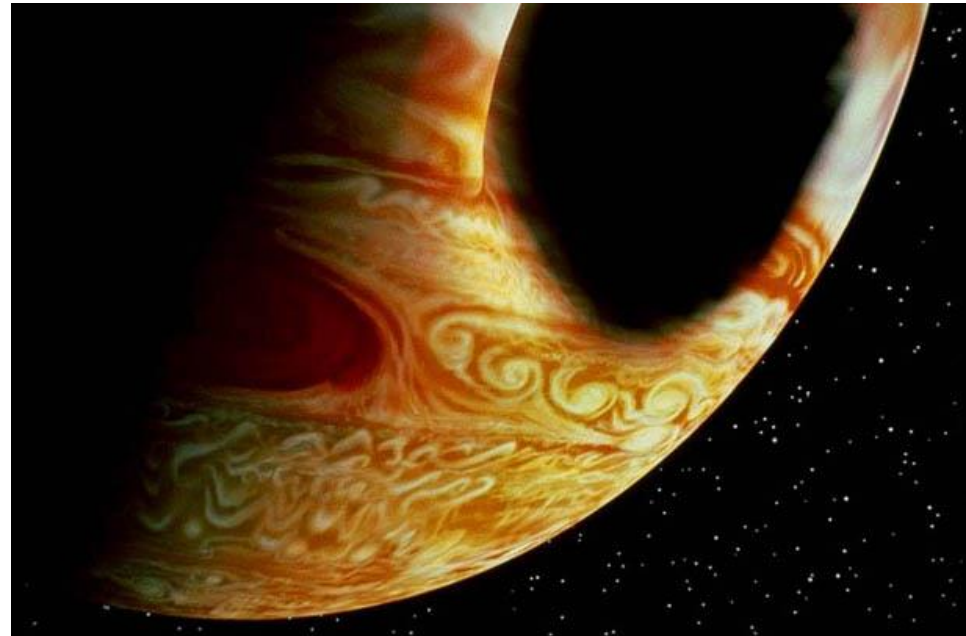
The Last Starfighter (1984)

This was the first film to use CGI for all its spaceship, planet and hi-tech hardware shots rather than the traditional model approach. This was the first time audiences were asked to accept that the CG was photorealistic and fully integrated with the live-action rather than computer graphics representing something abstract. The visual effects were created by Digital Productions using the legendary Cray X-MP supercomputer. The scene inside the Gunstar hangar bay was by far the most complex CG animation created to date



2010: The Year We Make Contact (1984)

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Pixar

In 1986 The Computer Graphics group at LucasFilm is purchased by Steve Jobs for \$10 million and renamed Pixar

Ed Catmull is named Co-Founder and Vice President



Ed Catmull, Steve Jobs and John Lasseter

The Adventures Of André And Wally B (1984)

A LucasFilm short directed by John Lasseter (who'd joined from Disney) that saw the first use of motion blur and the principles of “squash and stretch” – a traditional technique in 2D animation for making characters appear to move with more fluidity – in CG animation. Although usually credited as a Pixar short, it was made under the auspices of The Graphics Group, a part of Lucasfilm's Computer Division. Ceated on a Cray Computer.



Early Pixar Shorts- John Lasseter

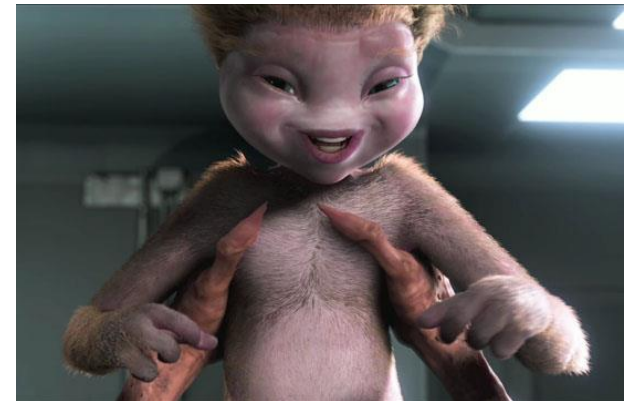
<u><i>The Adventure s of André and Wally B.**</i></u>	<u>1984</u>			
<u><i>Luxo Jr.</i></u>	<u>1986</u>	<u><i>Toy Story 2</i></u> ^[3]	<i>Toy Story 2</i> ^[4]	Nominated
<u><i>Red's Dream</i></u>	<u>1987</u>			
<u><i>Tin Toy</i></u>	<u>1988</u>		<i>Toy Story</i> ^[4]	Won
<u><i>Knick Knack</i></u>	<u>1989</u>	<u><i>Finding Nemo</i></u> ^[5]	<i>Finding Nemo</i> ^[4]	

The Uncanny Valley

The uncanny valley is a hypothesis in the field of robotics and 3D computer animation, which holds that when human replicas look and act almost, but not perfectly, like actual human beings, it causes a response of revulsion among human observers. The "valley" in question is a dip in a proposed graph of the positivity of human reaction as a function of a robot's human likeness. The term was coined by the Japanese robotics professor Dr. Masahiro Mori.



Japanese experimental android

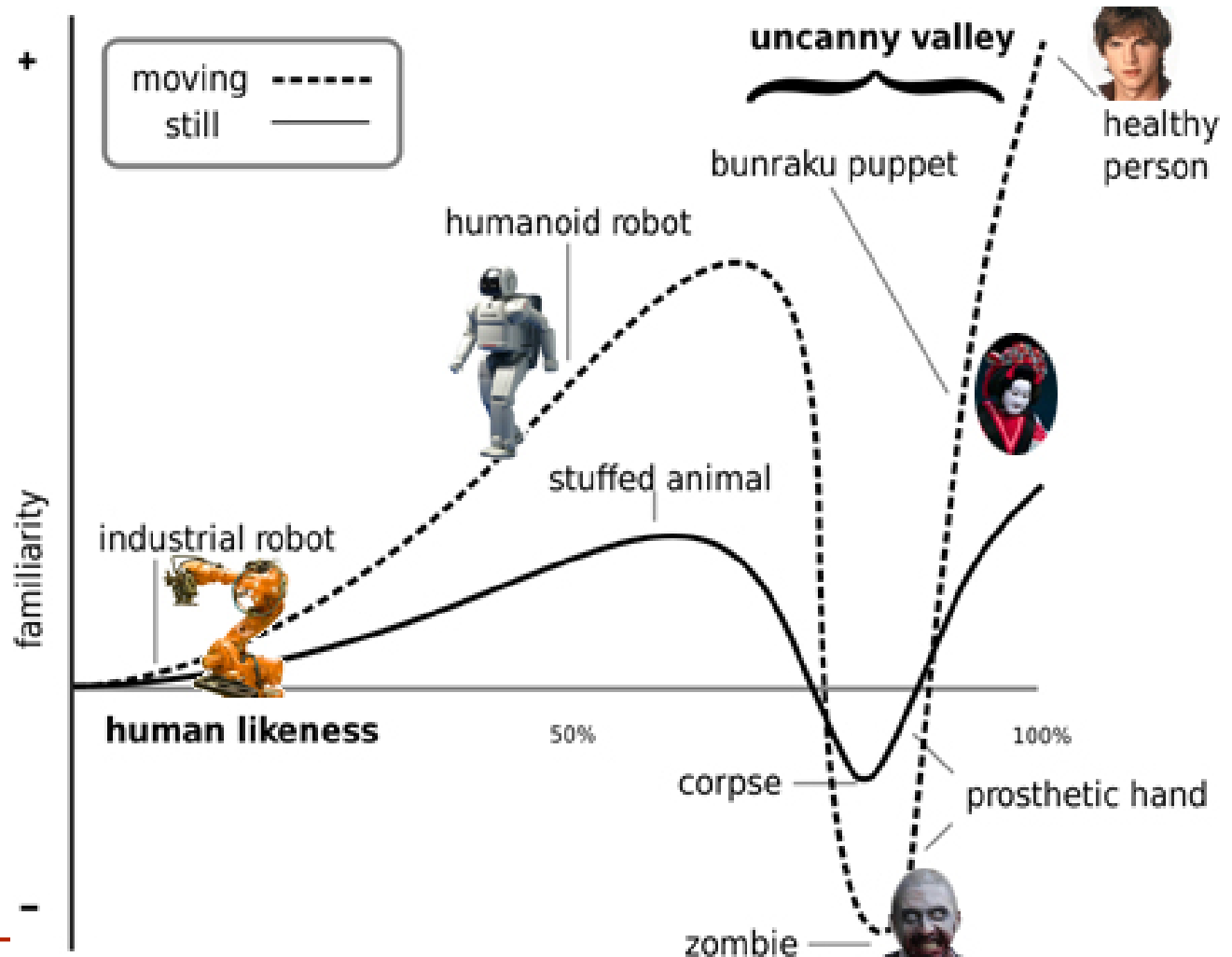


Baby from *Mars Needs Moms*

The Uncanny Valley



Baby from Pixar's Tin Toy



Industrial Light and Magic

Founded in 1975 by George Lucas to do effects work on Star Wars.

Owned by LucasFilm

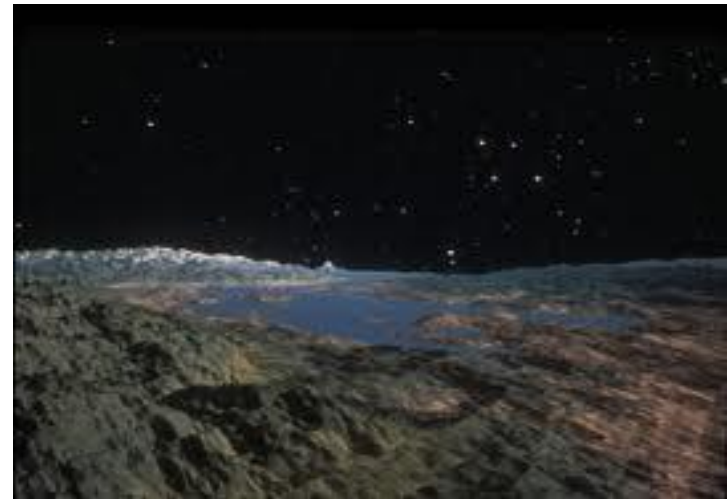
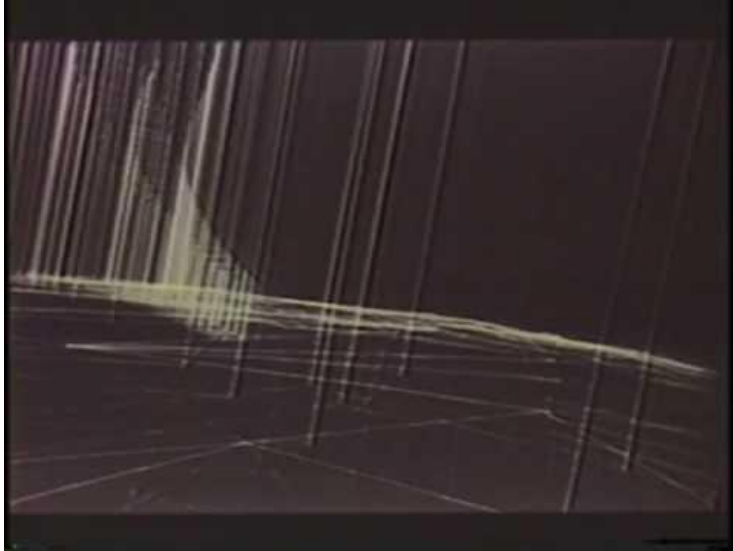
Located in San Francisco

The original Computer Graphics Group within ILM was sold to Steve Jobs and became Pixar.



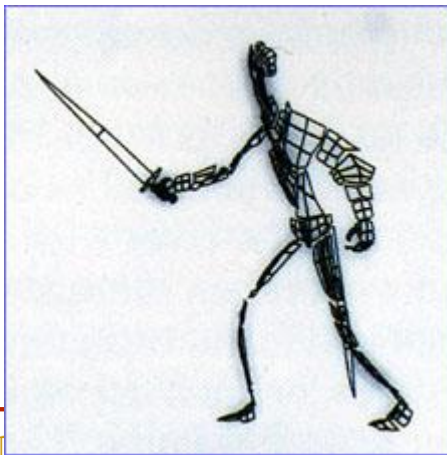
Star Trek II: The Wrath of Khan

1982: First completely computer-generated sequence the "Genesis sequence"



Young Sherlock Holmes (1985)

The first fully CG character, a medieval knight, springs to life from a stained glass window in "Young Sherlock Holmes." The 30-second sequence takes six months to accomplish. John Lasseter works on this as animator.



Willow (1988)

Story by George Lucas

Directed by Ron Howard

First morphing sequence



The Abyss (1988)

1989: First computer-generated 3-D character, the watery pseudopod.

First use of Photoshop

Directed by James Cameron (Aliens Terminator 1 & 2 Titanic and Avatar)



Terminator 2: Judgment Day (1991)

The liquid-metal cyborg T-1000 debuts "Terminator 2: Judgment Day," with five and a half minutes of screen-time devoted to 100 elements of CGI. Following six decades of optical printing, all of the effects work for this film is composited digitally.

Directed by James Cameron



Death Becomes Her (1992)

1992: First time the texture of human skin was computer generated



Jurassic Park (1993)

1993: First time digital technology used to create a complete and detailed living creature, the dinosaurs in Jurassic Park, which earned ILM its thirteenth Oscar



Jumanji (1995)

First computer generated furry character to appear in a feature film.



Toy Story (1995)

First feature length CG animated film.

Directed by John Lasseter at Pixar



Star Wars Episode I (1999)

Star Wars Episode I – The Phantom Menace, directed by Georges Lucas. ILM pushes the limits of computer graphics, working on a movie that require digital visual effects on almost every shot.



Polar Express (2004)

Polar Express was first film to use mo-cap in a feature length animated film.



PreViz

Previsualization (also known as previz or previs) can be any technique that attempts to visualize scenes in a movie before filming.

It is commonly used for big visual effects sequences.

Weta Digital

Weta Digital is a digital visual effects company based in Wellington, New Zealand. It was founded by Peter Jackson.

The company is named after the New Zealand weta, one of the world's largest insects.





To date, Weta Digital has won five Academy Awards for Best Visual Effects:

The Lord of the Rings: The Fellowship of the Ring (2001)

The Lord of the Rings: The Two Towers (2002),

The Lord of the Rings: The Return of the King (2003)

King Kong(2005)

Avatar (2009)

Andy Serkis

Noted Motion Capture Actor

Gollum: Lord of the Rings Trilogy (2001-03)

King Kong: King Kong (2005)

Caesar: Rise of the Planet of the Apes (2011)

Capt. Haddock: Tin Tin (2011)



Andy Serkis

Should there be an Oscar category for motion-capture acting?

Serkis: It should be in the [regular] acting category because the acting part of the process is entirely the same. I've been bombarded by hate mail from animators saying, "How dare you talk about 'your' character when all these people work on it after the fact? We're actors as well." They are actors in the sense that they create key frames and the computer will join up the dots, carefully choreograph a moment or an expression and accent it with an emotion. But that's not what an actor does. An actor finds things in the moment with a director and other actors that you don't have time to hand-draw or animate with a computer.



Motion Capture: The Controversy

Motion Capture also known as mo-cap.

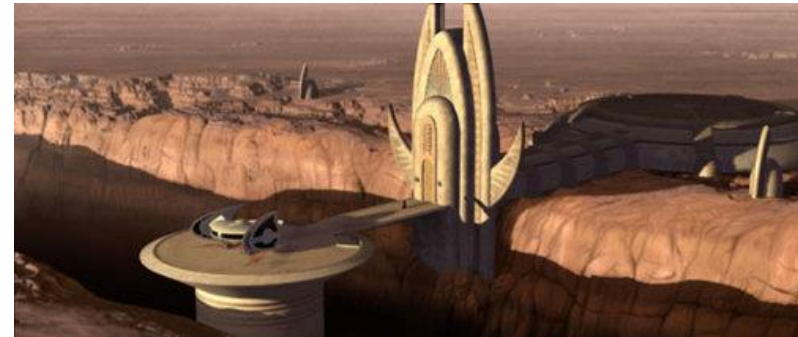
“It is called motion capture, not performance capture...I understand that good MoCap actors are hard to find and that it makes it easier to get the data if they're competent, but at the end of the day what they've provided is data that gets translated into what the animator works with to make the performance. They've provided motion.”

Star Wars Fan Films

Fan films are made for the fun of it, not profit.

George Lucas recognizes the best Star Wars with his annual Fan Film Challenge.

He permits this, as long as no money is made from it.



The End
