

3ds Max Terminology Cheat Sheet

- **Basics**
 - Vertex: A single point that exists anywhere in the world space
 - Edge: A line that connects two vertices
 - Polygon: A shaded, or colored, shape that fills the space formed when three or more vertices are connected by edges
 - Polygons are typically 3 or 4 sided shapes
 - Objects that exist in the 3d world space are calculated based on the x, y, and z coordinates of each vertex that defines the shape of the object
 - Think of the graphing exercises in high school algebra: y is up and down, x is left and right
 - Add a third axis, z, which forms the third dimension of space
 - Polygon modeling
 - Also known as "box modeling"
 - Objects begin as a primitive shape, most commonly:
 - Box
 - Cylinder
 - Sphere
 - Standard spheres are divided longitudinally like a globe of the earth
 - Horizontal bands intersect vertical bands that meet at each pole
 - Geospheres are created by a series of triangular polygons and more closely resemble a soccer ball than a globe
 - Geospheres typically create fewer polygons than a similarly smooth standard sphere
 - Plane
 - A rectangular, single-sided flat surface
 - Primitive shapes are then turned into editable polygon objects and can be subdivided into a greater number of polygons to achieve a higher resolution model with finer detail
 - The more polygons in the scene, the more work the CPU has to do in order to calculate the position of each additional vertex
 - Lower polygon models are not as smooth and detailed as higher polygon models, but run faster

- X, Y, and Z axes are tilted or rotated to be relative to the angle of the active polygon object or sub-selection
 - Sub-object selections of editable polygon objects can also be manipulated by a variety of tools
 - Extrude
 - Will extend a new shape outward from a selected polygon
 - Will create a triangular extrusion from a selected edge
 - May be manipulated in a positive direction (outward from the object) or negative direction (inward from the object)
 - Bevel
 - Similar to Extrude, but allows the final extruded shape to be tapered wider or narrower
 - Chamfer
 - Divides a selected edge into several parallel edges and creates a radius
 - Commonly used to round off sharp edges
 - Inset
 - Creates a new, smaller, polygon within a selected polygon
 - Bridge
 - Connects two opposing edges or polygons with new polygons, based upon certain situational rules
 - Connect
 - Creates a new perpendicular edge between two or more selected parallel edges
 - Combinations of various methods of manipulating sub-object selections of an editable polygon object allow it to be refined and shaped into complex geometry
 - Example: a simple 6 sided box can be divided by connecting edges; moved, scaled, and rotated by vertex sub-object selection; and formed into the complex organic shape of a human character
- **Mapping**
 - Editable polygon objects are by default shaded in a random solid color without detail
 - Complex 2d bitmap images (such as a picture of wood flooring) can be mapped to the 3d editable polygon object by assigning a U, V, or W coordinate to each pixel of the bitmap that corresponds to an X, Y, or Z vertex position on the editable polygon object
 - The assigned bitmap will then "tile" or repeat, a specified number of times across the surface of the Editable Polygon object
 - Mapping is accomplished with the UVW Map modifier, and assigning a default primitive shape to the map gizmo that best matches the shape of the object
 - Cylindrical
 - Spherical
 - Box
 - Planar

- A more advanced form of bump map that gives crisper and more well defined results, and holds the illusion of greater detail better than the standard bump map
 - Displacement
 - A two dimensional image map that physically displaces the surface of a polygon object into greater detail
 - Similar to bumps and normals, but actually alters the object rather than creating an illusion
 - Unlike a bump or normal, which can be applied to a single polygon, displacements require a more finely divided object in order to work
- Alpha Map
 - Not a slot in the mapping options (such as Diffuse, Bump, or Opacity), but rather a specific type of 2d image used to achieve certain results when used in different slots
 - Alpha maps are grayscale, ranging from pure white to pure black, and all shades of gray in between
 - Alpha maps behave differently when used in different map slots:
 - Opacity
 - Pure white is interpreted as 100% opaque
 - Pure black is interpreted as 100% transparent
 - Shades of gray create varying levels of transparency depending upon how light or dark the gray is
 - Self-Illumination
 - Pure white is 100% self-illuminated
 - Pure black is 0% self-illuminated
 - Shades of gray produce varying levels of self-illumination
 - Bump
 - Pure white creates the illusion of a surface being raised above neighboring surfaces
 - Pure black creates the illusion of a surface being lower than neighboring surfaces
 - Shades of gray can create an illusion of more complex topography by alternating between lighter and darker and, thus, higher and lower areas within one single polygon
 - Displacement
 - Interpreted the same as with a bump map, but actually deforms the object rather than creating a simple illusion
 - Normal Bumps
 - Normal bumps do not utilize black and white alpha maps

- The illusion of a normal map is created by a special purple/pink map that can be painted by hand, but is better derived from a black and white alpha map with a normal map filter applied to it in a program like Photoshop

- **Tips**

- Begin polygon modeling with a 6 sided box whenever possible
 - Lower polygon models are easier to "rough in" and then add subdivisions later, when necessary
 - It is easier to add new subdivisions than to remove subdivisions you do not need
- When modeling for low-poly (such as for a video game), cylindrical and spherical objects can add a tremendous number of polygons relative to a box object
 - It is natural to want to subdivide cylindrical and spherical objects into a smooth surface, which results in significantly higher polygon counts
- Instead of subdividing spherical and cylindrical objects into higher polygon counts, you can use smoothing groups to create an illusion of smooth seams between polygons
 - For example, two polygons intersect each other at a 45 degree angle. 3ds Max interprets the edge between them as a hard, angular line
 - By selecting the two polygons and setting the smoothing group value for that selection to a number greater than 45 degrees, 3ds Max will now interpret that edge as soft and rounded rather than crisp and sharp
- When selecting edges, selecting a single edge and using:
 - Loop
 - Selects all consecutive edges around the circumference of the object
 - For example, selecting one horizontal edge on the equator of a globe and using the loop tool would select the entire equator
 - Ring
 - Selects all edges parallel to the selected edge
- When making complex and time consuming sub-object selections that you may need to select again later, you can save a selection set and name it, so it can be re-selected later with a single button press
- When making large area selections, it is sometimes faster and easier to switch to paint selection mode from the default rectangular marquee selection tool
- Soft Selection can "partially" select a range of vertices so that manipulations performed on them vary at values less than 100%

- **Advanced Mapping and Rendering**

- Switching from the Default Scanline Renderer to a more advanced renderer such as Mental Ray, give you access to a library of "shader" materials

- Two "fill lights" which complement the key light by providing additional "fill" illumination
 - Simulates the various minor sources of light in a scene that contribute to the overall lighting level
 - Fill lights typically are not set to cast shadows
 - Fill lights are typically low-powered omni lights, but spots and directs may also sometimes be used as fills
- Lighting tips
 - The real world is filled with light from hundreds or thousands of sources in any given environment, from bright sunlight to the miniscule light cast by a mobile phone screen, in combination
 - The key and fill lights attempt to simulate these conditions with as few lights as possible
 - Situationally, lights in 3ds Max can be set to shine only on one or more specific objects, and not cast light or shadow on any of the others
 - Lights may also be set to only illuminate the diffuse maps without causing reflections, or to cause reflections without providing illumination, or to fill the entire environment with "ambient" light that uniformly lights every (or non-excluded) object in the scene
 - High powered ambient-only lights will erase all shadows in the scene and make everything appear very flat and washed out. Ambient-only lights are typically very low powered omni lights