

## 3ds Max

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3ds Max is an all-purpose 3D graphics package that excels in many production contexts. It can be applied to any industry or graphics discipline, including but not limited to design visualization, visual effects, animation, motion graphics, games, and simulations. This course covers the basic techniques of modeling, materials, animation, lighting, and rendering. Learn the capabilities and best practices of 3ds Max: navigation within the interface, efficient workflows, and choosing appropriate tools for desired results.

Topics covered include:

- General concepts of 3D production
- Project setup and asset management
- User interface
- Object creation and transforms
- Units, Grids, and Snaps
- Parametric modeling with the Modifier Stack
- Spline modeling
- Text and graphics
- Polygon modeling
- Subdivision surface modeling
- Material Editor
- Physically-based rendering
- Color and relief mapping
- UV coordinate projection, unwrapping, and layout
- Physical Camera and Exposure Control
- Photometric lighting
- Creating and editing animation keyframes
- Directing animation with Curve Editor
- Building hierarchies
- Scene management
- Production rendering
- Rendering an animation sequence

1. Introductions
  - a. Instructor background and experience
  - b. Learner backgrounds, career / production goals, and desired learning outcomes
2. Presentation: 3D graphic production concepts
  - a. Modeling: construction of objects
    - i. Form and structure
    - ii. Vector-based
    - iii. UV coordinate projection / unwrapping / layout
  - b. Materials
    - i. Superficial surface properties, e.g. color, roughness, transparency
    - ii. Maps: vary material attributes across a surface
  - c. Lighting
    - i. Photometric lighting: real-world light intensities
    - ii. Global illumination: light interaction with multiple surfaces
    - iii. Lighting paradigms
      - (1) Practical / available / diegetic
      - (2) Studio / stage / non-diegetic
      - (3) Environment / ambient
  - d. Layout and camera
    - i. Merge and place assets in a primary scene
    - ii. Placeholders may stand in while assets are being made
    - iii. Environment construction determined by camera angles
    - iv. Trickery such as forced perspective and matte paintings
  - e. Animation
    - i. Rigging: setup of animation controls
    - ii. Keyframing: automatic transitions between manual poses

- iii. Motion capture / performance capture
- iv. Dynamics: physical simulations
- v. Visual effects: non-character animation
- f. Rendering
  - i. Project 3D scene to 2D image
  - ii. Real-time: viewports, games, simulations
  - iii. Non-real-time (offline): motion pictures, animation
- 3. Project setup
  - a. Asset types and default folders
  - b. Create or set the active project
- 4. Interface basics
  - a. Menus
  - b. Toolbars
  - c. Command Panel
    - i. Create
    - ii. Modify
  - d. Selection and transform tools, hotkeys
  - e. Viewports: perspective and orthographic
    - i. Display modes
  - f. Status Line area
    - i. Transform Type-In area
    - ii. Time controls: Track Bar, transport
- 5. Units
  - a. Display Units
    - i. Generic units
  - b. System Units

6. Grid
  - a. Grid spacing and size
  - b. Background color
  - c. Grid color
7. Snaps
  - a. 3D / 2D / 2.5D
  - b. Axis constraints
8. Parametric modeling with Modifiers
  - a. Base object types: shape/curve, polygon mesh
  - b. Non-destructive modeling with primitives and Modifiers
  - c. Convert to Editable: bake / collapse / flatten to a raw collection of components, deleting all parameters and modifiers
9. Spline modeling
  - a. 2D Shape primitives
  - b. Editable Spline (aka "Line"): Bezier curves
    - i. Sub-object types: Control Vertex, Segment, Spline
    - ii. Control Vertex types: Bezier, Corner, Smooth
    - iii. Interpolation
    - iv. Editable Spline tools: Refine, Fillet
10. Text and graphics modeling
  - a. TextPlus
  - b. Import vector art from Illustrator
  - c. Extrude Modifier
  - d. Bevel Modifier
11. Polygon mesh basics
  - a. Sub-object types: Vertex, Edge, Border, Polygon, Element
  - b. Face normal: renderable or illuminated side of surface

- c. Smoothing: shading effect of soft edges
  - d. Level of detail vs. fidelity
12. Intro to Editable Poly
- a. Polygons vs. faces
  - b. Modify Panel
  - c. Ribbon tools aka Graphite
    - i. Modify Mode
    - ii. Edit Poly Modifier
13. Editable Poly tools
- a. Caddy controls
  - b. Extrude
  - c. Quickslice
  - d. Cut
  - e. Chamfer
  - f. Remove
  - g. Constraints
14. Symmetry Modifier
- a. Mirror plane
  - b. Weld Seam
15. Subdivision Surface modeling
- a. Concepts
    - i. Iterations / level of detail
    - ii. Topology
  - b. Best practices
    - i. Edge flow
    - ii. Poles

- iii. Quadrilaterals
  - iv. Edge Crease
  - v. Bake / collapse
16. Modeling Modifiers
- a. Array: duplicate forms within a single object
    - i. Distribution types: Grid, Radial
    - ii. Distance types: Offset, Dimension, Fill
    - iii. Offset vs. Spacing
    - iv. Transforms and Randomization
  - b. Boolean: combine volumes
    - i. Union
    - ii. Subtraction
    - iii. Intersection
  - c. Retopology
    - i. Increase or decrease level of detail
    - ii. Clean up a messy model
17. Materials basics
- a. Object color vs. material
  - b. Slate Material Editor interface
  - c. Scene materials
  - d. Physical Material parameters: Base Color, Reflection Roughness, Metalness
18. Viewport preview rendering
- a. Nitrous
    - i. Material display modes: Shaded vs. Realistic
  - b. ActiveShade / Arnold
    - i. CPU vs. GPU

- ii. Samples
19. Mapping basics
    - a. Compatibility: Legacy, OSL, and Arnold maps
    - b. Mappable parameters: color, relief, numeric (floating point)
    - c. Building shading networks
    - d. Deleting materials and maps
    - e. Sample Slots and Material Libraries
  20. Procedural maps
    - a. 2D or 3D patterns generated within the application
    - b. Don't require UV coordinates
    - c. OSL Uber Noise map
  21. File maps
    - a. 2D images stored in linked external files
    - b. Bitmap nodes
    - c. Asset Tracking
  22. UV projection
    - a. UV coordinates in the shading network vs. on objects
    - b. Controlling multiple bitmaps with OSL UVW nodes
    - c. UVW Map Modifier
  23. UV unwrapping
    - a. Unwrap UVW Modifier
    - b. Stitch / Break / Unfold
  24. UV layout
    - a. Boundaries of UV space
    - b. Tiling
    - c. Arrange / Pack / Reshape

25. Render settings
  - a. Nitrous viewport lighting
    - i. Active Viewport Settings
  - b. Arnold production rendering
    - i. Ray Depth
26. Lighting basics
  - a. Light compatibility: Standard, Photometric, Arnold
  - b. Photometric parameters
    - i. Intensity: lumens vs. candelas
    - ii. Color: temperature in degrees Kelvin vs. RGB Filter Color
    - iii. Shape and size
    - iv. Softness of light and shadows
27. Physical Camera
  - a. Free vs. Target
  - b. Field of View
  - c. Aspect ratio: Render Scene > Output Size
  - d. Safe Frames
28. Exposure Control
  - a. Global Exposure Value
  - b. Image Control (tonemap)
  - c. White Balance
29. Practical and studio lighting
  - a. "Realism" as a social construct
  - b. Accuracy vs. aesthetics
30. Photometric lights
  - a. Physically-based, quadratic decay



- b. Point, Sphere, Cylinder and Line lights: Uniform Spherical distribution
  - c. Optimizing the number of lights
  - d. Rectangle and Disc (area) lights: Uniform Diffuse distribution
  - e. Spotlight distribution
    - i. Hotspot and Falloff radii
31. Environment lighting
- a. Flat color
  - b. Blackbody map
  - c. HDRI Environment
32. Natural daylight
- a. Sun Positioner
  - b. Physical Sun & Sky Environment
33. Animation basics
- a. Time Configuration
  - b. Controllers
  - c. Creating keys with Auto Key mode
  - d. Editing keys and ranges in the Track Bar
34. Animation timing
- a. Creating keys in specific tracks with Set Key mode
  - b. Track View - Dope Sheet
    - i. Spreadsheet paradigm
    - ii. "Fake keys": hierarchical / categorical selection
    - iii. Edit Ranges
    - iv. Slide Keys
35. Animation fine-tuning
- a. Track View - Curve Editor

- i. Function curves
  - ii. Keyframe Statistics
  - iii. Move Keys, Scale Keys, Scale Values
  - b. Keyframe interpolation
    - i. Tangent types. Bezier, Linear, Step
    - ii. Editing tangent handles
    - iii. Lock Tangents: adjust multiple tangents simultaneously
36. Coordinate systems
- a. World: global scene axes / construction grids
  - b. View: screen space (except Perspective viewports, which are World space)
  - c. Local: transforms relative to object Pivot Point
  - d. Parent: transforms relative to object parent
    - i. If the object has no parent, then the World is the parent
    - ii. Parent coordinates are the true space of transform Controllers and animation
    - iii. All other coordinate spaces are temporary references
  - e. Gimbal: same as Parent, but more user-friendly for rotations
    - i. Gizmo displays the interaction of rotation axes relative to one another
    - ii. Avoids problems such as rotations getting stuck or animating out of control
37. Pivot Point
- a. An object transforms relative to its Pivot Point
  - b. Displayed transform values are those of the Pivot Point
  - c. Pivot Point position and orientation are critical for animated rotations
  - d. Must be finalized before creating keyframes
  - e. Hierarchy Panel: Affect Pivot Only
38. Hierarchies
- a. Chain of linked objects; articulated structure such as skeleton

- b. Children inherit transforms from their parents
  - c. An object may have many children, but only one parent
  - d. Any object can be linked: geometry, lights, cameras, etc.
  - e. Non-uniform scaling in hierarchies can cause problems
  - f. Group: an invisible parent node with unique properties
  - g. Point Helper: a visible but non-rendering transform node for building hierarchies and rigs
39. Scene management
- a. Scene Explorer: outline view of hierarchy
  - b. Display Panel, Quad Menus: Hide and Freeze objects
  - c. Layer Explorer: manage display properties of collections of objects
40. Production rendering
- a. Image sequences
  - b. File formats
  - c. Playback with RAM Player