

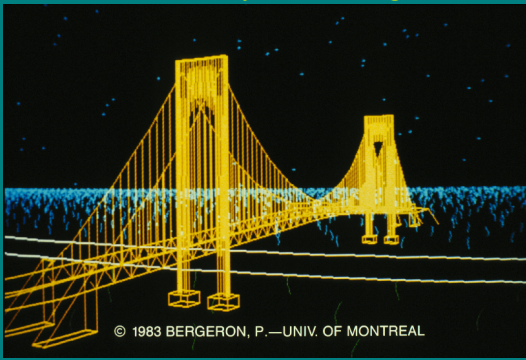
# CMSC 435 Introductory Computer Graphics

Penny Rheingans  
UMBC

## Elements of Realism

- Visibility / Viewing
- Shading
- Global Illumination
- Models
- Accuracy

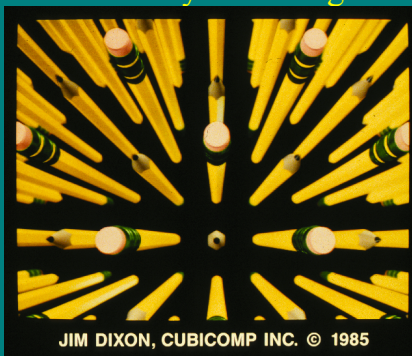
### Visibility / Viewing



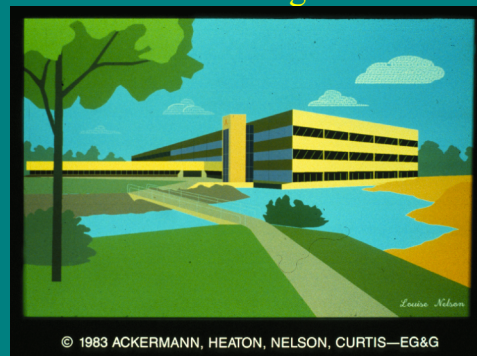
### Visibility / Viewing



### Visibility / Viewing



### Shading



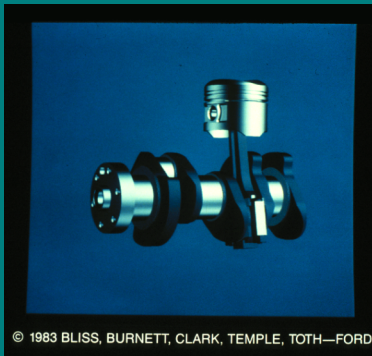
## Shading



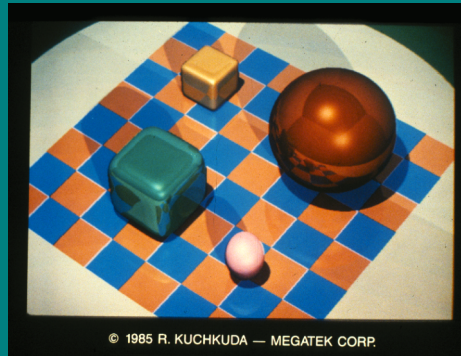
## Shading



## Material Properties



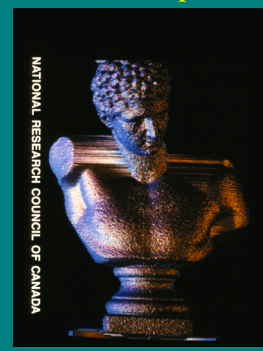
## Material Properties



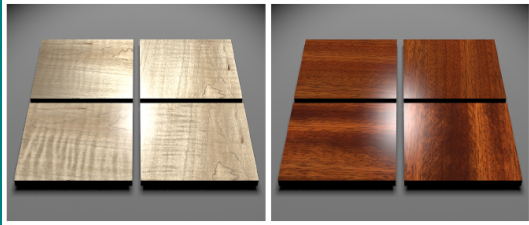
## Material Properties



## Material Properties

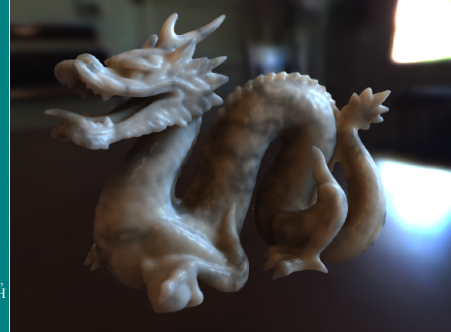


## Material Properties



Marschner et al., SIGGRAPH '05

## Material Properties



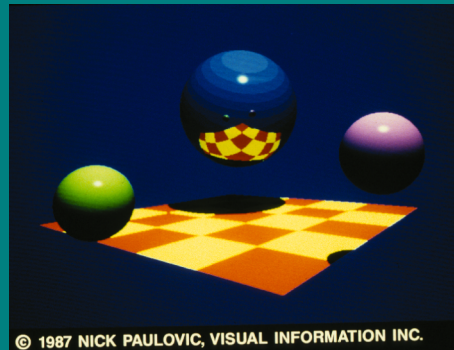
Wang et al.,  
SIGGRAPH  
'05

## Material Properties



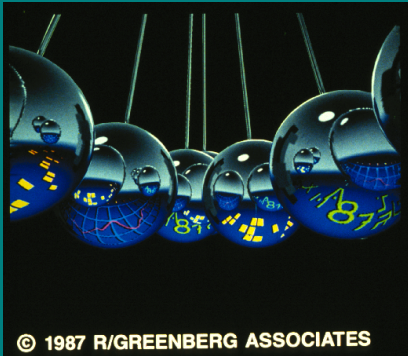
Donner et al., SIGGRAPH '05

## Transparency and Reflection



© 1987 NICK PAULOVIC, VISUAL INFORMATION INC.

## Transparency and Reflection



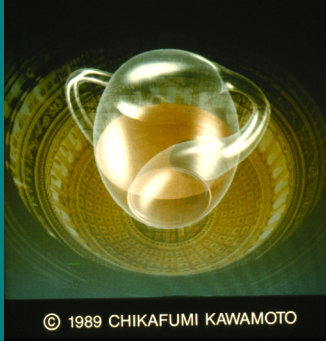
© 1987 R/GREENBERG ASSOCIATES

## Transparency and Reflection

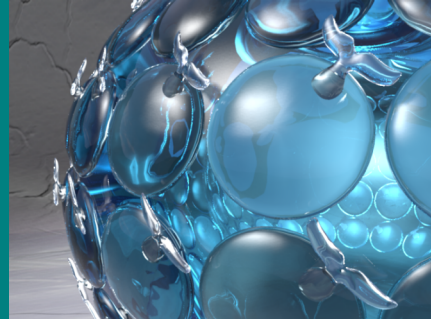


© 1985 R. KUCHKUDA — MEGATEK CORP.

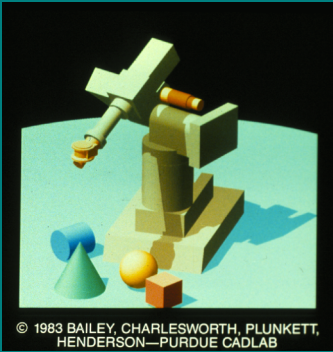
## Transparency and Reflection



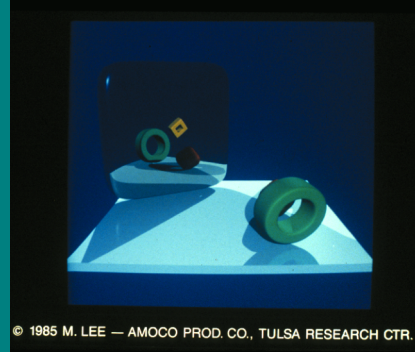
## Transparency and Reflection



## Shadows



## Shadows



## Shadows



## Shadows

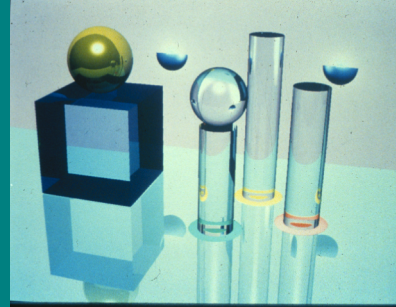


## Shadows



Laine et al., SIGGRAPH '05

## Global Illumination: Raytracing



© 1985 M. HONJOH — SEIKO INSTRUMENTS USA, INC.

## Global Illumination: Raytracing



© 1985 D. LEICH — DIGITAL EFFECTS INC.

## Global Illumination: Raytracing



© 1985 D.B. KIRK — RASTER TECHNOLOGIES, INC.

## Global Illumination: Raytracing



© 1983 COOK, R.—LUCASFILM LTD.

## Global Illumination: Raytracing



Clarberg et al., SIGGRAPH '05

Global Illumination: Radiosity



© 1987 S. KASAHARA-KAJIMA CORP.

Global Illumination: Radiosity



©1991 SILICON GRAPHICS/UNC CHAPEL HILL

Global Illumination: Radiosity



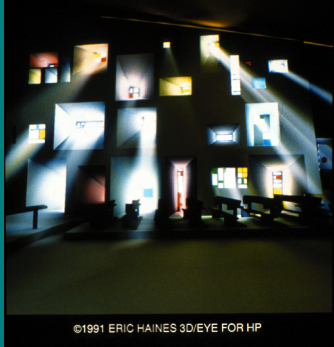
©1991 SILICON GRAPHICS

Global Illumination: Radiosity



©1995, Skidmore, Owings & Merrill

Global Illumination: Radiosity



©1991 ERIC HAINES 3D/EYE FOR HP

Global Illumination: Radiosity



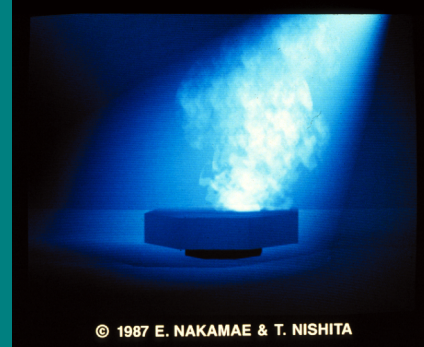
EIHACHIRO NAKAMAE—HIROSHIMA UNIVERSITY

### Global Illumination: Radiosity



© 1987 CORNELL—PROG OF COMPUTER GRAPHICS

### Global Illumination: Radiosity



© 1987 E. NAKAMAE & T. NISHITA

### Global Illumination: Lightcut



Lightcut Image

Reference Image

Walter et al., SIGGRAPH '05

### Models: Lots of Pgons



©1991 KAJIMA CORP

### Models: Lots of Pgons



©1991 DESIGN VISION INC.

### Models: Lots of Pgons



©1995, Yoshiki Nishimura

Models: Curves



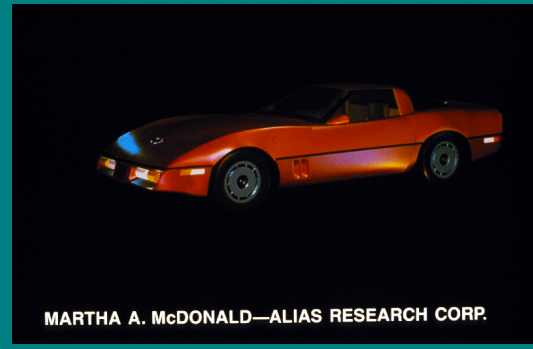
Models: Curves



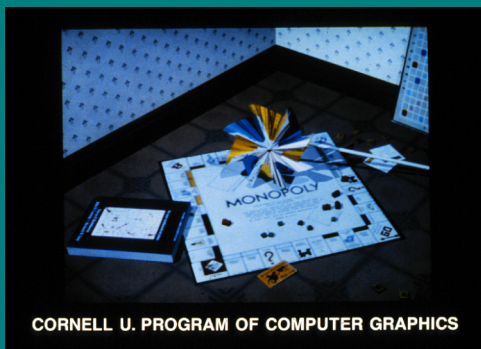
Models: Curves



Models: Curves



Models: Texture



Models: Texture





### Models: Texture



ALGEBRA DATA © 1986

### Models: Texture



© 1985 G. GARDNER — GRUMMAN CORP.

### Accuracy: Form



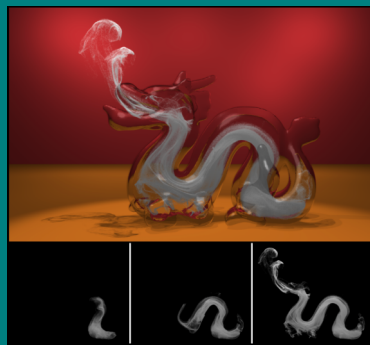
©1995, Jos Stam U of Toronto

### Accuracy: Form



©1995, M. Noronha Gamito, INESC

### Accuracy: Form



Feldman et al.,  
SIGGRAPH '05

### Accuracy: Form



©1995, US Army Research Lab

Accuracy: Form



© 1985 J. BLOOMENTAL — XEROX CORP.

Accuracy: Form



©1991 N. GREENE/NYIT

Accuracy: Form



Runions et al,  
SIGGRAPH  
'05

Accuracy: Form



© 1992 D.R.FOWLER ET AL., U. OF CALGARY

Accuracy: Form



©1995, Jane Wilhelms UC Santa Cruz

Accuracy: Form



©1991 A. LEBLANG, A. PAOURI, N. & D. THALMANN

### Accuracy: Dynamics



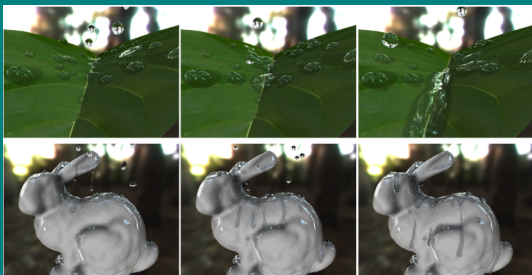
©1990 IBM

### Accuracy: Dynamics



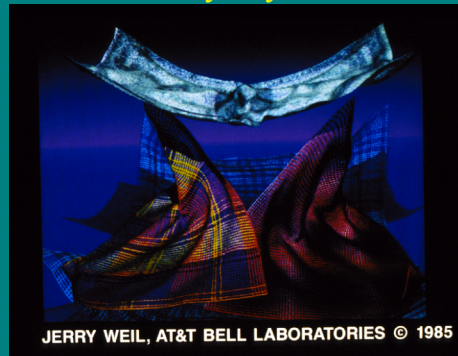
©1995, GVV Center, Georgia Tech

### Accuracy: Dynamics



Wang et al., SIGGRAPH '04

### Accuracy: Dynamics



JERRY WEIL, AT&T BELL LABORATORIES © 1985

### Accuracy: Dynamics



© 1983 KOREIN, SHAPIRO, PYLE, YAGER, BADLER—  
UNIV. OF PA.

### Accuracy: Dynamics



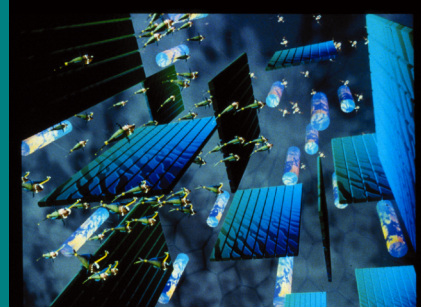
© 1992 HITACHI, LTD.

Accuracy: Dynamics



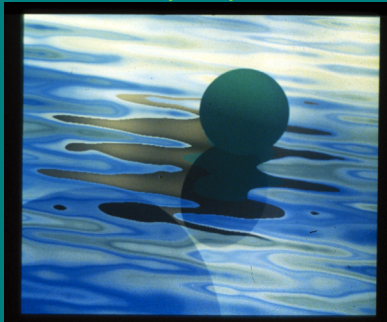
©1990 T. KURIHARA, K. ARAI, HITACHI LTD.

Accuracy: Dynamics



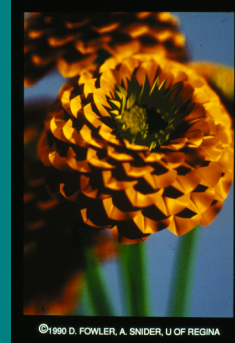
© 1987 CRAIG REYNOLDS (ET AL) SYMBOLICS

Accuracy: Dynamics



© 1985 D.B. KIRK — RASTER TECHNOLOGIES, INC.

Accuracy: Camera

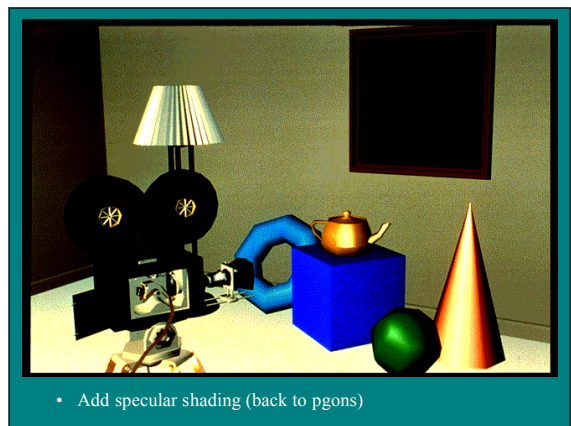
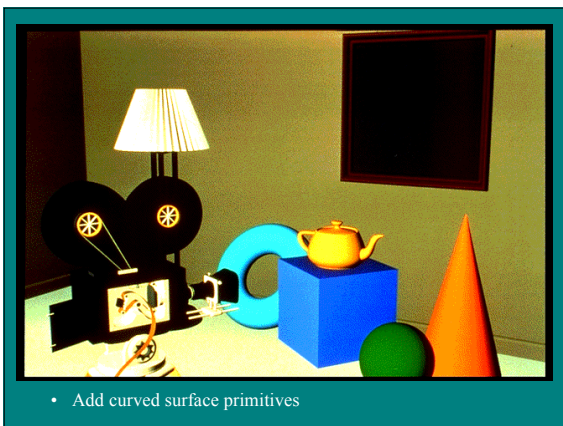
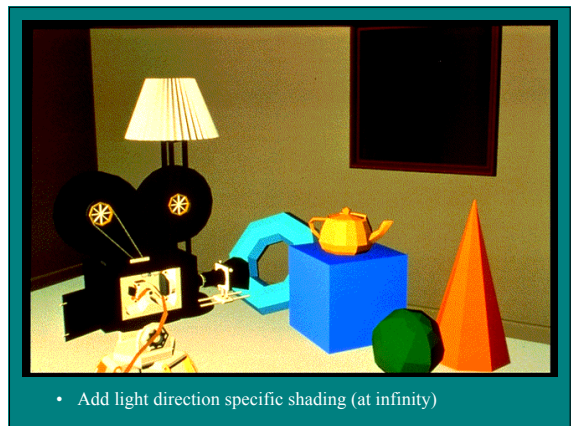
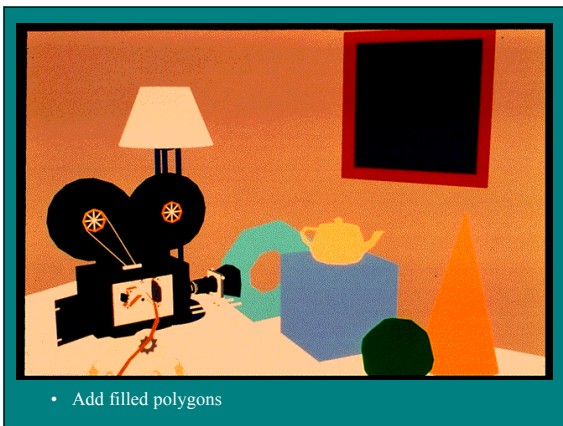
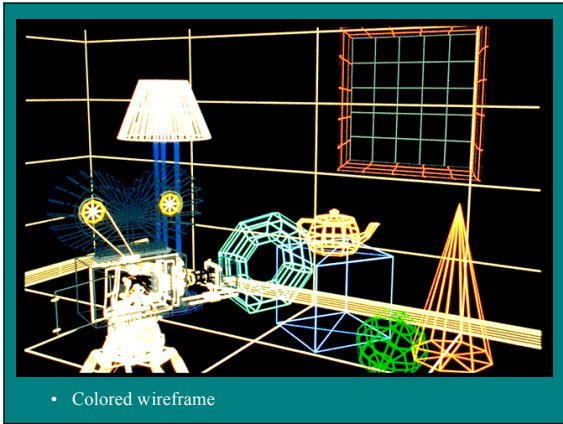


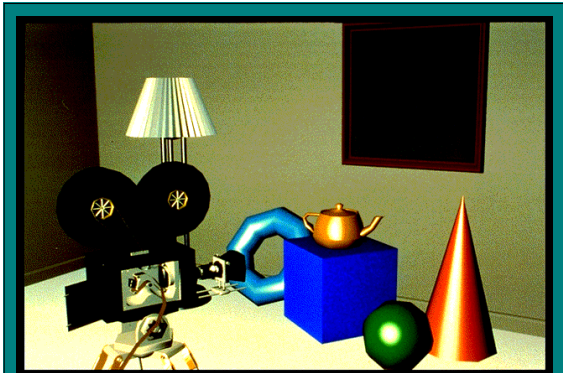
©1990 D. FOWLER, A. SNIDER, U OF REGINA

Accuracy: Camera

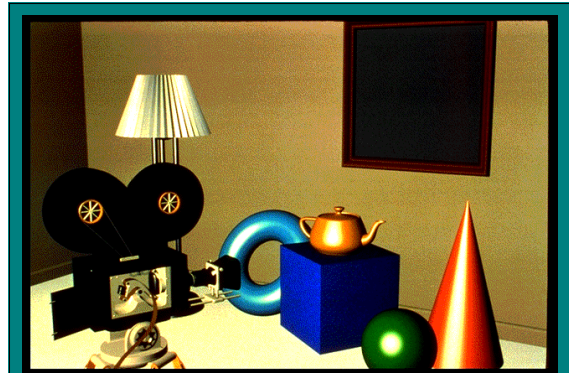


©1990 HIROSHIMA UNIVERSITY

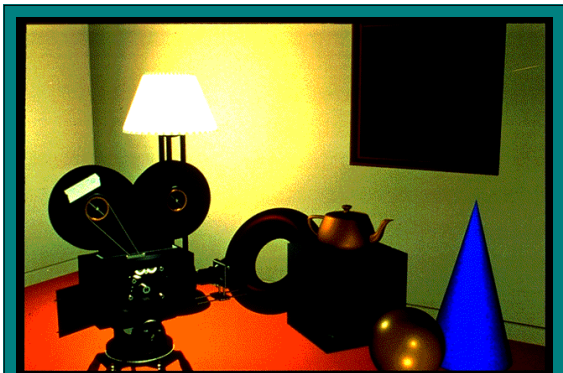




- Add normal interpolation (Phong)



- Specular shading on curved models



- Add metallic surfs, improved light model (nearby)



- Add textures



- Add bump mapping



- Add reflections