Autodesk Maya
modeling, animation, scripting and C++ programming
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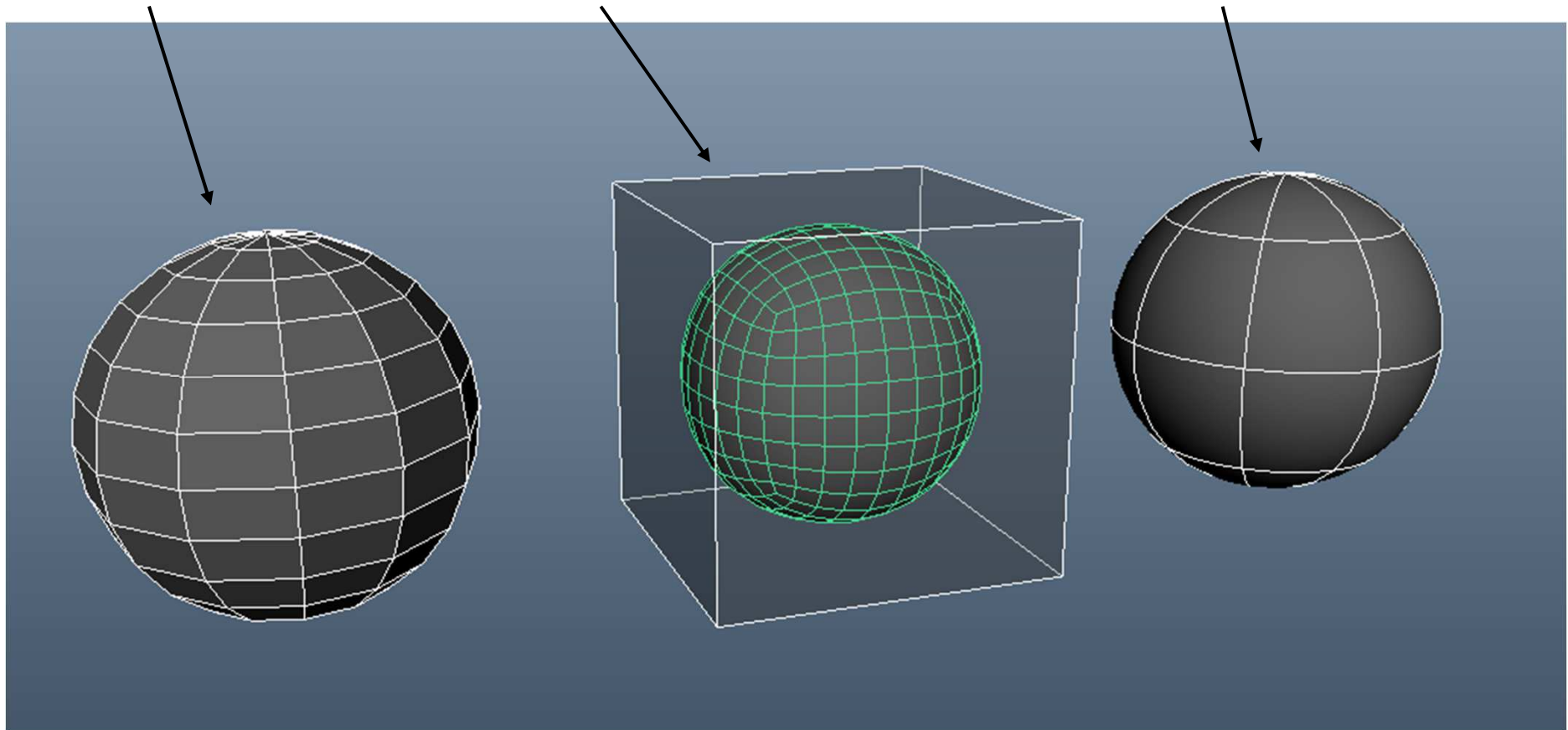Cours ENSIMAG, Ingénierie de l'Animation 3D

Maya modeling

- Different geometry types

Polygons   Subdivision surfaces   NURBS surfaces and curves

Polygons

- Pros
  - Intuitive (at least for modelers)
  - Mathematically simple
    - a set of 3D points and a list of cycles (faces)
  - Direct from 3D scanner

- Cons
  - Local transformation only
    - tedious editing
  - Complex link with texture
    - require projection schemes from 3D to 2D

Polygons' tools with Maya

- Base shape creation
  - cube, torus, etc. => menu "Create>Polygon Primitives"
- Translate, rotate, scale components
- Edit Polygons
  - subdivide or split tool
  - extrude (vertex, edge, face) => try tool parameters
- More:
  - smooth, reduce
  - bevel, chamfer
  - …

Texturing polygons

- UV editing => "Window>UV texture editor"
  - Choose an image
    - texture is related to a material (2D or 3D)
    - texture coordinates are related to a mesh (placement)
  - Try on a cube
    - UVs can be moved, rotated or scaled in 2D
  - Try on a cone or a sphere
    - Try different projection scheme => menu "Create UVs"

NURBS

- Pros
  - Smooth by definition
  - Direct link with texture mapping (2D/2D)
  - Mathematically well-defined
    - polynomial curves $\mathbf{C}(u)=\Sigma i Pi(u)\mathbf{P}i$
    - bi-polynomial surface $\mathbf{S}(u,v)= \Sigma ij Pi(u)Qj(v)\mathbf{P}ij$
    - => set of points and polynomial interpolators
- Cons
  - Less intuitive than polygon meshes
    - quite difficult to manipulate

NURBS' tools with Maya

- Base shape creation
  - curves et surfaces => menu "Create>NURBS primitives"
- Using components
  - curve: control vertex, hull, edit point
  - surface: control vertex, hull
  - components (interpolators) can be inserted
  - display various level of interpolation ('1', '2', '3' keys) for interactive view
- More complex tools
  - revolve a curve
  - loft two curves
  - cut and sew patches
  - …

Texturing NURBS surface

- Surface S(u,v) == Image I(u,v)
- Compare poly sphere and NURBS sphere
  - use checker texture and move vertex/CP

Subdivision surfaces

- Pros
  - Smooth subdivision of ANY control polygon
  - No polynomial interpolation
  - Good rendering properties (aliasing)
- Cons
  - No clear mapping between 3D surface and 2D texture

Painting

- Select object and RMB > Paint
  - Sculpt
    - a brush to modify 3D shape
  - Paint 3D
    - a brush to modify 2D texture

Scene hierarchy

- Objects positioned with respect to each other
  - wheels w.r.t cars, cars w.r.t roads, etc
- Representation
  - internal: 4x4 matrices
  - user: xyz vectors and Euler angles
  - pivots can be edited ('insert' key)
  - move/rotate can be local or global
  - see Node **transform** help reference
- Base command: "Edit>Parent"