

Non-Photorealistic Rendering

Aaron Hertzmann
CSC 252 I, Fall 2007

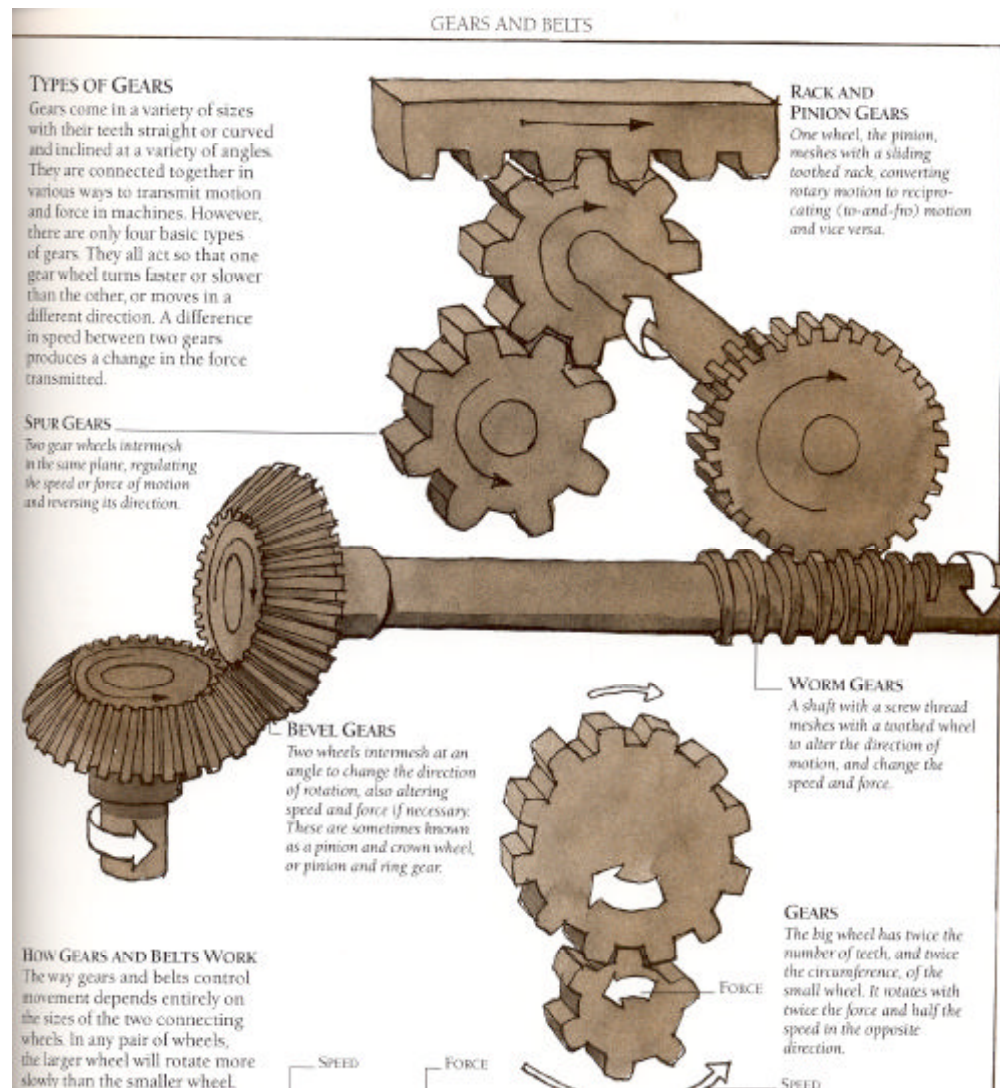
(A few of these slides are based on talks by David Salesin and Pat Hanrahan)

The “Quest for Realism”

$$L_o(x, \vec{w}) = L_e(x, \vec{w}) + \int_{\Omega} f_r(x, \vec{w}', \vec{w}) L_i(x, \vec{w}') (\vec{w}' \cdot \vec{n}) d\vec{w}'$$



We don't always want photorealism



Macaulay: *The Way Things Work*, 1988

A new question emerges

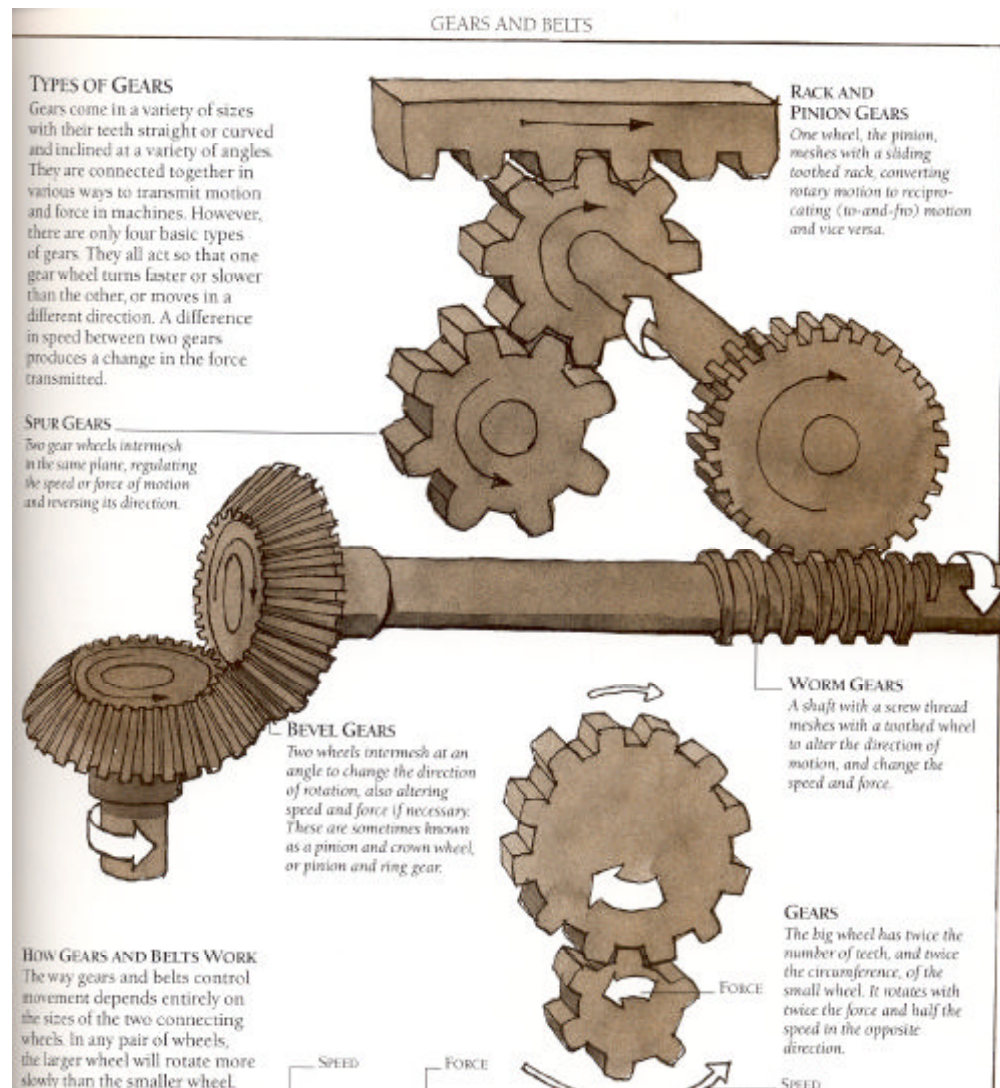
How do we create imagery that is
useful and/or **beautiful**
rather than just **realistic**?

A new question emerges

In other words, how do we create tools for visual communication?

Illustrations have many advantages over photorealism...

Omitting extraneous detail



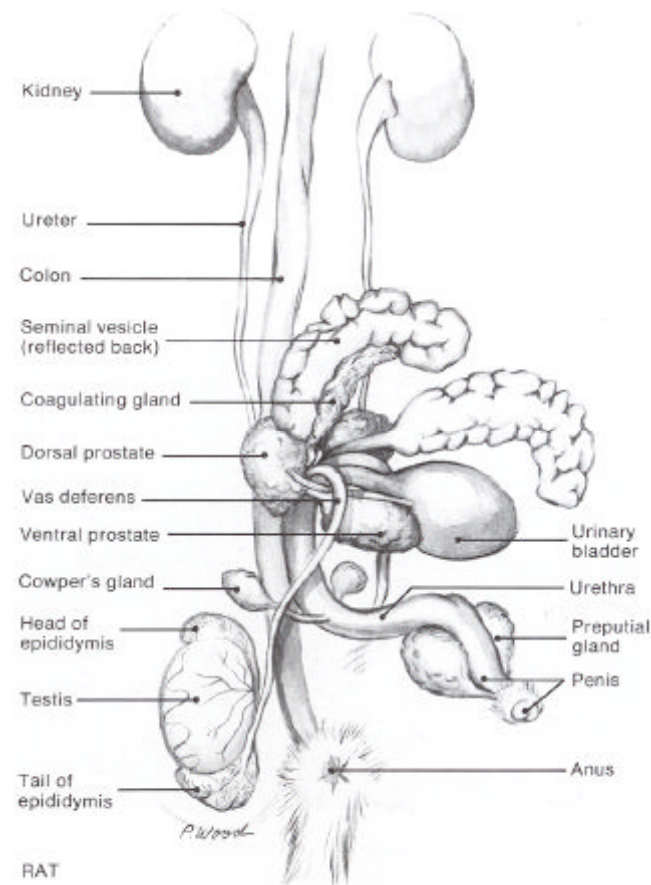
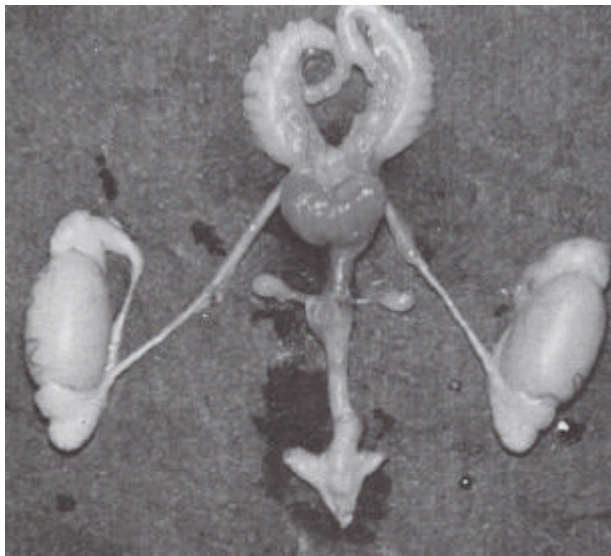
Macaulay: *The Way Things Work*, 1988

Focusing attention

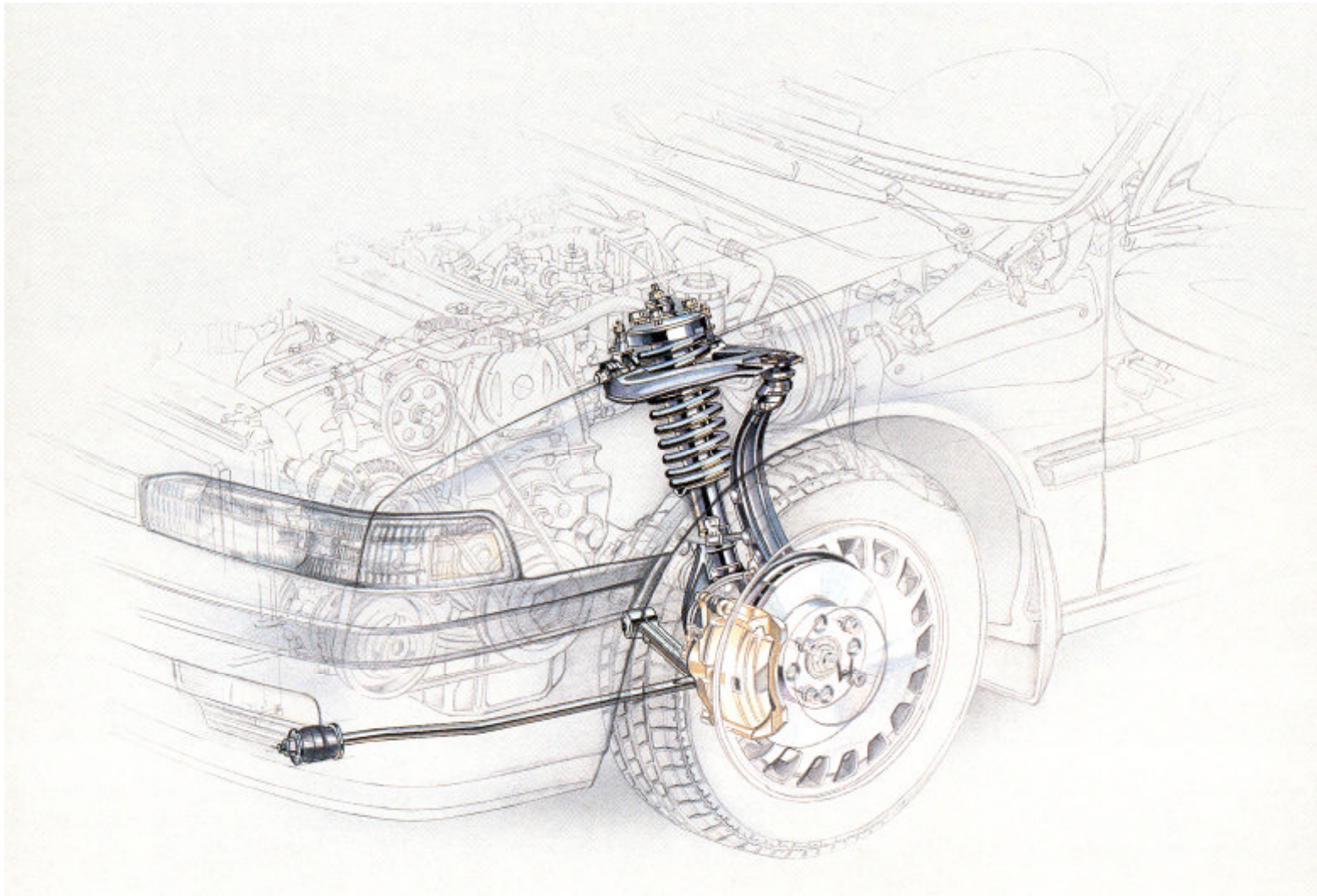


Guptill & Meyer: *Rendering in Pen & Ink*

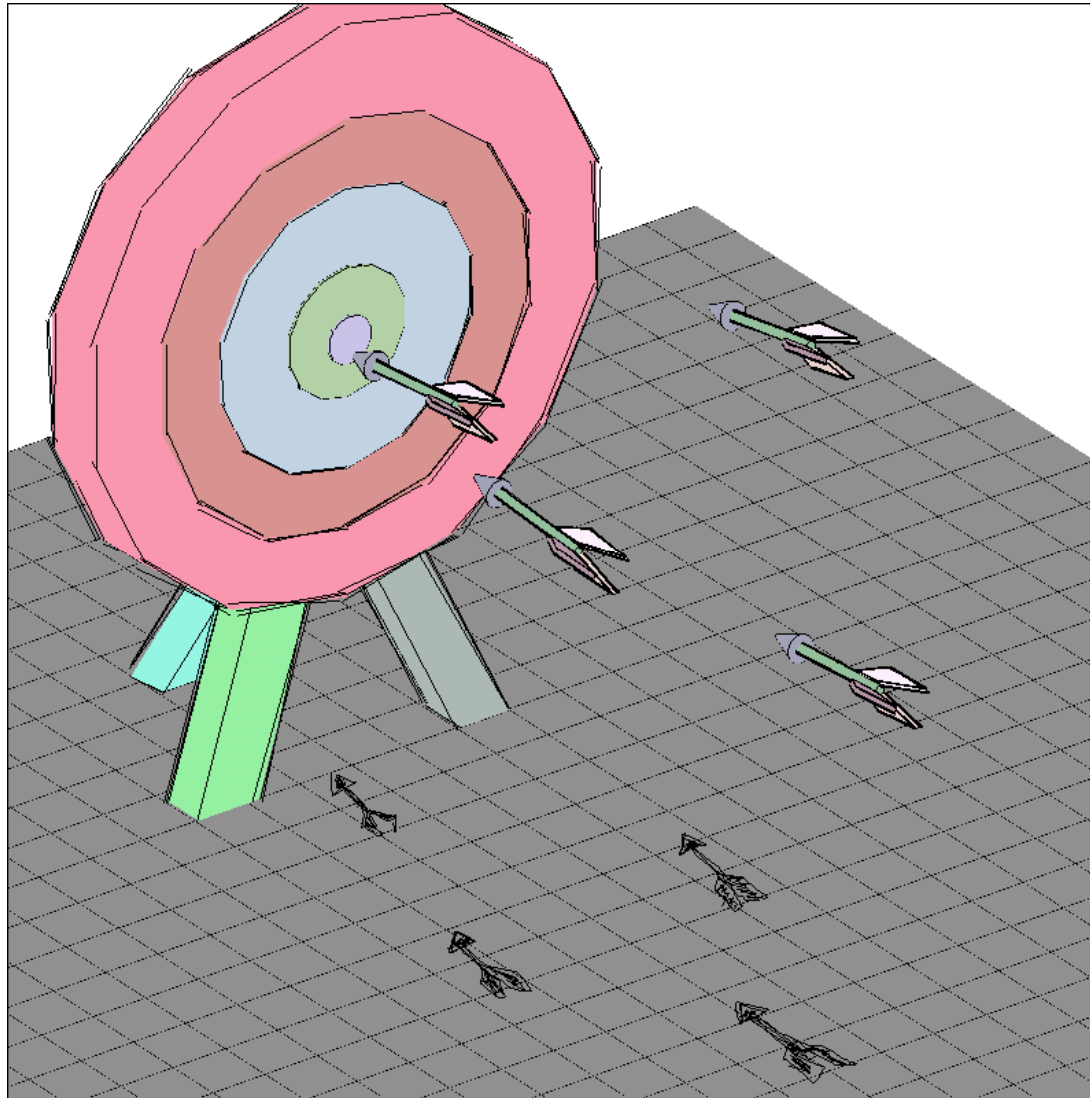
Clarifying & simplifying shapes



Exposing parts that are hidden



Sketching approximate ideas

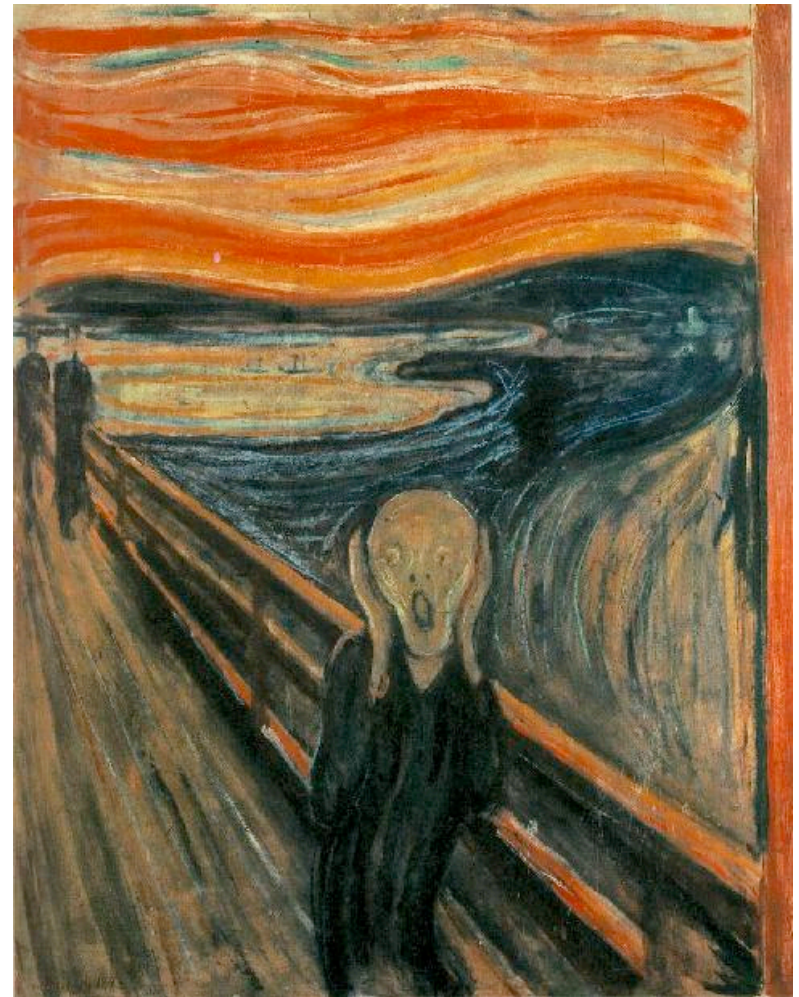


Sketch, Zeleznik et al., SIGGRAPH 96

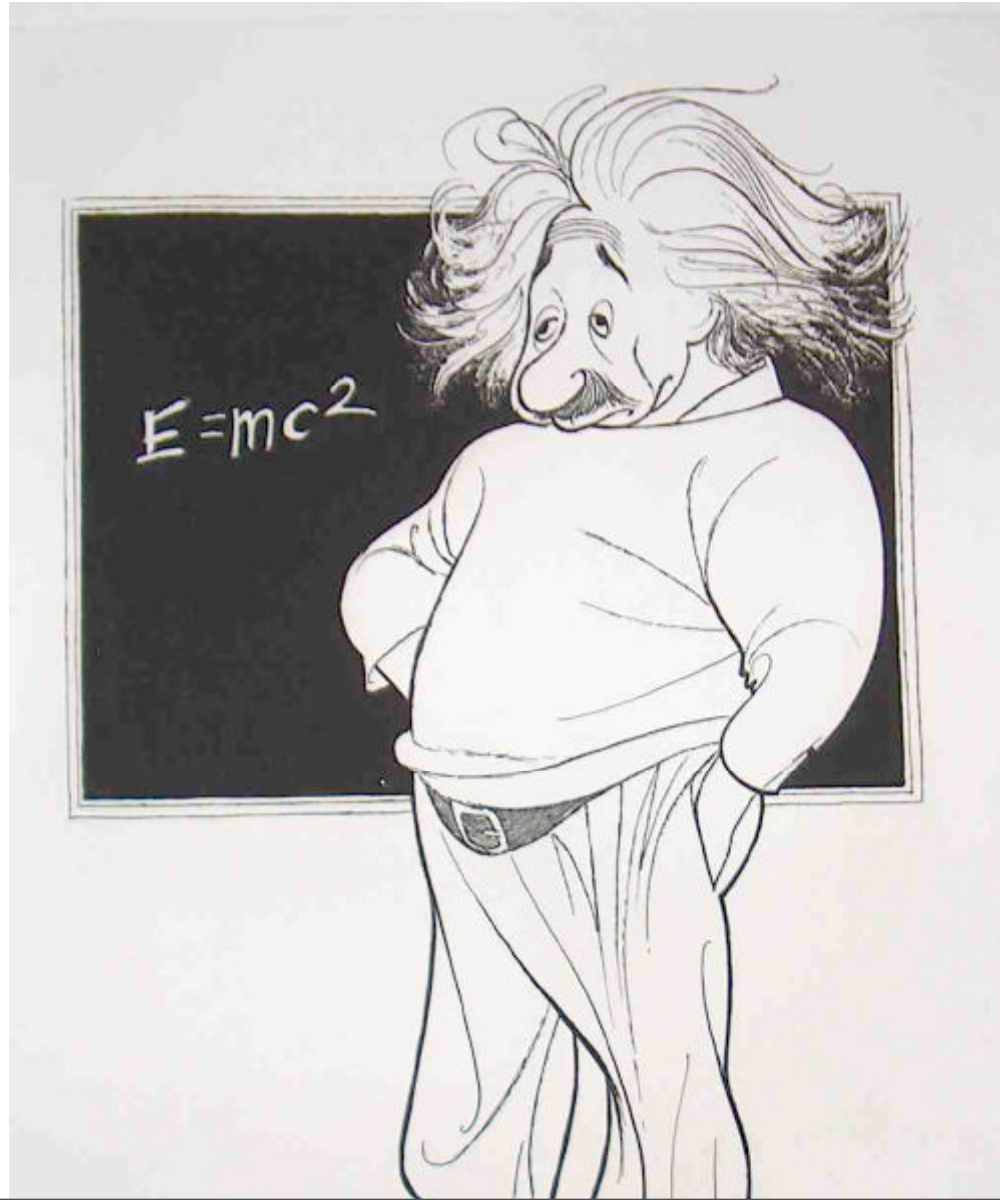
Illustrating approximate ideas



Conveying mood and emotion



Conveying other attributes



Art, beauty, expression



In some ways, the history of CG is like
the history of Western art...



Giotto, 1305



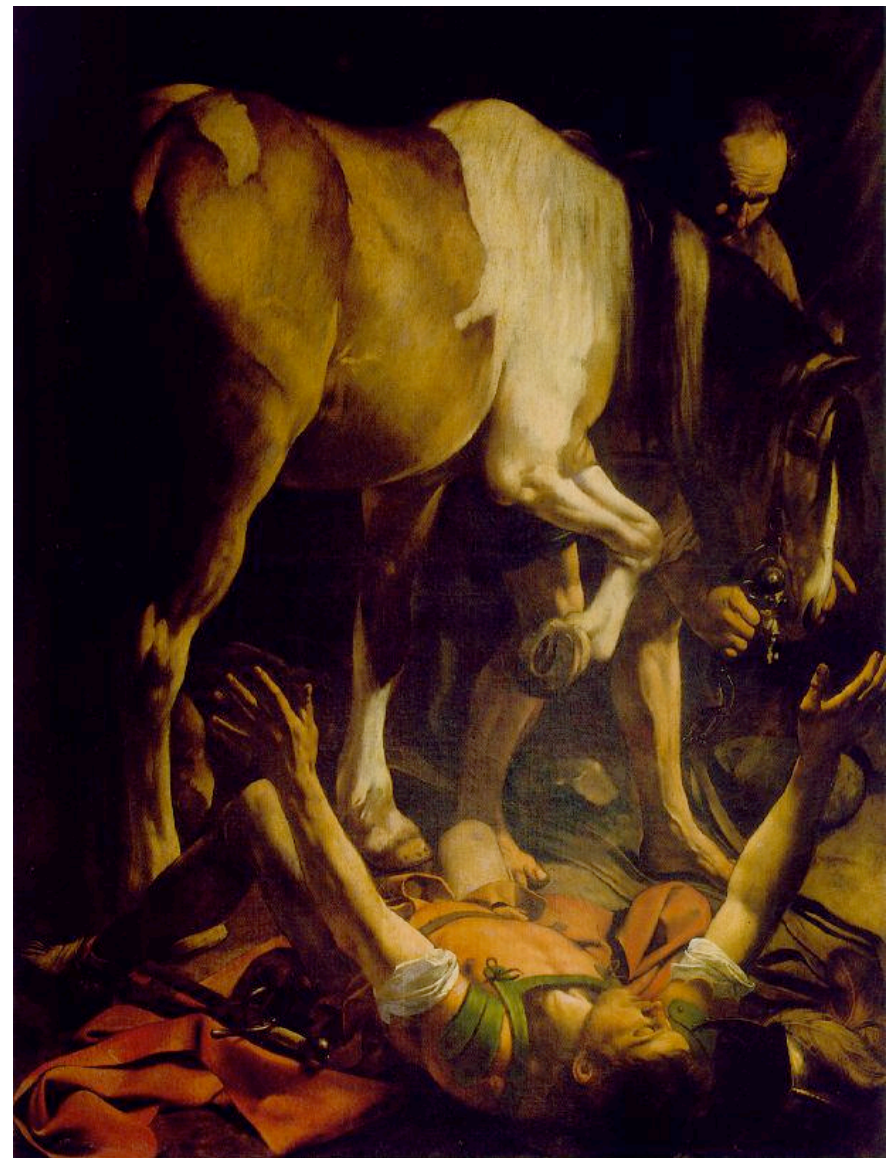
Perugino, 1483



Rafael, 1511



Rubens, 1610



Caravaggio, 1601



Wright, 1765



Bouguereau, 1884

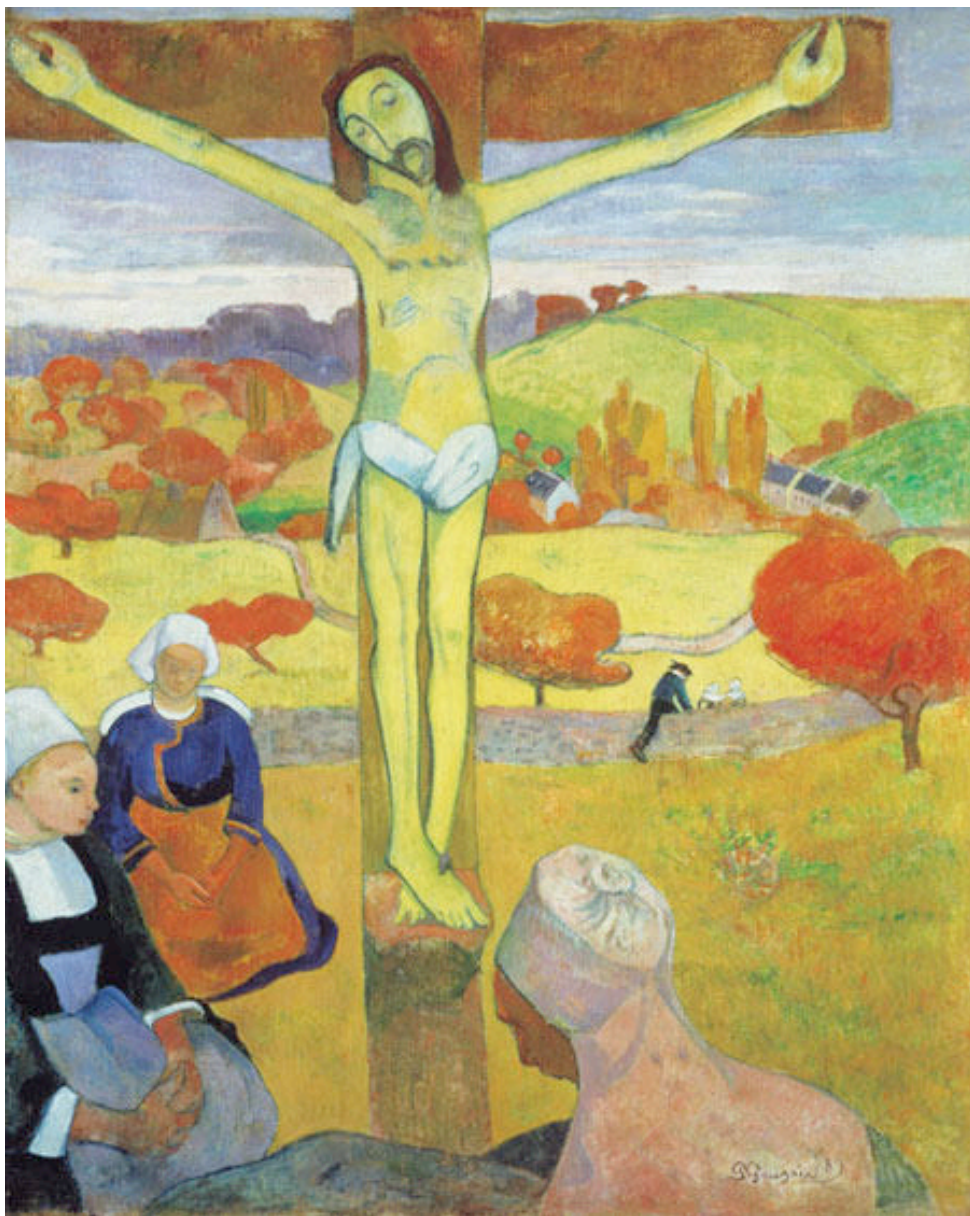
Then, photography was invented in the mid-19th century...



Renoir, 1876



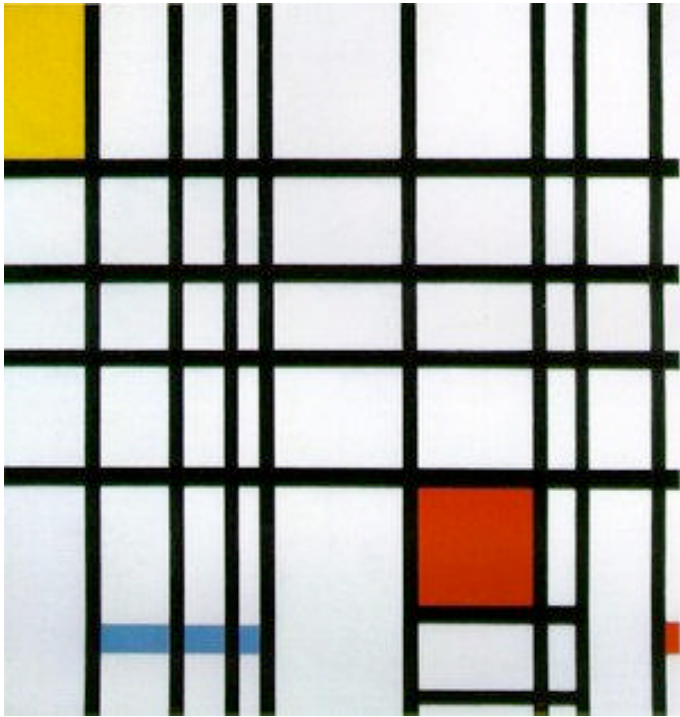
Van Gogh, 1889



Gauguin, 1889



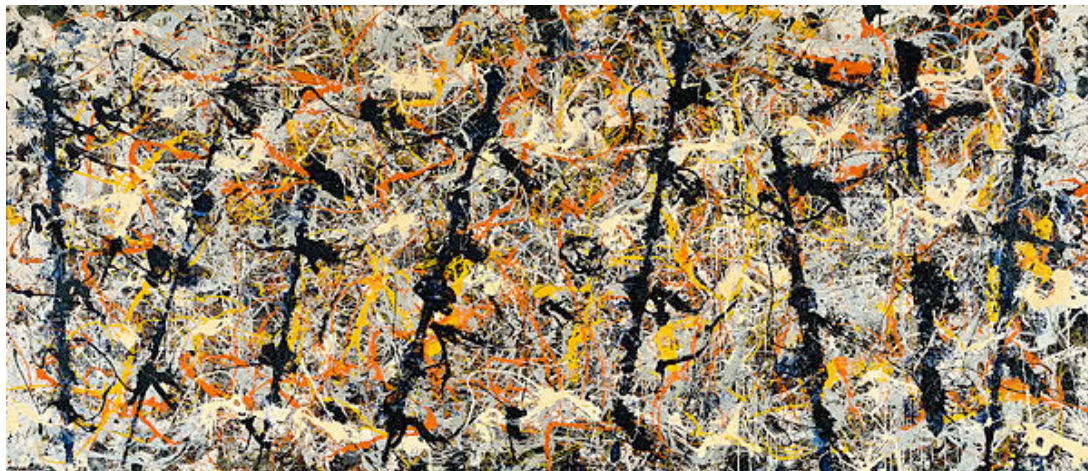
Picasso, 1907



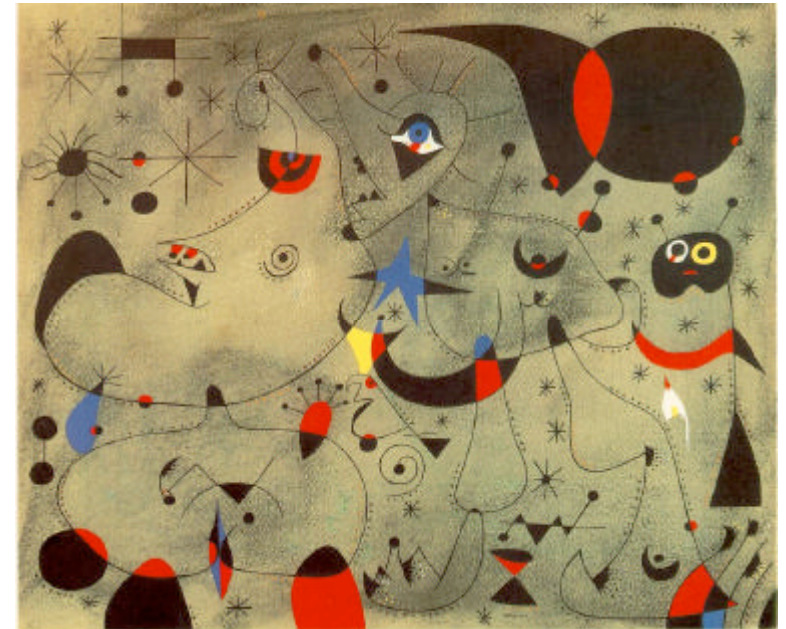
Mondrian, 1942



Rothko, 1943



Pollock, 1952



Miro, 1940

Photorealism in painting



Richard Estes

Photorealism in painting



Discovered by Denis Zorin

“Non-photorealistic rendering” is a funny name...

What do we call it?

"The study of non-linear physics is like the study of non-elephant biology." - Stanislaw Ulam (attributed)

The term “non-photorealistic rendering” first appears in Winkenbach and Salesin, 1994

What do we call it?

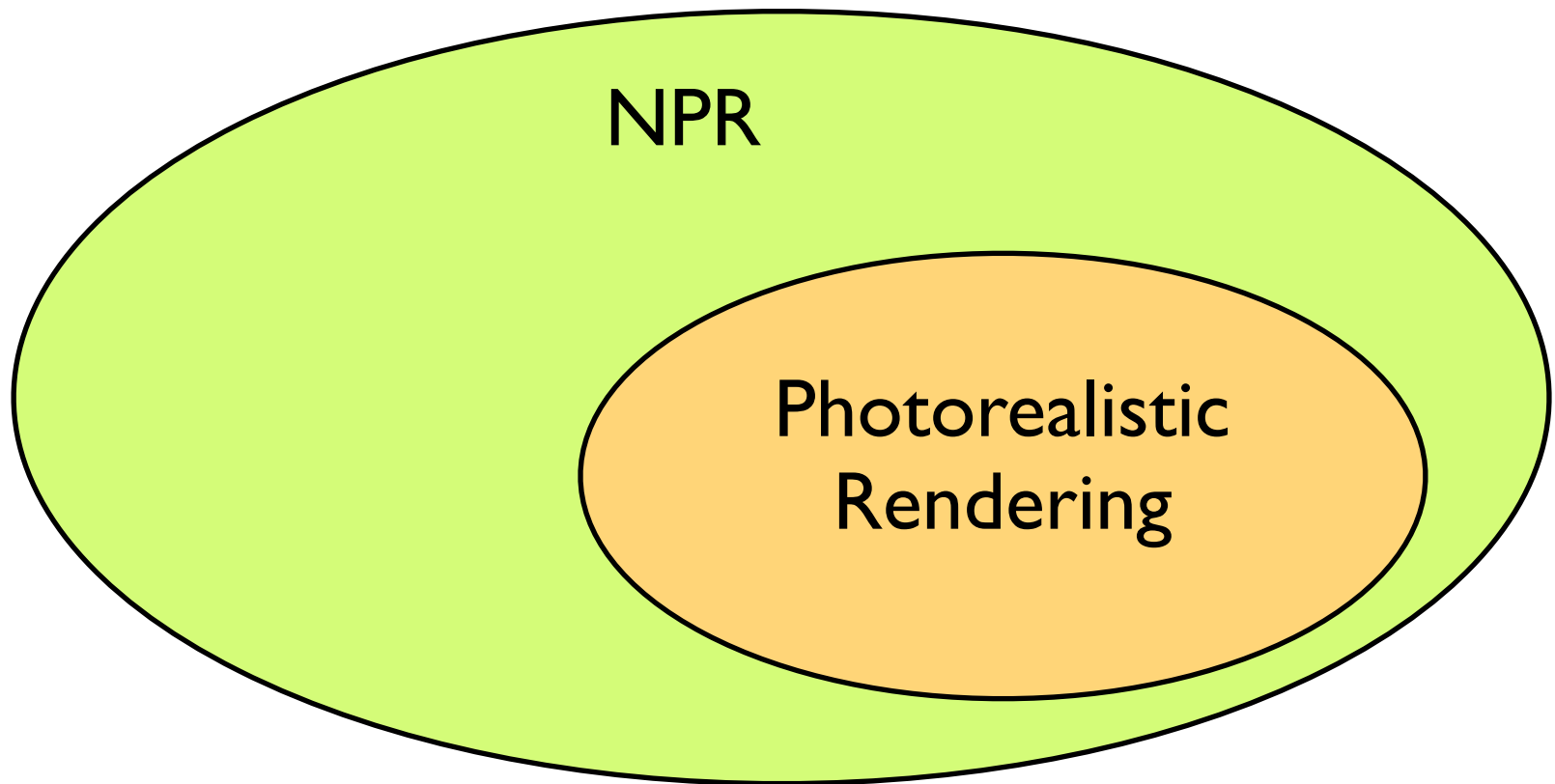
Some alternative names (from various sources):

Artistic rendering, nonrealistic rendering, expressive rendering, expressive visualization, art-based rendering, depiction, interpretive rendering, pictorial rendering, stylized rendering, graphical depiction, communicative rendering, interesting rendering, cultural rendering, non-literal rendering, interesting rendering, imaginative rendering, freestyle graphics, aesthetic rendering, electric pencils...

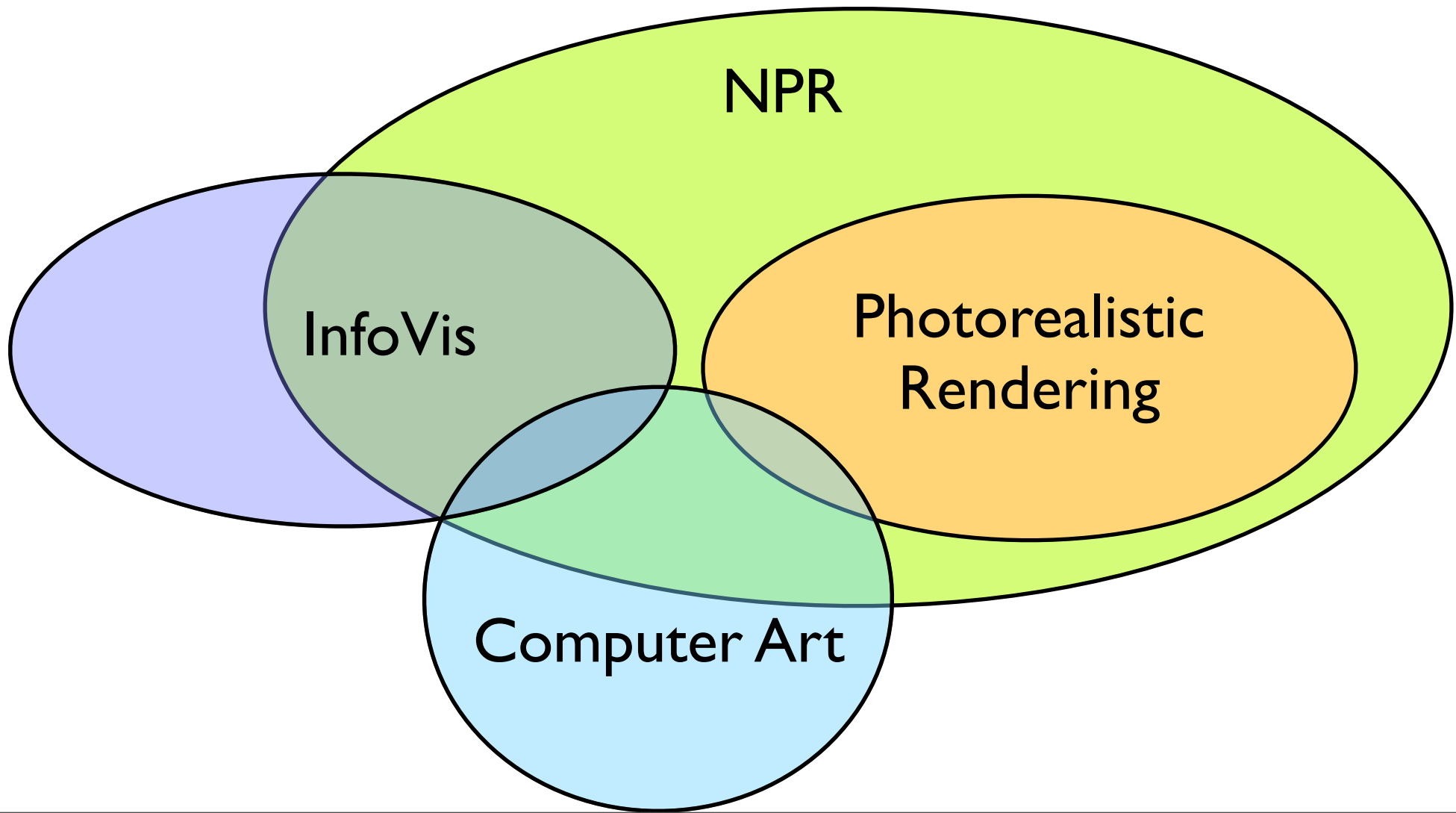
“Photorealistic rendering” isn’t



The real place of photorealism



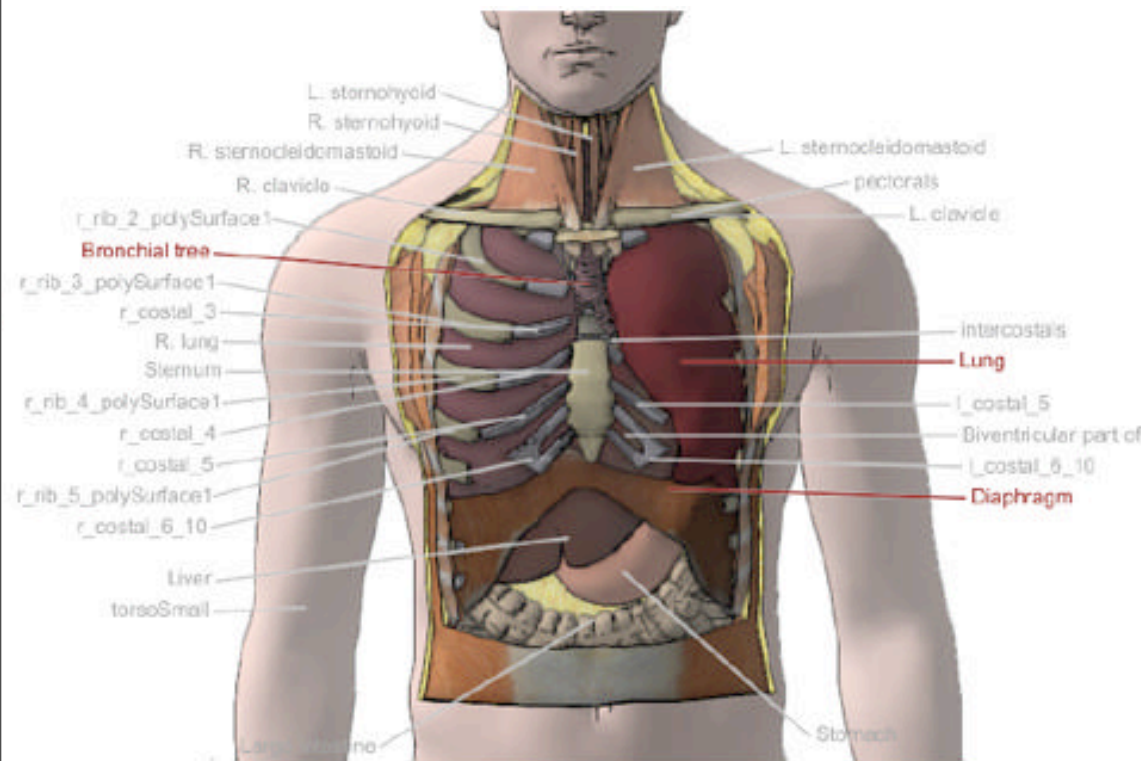
The real place of photorealism



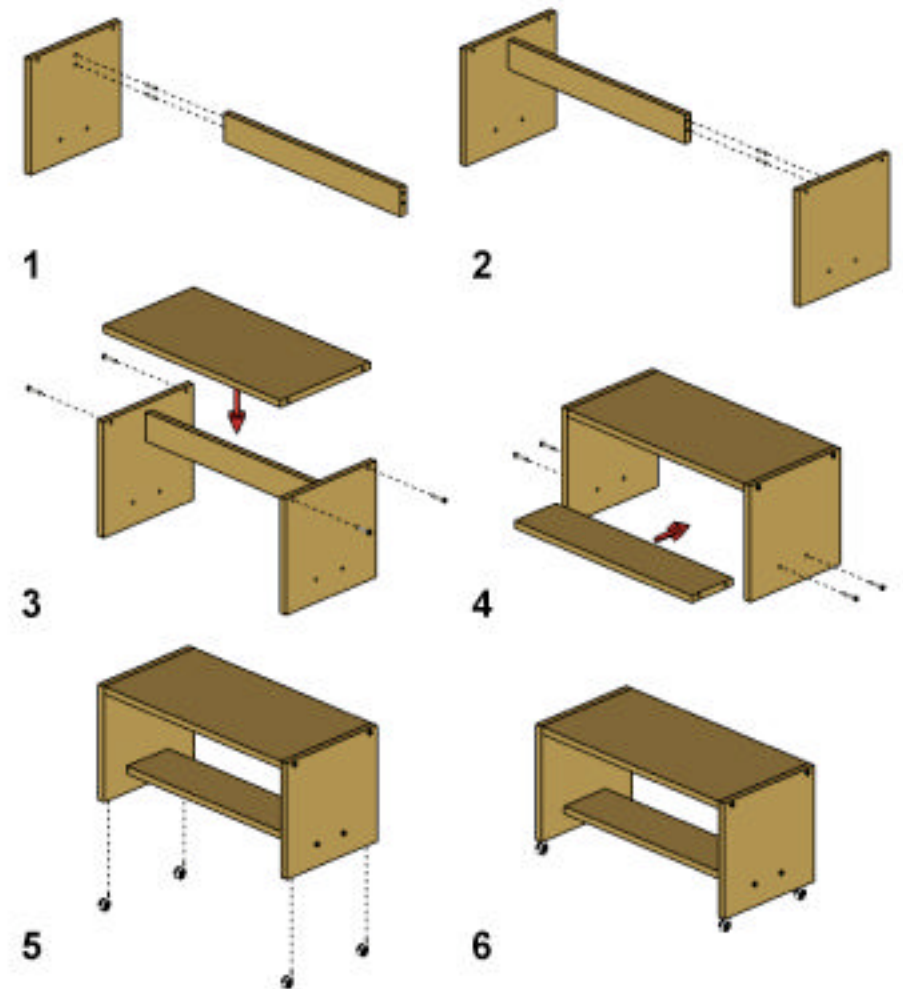
Adobe, the leading vendor of software tools to produce documents and illustrations, yesterday had a market cap of \$13.25B. Another major software tool builder Macromedia is being acquired by Adobe for something like \$3.5B. In contrast, Alias-Wavefront the premier vendor of tools to make 3D animation and realistic imagery - was sold in 2004 for \$57.5M.

(Pat Hanrahan, 2005)

Vis connections



(b) Thorax



Agrawala et al.

NPR is an exciting field!

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BIG challenges:

1. How do design tools for design and creativity?
2. How do we automate design?
3. How do human artists and designers work?
4. How does the brain interpret imagery?
5. Can we enable new artistic and illustration styles?

NPR is an exciting field!

BIG impact:

Image quality is *extremely important* for understanding and appreciating imagery.

Bad imagery is currently multiplying.

Many application areas.

Course requirements

Assignments:

1. Impressionist
2. 3D NPR

You may substitute a project for assignments

Reaction reports each week

Paper presentations

Auditors must present papers