

Introduction to Computer Graphics

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Education

2002~2006 Computer Science & Engineering, Korea University (Ph.D.)

Career

- 2006~2008 Telecommunication Network Business (TN), Samsung Electronics
- 2008~ 2020 Dept. of Game Engineering, Paichai University
- 2020~ Current Dept. of Computer Engineering, Jeju National University

Publication

- 2006~ Current 50 International Journal Papers (including SCIs and SCIE)
- 2006~ Current International Journal Papers (including SCOPUS)
- 2015 International Book (Springer)



배재대학교 게임공학과 김수균 교수(41)가 대표저자로 국내 교수 4명과 함께 쓴 '게임 프로그래밍을 위한 실시간 시각효과 기법'(Real-Time Visual Effects for Game Programming)이 세계적으로 유명한 미국 Springer 출판사에서 발간돼 인터넷 서점인 아마존에서 판매에 들어갔다.

이 책은 영화와 게임에서 사용되는 컴퓨터그래픽(CG) 기술에서 물, 불, 연기, 바람 등을 더욱 사실감 있는 표현하는 컴퓨터 그래픽스 알고리즘을 소개하고 게임에 현실적으로 적용할 수 있도록 실시간 렌더링

The screenshot shows the Amazon product page for 'Real-Time Visual Effects for Game Programming (Gaming Media and Social Effects)' by Chang-Hun Kim, Sun-Jeong Kim, Sun-Yeon Kim, and Shin-Jin Kang. The page includes the book cover, ISBN information (ISBN-13: 978-9812674863, ISBN-10: 9812674860), and purchase options. It highlights a price of \$122.82 and free shipping. The page also features a 'FREE TWO-DAY SHIPPING FOR COLLEGE STUDENTS' offer.

This book introduces the latest visual effects (VFX) techniques that can be applied to game programming. The usefulness of the physically-based VFX techniques, such as water, fire, smoke, and wind, has been demonstrated through active involvement and utilization in movies and images. However, they have yet to be extensively applied in the game industry, due to the high technical barriers. Readers of this book can learn not only the theories about the latest VFX techniques, but also the methodology of game programming, step by step. The practical VFX

Contents

- What is Computer Graphics?
- Demo Video
- Graphics Process
- Technical Demo

What is Computer Graphics?



Computer Graphics(1)

- 정의
 - 컴퓨터를 이용하여 영상을 제작하는 기술



Computer Graphics(2)

- 정의
 - 컴퓨터를 이용하여 영상을 제작하는 기술
- 예제
 - 광고 및 영화



Batman & Robin (Buf Campagine)

영상 관련 학문 분야

■ 영상 관련 학문 분야

- 영상처리 : 입·출력이 모두 영상
- 컴퓨터 비전 : 입력이 영상이며 출력은 심볼
- 컴퓨터 그래픽 : 입력이 심볼이며 출력은 영상
- AI : 입·출력이 모두 심볼

출력	입력	영상	심볼
영상			
심볼			

영상과 심볼의 입출력에 따른 학문 분야

영상 관련 학문 분야

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- AI : 입·출력이 모두 심볼

입력	영상	심볼
영상	영상처리	컴퓨터 그래픽
심볼	컴퓨터 비전	AI

영상과 심볼의 입출력에 따른 학문 분야

Computer Graphics(3)

- 이미징 (Imaging) - 2차원 이미지 표현
- 모델링 (Modeling) - 3차원 오브젝트 표현
- 렌더링 (Rendering)
 - 3차원 모델들로부터 2차원 이미지 생성
- 애니메이션 (Animation) : 인크레더블
 - 시간의 흐름에 따라 변화를 시뮬레이션



Imaging(1)

- 예술적 이미지를 생성



와핑 (Warping)



경계선 검출 (Edge Detection)

Imaging(2)

- Michael Jackson - Black Or White



Imaging(3)



모핑 (Morphing, Metamorphosis)



Modeling

- 3차원 모양을 묘사하고 디자인

폴리곤
(Polygon)



서브디비전
(Subdivision)



NURBS



CSG



프랙탈
(Fractal)



Blobby

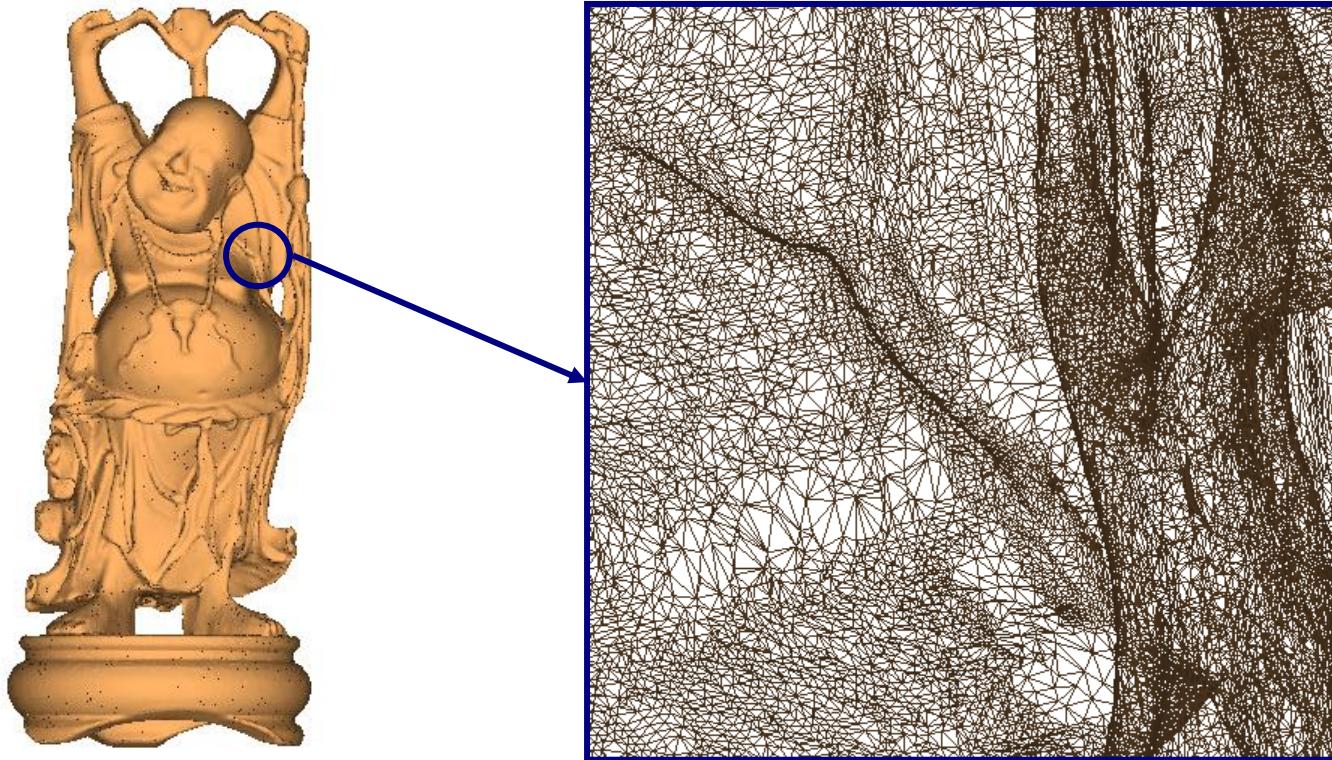


지형
(Terrain)



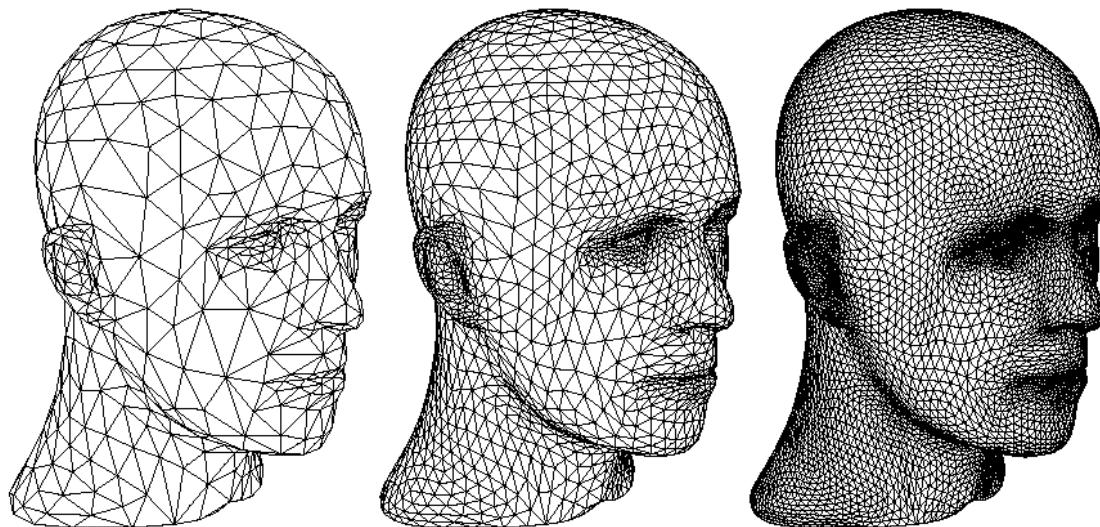
Modeling

- 폴리곤 (Polygon)



Modeling

- 메쉬 분할 (Subdivision Surface)

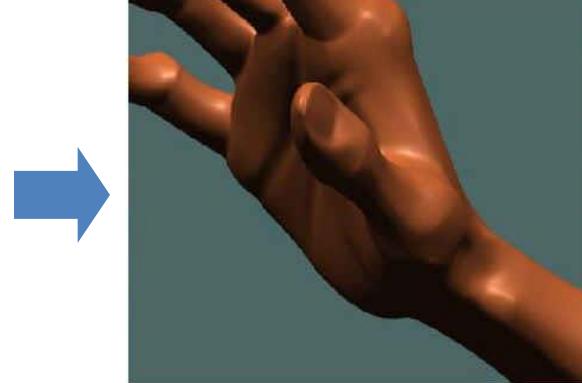


Modeling

- 메쉬 분할 (Subdivision Surface)



기본 메쉬



분할 메쉬



Pixar animation
[Geri's Game]

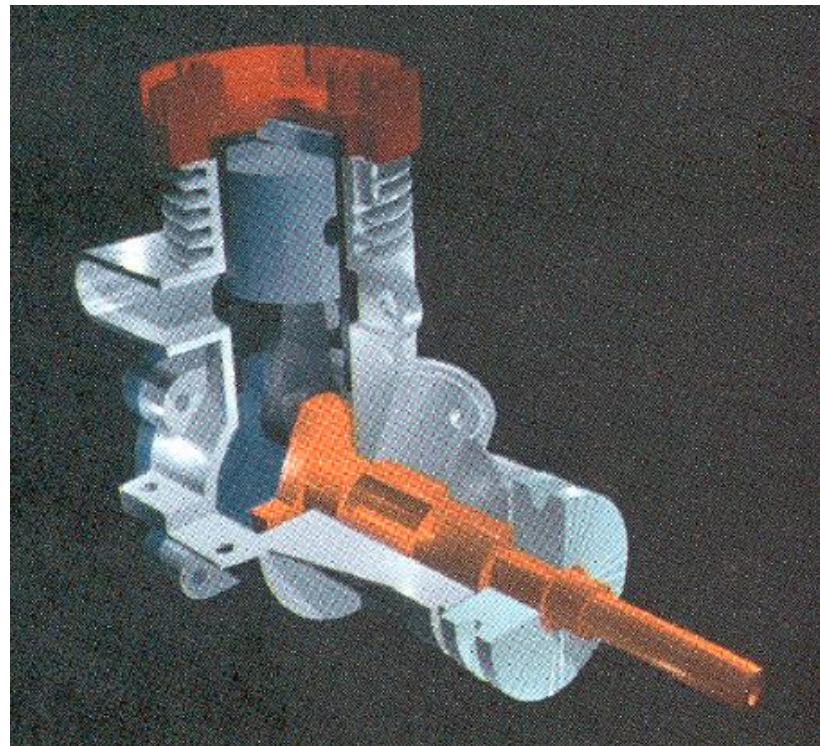
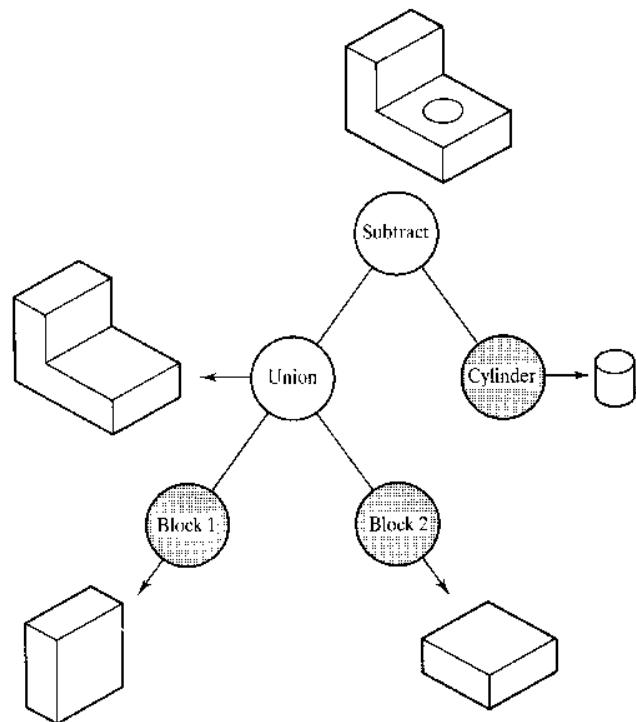
Modeling

- Geri's Game



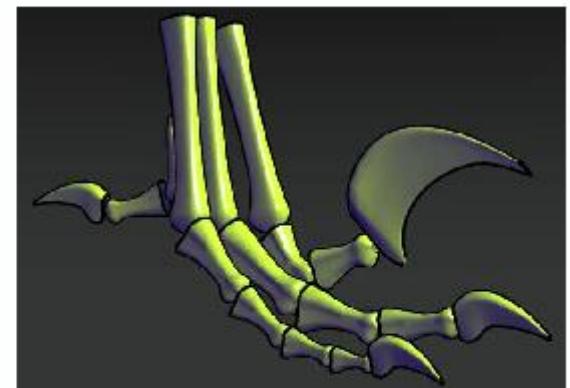
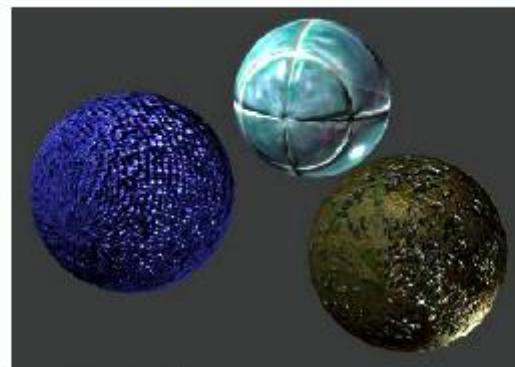
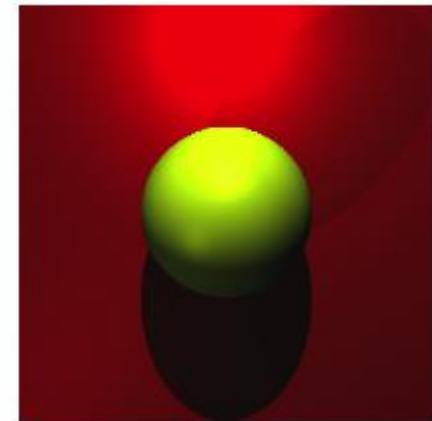
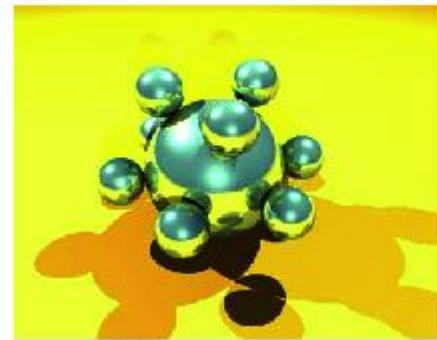
Modeling

- 간단한 모양의 물체들에 Boolean 연산 (합집합, 교집합, 차집합) 을 계층 (Hierarchy) 적으로 표현



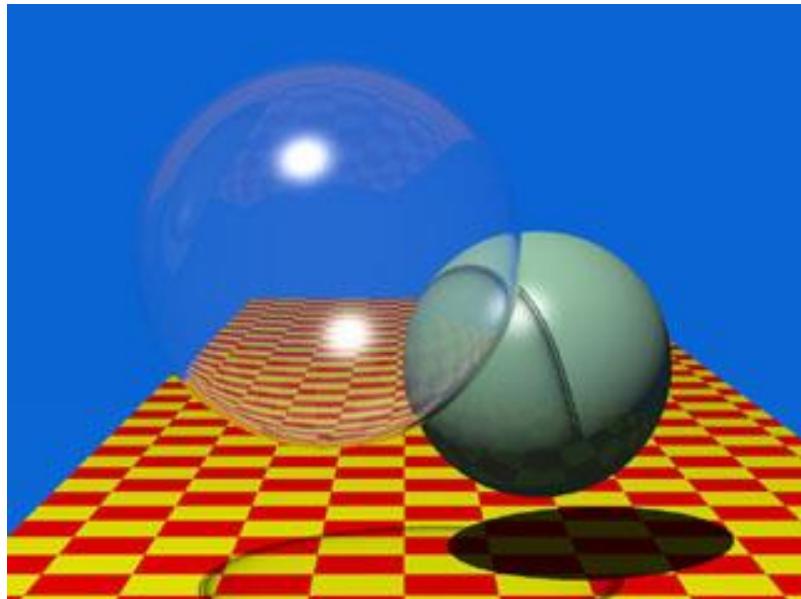
Rendering

- 빛의 움직임을 시뮬레이션 하여 이미지 형성



Rendering

- Photorealistic Rendering



1980 "An Improved Illumination model for shaded display" - Turner Whitted, SIGGRAPH



<http://www.oyonale.com/accueil.php?lang=en>

Rendering

- Non-Photorealistic Rendering



Traditional Rendering



Cartoon Rendering

Demo Video (1/8)



[Geri's game, 1997]

Demo Video (2/8)



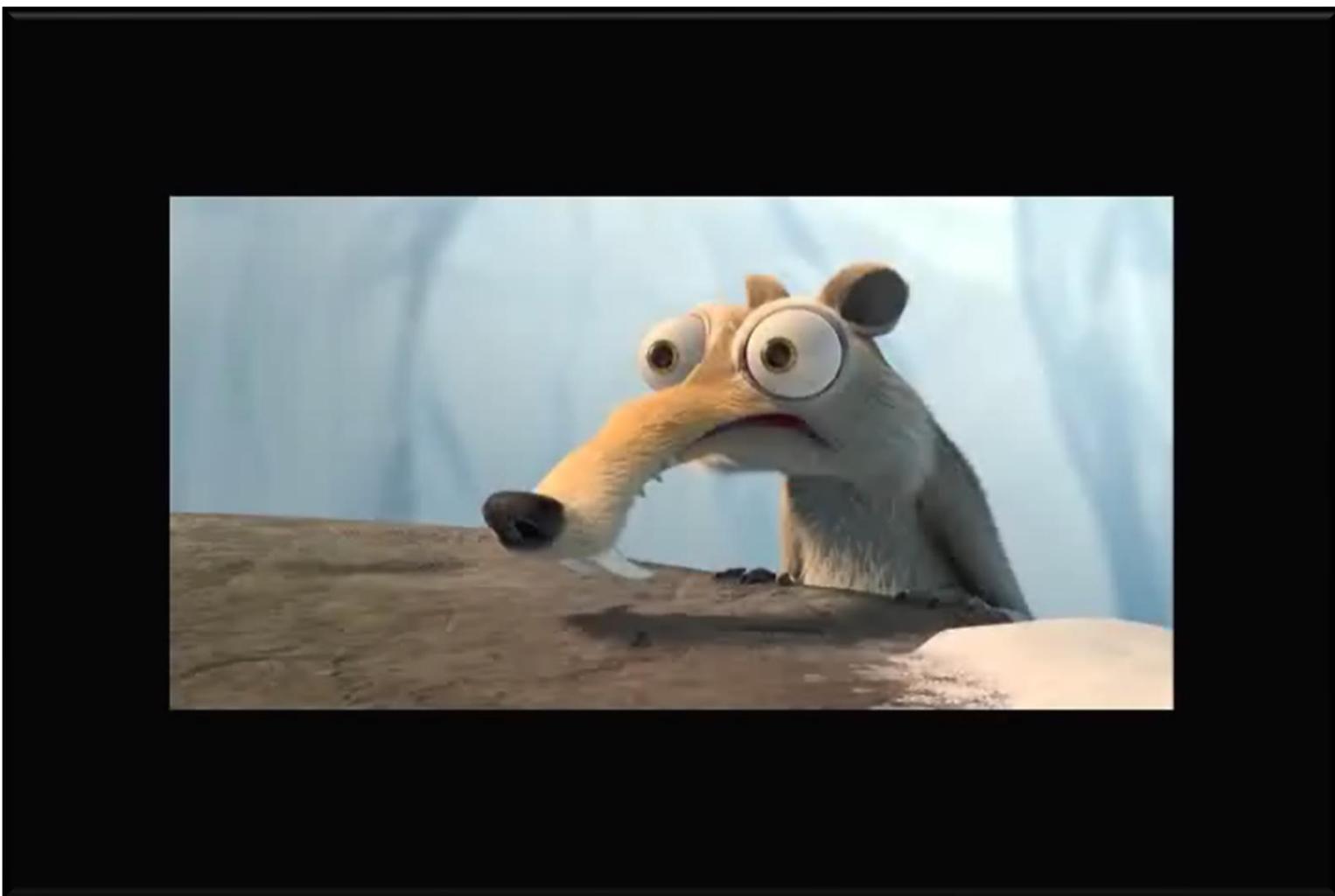
[Pan's Labyrinth, 2006]

Demo Video (3/8)



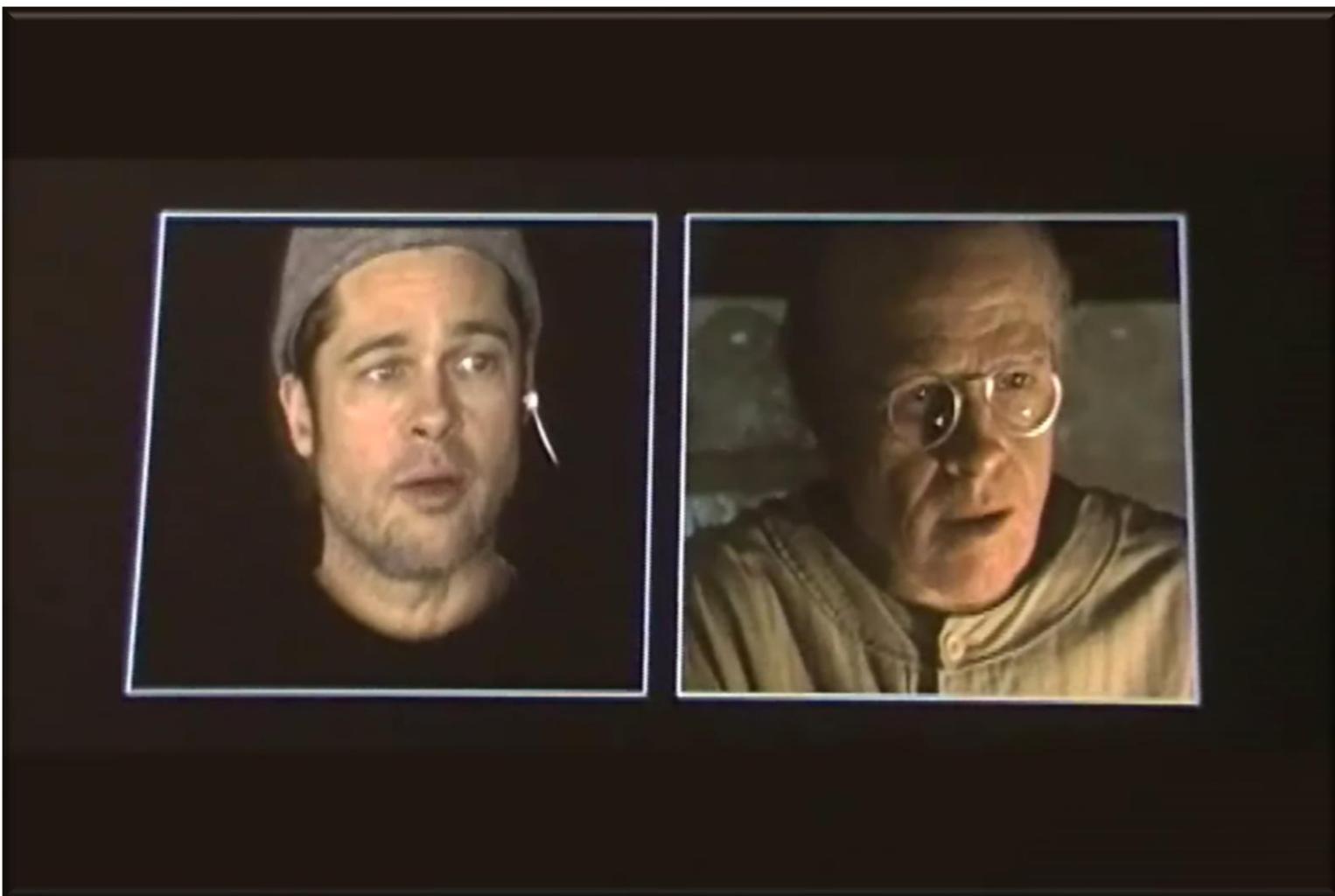
[The Chronicles Of Narnia: Prince Caspian, 2008]

Demo Video (4/8)



[Ice Age 3 : Dawn of the Dinosaur, 2008]

Demo Video (5/8)



[The Curious Case of Benjamin Button, 2008]

Demo Video (6/8)



[추노, 2010]

Demo Video (7/8)



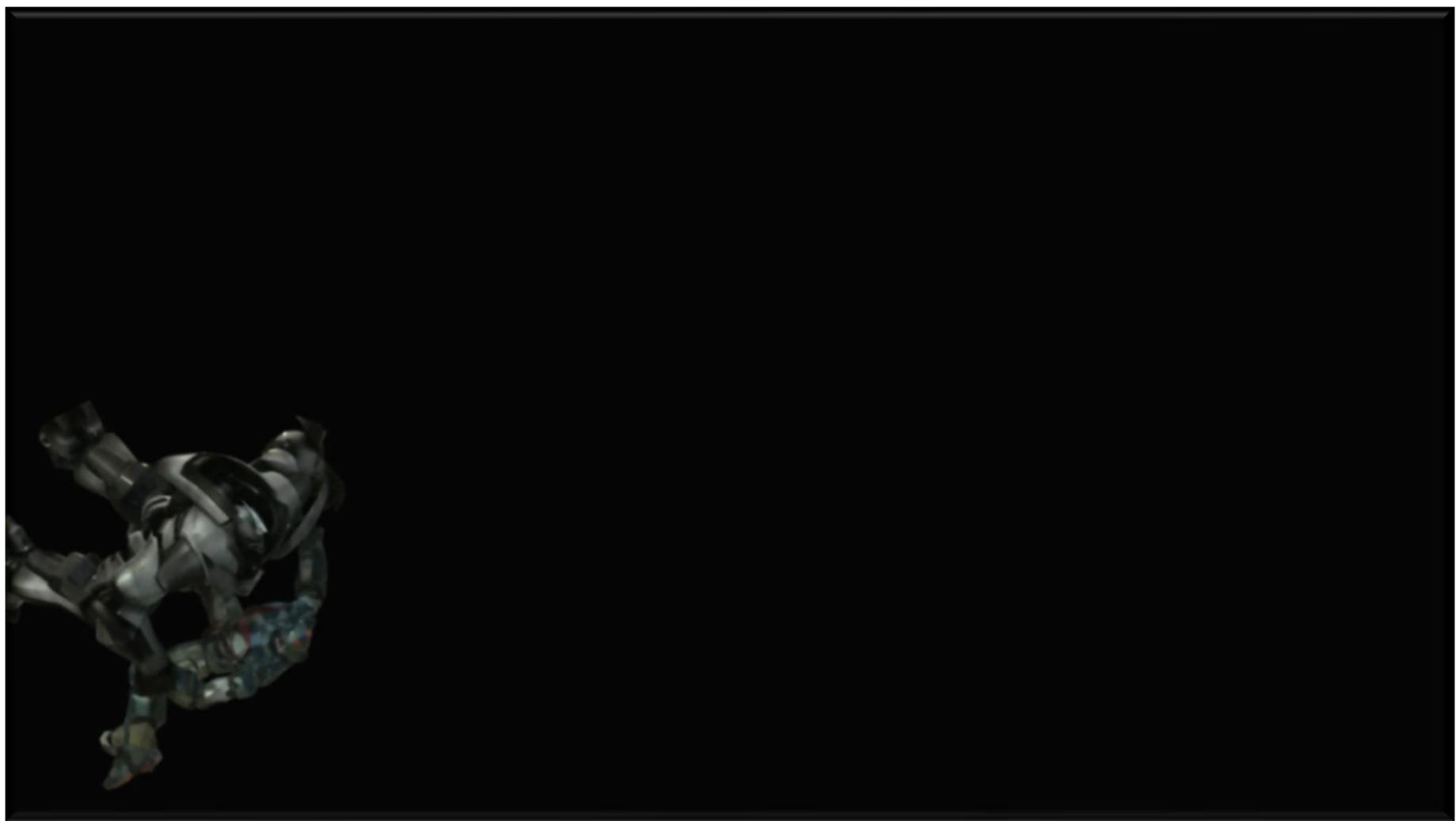
[The Last Airbender, 2010]

Demo Video (8/8)



[Inception, 2010]

CG Production Process (1/2)



[Robot Taekwon V, 2009]

CG Production Process (2/2)

1920 x 1080



RF002_ShotCAM

RF002 Pre-version Animatics
FXGear / Mobydic / Puppetar Studio

[Robot Taekwon V, 2009]

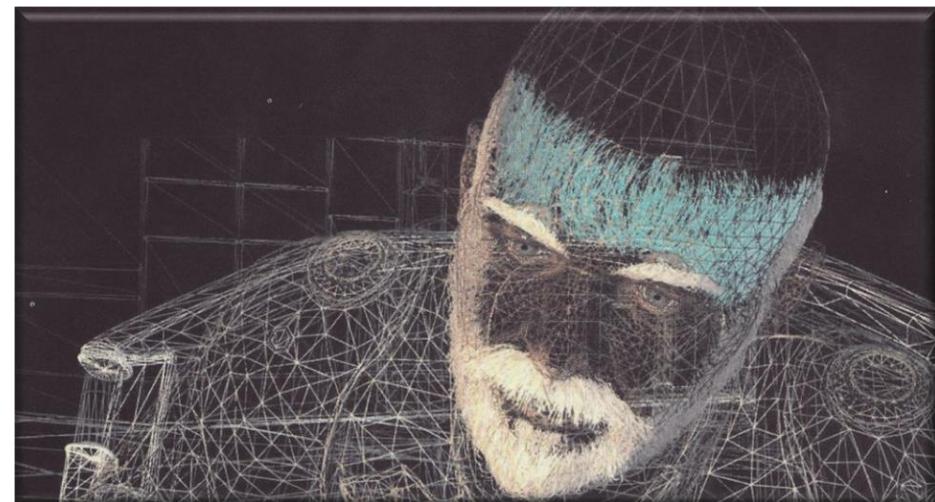
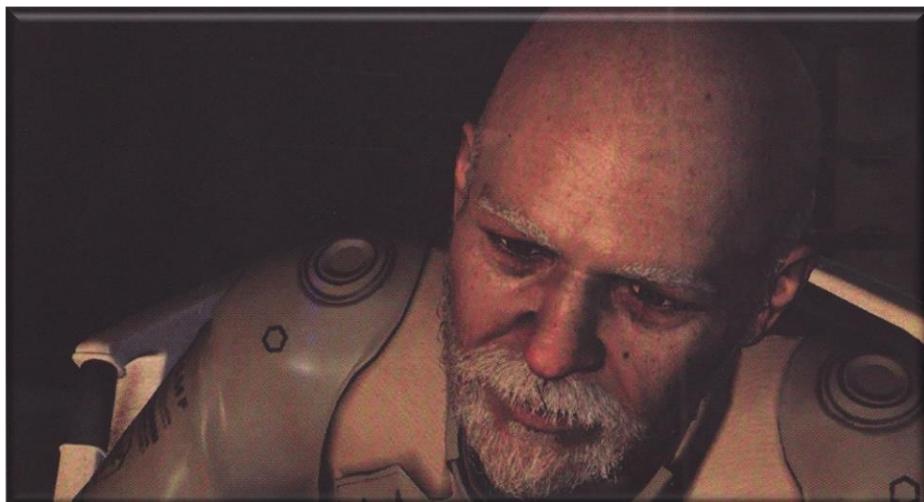
Real-time Rendering

- Normally means 3D rendering
- The frame rate at which images are displayed
 - Frames per second (fps) / Hertz (Hz)
 - 1 fps
 - The user painfully waits for the arrival of each new image
 - Around 6 fps
 - A sense of interactivity starts to grow
 - Around 15 fps : Interactive (almost real-time)
 - The user focuses on action and reaction
 - Above 30 fps : Real-time

Interactivity and some sense of connection to **3D space**

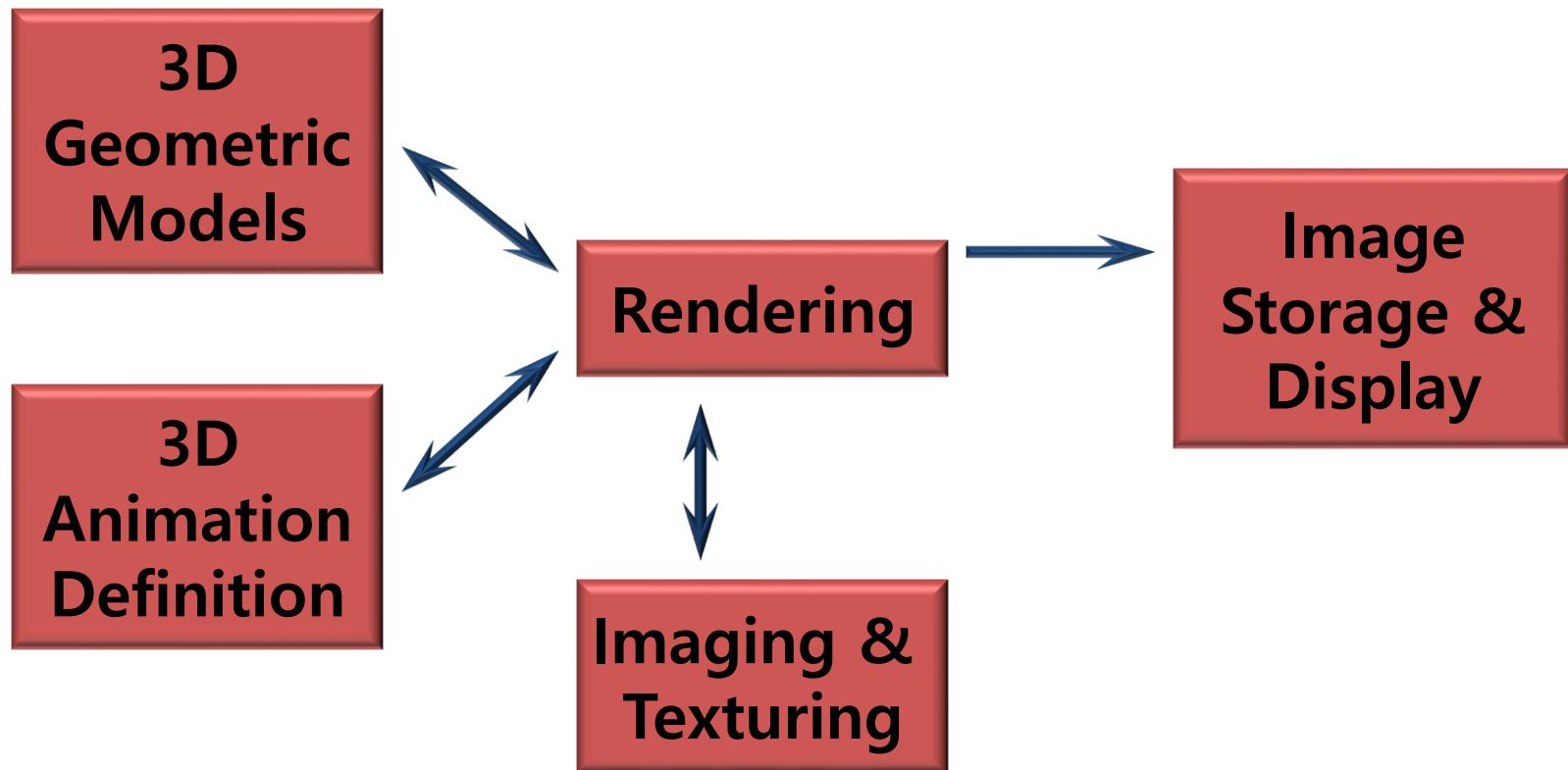
Graphics Acceleration Hardware

- Has become a part of real-time rendering
- Real beginning of the 3D accelerator at the consumer level
 - 3Dfx Voodoo 1 in 1996 : Add-on type

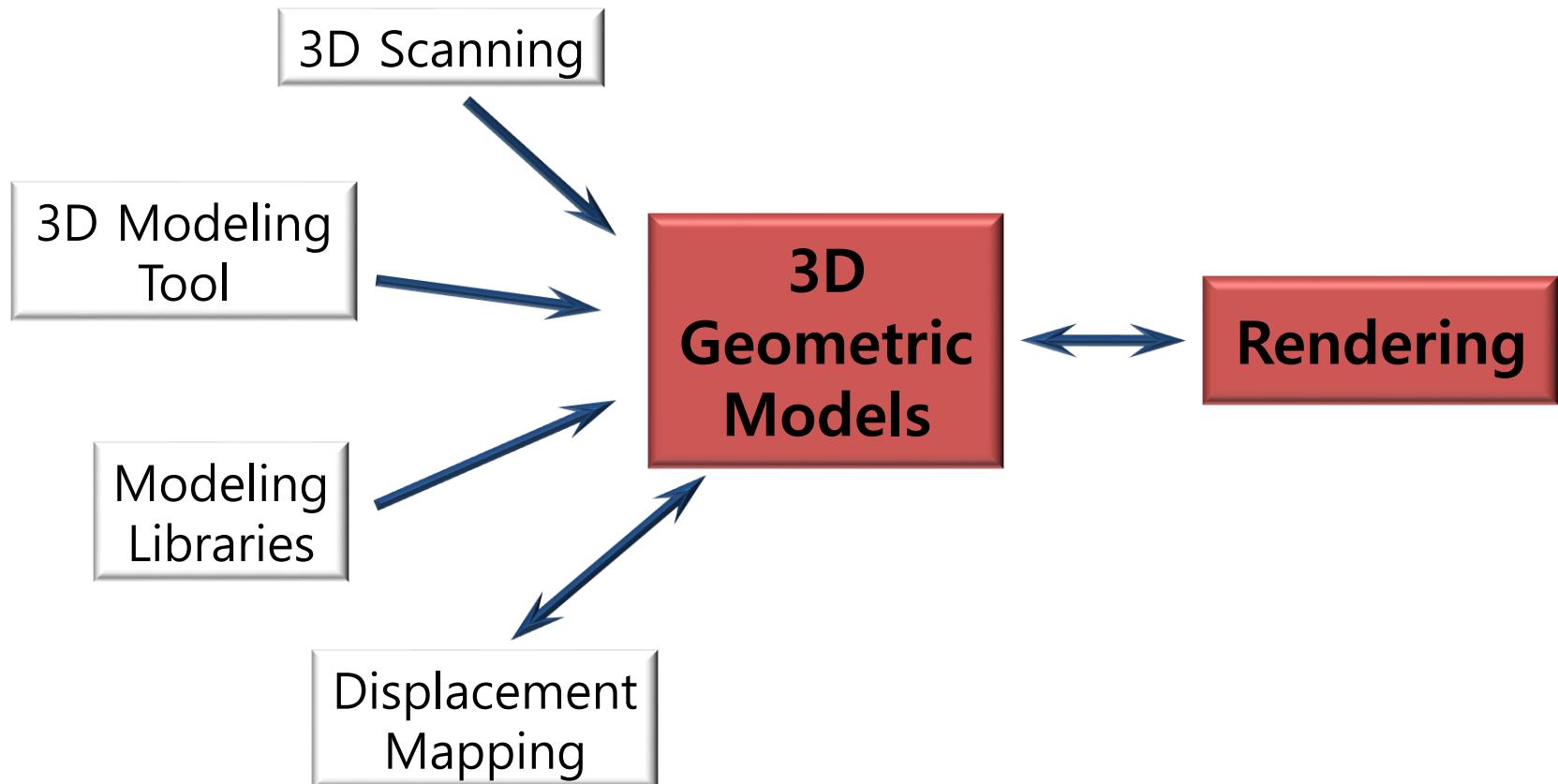


[Final Fantasy : The Spirits Within, 2001]

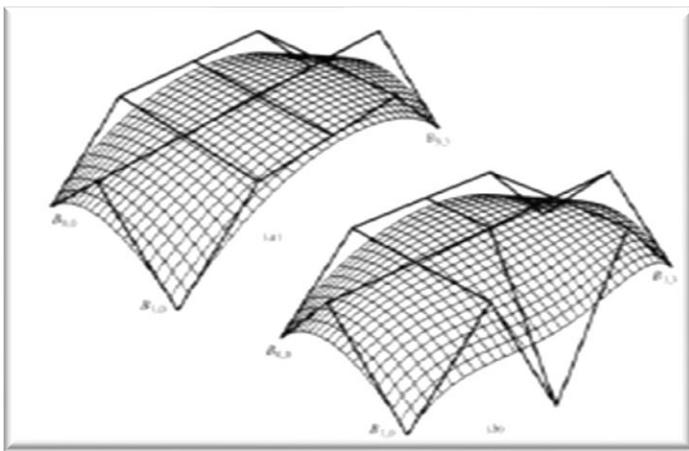
Graphic Process



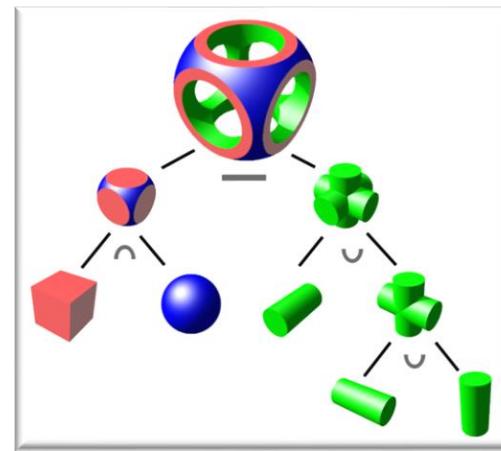
Graphics Process : Geometric Modeling



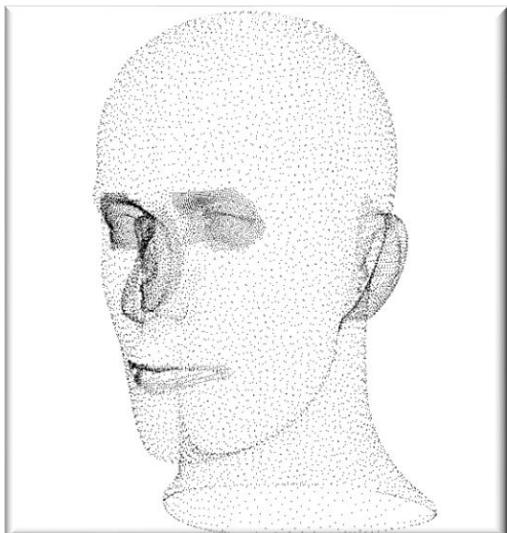
Geometric Modeling Examples



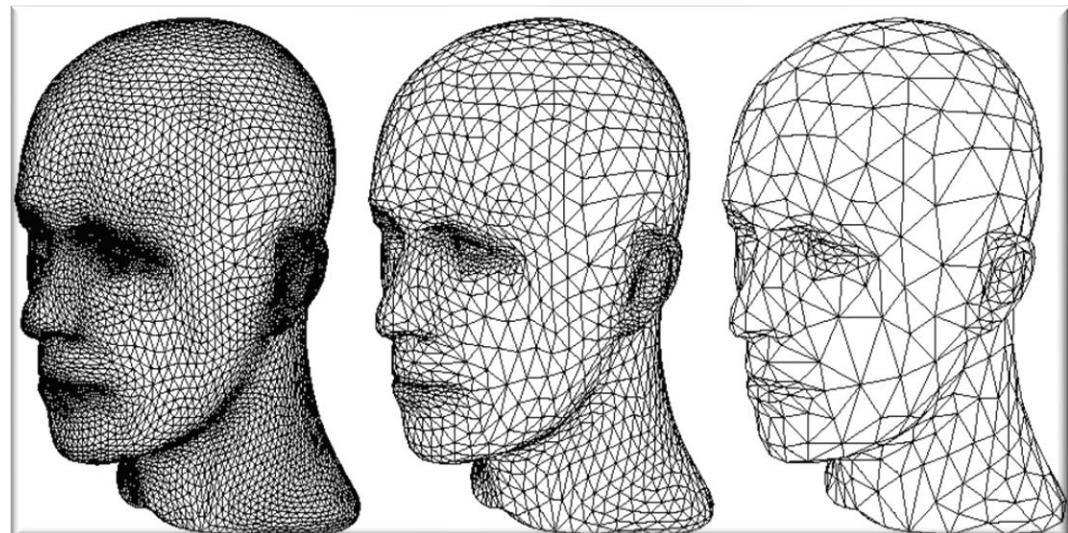
[Curved Surface]



[Constructive Solid Geometry]

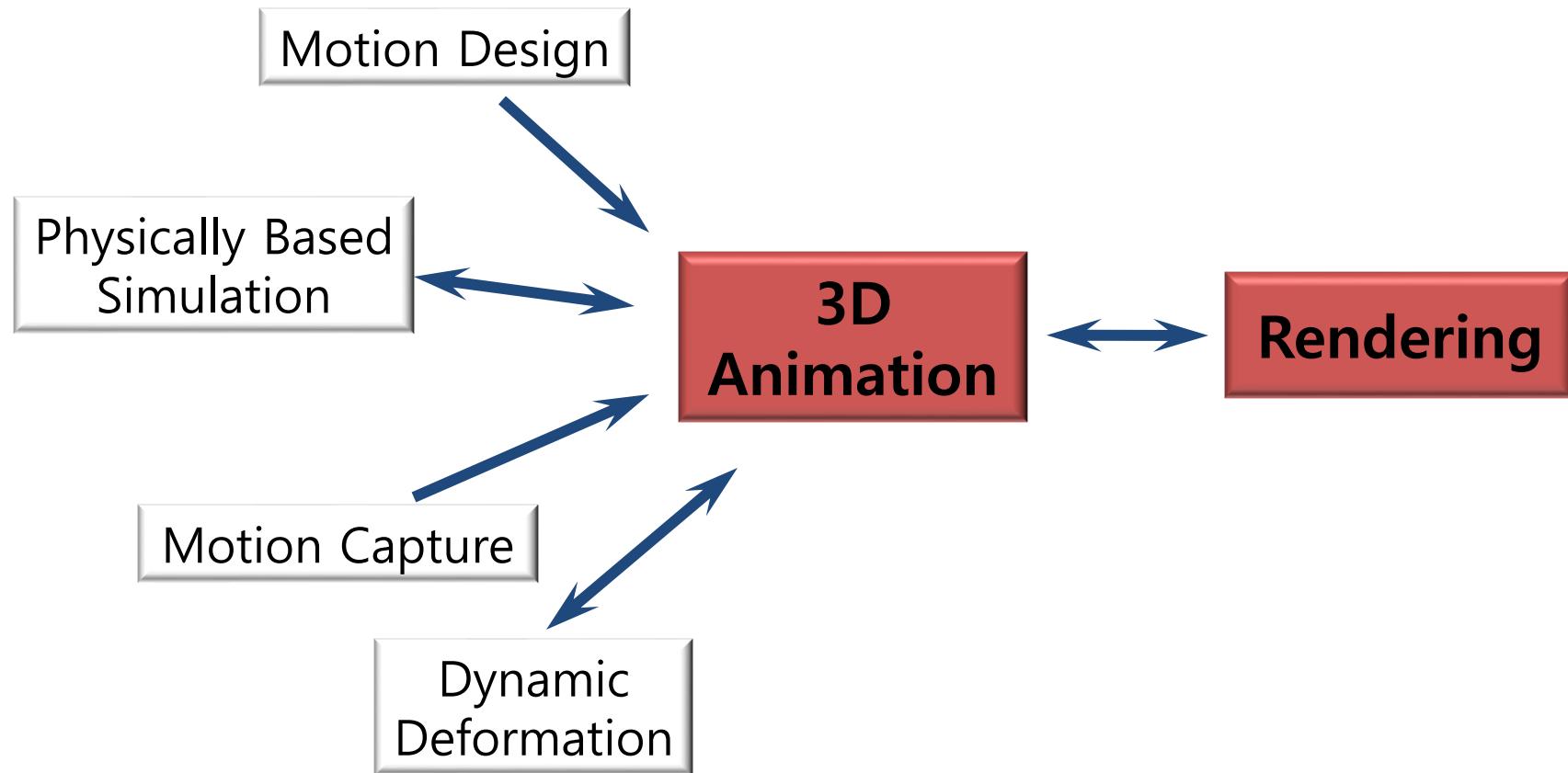


[Scanned Point Cloud]

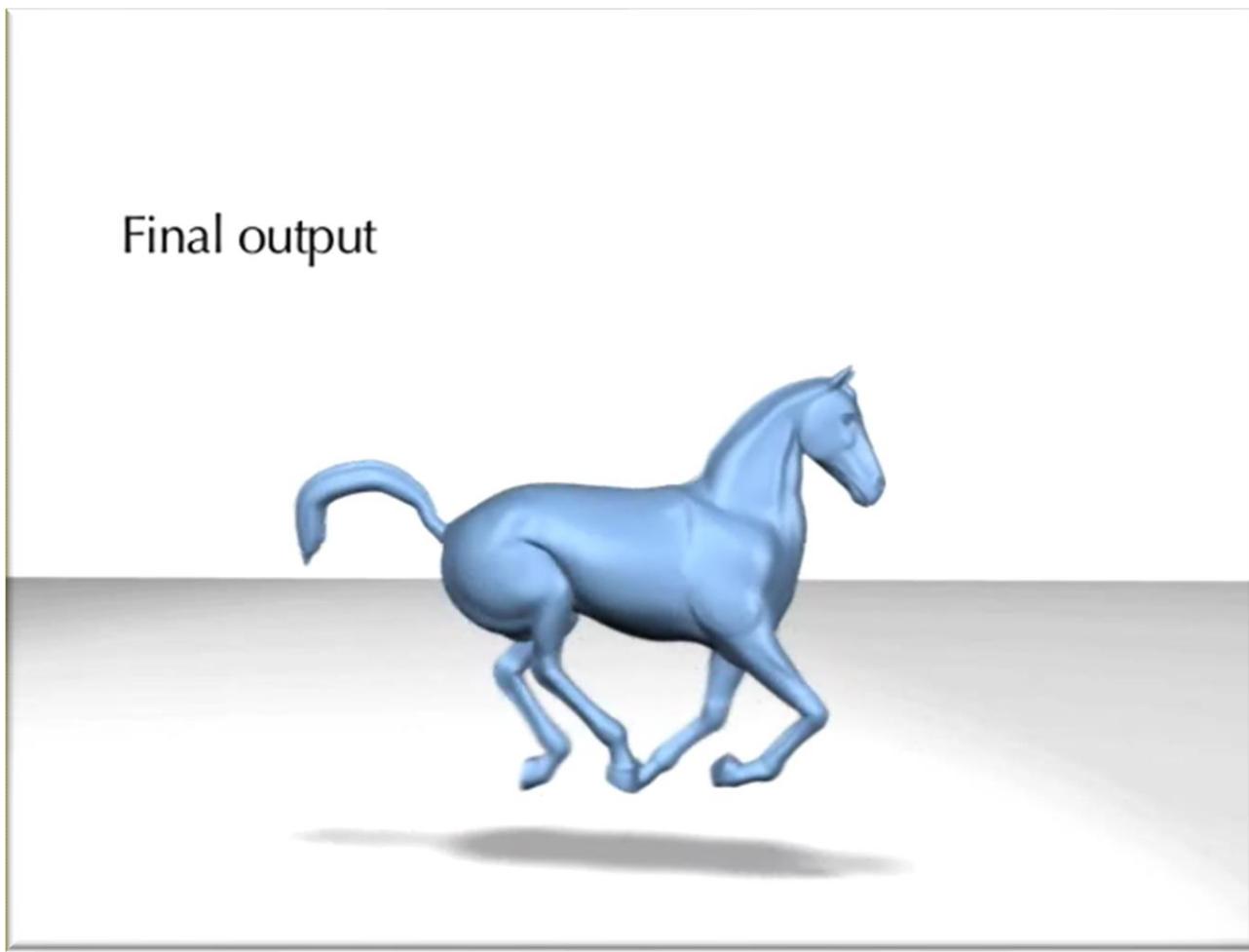


[Subdivision Surface]

Geometric Process : 3D Animation



3D Animation Example



[Embedded Deformation for Shape Manipulation]
(Robert W. Sumner et al., SIGGRAPH 2007)

Graphic Process : Imaging

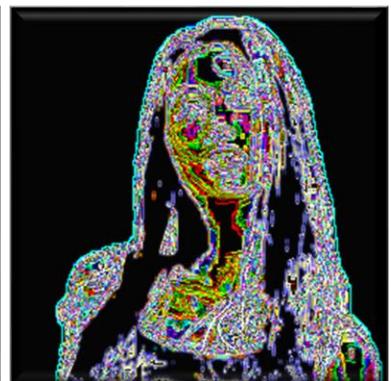
- Generating an Artistic Image



[Image Modification]

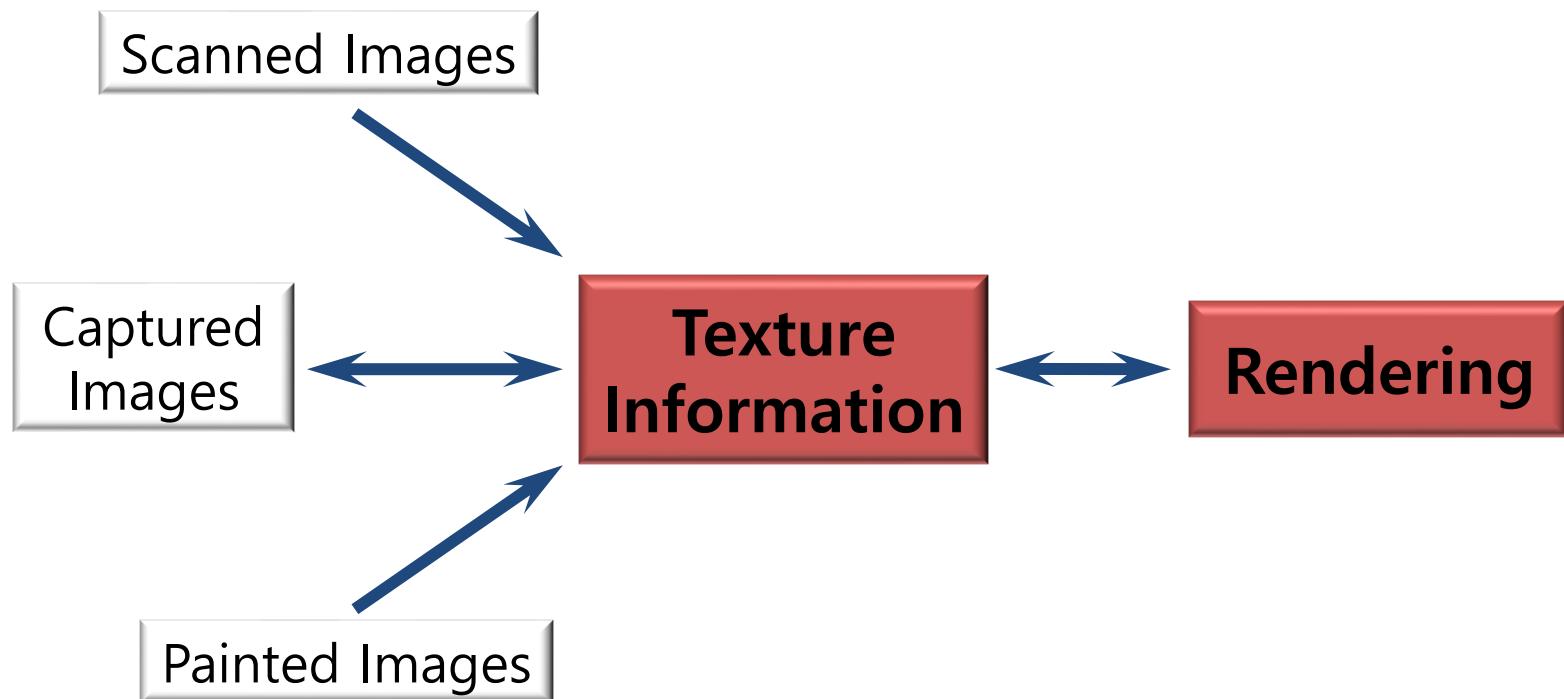


[Image Filtering]



[Morphing]

Graphics Process : Texturing



Texturing Examples



[Final Fantasy : The Spirits within, 2001]