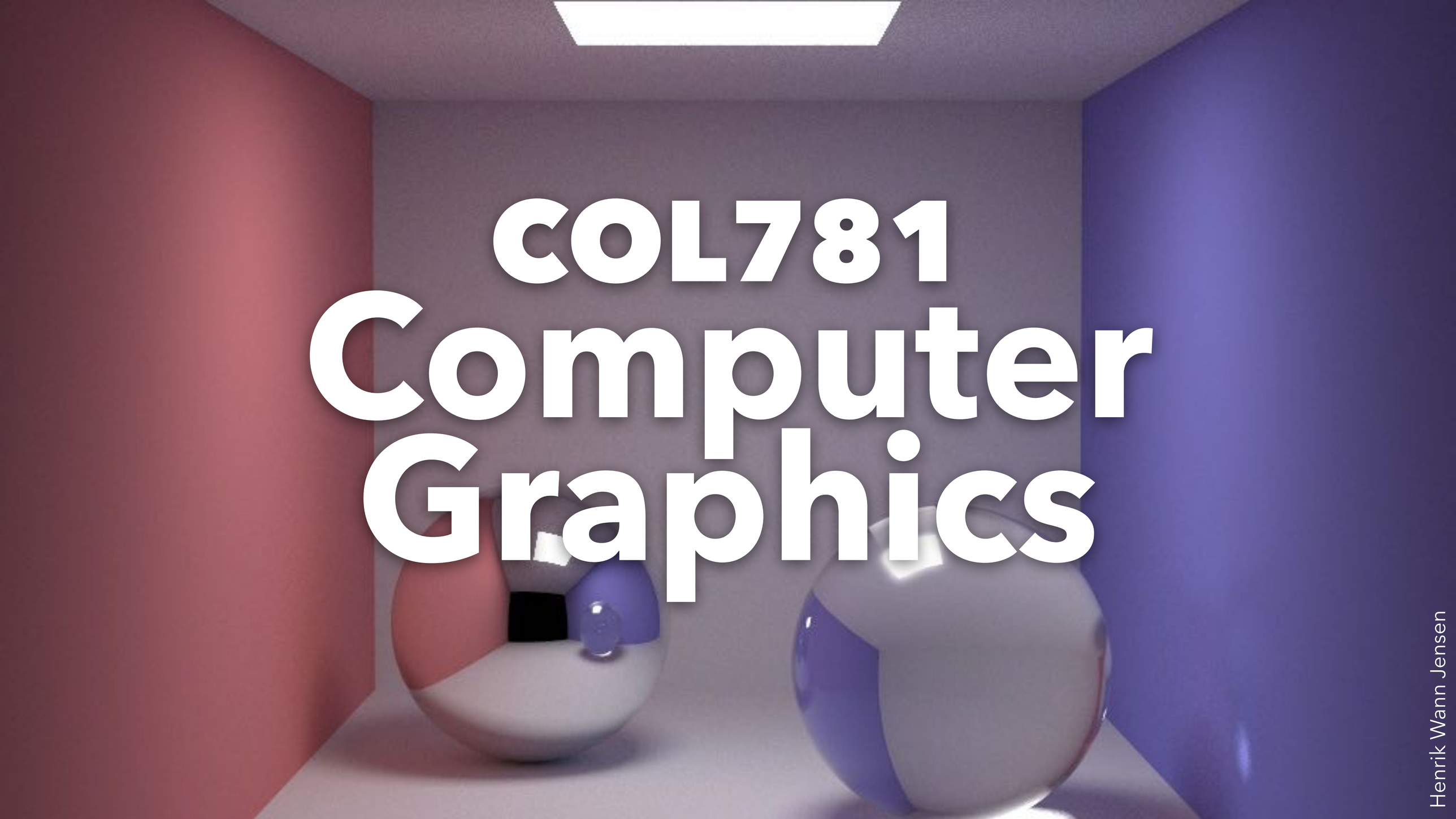

COL781
Computer
Graphics
Henrik Wann Jensen

Major exam format

Sunday, 7 May
8:00–10:00 AM (?!🤬)
LH 416

Syllabus is the entire course content, but more emphasis on latter part:

- 20% Minor 1 topics
- 20% Minor 2 topics
- 60% everything after Minor 2

You're allowed to bring a double-sided A4 size page of handwritten notes

Remaining evaluations

Assignment 2 marks to be released soon

Assignment 3 demos to be scheduled (during / after majors)

Assignment 4:

- We will update the viewer code this weekend
- Demos on 13 May (Saturday after majors)

Participation (quizzes, Moodle Q&A) to be evaluated soon

Course goals (from lecture 1)

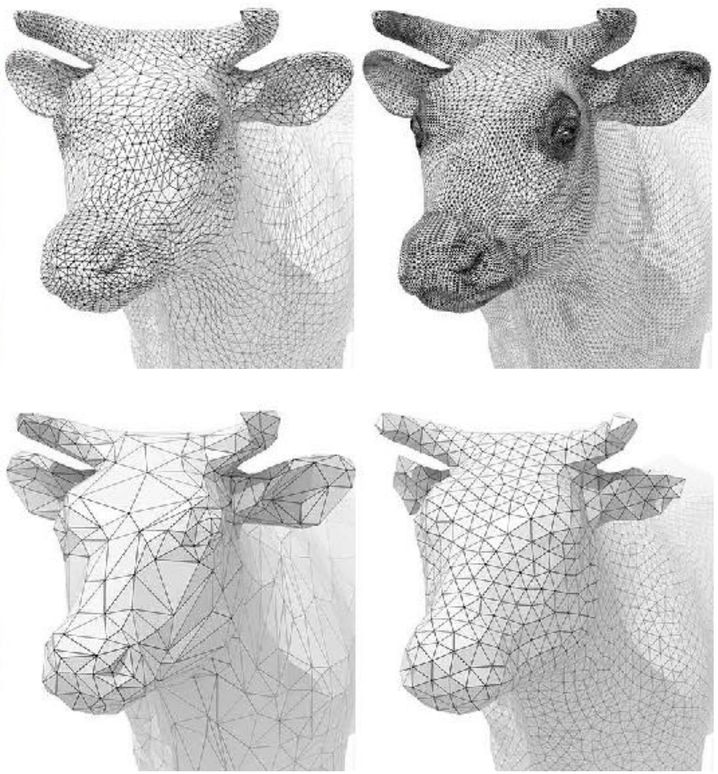
Scientific and mathematical foundations of graphics

- Physics of light and colour, materials, dynamics for animation, …
- Mathematics of curves and surfaces, perspective projection, sampling, …

Representations, algorithms, and systems

- Modelling geometry, images, transformations, …
- Mesh subdivision, ray tracing, time integration, …
- GPUs, hardware rendering pipeline, …

Course content

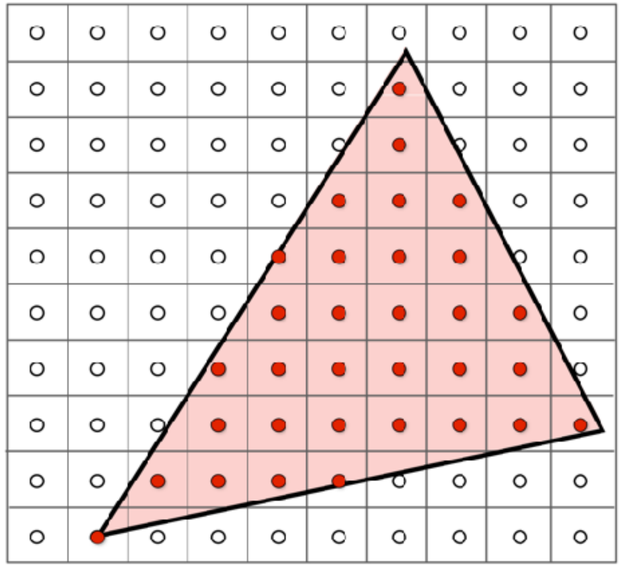


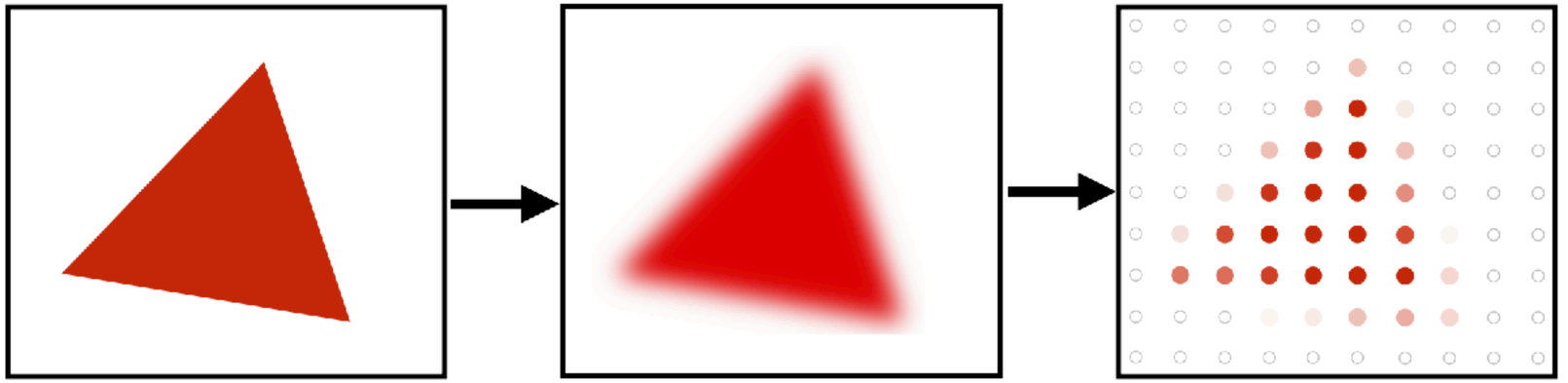
Modelling

Rendering

Animation

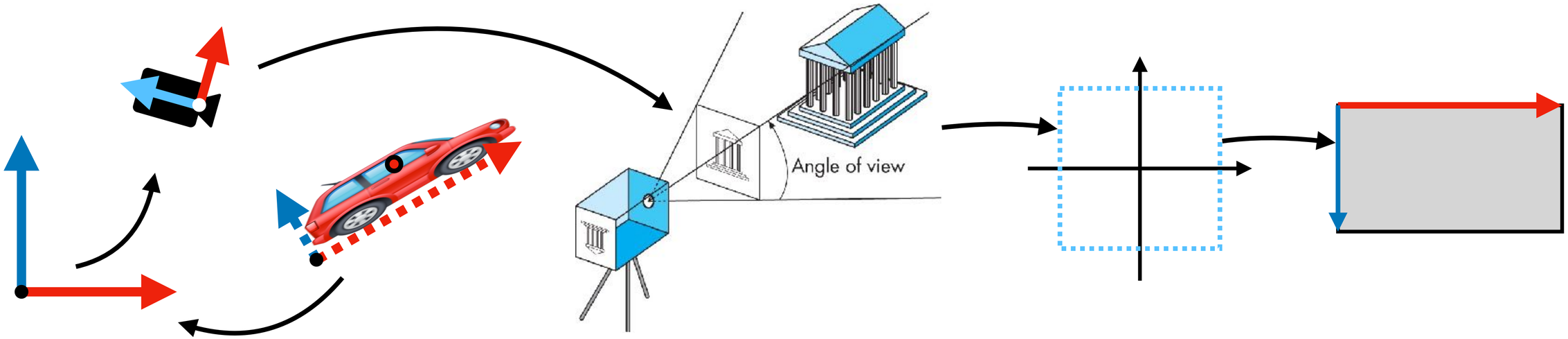
Rasterization, sampling, …





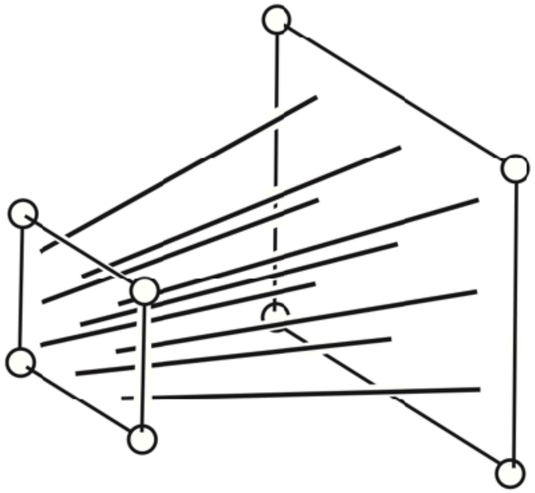
Vector vs. raster, point-in-triangle test, bounding boxes, supersampling, filtering, …

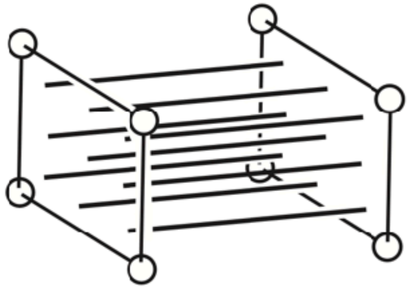
Transformations: linear, affine, …



Matrices as linear transformations, coordinate systems, homogeneous coordinates, hierarchical transformations, transformation pipeline, …

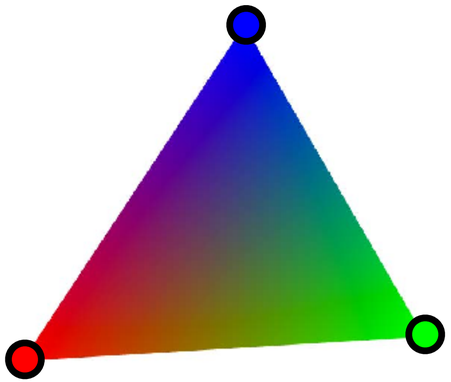
Perspective, visibility, …

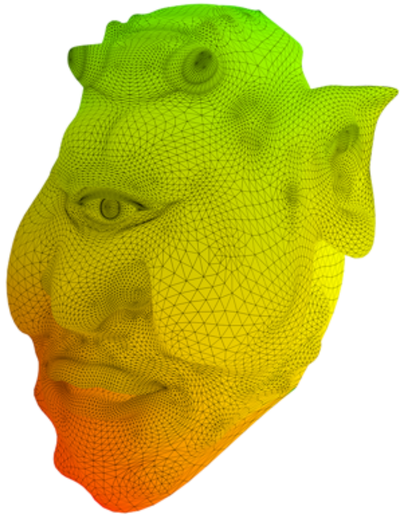


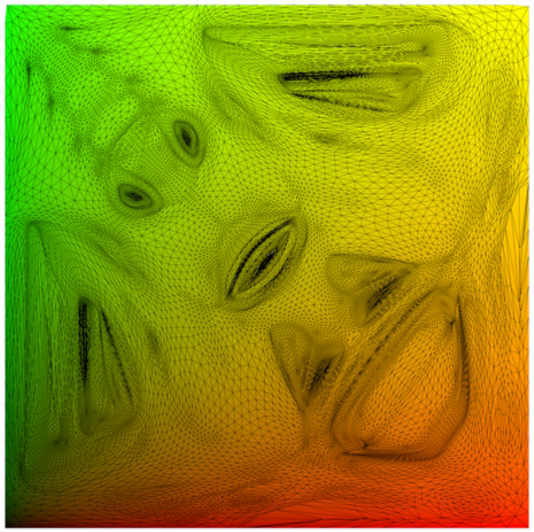


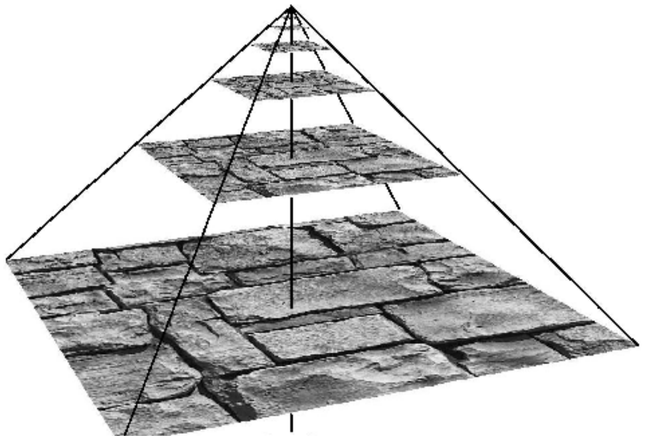
Perspective via homogeneous coordinates, the visibility problem, z-buffering, …

Interpolation, texture mapping, …



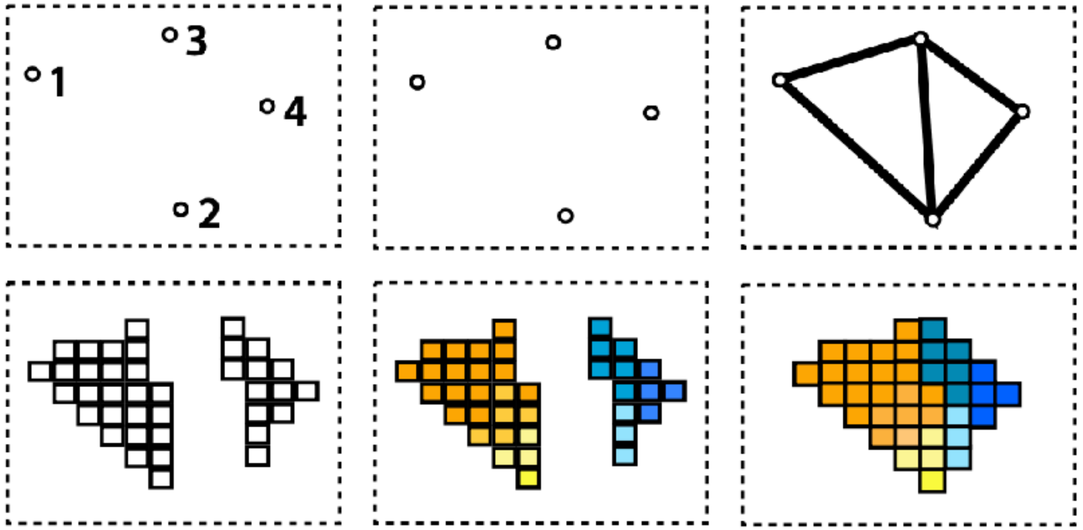


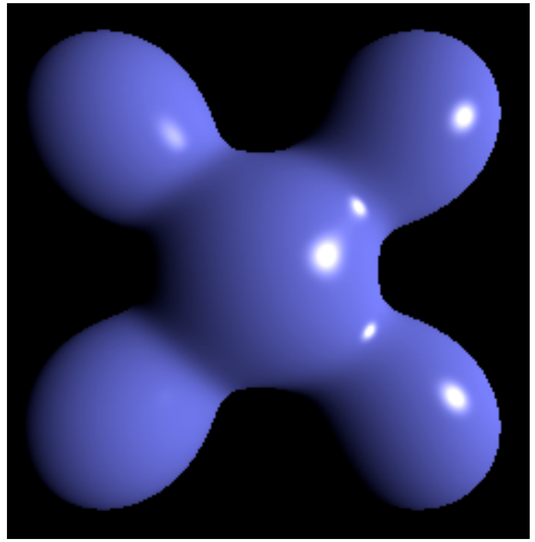




Barycentric coordinates, basis functions, parameterization via texture coordinates, bi- and trilinear interpolation, mipmaps for prefiltering, …

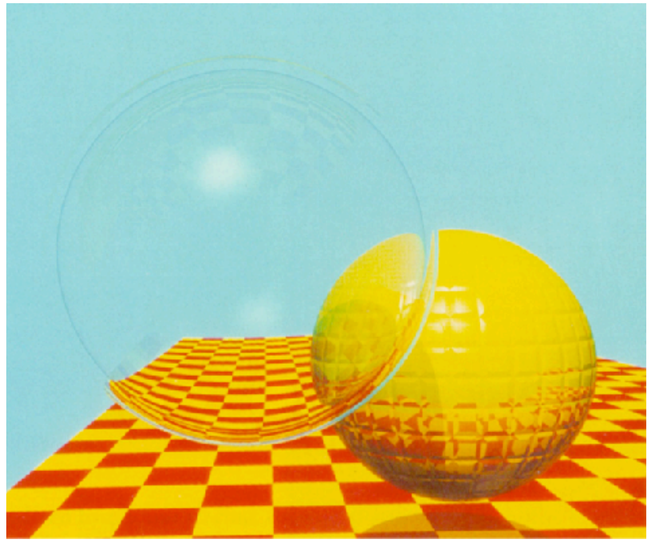
Rasterization pipeline, transparency, shading, …

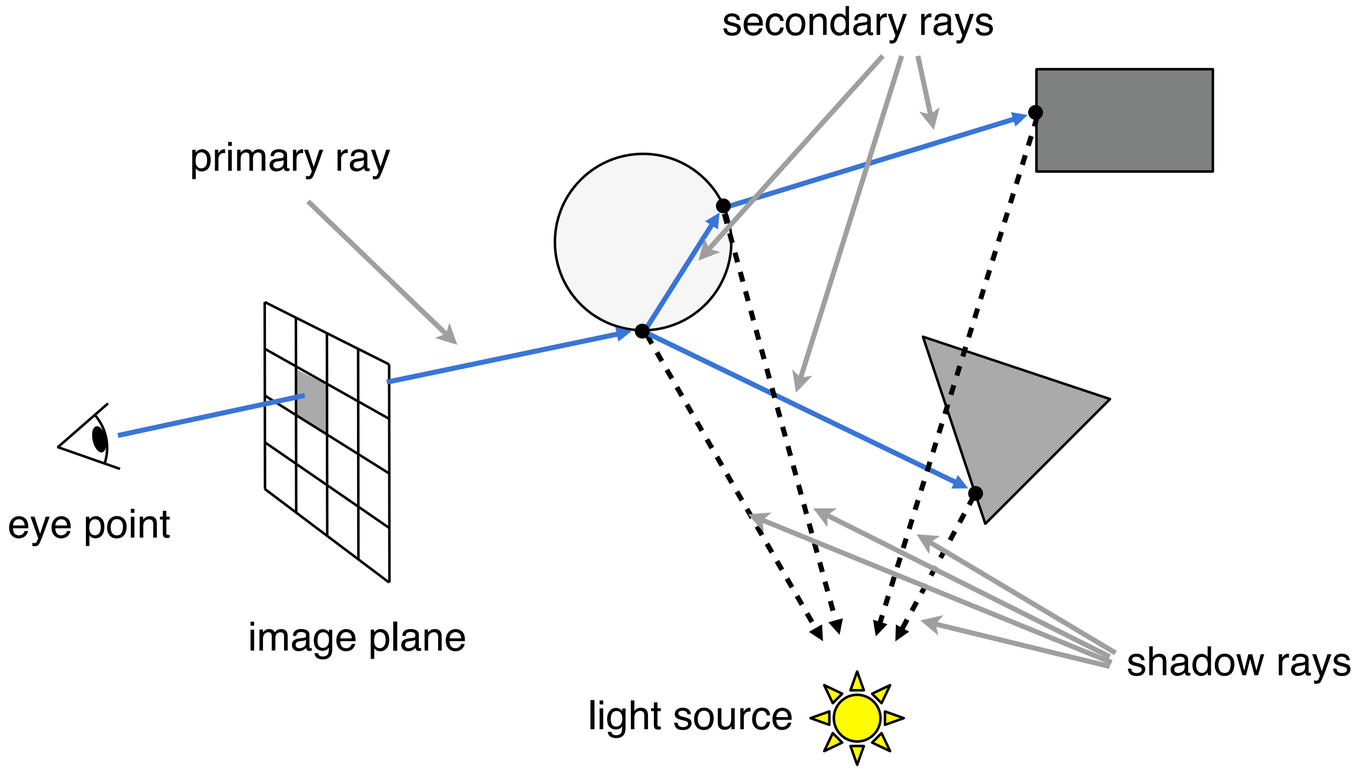




Programmable vertex and fragment processing, alpha compositing, Blinn-Phong reflectance model, …

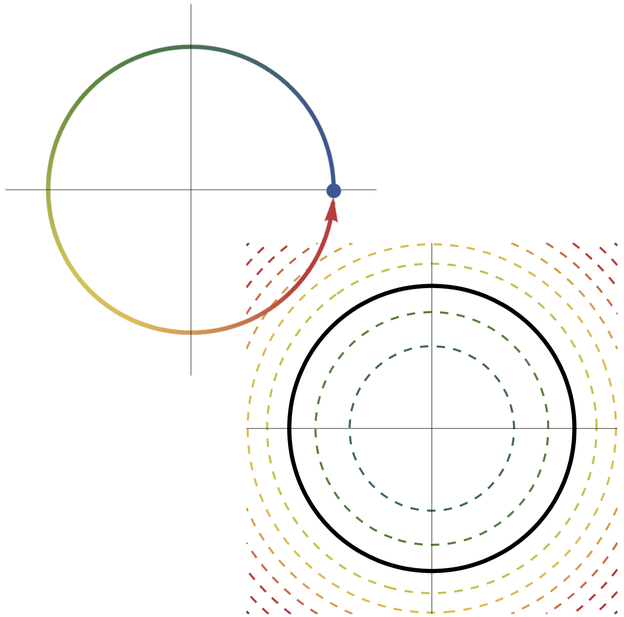
Ray tracing, …

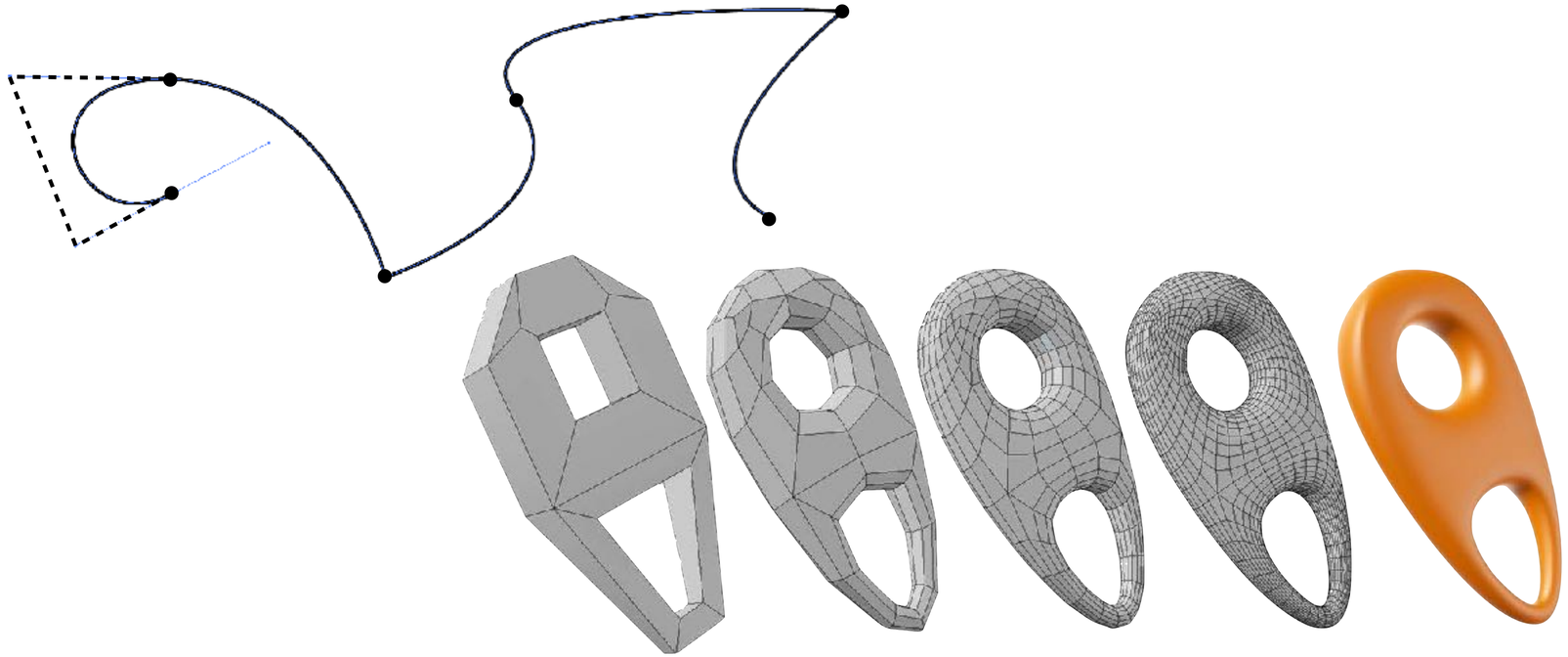




Ray-shape intersection, intersecting transformed shapes, shadow rays, recursive ray tracing, reflection and refraction, …

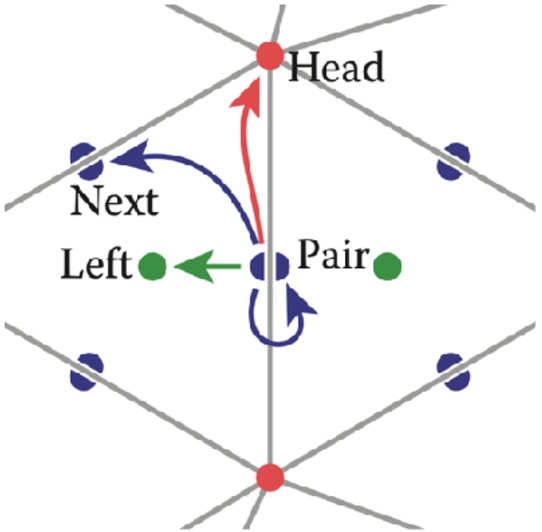
Modeling, Bézier splines, subdivision, …

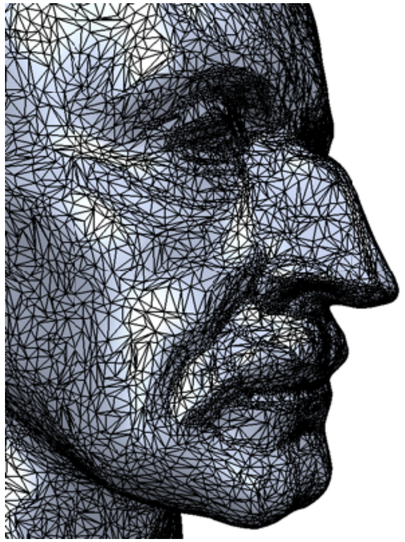


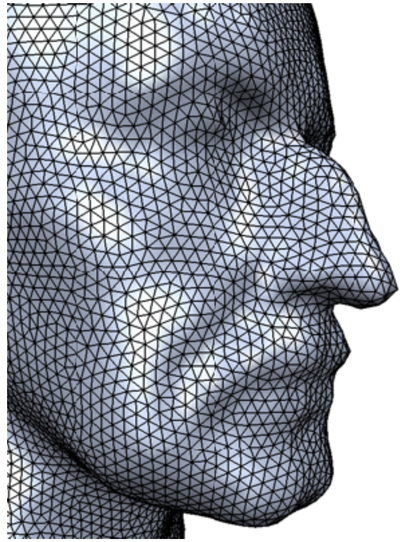


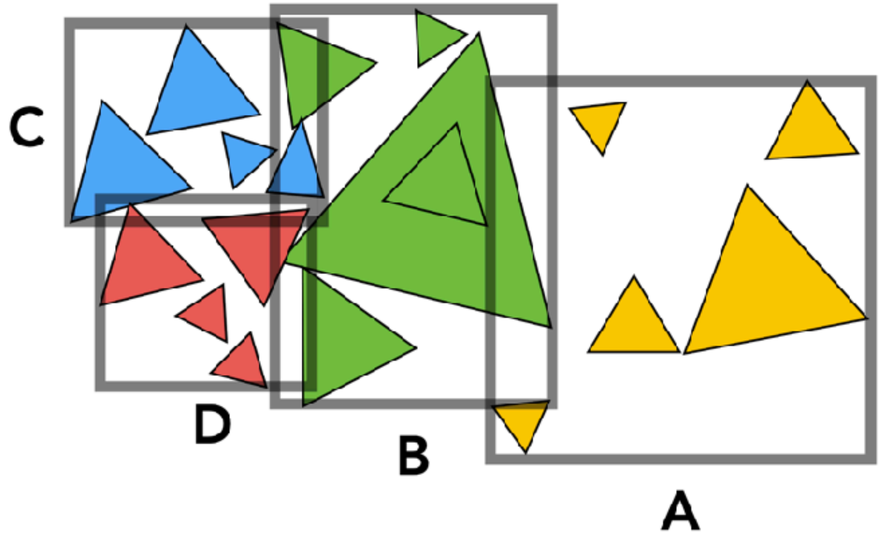
Explicit vs. implicit representations, splines, procedural vs. analytical forms, continuity, subdivision surfaces, …

Meshes, editing, spatial data structures…



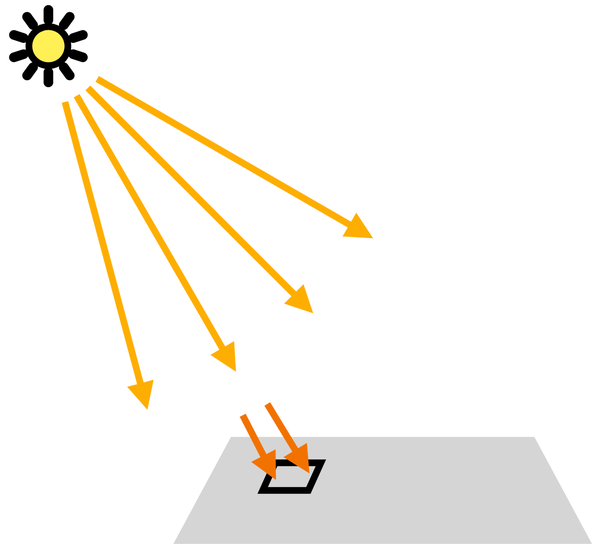


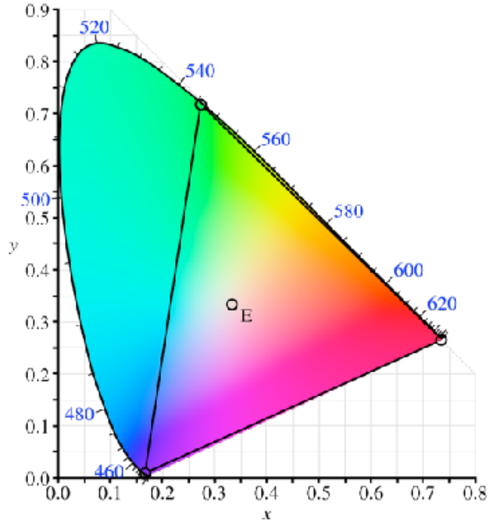




Manifoldness and orientation, connectivity vs. geometry, local operations, geometric queries, bounding volumes, space partitioning, recursive traversal, …

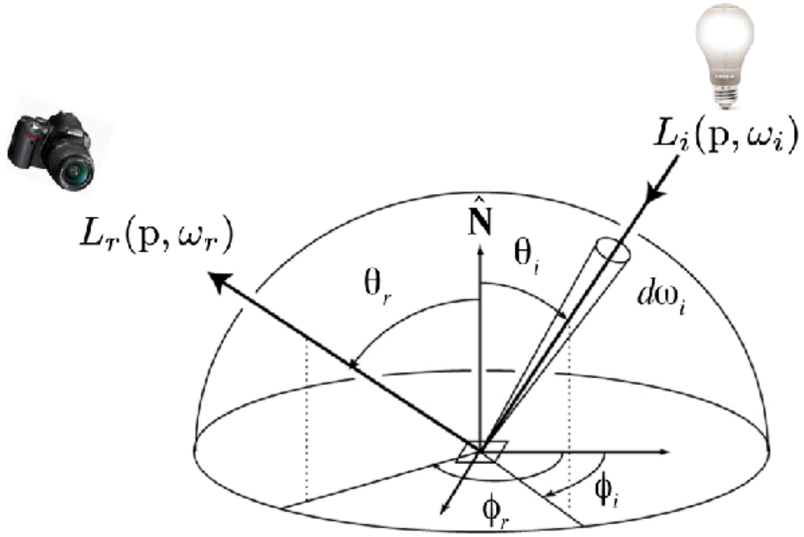
Radiometry, colour, materials, …

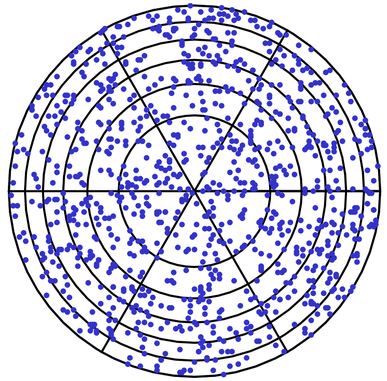


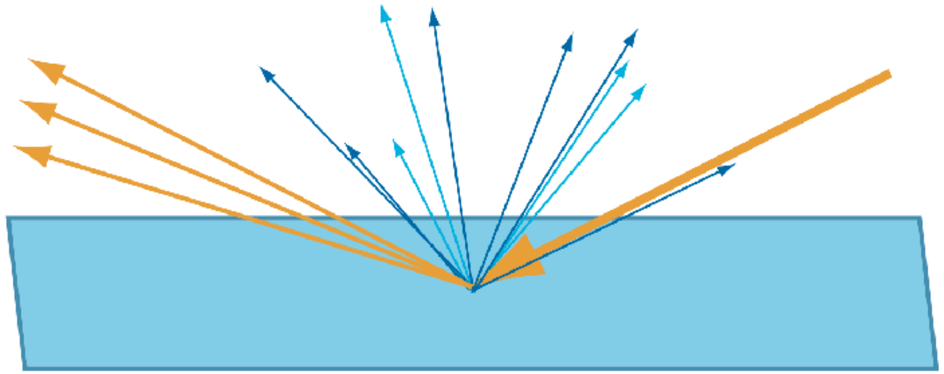


Radiant flux, irradiance vs. radiance, tristimulus values, gamma correction, BRDFs, microfacet models, Fresnel reflectance, …

The rendering equation, path tracing, …

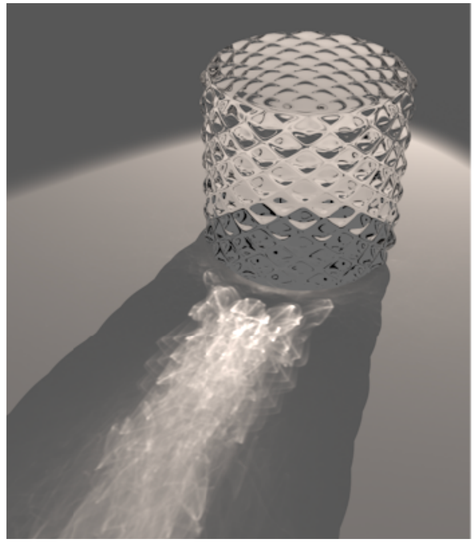
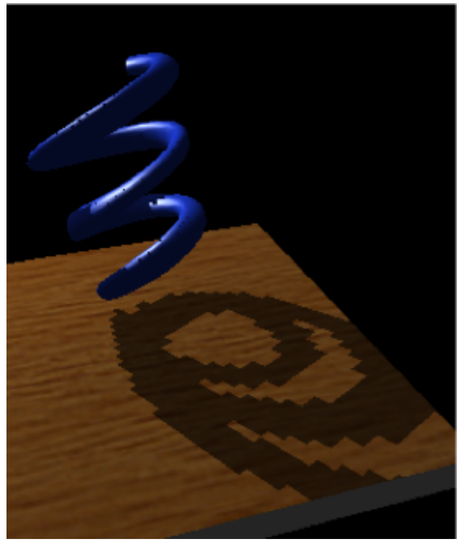






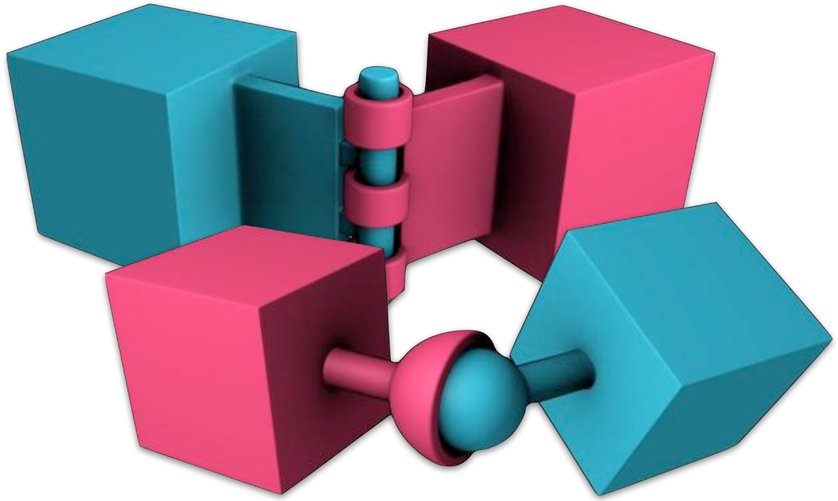
Global illumination, Monte Carlo integration, path tracing, inversion vs. rejection sampling, Russian roulette, importance sampling, …

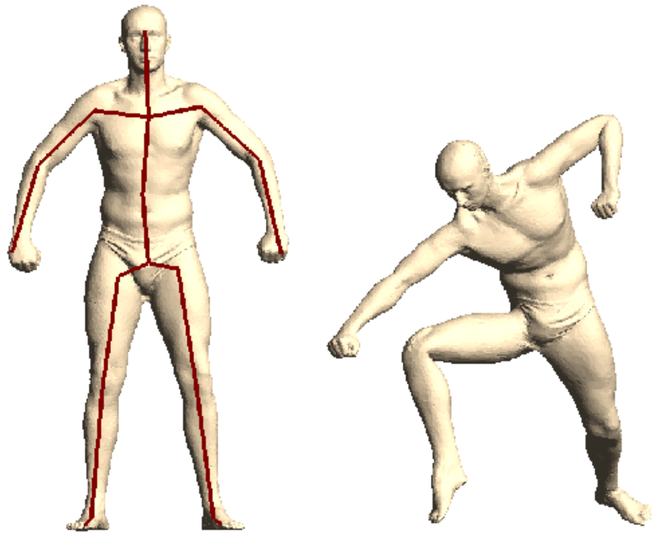
Bidirectional methods, real-time rendering, …


Variations of path tracing (independent samples) vs. photon mapping (reuse of light paths), gathering data from the right viewpoint, precomputed shading, …

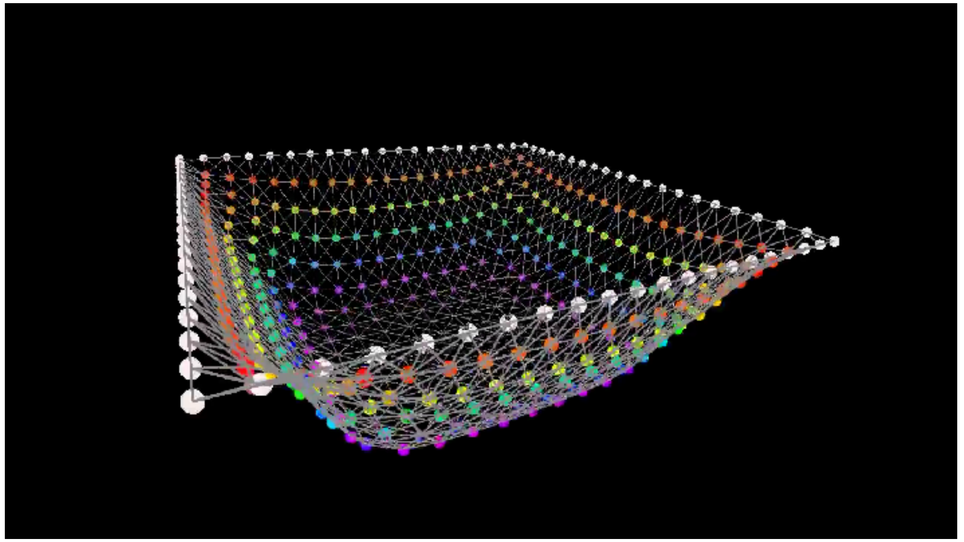
Skeletal animation, skinning, …

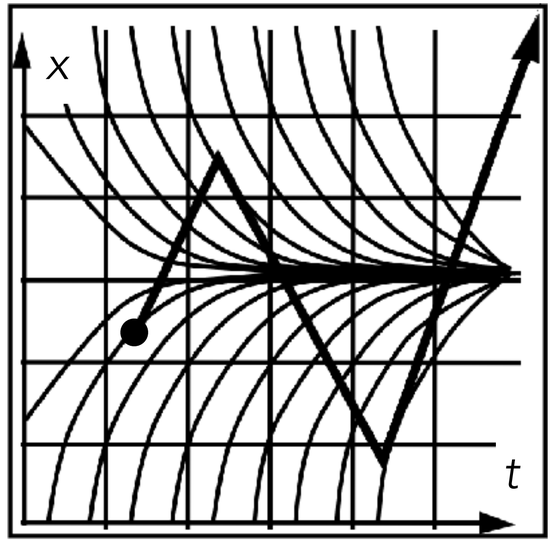




Animation controls, keyframing vs. motion capture, quaternions, forward vs. inverse kinematics, linear blend skinning vs. dual quaternions, …

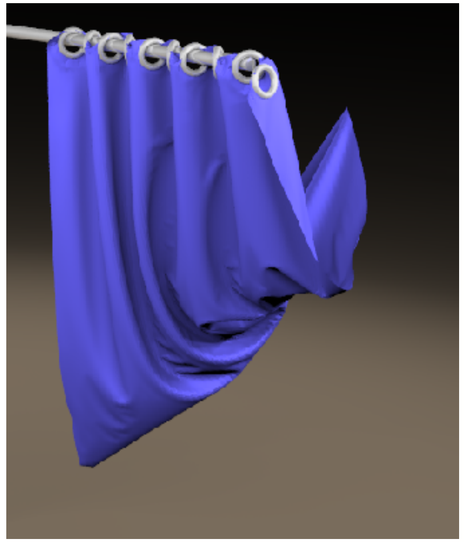
Particles, mass-spring systems, time stepping, …

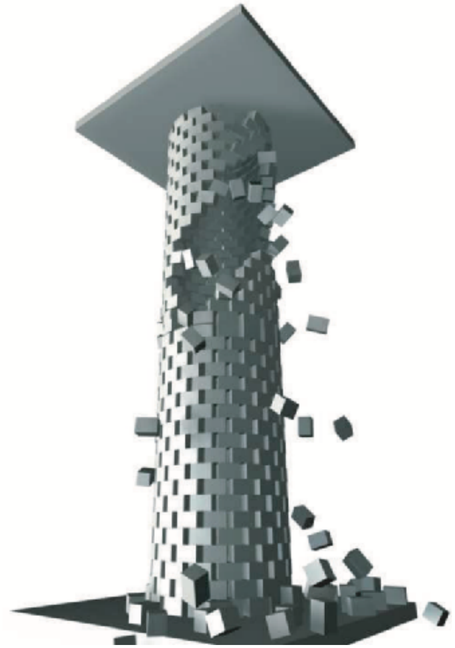


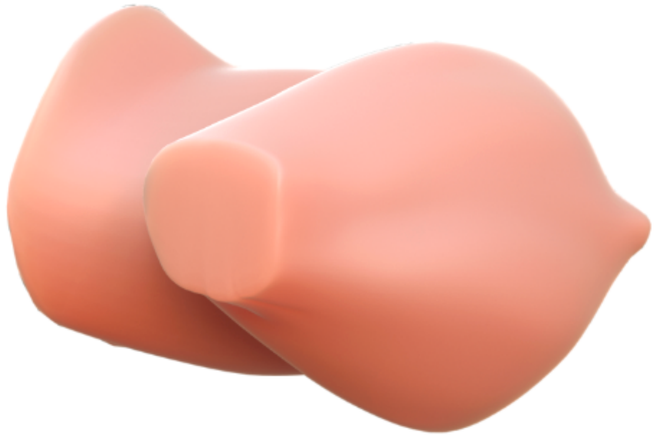


Time stepping, inter-particle interactions, generalized coordinates, forces from potentials, strains, implicit integration, Newton’s method, …

Constraints, collisions, continuum models, …







Constraint projection, rigid body dynamics, collision detection vs. response, Laplacian operator, discretization, finite elements, splitting methods, …