

Box Modeling (using edit mesh and mesh smooth modifiers)

Overview

Polygons

The planar surfaces that define most 3d objects are also called facets (as in diamond cuts) or polygons. Simple geometric shapes can be defined by multiple polygons (usually triangle or rectangle shapes). **More detail = more polygons.** All models are eventually converted to polygons when rendered. Polygons are built using the 3 basic elements – **vertex, edge, face.**

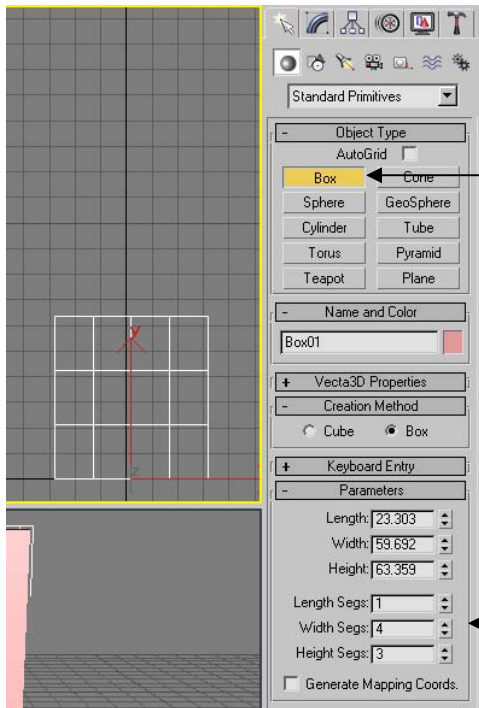
× **Vertex:** single point in space. Usually described as an 'x'

／ **Edge:** a line connecting two vertices. 2d objects.

△ **Face:** 3 vertices connected together to create a plane in 3d space.

□ **Polygon:** surface defined by 4 edges/vertices. defined in 3dimensional space.

Segment: portion of a spline between 2 vertices. In order to create a more detailed model you will want to start with the appropriate amount of segments in your primitive shape for future manipulations.

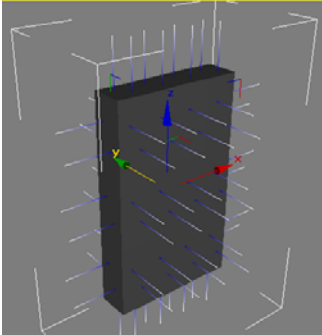


Create a primitive and add additional initial detail by changing # of segments

For a hand with 5 fingers and an opposable thumb these are the basic segment parameters

(lenath: 1; width: 4; height: 3)

Normals: all polygons have normals. They are created automatically when the object is first initiated. Normals designate which side of the face points out. The outside of the face is rendered while the inside is not (with exception of objects with 2-sided materials).



selected face with normals showing

How to Directly Manipulate Vertices

1. add a edit mesh modifier to your segmented box
2. edit your box using extrudes, bevels, chamfers, etc. or just pull points
3. add a mesh smooth modifier above your edit mesh modifier

Edit Mesh Modifier: modifier to allow editing of vertices, edges, faces, polygons

Sub-object selection types

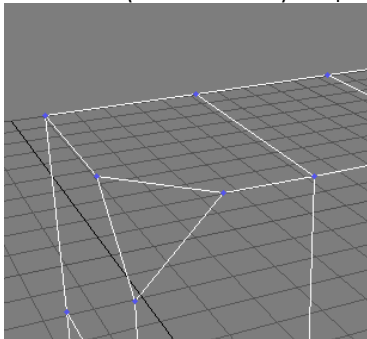
Vertex
Edge
Face
Polygon
Element

Edit Mesh Modifier Parameters

dependant on sub-object selected

Extrude (poly level): pulls out face or polygon based on front facing normal;
adding more segments

Chamfer (vertex level): expands vertex to polygon along edges



Bevel: extrude with inset

Collapse: collapses selection down to vertex

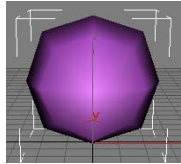
Refine (vertex): add more vertices

Ignore Backfacing: when creating a fenced selection does not include faces with normals facing away from view

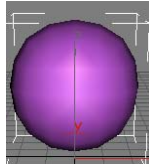
Mesh Smooth Modifier: modifier applied to low-resolution poly to further subdivide polygonal surface with the added benefit of letting you apply weight to certain vertices and edges as well as a crease on edges.



0 itineration



1 itineration



2 itineration

Mesh Smooth Modifier Parameters

NURMs (*Non-Uniform Rational MeshSmooth*): subdivision method most accurate and appropriate for meshes. This choice allows you to affect the selective weight of vertices and edges.

Subdivision: the higher the number the higher the detail the more likely your computer will crash! (*choose 1- or 2 at the most!!!!*)

Weight (mesh smooth): pulls the vertices/ edges closer to the control net

Crease (mesh smooth): creates a crease on the edge (*or series of vertices*) selected

Efficient animation using low-res model

Animate a low-polygon model then apply a mesh smooth to it before rendering the high polygon version.

Deformation through indirect Manipulation

Free Form Deformations modifier: creates a control mesh around your object; moving the control mesh deforms the polygon underneath (*good for animation!*)

Box Model your Hand

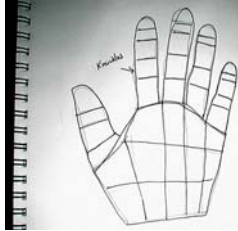
1) Sketch First!

Sketch out a hand (*I traced my own hand*)...

Divide the drawing into the different cross-sections (Segments) as figured below.

You will use this source sketch to develop your polygonal model using a fixed amount of segments to create basic detail and/or movement (*for animation*).

If you initially design on paper you will not have to go back or add any more modifiers to 'fix' your mistakes.



2) Create a primitive box: The hand is basically a box primitive with extruded boxes for fingers

Create: box

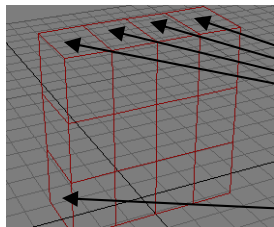
This box represents the palm of the hand (not the fingers or thumb!); you can create it in the front, top or perspective view.

3) Set segment count for box

side of hand - 1

fingers to be extruded (add 8 for extra detail / animation) - 4

thumb and palm curve - 3



Fingers extruded from here on normal

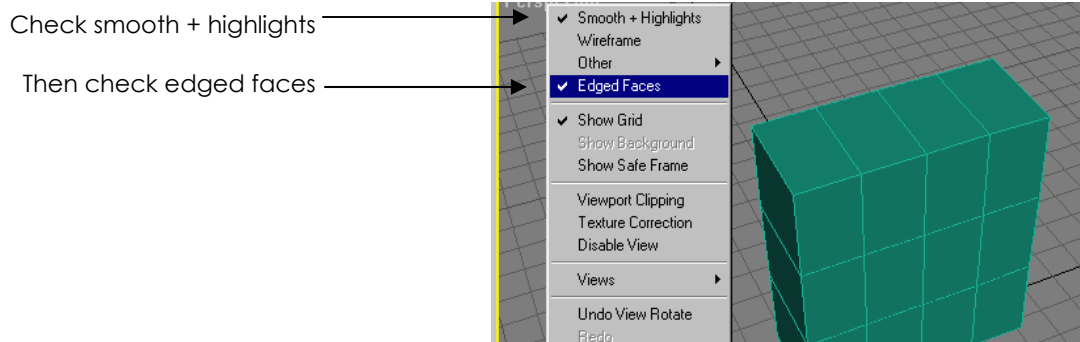
Thumb extruded from here on normal

4) Add an Edit Mesh Modifier to the Box you created

Mesh Editing: Edit Mesh

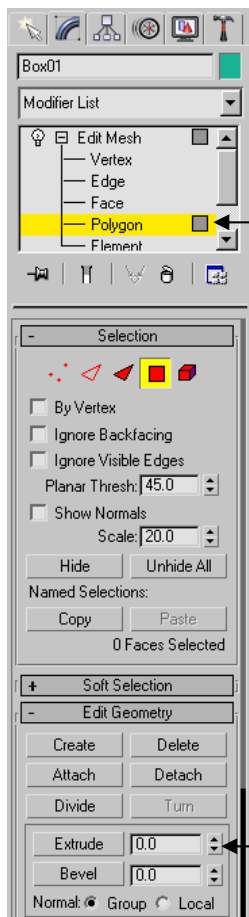
5) Show edged faces

Right-click on View Name in view port top left corner (I right-clicked on perspective) to get menu - check edged faces. When this view is combined with smooth and highlights you can see the lined edges of each polygon. (As shown below)



6) Select polygon sub-selection in edit mesh modifier so it can be extruded

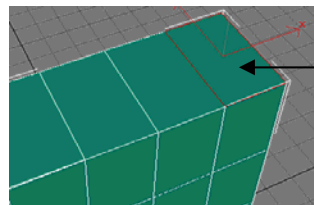
Click on first 'finger' to extrude and toggle the extrude button shown below – either drag from view port to extrude polygon or use arrow spinner next to extrude button.



Select polygon in edit mesh sub-selection

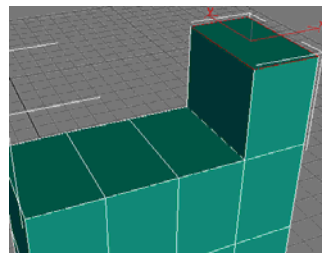
(you can also right-click over the object for this option:
Tools 1: Sub-object: Polygons)

Extrude button

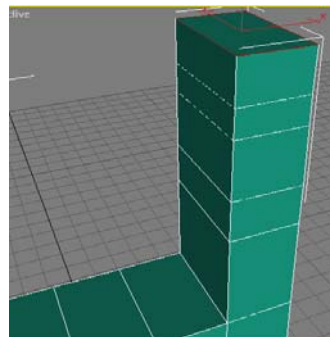


Selected top poly

1. select poly on top (viewed from perspective)



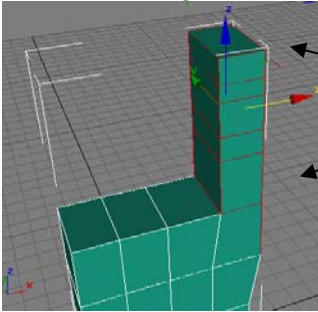
2. extrude poly (each time you release the mouse you create segments)



3. repeat 4 more times to create finger joints

7) Select all vertices and Move away from hand: this way fingers will be easier to select later
Untoggle Extrude

Click and drag around polygons representing finger



Fence these polygons
(make sure ignore
backfacing is unchecked!!)

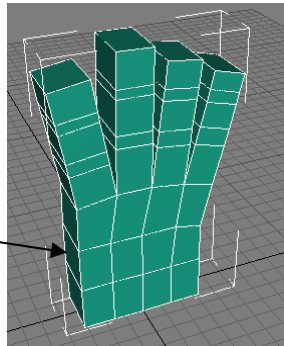
Drag on the constrained axis
Rotate a bit on the axis to point the finger out a bit

8) Extrude other fingers

Repeat move and rotate after extruding each finger to give a bit of space for easy manipulation and selection later.

Untoggle Extrude when you are done.
(should look like illustration below)

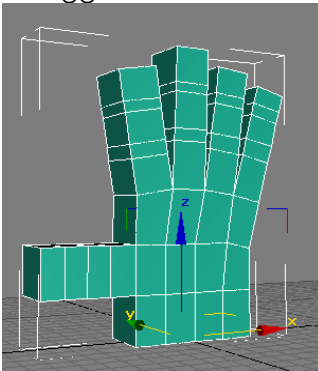
Extrude for thumb



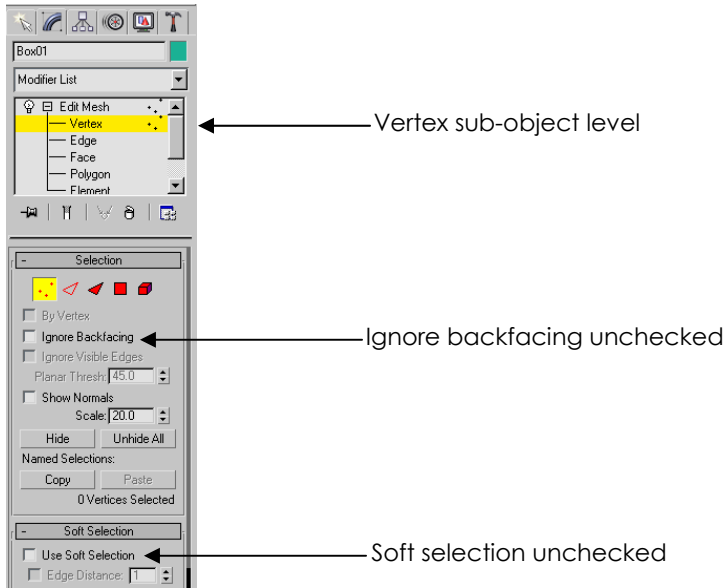
9) Extrude an Opposable thumb

Select the second to last polygon on left side of segmented box (or right hand side depending on your hand) and extrude 4 times out.

Untoggle Extrude



10) Push and Pull Vertices: change to vertex sub-object select mode in edit mesh modifier.
 Change sub-object selection to vertex to model the polygon to look more like a hand. Use your sketch and real hand as a reference. Start in the front view and select points to approximate the contour of the hand then move to the left or right view for thickness of the palm and tapering of fingers. Be sure to constrain your transformations. Rotate last.



11) Select Vertices and transform, scale or rotate as necessary: before you being make sure you have the following options set.

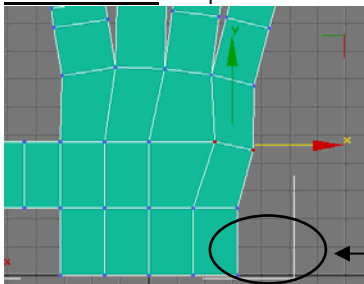
a) Viewports: Front/side views: make sure smooth + highlights + edge faces is checked



Selection fence types

b) Front facing and back facing vertices: remember when you select you select not only the vertices you see and vertices behind those you see...

Move tool: to position multiple points (make sure *ignore backfacing* is unchecked!)



Select vertices and transform to mold basic shape of hand

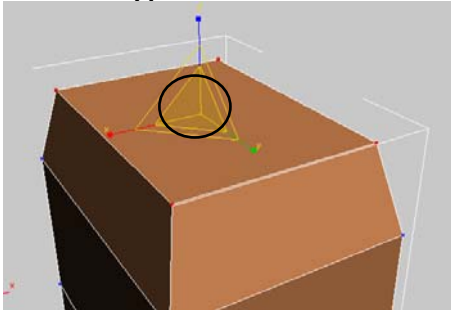
Use move tool (shown above) to select multiple points; constrain on the x-axis

Scale tool: use to taper fingers

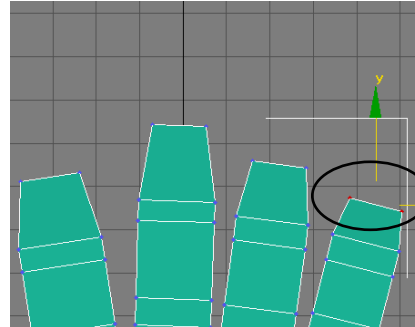


Uniform scale tool (used in most cases)

Scale tool types



UNIFORM SCALE: hover over center area.



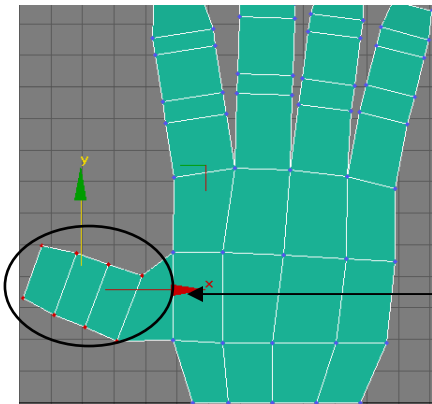
Select top vertices and uniform scale (selection center)

Use uniform scale; select the top 4 vertices and taper fingers from front view; be sure to select uniform scale **then** choose selection center



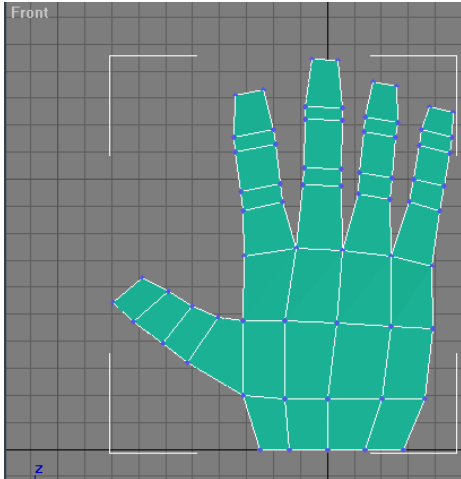
Use selection center

Rotate tool: use to add more degrees of separation between fingers; don't rotate too much! It makes it harder to use a fence selection tool to select vertices.



Select to rotate and move

use the rotate tool to select all the vertices on the thumb and rotate on the hidden z axis; then use the move tool to move up on the y axis



should look like this in front view

Add a slice in geometry if you need more segments

if you want more segments use the slice plane(sub-object selection) or slice modifier; keep in mind the slice plane in the sub-object selection slices to infinity. The slice modifier slices only selected areas.

Below are steps to using the sub-object slice plane.

1. move geometry away from plane area if you do not want sliced
2. toggle slice plane
3. position slice plane in viewport where you want segments
4. click slice plane

12)Add a mesh smooth modifier to see resulting tessellation

Turn off sub-object selection

Add a Mesh Smooth modifier

Subdivision Surfaces: Mesh Smooth

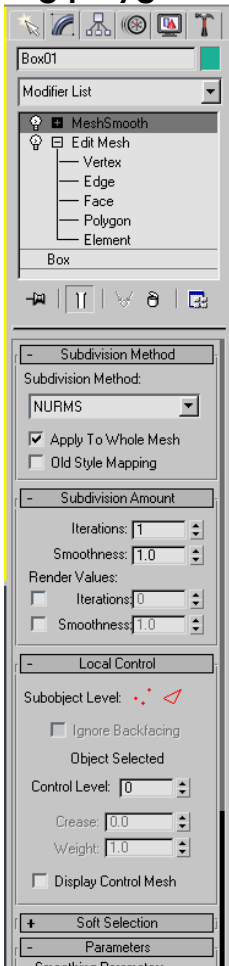
13)Modify the mesh smooth parameters as noted below

Subdivision Method: NURMs

Check: Apply to Whole Mesh

Iterations: 1

14)Editing polygon hand while in mesh smooth modifier (method a)



Make sure parameters are set similarly

You can further edit the shape by selecting vertex sub-object here and checking display mesh below

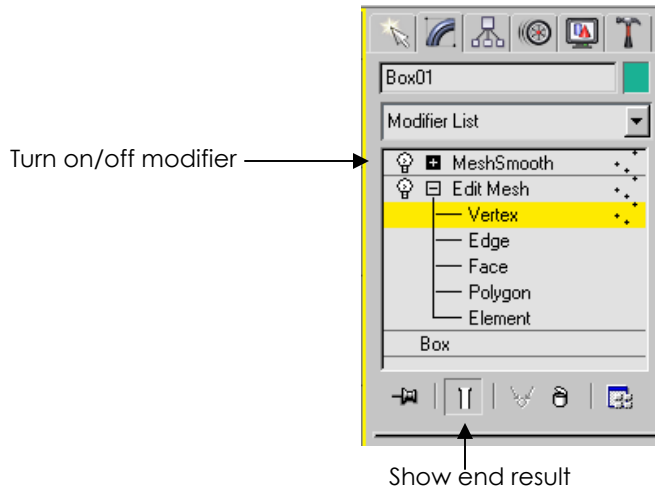
Display mesh checked; control level set to 1 and more points to manipulate

Edit the shape directly from the mesh smooth as shown above

15) Editing polygon hand while in mesh smooth modifier (method b)

Select Vertex sub-object level under edit mesh

Toggle Show end result (the resulting mesh smooth is shown in the view port; when vertices are moved the mesh smooth updates)



Box Modeling Tips

Select front facing vertices only: check 'ignore backfacing' box in edit mesh modifier. Now only vertices facing your view will be selected.

Use perspective view to check work and transform object vertices: Use the perspective view; select axis to constrain to move vertices. Make sure axis is visible. 'X' on the keyboard toggles the axis and it can also be turned off from the menu (Views: Show Transform Gizmo)

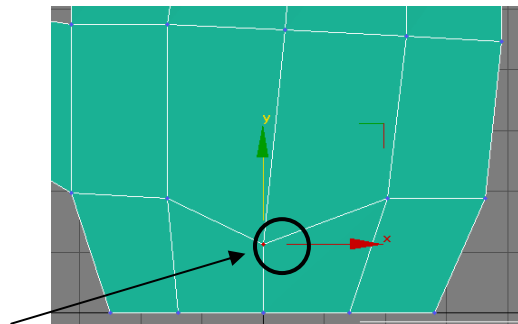
Rotate Around Object's selected center: Set Arc Rotate to 'arc rotate subselection' (highlighted in yellow) to rotate around the selected object's center not the world center.



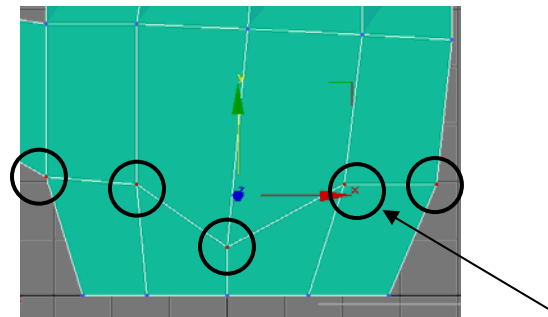
To level multiple points

Select non-uniform scale

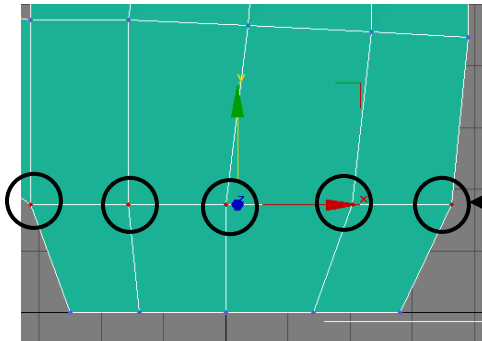
Scale on axis perpendicular to selected set of vertices



1. vertex out of kilter



2. select all vertices to be straightened



All vertices aligned horizontally

3. In this instance non-uniform scale on the y axis to bring them all into line again. The non-uniform scale will no longer move any points

Soft selection (available in mesh smooth and edit mesh): allows you to select vertices and modify in a gradual way the vertices selected as well as in a diminished radius around the main selection. Use to create knuckles.

In Vertex sub-object selection or mesh smooth

Check soft selection

Use the spinner next to falloff and keep an eye on the color of the vertices

Red- direct selection – will receive full effect

Yellow - receives some effect

Blue - no effect

To make fingernails (crease)

Mesh Smooth modifier

Toggle edge selection

Show control mesh

Select edges to create fingernails

Play with weight and crease values to create crease

(might want to turn off edged faces in viewport)

Rotate perspective view to see results of any transformation from all sides and angles

Always constrain axis when translating or rotating vertex