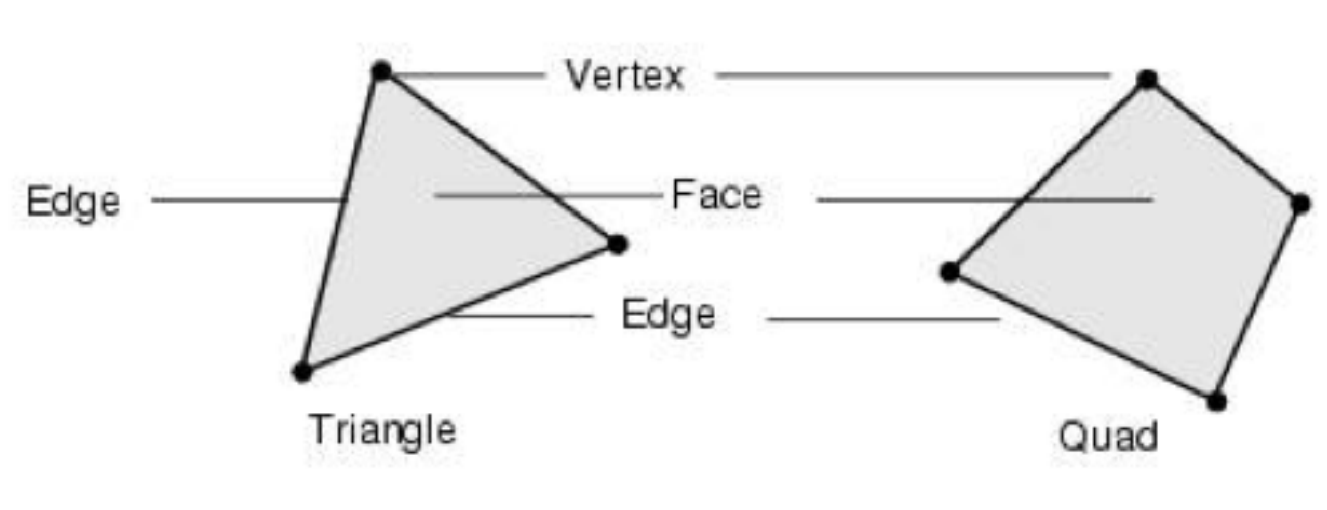
3D Modeling

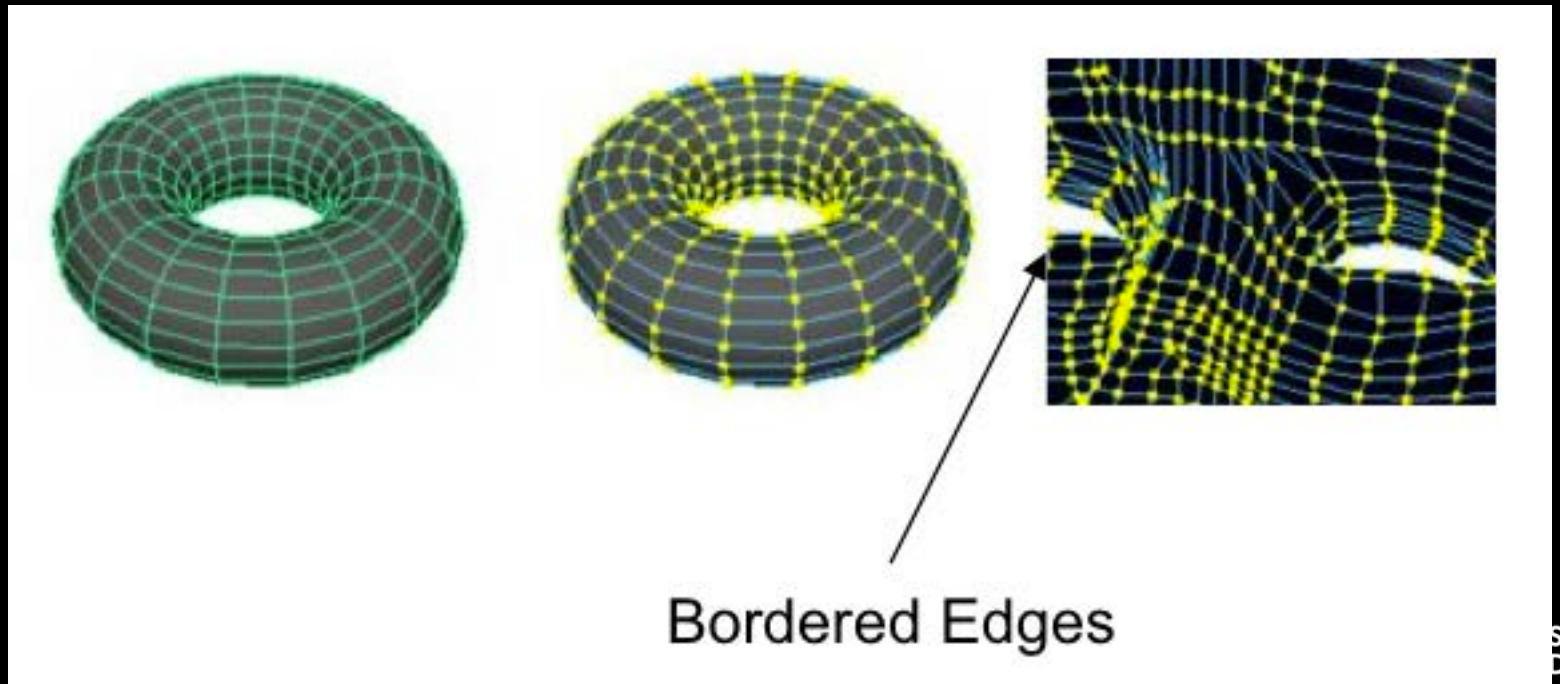
Vertices, edges, and faces are the basic components of polygons. When you model with polygons you usually use three-sided polygons called triangles or four-sided polygons called quadrilaterals (quads). Maya also supports the creation of polygons with more than four sides (n-gons) but they are not as commonly used for modeling.



UIC School of Design

3D Modeling

edges

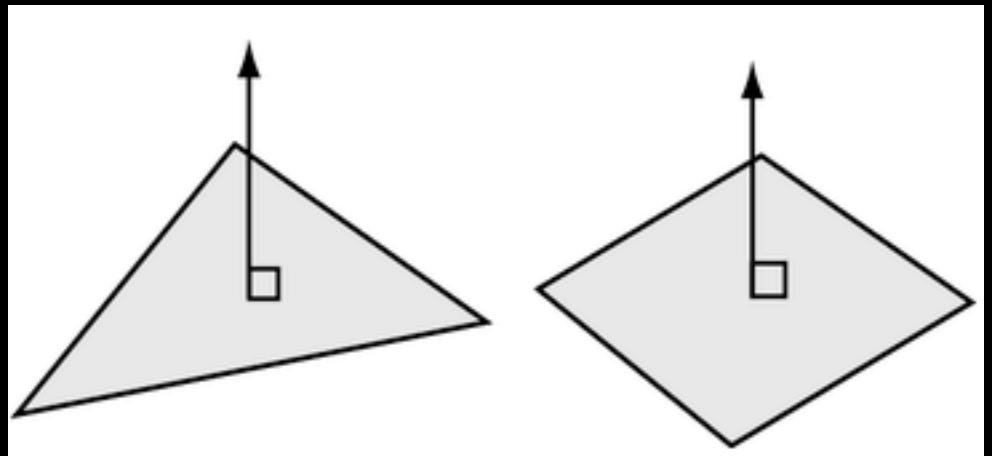


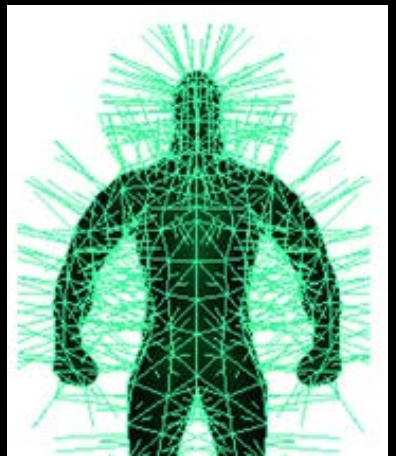
Normals

Normals are imaginary lines perpendicular to each point on a curve or surface (NURBs), or to the surface of a polygon (Polygon)

In Maya, normals are used to determine the orientation of a polygon face (face normals), or how the edges of faces will visually appear in relation to each other when shaded (vertex normals).

Face normal



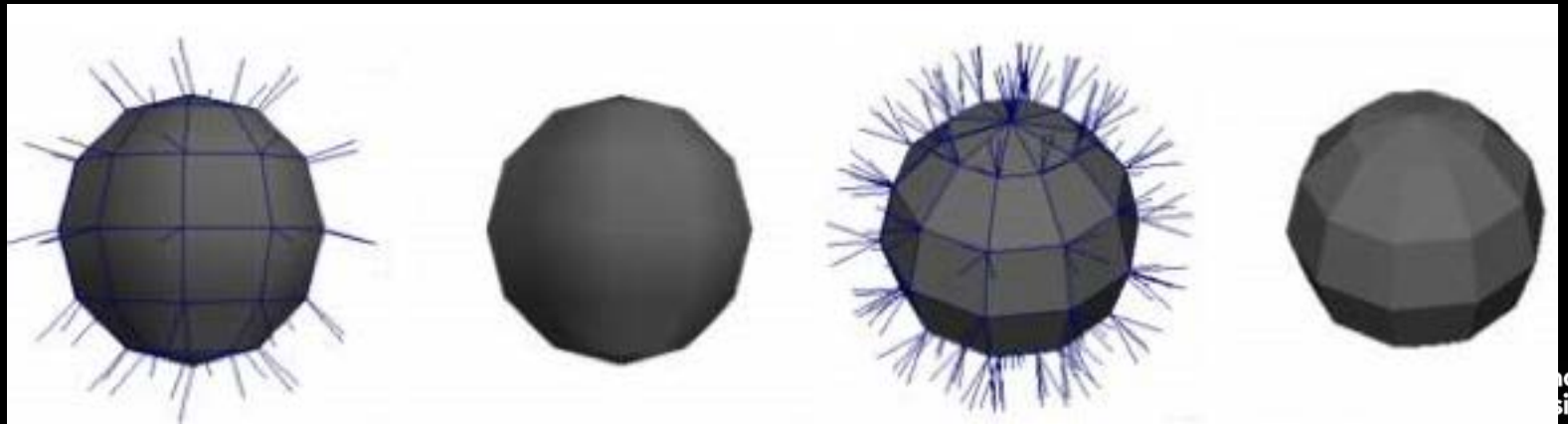


Normals

Vertex normals

You can modify the shading of individual polygons by manually editing the vertex normals associated with the polygon mesh.

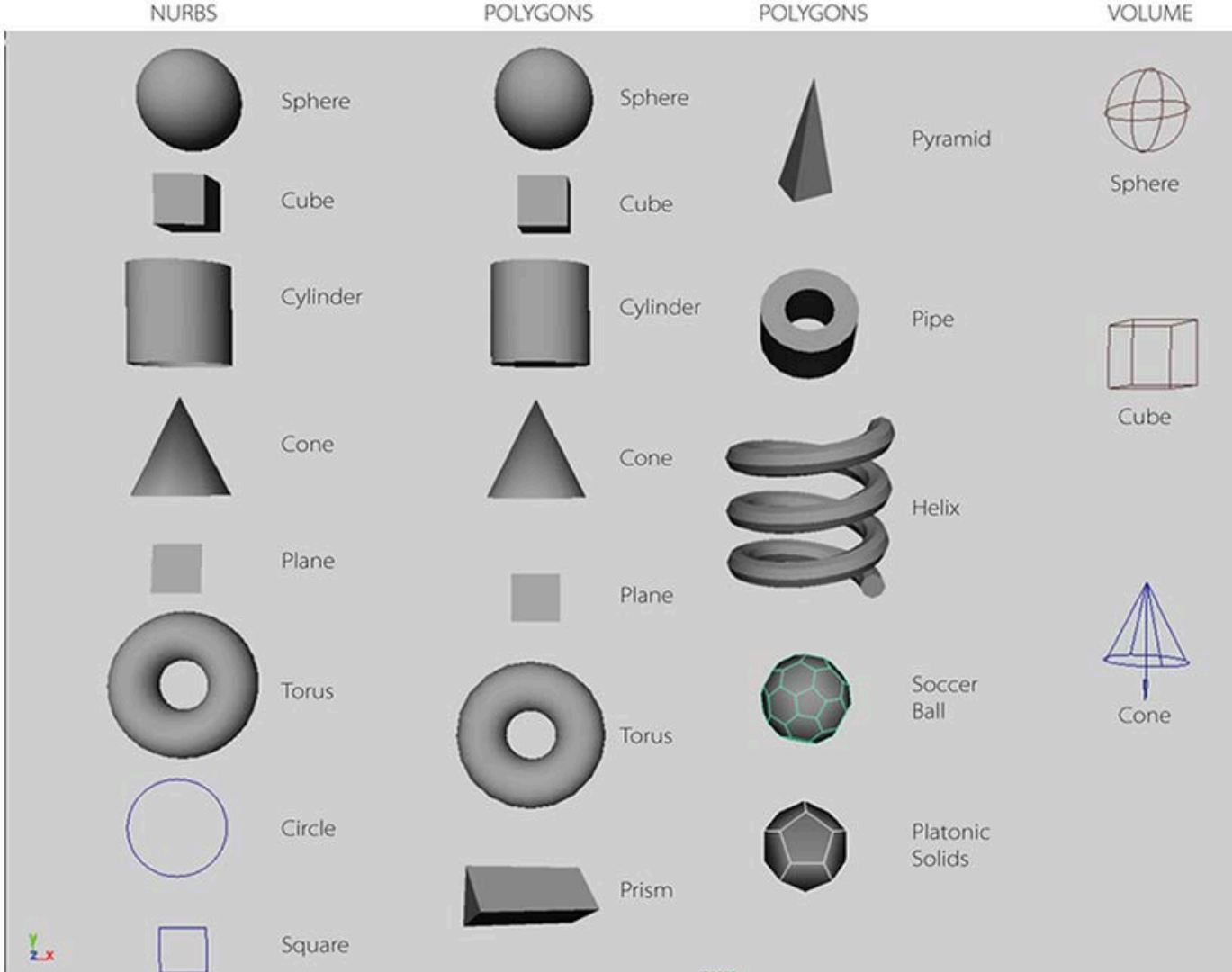
Since they are always perpendicular to the curve or surface, the way normal lines point toward or away from each other can reveal subtle curvature.



Creating polygons

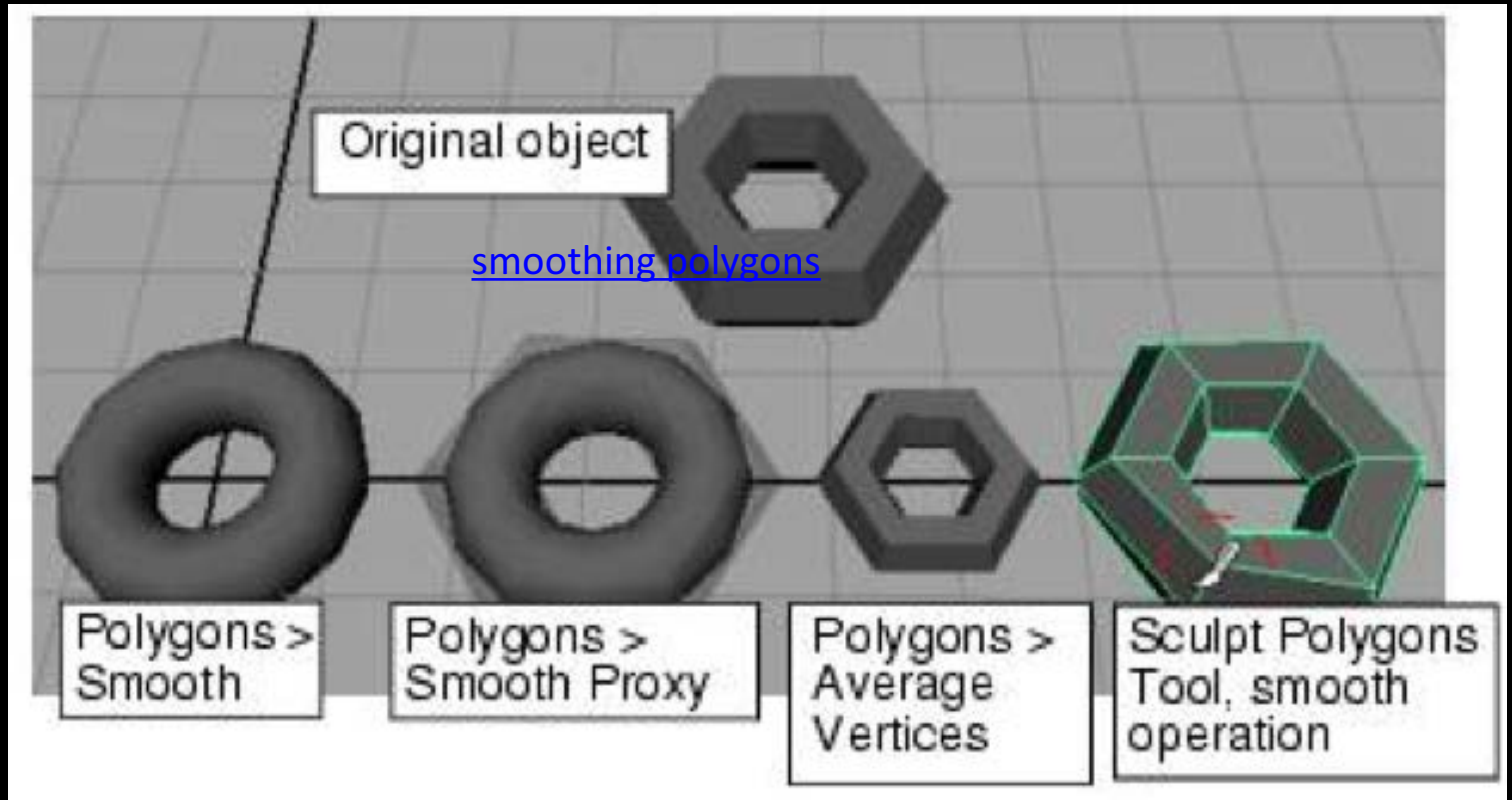
- Using primitives (Create / Polygon Primitives)
- Creating Polygon from scratch (Mesh Tools / Create Polygon Tool)

Primitives


NURBS
POLYGONS
POLYGONS
VOLUME
Sphere
Cube
Cylinder
Cone
Plane
Torus
Circle
Square
Sphere
Cube
Cylinder
Cone
Plane
Torus
Prism
Pyramid
Pipe
Helix
Soccer Ball
Platonic Solids
Sphere
Cube
Cone

Creating polygons

Smoothing polygons



Creating polygons

Editing in component mode

- Transform vertices, edges, and faces
- Extrude faces or edges (Edit Mesh / Extrude)
- Split faces using snap (Mesh Tools / Multi-Cut)
- Combine or separate meshes
- Merge vertices, edges, and faces
- Delete vertices, edges, and faces
- Append the deleted faces (Mesh Tools / Append to Polygon)

3D modeling

Real-time vs recorded

Real-time: rendering for interactive media, such as games and simulations, is calculated and displayed immediately. It uses the viewer's PC processor and graphics card to produce individual frames of animation as they are displayed.

Non real-time (offline rendering): animations for non-interactive media, such as feature films and video, are rendered much more slowly and presented as video files. Non-real time rendering enables the leveraging of limited processing power in order to obtain higher image quality.

3D modeling

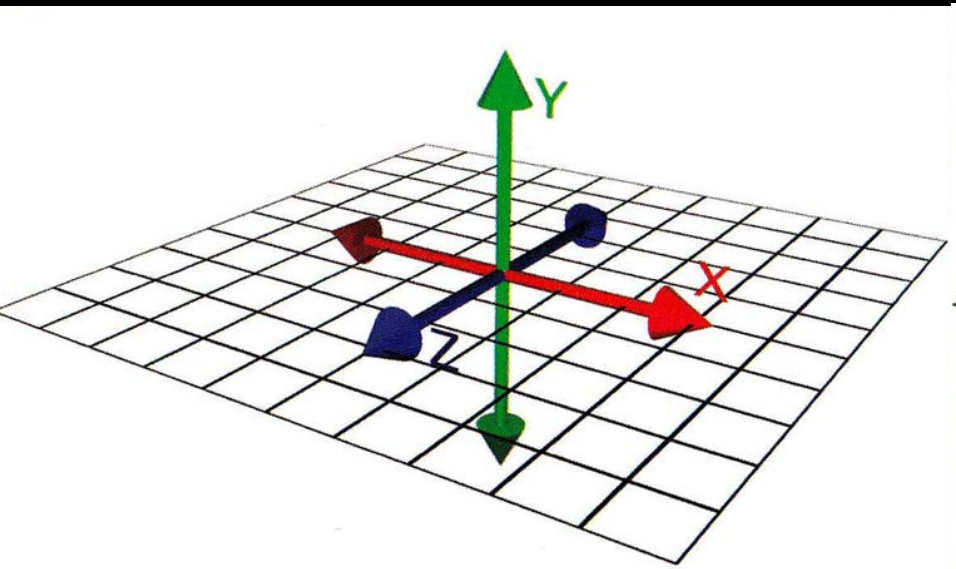
A screenshot image of Minecraft scene: Stonehenge in Wiltshire, recreated in Minecraft blocks by Ordnance Survey Innovation Lab.

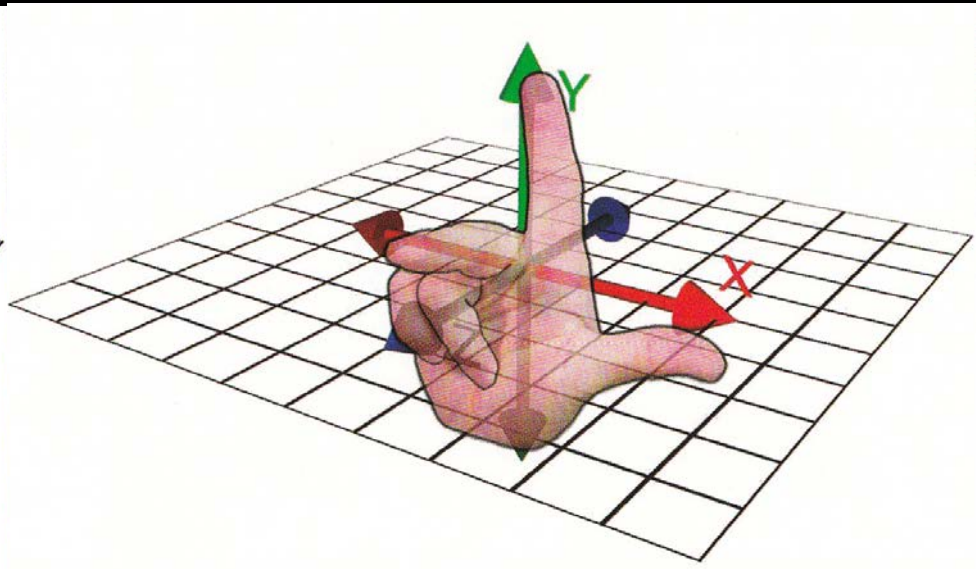
School of Design

3D modeling

3D coordinate system

The 3D world in computer graphics applications is visualized using a Cartesian coordinate system.





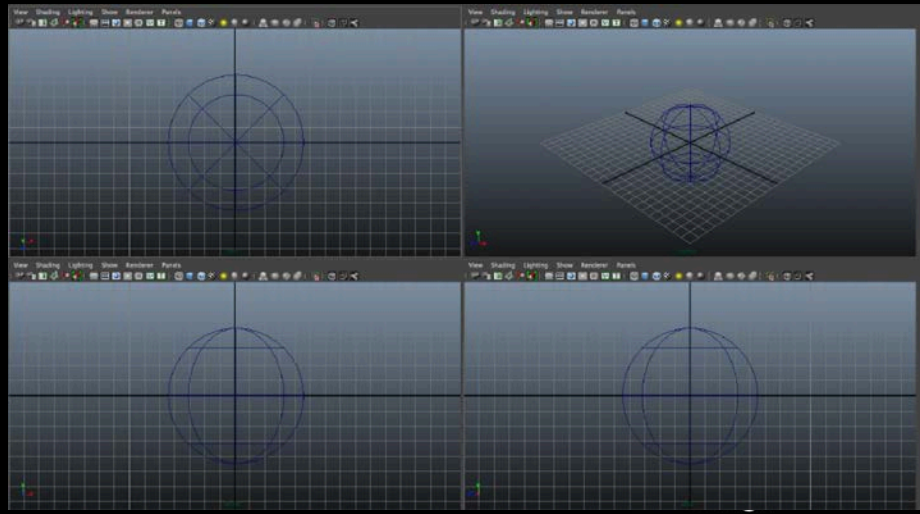
3D modeling

Navigating display windows

View panel change (Space Bar or check the left area layout) : Single View vs. Four View

Perspective View + Orthographic View

Tumble, Track, Dolly Tool (Alt (option) + Mouse Button (left, middle, right button))



Hierarchy

View panel

Check out objects in the scene. Each modeling object is consisted with transform and shape nodes. You can control their hierarchical relations in these windows:

Outliner window

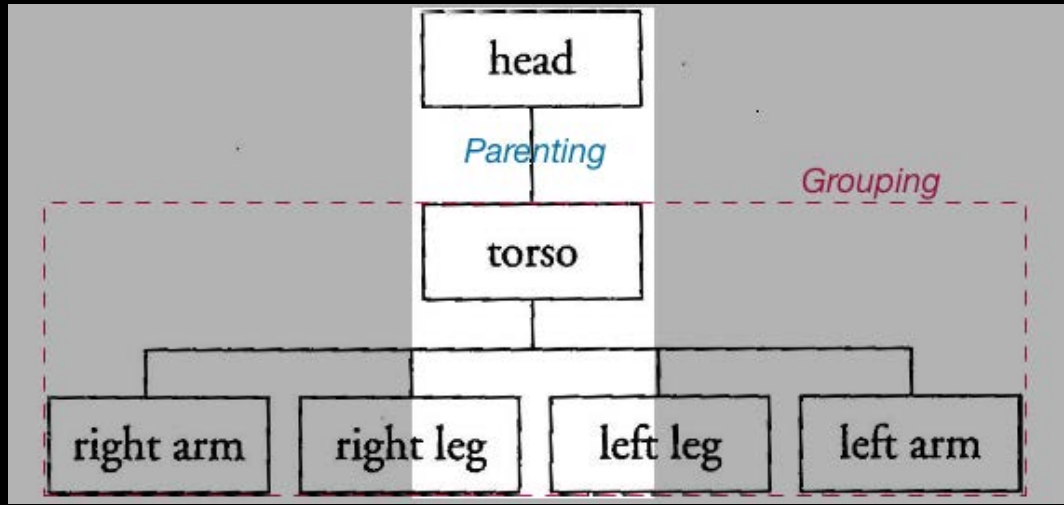
Hypergraph window

Hierarchy

Group vs. parent

Toggle on [Outliner/Display/Shapes] to show shape node along with transform node.

It is important to understand the relations between a transform node and its manipulator's position as a pivot point, when you move, rotate, and scale an object.



Hierarchy

Move the pivot point

Changing the *pivot*, which is a center of manipulator

insert key, or *fn* + *left* arrow key, or *d* key

Hierarchy

Move the pivot point

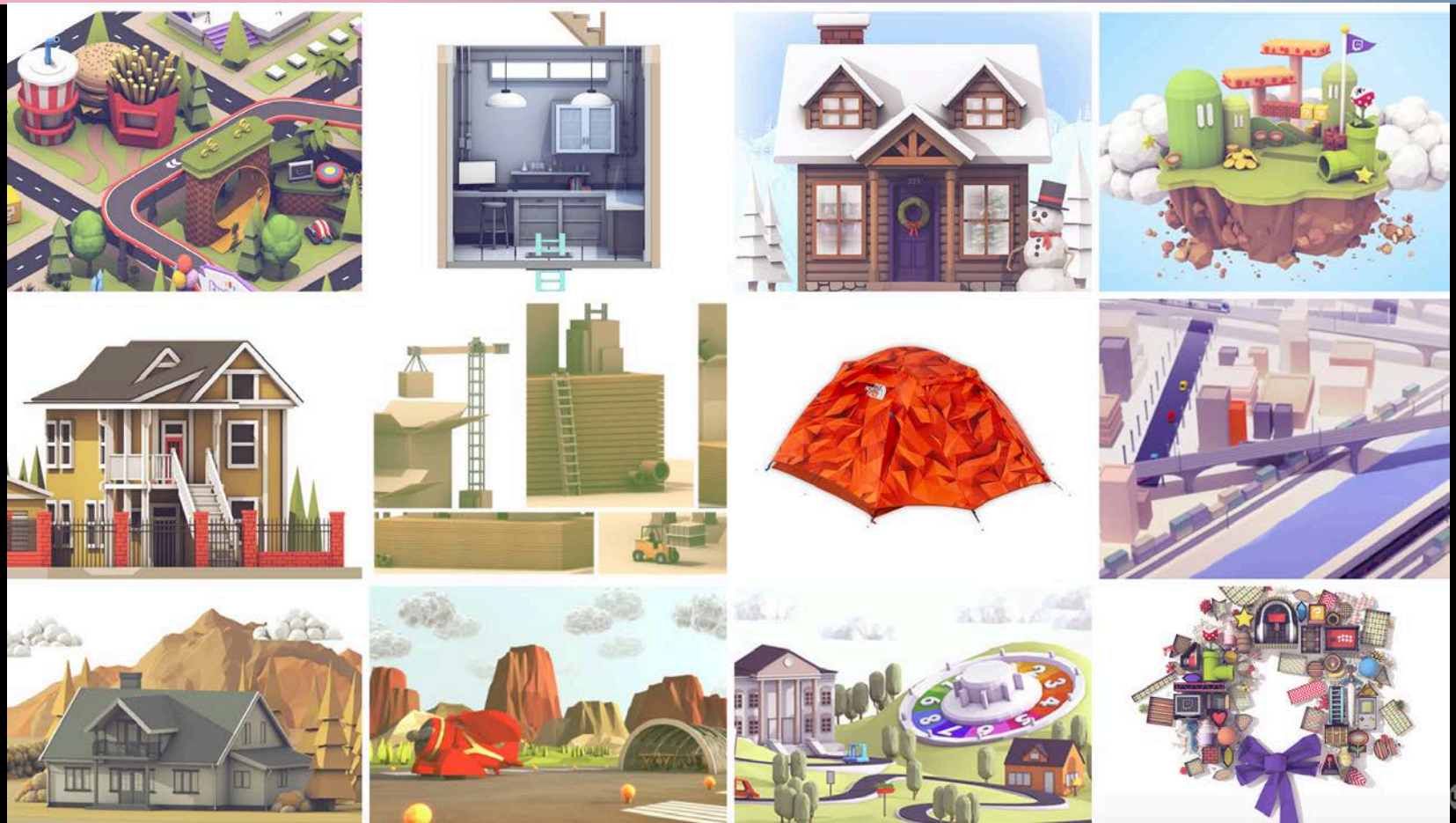
Changing the *pivot*, which is a center of manipulator

insert key, or *fn* + *left* arrow key, or *d* key

3D modeling examples

3D printing of a generative design lamp
Image courtesy of Nervous System.

3D modeling examples



UIC School of Design

3D modeling examples

Timothy J. Reynolds, Low poly art, AWWWARDS
Paper City Vimeo
Kenneth A. Huff
Meats Meier
Game of Thrones intro
Official Show Open
Art of VFX
What software was used to create the intro for Game of Thrones (TV series)?
Pixar Animation- Luxo Jr.
Timothy j. Reynolds

Virtual Kizhi

cultural heritage art project
World Heritage List of UNESCO
real-time interactive high-resolution 3D art visualization
historical reconstruction of Kizhi
advanced concepts in real-time graphics

- complex illumination with dynamic-irradiance environment mapping
- shadow mapping
- complex materials with normal and gloss mapping

Virtual Kizhi

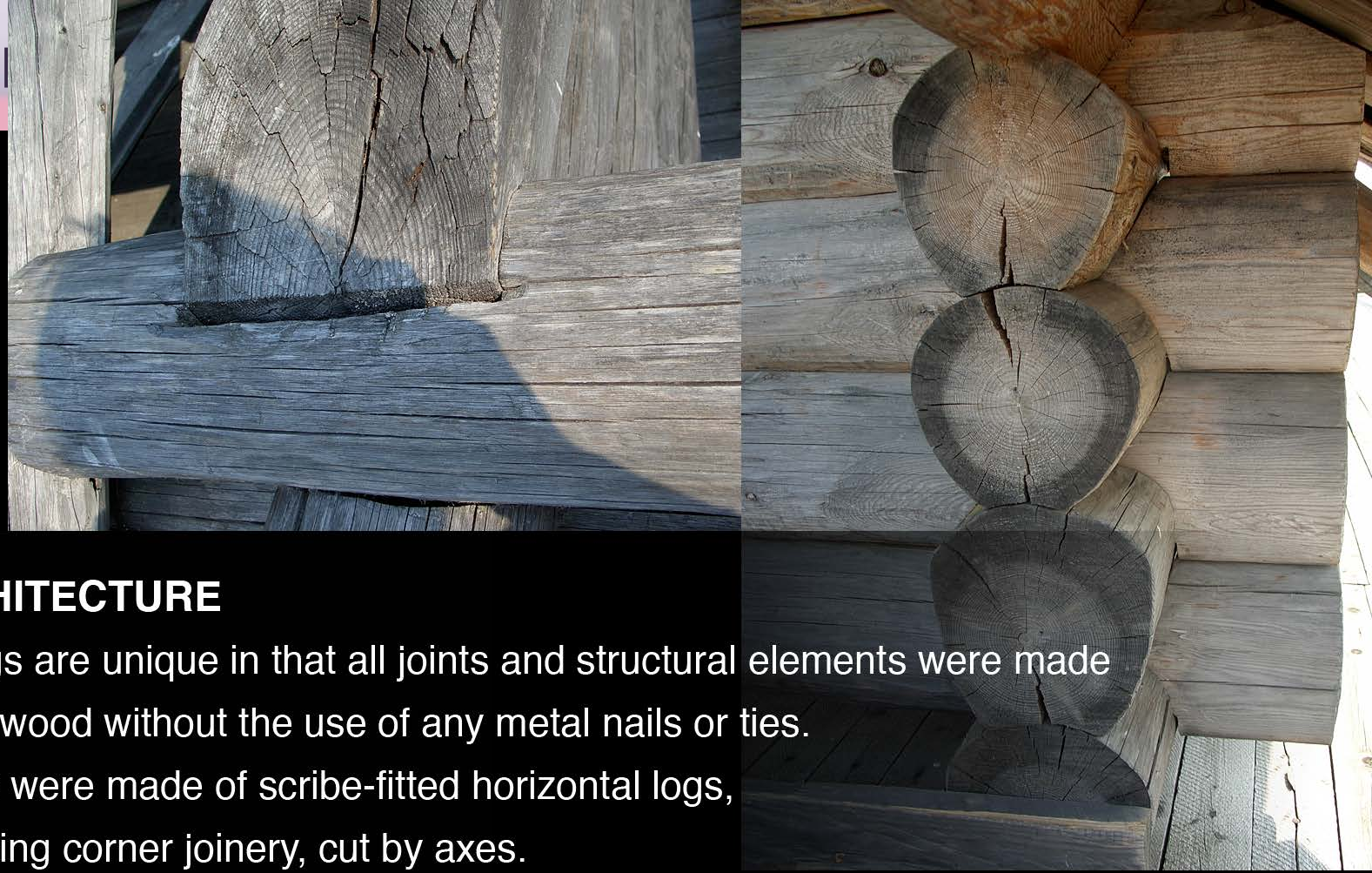
KIZHI ISLAND

Kizhi is located on an island in Lake Onega in northern Karelia in Russia.

It is an outdoor museum of fascinating edifices of northern wooden architecture.

Kizhi museum preserves a concentration of masterpieces of the Russian heritage and protected by World Heritage List of UNESCO.

Virtual



KIZHI ARCHITECTURE

Kizhi buildings are unique in that all joints and structural elements were made entirely from wood without the use of any metal nails or ties.

All structures were made of scribe-fitted horizontal logs,

with interlocking corner joinery, cut by axes.

KIZHI ARCHITECTURE

The Kizhi ensemble consists of

Church of the Transfiguration
1714, summer church

Church of the Intercession
1764 winter church

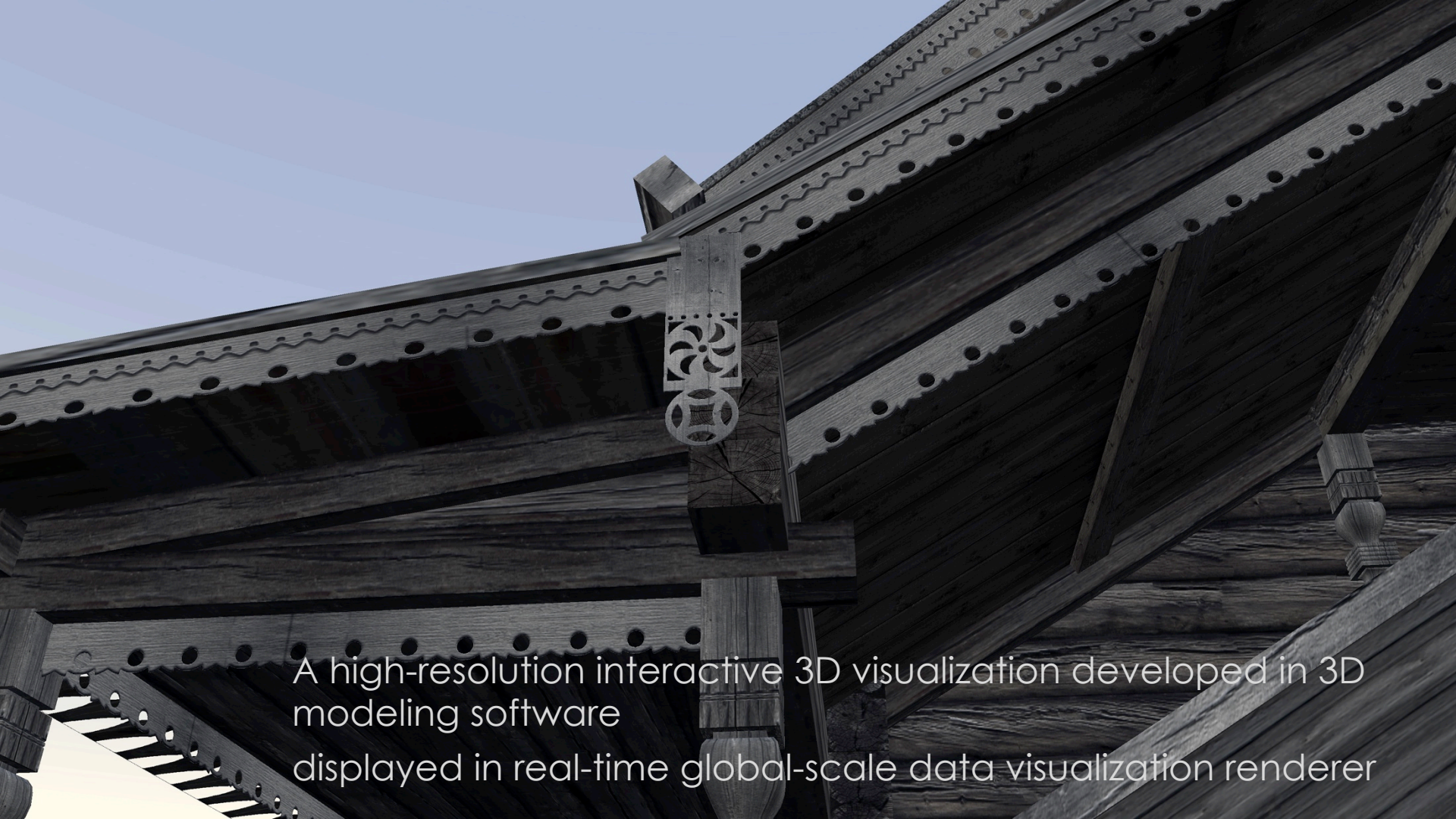
Belfry 1874

KIZHI ACCESS

Word “kizhi” is translated from Karelian as “a place for games.”
In ancient times people gathered here and performed their religious rituals.

A remote location, travel distance, limited building access due to restoration efforts make the Kizhi site difficult to visit. The museum is inaccessible during fall through spring months. During the summer the island is accessible by boats only.
Church structures and their textures continue to deteriorate.

The churches remain functional and served the parish until 1937 when the Church of the Transfiguration was officially closed and last priest was shot.


A high-resolution interactive 3D visualization developed in 3D modeling software
displayed in real-time global-scale data visualization renderer