Rhino 7 Essential Training

LinkedIn Learning

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I. Introduction
    A. Rhino Essentials
        1. Commands, interface, transforming geometry, construction strategies, surfacing
II. The Rhino Interface
    A. Launching Commands
        1. 5 ways to launch a command
            a) Menu dropdowns
            b) Icons in toolbar/panels
            c) Command line
            d) Pop-up (with middle button on mouse)
            e) Keyboard shortcuts
        2. 4 ways to repeat a command
            a) Right click on mouse
            b) Spacebar
            c) Enter key
            d) Right click on mouse in command line
                (1) Last 10+ commands
        3. Selecting multiple copies
            a) Edit dropdown —> Select Objects dropdown —> Duplicate Objects tool
        4. Troubleshooting problems
            a) Undo
            b) Re-start same command
            c) Go a little slower
            d) Read the command line
    B. Customizing the UI for Commands
        1. Modifying Toolbar
            a) Right click in blank area on Toolbar —> Show Toolbar dropdown
            b) Select Curve Drawing
            c) Select Lines
            d) Drag Curve Drawings in front of Curve Tools on Toolbar
            e) Drag Lines in front of Curve Tools on Toolbar
        2. Customizing Panels

        a) Right click in blank area on Panel —> Calculator tool
    3. Customizing Pop-up Toolbar
        a) Click middle mouse button (wheel) in blank area on viewport
        b) Click and drag momentarily, will convert to tabular window
        c) Ctrl + Click on any other tool icon, drag onto Pop-up toolbar window
    4. Keyboard Shortcuts
        a) Tools dropdown —> Options —> Keyboard
        b) Adding Zoom Selected shortcut
            (1) Find Ctrl+W (Zoom) —> Copy
            (2) Find Ctrl+1 —> Paste
            (3) Add "_Selected"
            (4) Will read: "_Zoom _Selected"
    5. Deciding what to customize
        a) Save pop-up/shortcuts for experience later
        b) Screen size
        c) Personal preference
C. Getting Feedback
    1. Expand the command line
    2. Eyeball method
        a) Imprecise
    3. Precision Method
        a) Using Osnaps and typing into command line
        b) If you can click somewhere randomly (when in a command), you can instead type a number
    4. Cursor ToolTips
        a) Standard tab —> Options tool —> Modeling Aids dropdown —> Cursor ToolTips
        b) Select Distance
D. Using the Properties Panel
    1. If 'Properties' is gone, right click on any blank space in panel —> Select Properties
    2. Information also available
        a) Edit dropdown —> Object Properties tool
        b) F3
        c) Standard tab —> Object Properties tool
    3. Some information also available on Status Line
    4. Isocurves reveal topography
        a) Properties panel —> Isocurve Density —> Density (standard 1)
        b) Turn on/off by selecting 'Show surface isocurve'
    5. Colors

a) Select object(s) —> Properties panel —> Match tool —> Select source object (of desired color) —> Will bring up Match Properties window —> Deselect everything but 'Color'
    (1) Match Properties selections will become default
b) When Display Color is different from Layer color
    (1) Select geometry —> Properties panel —> Display Color —> 'By Layer'

E. The Versatile Gumball
1. Moves, rotates, scales, and more
2. Turn on Gumball
    a) Status Line —> Select Gumball tool
    b) Select object, gumball will appear
    c) Works best when selecting single objects
3. Arrows: move along cardinal directions
    a) Click once on arrowhead to type in move distance
    b) Alt+Arrow: creates copy at distance
4. Squares: move along axis
5. Dot: extrude
6. Quarter circles: rotate
    a) Click once on quarter circle to type in rotation angle
7. Gumball settings
    a) Status Line —> Right click on Gumball tool —> Settings —> Will open Rhino Options window
    b) Menu Ball Size: 6
        (1) Reveals orange ball
    c) Right click orange ball —> Relocate Gumball —> Select new origin & set axes
8. Square boxes: scale
    a) Shift + Box: scales in all dimensions
9. Can also use tools in Transform tab for ultra precision

F. File Features and Strategies
1. Importing
    a) File dropdown —> New —> Opens file template window
    b) File dropdown —> Import —> Select file —> Open
        (1) Matches origin
2. Inserting
    a) File dropdown —> Insert —> Opens Insert window —> 'Open' icon —> Select file —> Opens Insert File Options window
        (1) Block Definition Type —> Select Embedded —> OK
        (2) Insert As —> Individual Objects
            (a) Insertion Point: Select 'Prompt'
            (b) Scale: Select 'Uniform'

(c) Rotation: Select 'Prompt'

(3) Wireframe preview in viewport

(a) Select Insertion Point

(b) Select Rotation

3. Exporting
    a) File dropdown —> Export Selected tool —> Select desired geometry —> Right click —> Opens Export window
4. Saving
    a) File dropdown —> Save tool
        (1) Ctrl+S
    b) Save Small: good for file sharing
    c) Save As every so often with new name (for backups)
    d) Incremental Save (every 30 minutes or so) for backups

III. Workflow Basics

A. Setting and Fixing Rhino Preferences

1. Tools dropdown —> Options tool —> Modeling Aids —> Nudge tool
    a) Nudge Keys —> Select 'Arrow Keys'
    b) Nudge Steps:
        (1) Nudge Key Alone: 1.0 unit
        (2) Ctrl + Nudge key: 0.1 unit
        (3) Shift + Nudge key: 10.0 units
2. Tools dropdown —> Options tool
    a) Document Properties
        (1) Edits file options
    b) Rhino Options
        (1) Sets default for Rhino options
        (2) View —> Viewport Properties —> Default 35mm Camera Lens Length —> Set to 30mm
        (3) Appearance —> Colors —> Viewport Colors
            (a) Background: white
            (b) Major/minor grid lines: darker
3. Layer panel —> Set layer colors black
    a) Customize layers that you need to pop

B. Selecting Objects

1. Clicking objects
    a) Shift + Click: adds to select chain
    b) Ctrl + Click: deselects
2. Dragging
    a) Left-to-right: selects only what is inside box
    b) Crossing box (right-to-left): selects anything that intersects box
3. Why so many clicks?
    a) Complex functions

    b) Rhino unsure if selection is complete
    c) Right click/Spacebar/Enter key to exit command
4. Selecting By Entity Type
    a) Edit dropdown —> Select Objects dropdown —> Select entity type
    b) Select tab —> each icon is a certain entity selection
    c) Can isolate layers by locking, will not be selected
    d) Able to select entity types sequentially

C. Organizing a Project Using Layers
1. Never work on Default layer
2. Ensure layers panel is docked
    a) Current layer, On/Off, Locking, Color
    b) Material
    c) Linetype, Print Color, Print Width
3. Locked layers can still be used for snapping
4. Layers panel —> New Layer tool icon
    a) Inserts as High Layer
    b) Can click and drag to another High Layer to convert to Sublayer
    c) Use Arrow icons on Layer panel to reorder
        (1) Do not click and drag, will create new layer
5. Identifying geometry in layers
    a) Layers panel —> Right click on desired layer —> Select All Objects tool
    b) Changing layer assignments:
        (1) Select geometry —> Layers panel —> Right click on desired layer —> Change Object Layer tool
6. Deleting layers
    a) If geometry is on a layer, Rhino will warn about deleting
7. Duplicating Layers
    a) Layers panel —> Right click on desired layer —> Duplicate Layer and Objects tool —> Will open 'Duplicate Layer' window
        (1) Duplicating sublayers
        (2) Rename

D. Basic Transformations: Moving
1. Method depends on desired accuracy
2. Select and drag: inaccurate
3. Main toolbar —> Move tool
    a) Ensure Osnap is on
    b) Select object —> Right click to accept —> Click on edge, will snap to center
        (1) Move to desired location
        (2) Or, type in specific distance, will be able to move along radius

(a) Hold Shift for cardinal positions

(3) Relative distance

(a) Type 'R# (X differential), # (Y differential)'

(i) I.e. R50, 60

4. Nudge keys (see above)

E. Basic Transformations: Rotating

1. Generally in 2D viewport
2. Select object —> Main toolbar —> Rotate 2-D tool (left click) —> Define rotation origin —> Select starting point (click)
    a) Select ending point (click)
    b) Can type exact angle
3. 3D Rotation
    a) Select object —> Main toolbar —> Rotate 3-D tool (right click) —> Define axis (clicks) —> Select starting point (click)
        (1) Select ending point (click)
        (2) Can type exact angle
4. Fixing unknown angles
    a) Select object —> Main toolbar —> Rotate 2-D tool (left click) —> Define rotation origin —> Select starting point (click)
        (1) Hold Shift for cardinal positions —> Select ending point (click)

F. Basic Transformations: Scaling

1. Main toolbar —> Click and hold Scale tool to access fly out —> Click on heading bar, drag to dock
2. 1D scaling
    a) Scale 1D tool —> Select object —> Set base point (click) —> Set scale reference point (click)
        (1) Click new position (inaccurate)
        (2) Type in new measurement
    b) Can scale 3D objects along axis
3. 2D scaling
    a) Scale 2D tool —> Select object —> Set base point (usually center) —> Type in Scale Factor
4. 3D scaling
    a) Scale 3D tool —> Select object —> Select base point (usually center) —> Type in Scale Factor

IV. Drawing with 2D Geometry

A. Lines and Polylines

1. Line segments have not been joined
2. Polyline has two or more segments; have been joined
3. Single Open Curves
    a) Curve dropdown —> Line dropdown —> Single line tool

b) Line tab —> Single line tool
c) Drawing line segments
(1) Main toolbar —> Right click Polyline tool (Line Segments)

4. Joining Open Curves
a) Can join line segments that share endpoints
(1) Select line segments —> Main toolbar —> Join tool
(2) Ctrl+J
b) Troubleshooting open curves
(1) Select geometry —> Main toolbar —> Show Object Control Points tool —> Click and drag endpoint
(2) Ensure Endpoint Osnap is engaged

5. Unjoining Closed Curves
a) Can unjoin closed curves into open curves/line segments
(1) Select geometry —> Main toolbar —> Explode tool

6. Curve techniques
a) Curve dropdown —> Line dropdown —> Perpendicular from Curve tool
b) Curve dropdown —> Line dropdown —> Tangent to 2 Curves tool

B. Creating 2D Shapes
1. Build 2D shapes first, then make surfaces or solids later
2. Rectangles
a) Can type in dimensions
(1) First entry: X dimension
(2) Second entry: Y dimension
b) Main toolbar —> Rectangle tool —> Command line —> Center
(1) Chamfered: Command line —> Corner=Arc

3. Polygons
a) Main toolbar —> Polygon tool
b) Change number of sides: Command line —> NumSides: —> type in desired number of sides
c) Default inscribed polygon
(1) Circumscribed: Command line —> Mode=Inscribed toggle
d) Orienting around 3D curves
(1) Command line —> AroundCurve toggle —> Select curve —> Define center of polygon on curve —> Select distance
(2) Will be perpendicular to curve

4. Leverage work (build bigger, then trim)

C. Creating Arcs, Circles, and Ellipses
1. Arcs
a) Main toolbar —> Arc: Center, Start, Angle tool —> Select center —>
(1) Select starting point —> Select end point

(2) Type radius distance —> select starting point —> Type in angle

b) Curve dropdown —> Arc dropdown —> Tangent to Curves tool —> Select point on first curve —> Select point on second curve (—> select point on third curve)

2. Circles
    a) Curve dropdown —> Circle dropdown —> Fit Points tool —> Select points
    b) Main toolbar —> Circle tool —> Command line —> Around Curve toggle —> Select curve —> Select point on curve as center of circle —> Select radius
        (1) Will be perpendicular to curve
    c) Curve dropdown —> Circle dropdown —> Tangent to Curves tool —> Select point on first curve —> Select point on second curve (—> select point on third curve)
3. Ellipses
    a) Curve dropdown —> Ellipse dropdown —> From Center tool —> Select center —> Select first radius —> Select second radius
    b) Main toolbar —> Ellipse tool fly out —> Ellipse Diameter tool —> Select first point —> Select endpoint —> Select radius
    c) No pinch/seam ellipse
        (1) Curve dropdown —> Ellipse dropdown —> From Center tool —> Command line —> Deformable toggle —> Select center —> Select first radius —> Select second radius
            (a) Select ellipse —> Main toolbar —> Show Object Control Points tool

D. Free-Form Curves: The Key to Organic Modeling
1. Use Control Point curves for best result
2. Types of freeform curves
    a) Sketch
    b) Handle curve
    c) Interpolate points
    d) Control points
3. Keys to drawing
    a) Simpler is better
        (1) Use fewer control points
    b) Need more detail? Use closer spacing of points
    c) Avoid curve-loops and point-stacking
    d) Spend more time editing than drawing
4. Editing tips (after turning on Control Points)
    a) Click and drag or use Nudge to move points
    b) Open Point Edit toolbar for more options

(1) Add more points with Insert a Control Point tool
(2) Delete points with the Delete key

5. Handle Curve
    a) Curve dropdown —> Free Form dropdown —> Handle Curve tool
6. Interpolate Points
    a) Curve dropdown —> Free Form dropdown —> Interpolate Points tool
7. Sketch
    a) Curve dropdown —> Free Form dropdown —> Sketch
8. Control Points
    a) Curve dropdown —> Free Form dropdown —> Control Points tool
    b) Main toolbar —> Control Points tool
    c) Ensure End OSnap is engaged
    d) Select curve —> Main toolbar —> Show Object Control Points tool
        (1) Dockable Point Edit window

E. Curve Tips
1. Offset
    a) Select geometry —> Curve Tools tab —> Offset Curve tool
        (1) Can type distance
    b) Offset both sides of a single open curve
        (1) Select geometry —> Curve Tools tab —> Offset Curve tool —> Command line —> BothSides toggle
    c) Offset both sides and cap
        (1) Select geometry —> Curve Tools tab —> Offset Curve tool —> Command line —> Cap=None toggle —> Command line —> Round toggle —> Command line —> BothSides toggle
2. OSnap with One-Shot
    a) Main toolbar —> Polyline tool —> Status Line —> Hold Shift + Ctrl keys —> 'Between' toggle —> Select point on first geometry —> Select point on second geometry —> Will set first point —> Set second point
3. Curve Boolean
    a) Curve Tools tab —> Curve Boolean tool —> Command line —> DeleteInput=None toggle —> Command line —> All toggle —> Select desired curves —> Right click to finish —> Select regions to keep —> Right click to complete
    b) Curve Tools tab —> Curve Boolean tool —> Command line —> DeleteInput=None toggle —> Command line —> All toggle —> Select desired curves —> Right click to finish —> Click inside/outside perimeter —> Right click to complete

V. Modeling with Basic Surfaces
A. Construction Strategies

1. Start with a sketch
    a) Two is better if they intersect (i.e. plan and elevation)
2. Look for symmetry
    a) Build a section and mirror it
3. Make it bigger, then trim it back
    a) Two simple parts > one complex part
4. Intersection technique
    a) “Split, split, throw away garbage”
    b) Define an enclosed area
5. Small(er) details done later
    a) Hole punching
6. Smallest details done last
    a) Fillets and chamfers

B. Extruding Curves and Modeling Strategies
1. Select curve —> Surface dropdown —> Extrude Curve dropdown —> Straight tool —> Set height (type, eyeball, snap)
2. Surface dropdown —> Planar Curves tool —> Select first curve —> Select second curve —> Right click to accept
    a) Creates simple surface from one or more curves on same plane
    b) Can also use edges of geometry instead of curves
3. Join together surfaces to create polysurface
4. Solid dropdown —> Fillet Edge dropdown —> Fillet Edge tool —> Command line —> NextRadius toggle —> Type radius —>
    a) Select edges to fillet —> Right click to preview —> Right click to accept
    b) ChainEdges toggle —> Select first edge —> Should highlight all chained edges —> Right click to preview —> Right click to accept

C. Lofting Surfaces
1. Requires three or more curves to loft
2. All curves should either be open or closed, but never both
3. Loft captures most complicated curve (control points)
    a) I.e., match amount of control points in original curves before lofting
4. Select curves —> Surface dropdown —> Loft tool —> Will open Loft Options window —> OK
5. Closed curve lofting
    a) Seam issues
    b) Select curves —> Surface dropdown —> Loft tool —> Will open Loft Options window —> OK
        (1) Click and drag seam points to align
            (a) Use Knot and Vertex Osnaps
        (2) Command line —> Automatic
            (a) Will align arrows

(3) Right click to apply —> Will open Loft Options window
(a) Can adjust Style

D. Using Revolve and Rail Revolve
1. Use an axis line
a) Avoid pinches and holes
b) Hit axis line at 90°
(1) Last two control points at 90°
2. Add details to curve geometry before revolving
3. Select curve —> Surface dropdown —> Revolve tool
a) Ensure End Osnap engaged
b) Select first endpoint of axis —> Select second endpoint of axis —> Command line —> FullCircle toggle
4. Rail Revolve
a) Uses a linear axis but a non-circular ("follow") path
b) Surface dropdown —> Rail Revolve tool —> Select profile curve (geometry) —> Select rail curve —> Select first endpoint of axis —> Select second endpoint of axis

E. Sweeping Rails
1. Ensure consistent number of control points between both cross-section curves
2. Sweep 1 Rail
a) Surface dropdown —> Sweep 1 Rail tool —> Select rail curve —> Select first cross-section curve —> (Select second cross-section curve —>) Right click to finish —> Will open Sweep 1 Rail Options window —> OK
(1) Stay consistent with position of click between both cross-section curves
3. Sweep 2 Rails
a) Surface dropdown —> Sweep 2 Rails tool —> Select first rail curve —> Select second rail curve —> Select first cross-section curve —> [Select second cross-section curve —> (Select third cross-section curve —>)] Right click to finish —> Will open Sweep 2 Rail Options window —> OK

F. Surface From Curve Network
1. Original curves are just a small set of isocurves of final geometry
2. All curves should either be open or closed, but never both
3. Surface dropdown —> Curve Network tool —> Select desired curves —> Right click to apply —> Will open Surface From Curve Network window —> OK
4. Use in conjunction with trim, extrude, etc.

VI. Conclusion
A. Next Steps

1. More trainings available
2. Dieter Rams courses
    a) Principles of Good Design
3. Sketching for Product Design and AEC
4. Look for “Essential Training” in other courses