ARCH 3410 – Rhino Tips & Tricks

From: Troy M. Malmstrom

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I. Notes:
- A. Zoom to be recorded
- B. Office Hours – Tuesdays, 9-11pm

Meeting URL: https://gbbn.zoom.us/j/83634782988
Meeting ID: 836 3478 2988

II. **Intro**

A. **About Rhino** screen (help>about rhinoceros…) – Welcome screen to Rhino, allows you to create new files, open existing, and view license info. Also has News and Tips.
- New – Preloaded Template Files with various sizes/dimensions
- Recent – Recently opened files
- Open… - Open an existing file
- License – License Information

B. **Screen Layout** – Model Space (4 quadrants), Left Toolbar, Top Toolbars, Command Line, Top Menu Bar, Layer/Properties/Help, Bottom Menu (Grid Snap, Ortho, OSnap, SmartTrack, Gumball, Record History)

C. **Model Space** 'perspective' dropdown – Render Types, Set View, Set CPlane

D. **Rhino Options** (tools>options…) – Walk through various applicable Document Properties and Interface Options.

1. **Document Properties**
   a. Units – Model Units (Feet, Inches, Meters, Centimeters, etc)
   b. Absolute Tolerance: 0.001 units
2. **Rhino Options**
   a. Files – AutoSave (Save every 20minutes)
   b. Keyboard – F1 (CPlane World Top) "_CPlane _World _Top"
      F2 (CPlane World Front) "_CPlane _World _Front"
      F3 (CPlane World Right) "_CPlane _World _Right"
      F4 (CPlane Mobile Plane) "_MPlane _R"
   c. Licenses – Check out a License to use offline
   d. Mouse – Middle Mouse Button – 'Most-recently-used commands pop-up menu' or 'Popup this Toolbar'
   e. Toolbars – Files – Load SketchUp Toolbar
   f. View > Display Modes – Import 'SketchUp' display mode
   g. View > Display Modes > Shaded > Shading Settings – Backface Settings – "Single Color for all Backfaces", Set Single Back Face Color to something unique (Magenta
   h. View > Display Modes > Shaded > Visibility – uncheck 'Show Isocurves'

III. **Gumball** – RGB (XYZ) Axis to transform an object. Click-hold and drag to move organically, click-release to enter numeric value.

A. **Hot Keys** combos
- 1Shift+Ctrl Select – Picks a sub-object (i.e. sub-surface, sub-edge, sub-vertex)

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- Alt Select – Makes a copy

B. **Operations**
- White Circle – Gumball Properties
- Arrow Heads – Move about an axis (World XYZ)
- Arcs – Rotate an object about an axis (i.e. Blue arc rotates about the Z-axis)
- Squares – Scale an object along an axis. Hold Shift to scale 3D uniformly
- Planes – Move about a plane (two axis simultaneously). Color combo indicates which plane you'll move the object about (i.e. RB is XZ plane)
- Dot on Axis line or hold CTRL with Srf/Crv arrow move (when sub-object is selected) – Extrude Srf/Crv from Face/Edge

IV. **View/Display**

A. **Pan** – Move across the model space (left mouse button + shift in perspective viewport, right mouse button in top/front/right viewport)
B. **Zoom Extents** (Zoom) – Zooms out to all objects in model. Zoom in/out (mouse wheel)
C. Zoom Selected (Zoom) – Zooms into a pre-selected object, also use to recalibrate your zoom in/out
D. **Rotate View** – Orbit around the model space (right mouse button in perspective view port)
E. **Perspective/Top/Front/Right View** – Changes the view in of the model, also changes default CPlane (i.e. Top = XY CPlane, Front = XZ CPlane, Right = YZ CPlane)
F. **2 Pt Perspective** – Changes view to use 2pt perspective view
G. **Wireframe/Shaded/Rendered/Ghosted Viewport** – Switch between various ways to represent the model within the viewport. Shaded is most often used
H. **Lock/Unlock/Unlock Selected** – Objects are visible but not editable (you can also turn on/off editability of an entire layer in the 'layers' tab)
I. **Hide/Show** – Turn visibility on/off on a by-object basis (you can also turn on/off visibility of an entire layer in the 'layers' tab)

V. **CPlane** – Construction Plane is the plane all geometry is drawn on unless an object snap override

A. **CPlane Top/Front/Right** (CPlane) – Changes the CPlane to XY, XZ, or YZ
B. **CPlane 3pt** (CPlane) – Creates a CPlane using 3 points. First point is origin, first to second point is xaxis direction, first to third point is y-axis direction.
C. **CPlane Object** (CPlane) – Sets a CPlane in the centroid of selected object. Uses object's UV to set up orientation
D. **CPlane Surface** (CPlane) – Creates a CPlane on an objects surface. Select surface, select origin, set xaxis direction, set y-axis direction.
E. **MPlane** – Mobile Construction Plane you can lock to an object. As you move the object, the plane is tethered to it.
F. **SaveCPlane** (NamedCPlane) – Allows you to save a CPlane and reference it later (Toggle Named CPlane Panel)

VI. **Primitive** – These are the basic building tools within Rhino that will allow you to build and edit any type of geometry.

A. **Single Point** (Point)- creates a point in the WCS
B. **Polyline** (Polyline)– Polyline creates a series of joined line segments which can be open or closed. Line will create a single line segment. By typing a distance between clicks

you can dictate the length of a particular segment. L-Click for polyline, R-click for single line segment.

C. **Control Point Curve** (Curve) – Draws a curve from a series of control points
D. **Curve: Interpolate Points** (InterpCrv) – Draws a curve using a series of through-points
E. **Rectangle: Corner to Corner** (Rectangle) – Draws a rectangle using two corner points. Default is absolute coordinate points. "@" utilizes relative coordinate points (i.e. @10,15 makes a rectangle that is 10units by 15units).
F. **Polygon: Center, Radius** (Polygon) - Draws a closed polyline with a specified number of sides.
G. **Surface from 3,4 Corner Points** (SrfPt) - Draws a surface from specified corner points.
H. **Plane: Corner to Corner** (Plane) - Draws a rectangular planar NURBS surface.
I. **Box: Corner to Corner, Height** (Box) – Draws a solid box
J. **Cylinder** – Draws and extruded cylinder
K. **Divide Curve by Length** - Creates point objects along a curve or splits a curve by equal length or number of segments. L-click to divide by a length or R-click to divide into equal number of segments.
L. **Duplicate Border** (DupBorder) – Creates curves from the boundaries of the selected objects.
M. **Duplicate Edge** (DupEdge) – Creates curves from the selected surface(L-click) or mesh edges(RClick).
N. **Surface from Planar Curves** (PlanarSrf) – Creates a planar surface from a set of planar curves that define the surface edges.
O. **Extrude Straight** (Extrude Curve) - Creates a surface by tracing the path of a curves in a straight line
P. **Extrude Along Curve** (ExtrudeCrvAlongCrv) – creates a surface by tracing the path of a curve along another path curve.
Q. **Cap Planar Holes** (Cap) – Fills planar hols in objects with planar faces
R. **Extract Surface** (ExtractSrf) – separates or duplicates a polysurface or extrusion faces.
S. **Make 2-D Drawing** (Make 2D) – Draws objet edges and outlines in one or four views as flat curves on the World Top Plane
T. **Tween Curves** – creates curves between two open or closed input curves
U. **Contour** – Creates a spaced series of planar curves and points resulting from the intersection of defined cutting plans through objects.
V. **Extract IsoCurves** – Creates curves that duplicate surface isoparametric curves at locations on the surface.

VII. Edit – Modifying existing Rhino geometry

A. **Split** – Divides objects into parts using other objects as cutters. R-click splits a surface by its isocurve
B. **Trim** – Cuts and deletes selected portion of an object at the intersection with another object. R-click untrims an object
C. **Join** – Connects objects to form a single object. Lines joined to polylines, curves joined to polycurves, surfaces joined to polysurfaces or solids.
D. **Explode** – breaks an object down into its components
E. **Move Face** – Moves a polysurface face. Adjoining surfaces are adjusted to accommodate new face location. R-click moves unjtrimmed face
F. **Move Edge** - Moves a polysurface edge. Adjoining edges/surfaces are adjusted to accommodate new edge location. R-click moves unjtrimmed edge

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G. **Merge Two Coplanar Faces** (Merge Face) – Combines two selected co-planar surfaces into a polysurface into one surface. R-click combines all co-planar faces of an object into single surfaces.
H. **Solid Point On** (SolidPtOn) – Turns on grips at the ends of surface and joined polysurface edges, included closed solids
I. **Split Planar Face** (Split Face) – Divides a planar face of a polysurface with a line or an existing curve
J. **Move** – Moves an object by dragging or typing transformation distance an direction
K. **Copy** – Makes duplicates of the selected objects.
L. **Rotate 2D** (Rotate) – Rotates an objecta bou tan axis perpendicular to the current CPlane. R-click to Rotate 3D which rotates an object about a specified axis.
M. **Scale 1D** – Changes the size of the selected objects in one direction
N. **Scale 2D** – Changes the size of selected objects uniformly in the x-, y-, and z-directions.
O. **Scale 3D** (Scale) – Changes the size of selected objects uniformly in the x-, y-, and z-directions
P. **Mirror** – Creates a mirror-image copy of objects on the current CPlane. R-click to mirror about an object on a new 3-point plane.
Q. **Boolean Union** – Trims the shared areas of selected polysurfaces or surfaces and creates a single polysurface from the unshared areas.
R. **Boolean Difference** – Trims the shared areas of selected polysurfaces or surfaces with another set of polysurfaces or surfaces. First object(s) selected is object(s) to keep, second selected object(s) is the cutting object(s).

VIII. NURBS – Non-Uniform Rational B-Splines – very accurate mathematical representation of complex geometry such as curves/surfaces using b-spline

A. **Loft** - fits a surface through selected profile curves that define the surface shape. Select curves in sequential order. Additional options such as loft type are available.
B. **Surface from 2/3/4 Edge Curves** (EdgeSrf) - The EdgeSrf command fits a surface from two, three, or four selected curves.
C. **Surface from Network of Curves** (Network Srf) – Creates a surface from a network of crossing curves. All curves in one direction must cross all curves in the other direction and cannot cross
D. **Sweep 1-rai**l (Sweep1) – fits a surface through a series of profile curves that define the surface cross-sections and one curve that defines a surface edge (profile curves must all be open, or all be closed)
E. **Sweep 2-rail** (Sweep2) - fits a surface through a series of profile curves that define the surface shape and two curves that defines a surface edge (profile curves must all be open, or all be closed)
F. **Flow Along Curve** (Flow) – re-aligns an object(s) from a base curve to a target curve
G. **Flow Along Surface** (FlowAlongSurface) – morphs objects from a source surface to a target surface

IX. Rendering (Rhino Render)

A. **Loading Materials**
1. In 'Materials' toolbar click "+"
2. Choose 'import from material library' (C:\Users\"yourname"\AppData\Roaming\McNeel\Rhinoceros\6.0\Localization\en-US\Render Content)
3. Navigate through the library and choose a material to add

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4. The material should now appear in the 'Materials' toolbar
5. Right Click to Edit/Delete/Etc.

B. **Creating a New Material**

1. In 'Materials' tool bar click "+"
2. Choose 'Custom'
3. Assign the following
    a. Change the 'Name'
    b. Under 'Type' set it to 'Custom'
    c. Under 'Texture', for 'Color' select "Click to Assign Texture" and navigate to image file to apply. Assign 'Bump' texture if necessary, in the same way

C. **Applying a Material** (4 ways)

1. From the 'Material' toolbar, click and drag the material onto the Rhino object to 'assign' it. This will override any material setting in the 'layer' toolbar
2. With the objects pre-selected, right-click on the material from the 'Material' toolbar and choose 'assign to objects'. This will override any material setting in the 'layer' toolbar
3. With the object pre-selected, go to 'Properties' and select the 'material' panel. At the top assign an existing material (or reset to 'default') using the material drop-down.
4. From the 'Layer' toolbar, set the "material" to apply that material to all objects on the layer.

D. **Scaling/Rotating a Material**

1. Be sure the Material Mapping is set to 'Mapping Channel'
    a. In the 'Materials' toolbar, select the material
    b. Under 'Textures' and 'Color' click on the image file name
    c. Under 'Mapping' ensure 'mapping channel' is selected
    d. Exit out by clicking on the material name at the top of the Material toolbar
2. With the object selected, go to the 'Properties' tab and select 'texture mapping'
3. Select 'apply box mapping' at the top of the toolbar (B&W Cube icon)
4. Make the following settings in the command line…
    a. For 'First corner of base' select 'boundingbox'
    b. For 'Coordinate System' select 'world'
    c. For 'Capped' select 'yes'
5. With the object selected, go to the 'Properties' tab and select 'show mapping'. A dotted bounding box with gumball should appear around your object. You can now move/rotate/scale/etc your material about the object. When you are done, hit 'esc' on the keyboard

E. **Matching Materials Properties**

1. Select the object you want to apply the matching material on
2. In the 'Properties' tab, select 'Texture Mapping'
3. At the top of the Texture Mapping options choose 'Match Mapping' (paint brush icon)
4. Select the source object you want to match mapping properties, your target object should have updated its material properties

F. **Render in Rhino Render**