Pixar

Luiz Velho
IMPA

The Dream Factory

Timeline

1979

- George Lucas recruits Ed Catmull from the New York Institute of Technology to head Lucasfilm's Computer Division

1982

- The Computer Division's Graphics Group creates their first film-resolution image, "The Road to Point Reyes."

1984

- John Lasseter is hired full-time, joining the Computer Division as an "Interface Designer."

- At SIGGRAPH, the Computer Division also shows off its prototype Pixar Image Computer.

1986

- Steve Jobs purchases the Computer Division from George Lucas and establishes the group as an independent company, "Pixar."

- "Luxo Jr." is completed. The short film, John Lasseter's official directorial debut, is unveiled at SIGGRAPH.

1995

- Toy Story, the world's first computer animated feature film, is released in theaters and is recognized with Academy Award nominations for Best Original Song, Best Original Score, and Best Original Screenplay.

2017

- Pixar releases its Academy Award-winning RenderMan® software for non-commercial use.

2019

- Ed Catmull, original Pixar co-founder, retired from his role as President of Pixar Animation Studios

Lucasfilm's First Renderer

- REYES (Renders Everything You Ever Saw), 1981

- Authors:
  - Loren Carpenter
  - Rob Cook
  - Ed Catmull

- Included the "Renderman Shading Language"
  - designed by Pat Hanrahan

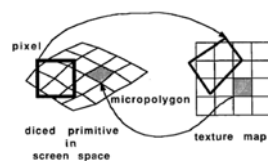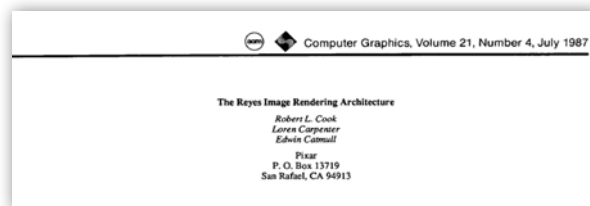# Reyes Image Rendering Architecture

- The Paper

Computer Graphics, Volume 21, Number 4, July 1987

The Reyes Image Rendering Architecture

Robert L. Cook
Loren Carpenter
Edwin Catmull

Pixar
P. O. Box 13719
San Rafael, CA 94913

Figure 2. With CATs, micropolygons map exactly to texture map pixels. With the inverse pixel method, pixels map to quadrilateral areas of texture that require filtering.
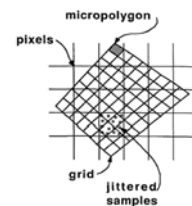
Figure 4b. The micropolygons in the grid are transformed to screen space, where they are stochastically sampled.

Road to Point Reyes

Genesis Effect

- Particle Systems Software
  - by Bill Reeves

- Star Trek II: The Wrath of Khan
  - The first use of Fractal-Generated Landscape in a film

Enters a New Ray-Tracer

- Monte Carlo Methods for Realistic Simulation of:
  - Motion Blur
  - Depth-of-Field
  - Soft Shadows

- Stochastic Sampling for Antialiasing

- Developed by:
  - Rob Cook, Thomas Porter, Loren Carpenter
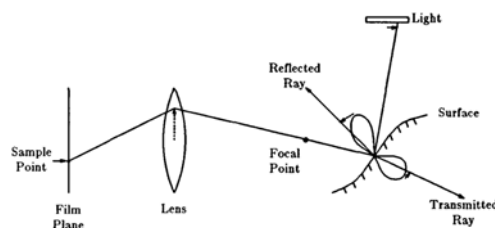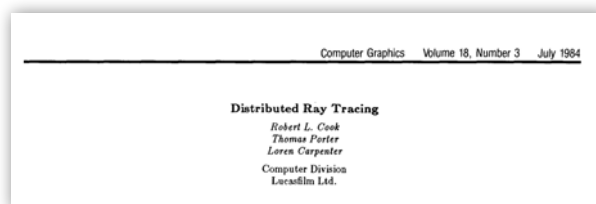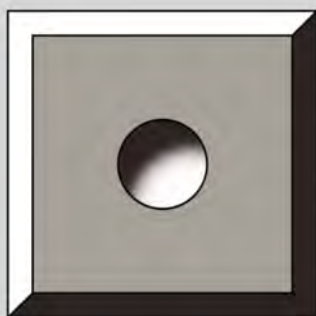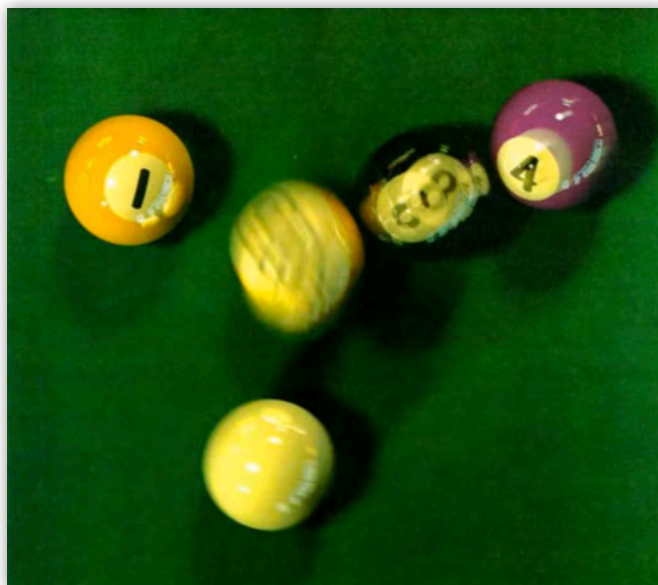
Distributed Ray Tracing

- The Paper

Computer Graphics   Volume 18, Number 3   July 1984

Distributed Ray Tracing

Robert L. Cook
Thomas Porter
Loren Carpenter

Computer Division
Lucasfilm Ltd.

Figure 2. Typical Distributed Ray Path

Pool Table
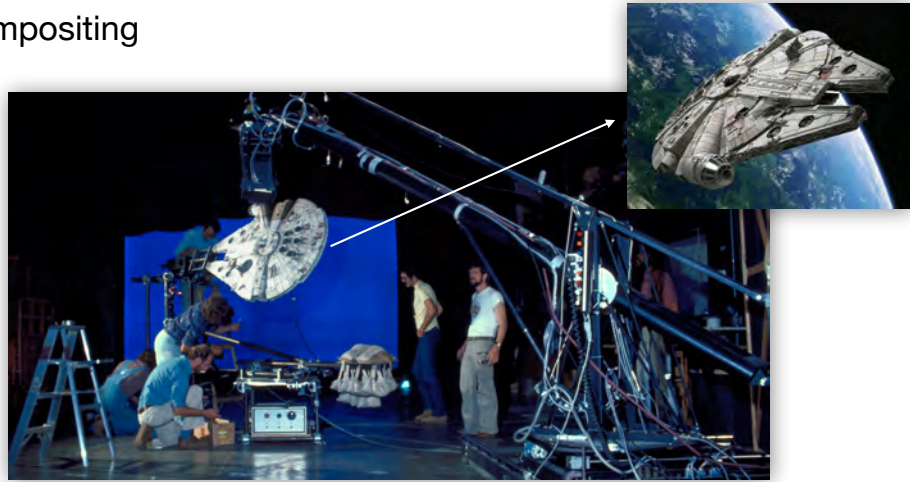
Lucasfilm Special FX

- Image Compositing

The Machine

- RGB-A Image Compositing Processor

The Pixar Image Computer

- Technical Details
  - (CHAP) Channel Processor: *(RGBA) image computer*
    - No. of parallel processors per CHAP: 4
    - No. of CHAPs per system: 1 to 3
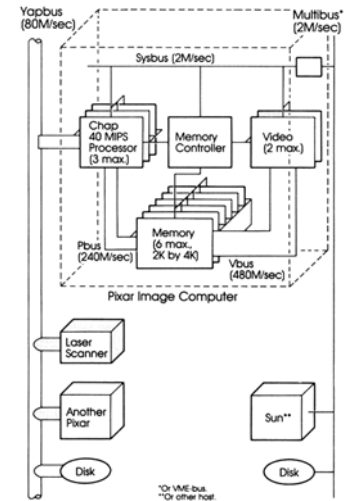   - Data word width per processor: 16 bits
  - Memory:
    - 192 MB of image memory (VRAM)
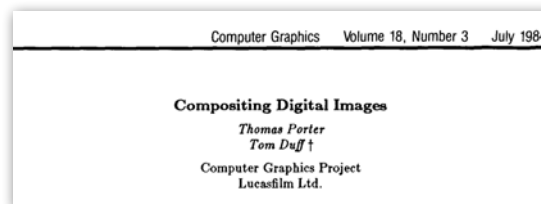   - full-color pixels at 48 bits for each pixel

- Price
  - Low-Cost Model: $30,000
  - Full-Up System: $300,000
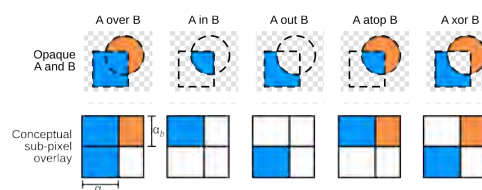
- First Prototype (1984) - Released Commercially (1986)

Digital Compositing

Computer Graphics   Volume 18, Number 3   July 1984

Compositing Digital Images

Thomas Porter
Tom Duff †

Computer Graphics Project
Lucasfilm Ltd.

- Alpha Compositing Algebra

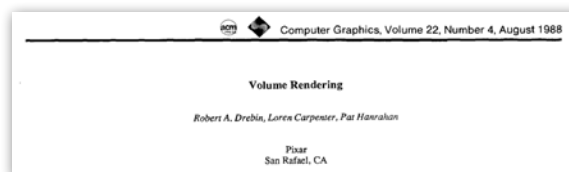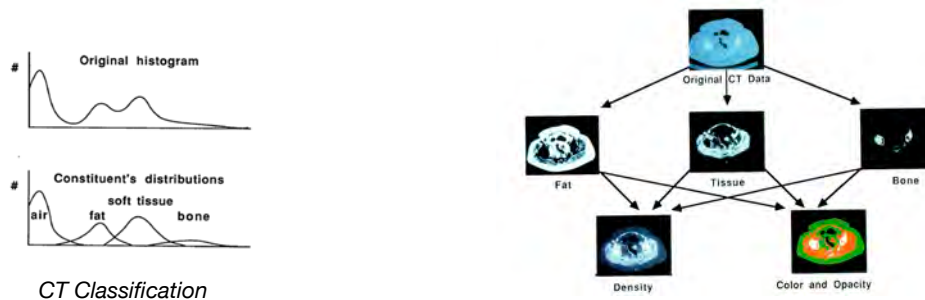| description	area
$\bar{A} \cap \bar{B}$	$(1-\alpha_A)(1-\alpha_B)$
$A \cap \bar{B}$	$\alpha_A(1-\alpha_B)$
$\bar{A} \cap B$	$(1-\alpha_A)\alpha_B$
$A \cap B$	$\alpha_A\alpha_B$

Film Industry

- The Young Sherlock Holmes (1985)

Volume Rendering

Computer Graphics, Volume 22, Number 4, August 1988

Volume Rendering

Robert A. Drebin, Loren Carpenter, Pat Hanrahan

Pixar
San Rafael, CA

- Voxel Mixtures / Classification / Surface Extraction
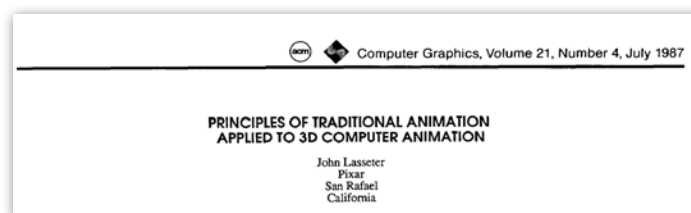

CT Classification

Scientific Applications

- Volume Visualization (1987)

The Principles of Animation

From Traditional to 3D Animation

Computer Graphics, Volume 21, Number 4, July 1987

PRINCIPLES OF TRADITIONAL ANIMATION
APPLIED TO 3D COMPUTER ANIMATION

John Lasseter
Pixar
San Rafael
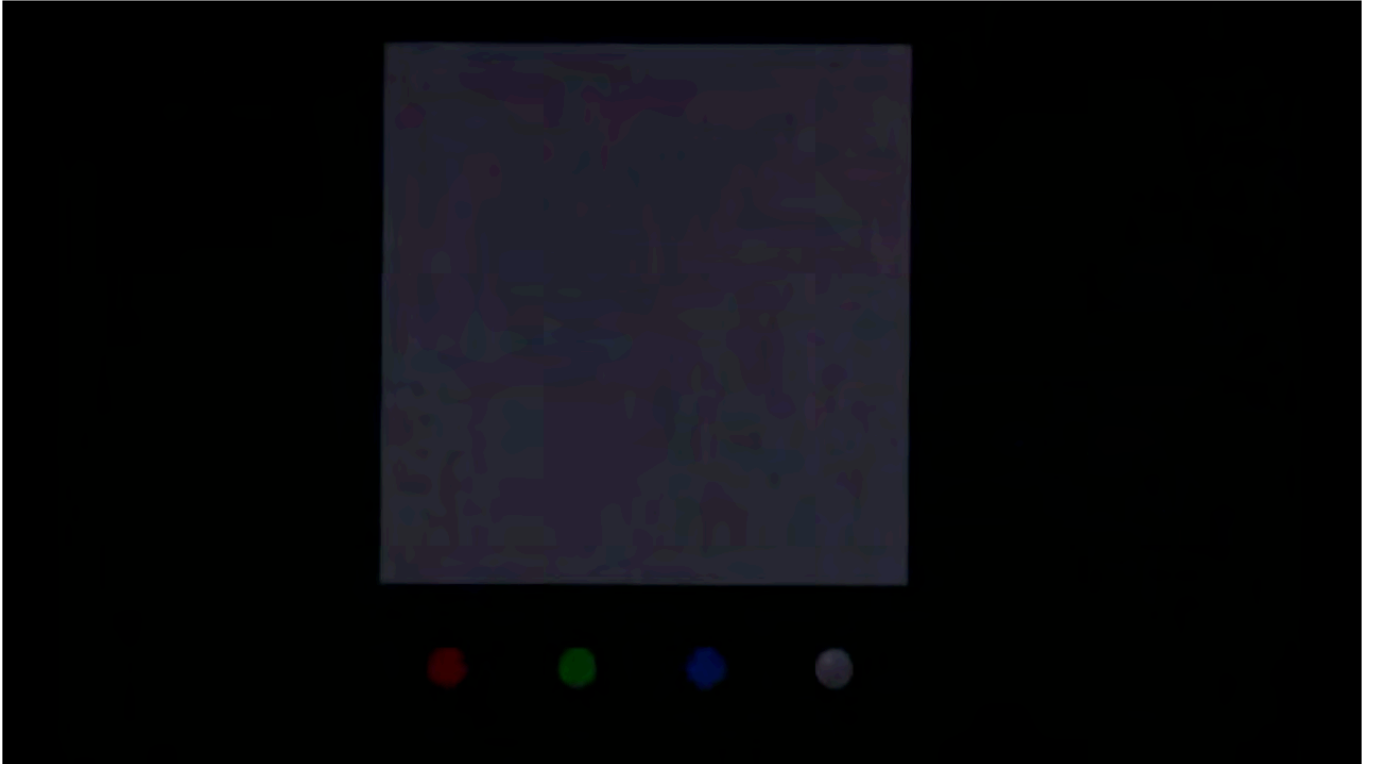California

• The 12 Principles

1. Squash & Stretch

EXTREME

EXTREME

Timing Chart

Luxo Jr.

making-of stories

Toy Story

and the Oscar goes to…
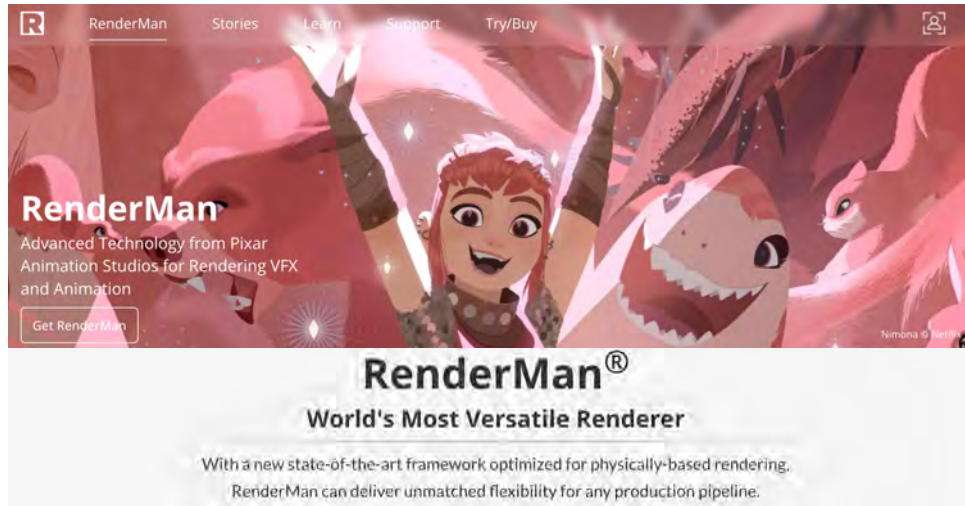
The Toy Story Franchise

Toy Story was the world's first computer-animated feature film,
It was nominated for three Oscars and recipient of a Special Achievement Academy Award.

- The Franchise Hall of Fame (4 Oscars)
  - Best Animated Feature (Toy Story 3, Toy Story 4), Best Original Song (Toy Story 3), Special Achievement Award (Toy Story)

Renderman

The Software

Academy Awards for RenderMan

- 1993: Scientific and Engineering Award (*Academy Plaque*)
  - Awarded to Ed Catmull, Tony DeRose, and Tom Duff for the development of RenderMan

- 2001: Academy Award of Merit (*Oscar Statuette*)
  - Awarded to Edwin Catmull, Loren Carpenter, and Rob Cook for pioneering work on RenderMan

- 2010: Scientific and Technical Academy Award (*Academy Plaque*)
  - Recognized improvements in global illumination and ray tracing techniques in RenderMan

Universal Scene Description

Academy Technical Awards

PIXAR ANIMATION STUDIOS
presents

One More Thing..

The Brazilian Connection

FERNANDO DE GOES
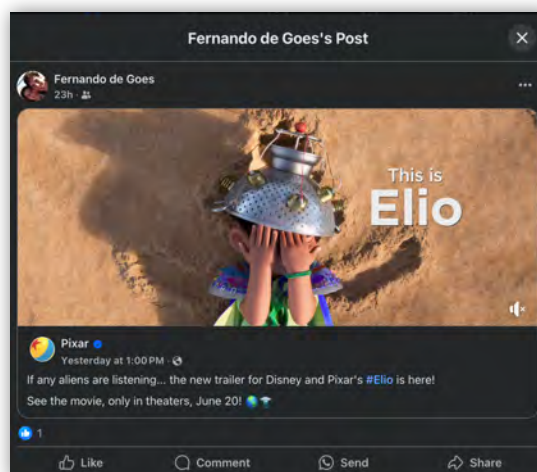fernando at pixar dot com

I am a principal research scientist at Pixar Animation Studios. My research centers on numerical methods for geometry processing and computational physics. I was awarded a SciTech Oscar in 2023 for coauthoring the design and development of *Fizt2*, Pixar's elastic simulation system. In 2023, I also became a member of the Academy of Motion Picture Arts and Sciences. I received a PhD degree in computer science from Caltech in 2014 supported by a Google PhD Fellowship, and earned an engineering degree in 2006 and a master degree in 2009 from Unicamp (Brazil).

- IMPA's student (2006)

By The Way …

- Real-Time Now (as we speak) -> June 20

Watch @ Home

- Humans, Machines and AI

Luiz Velho - VISGRAF Webinar