

Syllabus

Introduction to Sketch Up!

Instructor: Kevin M, Gentry, AIA NCARB

Time: T-TH 4:00pm - 6:00pm January 20-March 25,2004 Elm Rm. 208 AB Tech

COURSE DESCRIPTION:

This course will cover advanced techniques for the idea exploration, visualization and communication using the latest digital software, with the primary focus being on the creation of objects via computer modeling in the third dimension. Some emphasis will be placed on integration of various software packages with Sketch Up.

COURSE FORMAT:

Each class will be comprised of lectures/discussions with demonstrations by the instructor as well as hands-on exercises to be completed in class by each student. Because the nature of the class instruction, regular attendance by each student is critical.

COURSE PREREQUISITES:

The nature of this course is to demonstrate the ease of use of the software as compared to other more complex software packages available on the market today. No prerequisites are set for this course, however, a basic working knowledge of computers and a Microsoft Windows operating environment are necessary. Students will find that knowledge of any .DWG compatible CAD software program will be helpful during some classes. Please note that no in class time will be spent assisting with issues other than those dealing with Sketch Up!

INSTRUCTOR:

Kevin M. Gentry, AIA NCARB

kevin@mastersgentry.com

Masters Gentry Architects, PA

Asheville, NC

Instructor will only field questions via email. Please do NOT call the offices of Masters Gentry Architects with inquiries. It is highly recommended, for the fastest answers to your questions, that ALL inquiries be directed at the User Forum found on the Sketch Up web site at www.sketchup.com

COURSE OBJECTIVES:

1. To expand the students ability to explore design through the use of three dimensional modeling.
2. To provide students with the opportunity to gain a working understanding of emerging technologies.
3. To dispel myths commonly found in professional realms concerning the complexities and difficulties of computer modeling.

4. To have fun doing all of the above!

READINGS:

“The Sketch Up book” (version 3) by Bonnie Roskes, P.E. and Prof. Bob deWitt. Some in class hands on exercises will be based on those found in this book, so please bring your book to each class.

ASSIGNMENTS:

Each class will have hands on exercises or optional in class workshops as decided by the instructor. Each student will also be assigned a “Real World Project” to be completed during in-class workshops or on the students own time, to a level of completion as determined by the instructor. The contents or subject matter of the “Real World Project” can be determined by the individual student and approved by the instructor. Each student is encouraged to incorporate a current or past project from their office or home.

Class Schedule

January 20 Introduction to Sketch Up - The fundamental tools.

January 22 Understanding How Sketch Up Works -The Basic Approach to Modeling - Developing the Good Habits.

January 27 Mass Modeling versus Over-Modeling - Groups and Components Part One.

January 29 Tips and Tricks - Part One.

February 3 Groups and Components Part 2 - How to Work with Multiples and Nesting.

February 5 Working With Circles and Arcs. Smooth Move!

February 10 The Section Tool, more than meets the eye!

February 12 Textures and Materials.

February 17 Tips and Tricks Part 2 Hidden functions.

February 19 Importing into Sketch Up from CAD - The RIGHT way!

February 24 The Cumulative Model Method - Part One.

February 26 The Cumulative Model Method - Part Two.

March 2 Real World Model Assignment - the starting points.

March 4 Real World Model Assignment - in class workshop.

March 9 Real World Model Assignment - in class workshop.

March 11 Complete Real World Model - Show class.

March 16 Using Sketch Up! In page layout software (Exporting from Sketch Up!).

March 18 Working with Text and Dimensions.

March 23 Setting up Slide shows - Making a presentation movie (fly by or walk through).

March 25 Complete movie of real world model and show to class.

Tips and Tricks for the New User

(This section was produced with the help of Grant Marshall).

MODELLING - APPROACH

A good rule of thumb is to aim to model as little as possible. Of course if you model things for fun then have as much fun as possible and model in as much detail as you like. But if you're SketchUpping to put bread on the table there are no prizes for over-modelling. Try to model as little as you can to get the job done. Chances are you'll have to make changes to the model as soon as it's finished anyway, and changes are easier on a simpler model.

If your model is well ordered into groups and components you can always add detail at any stage without getting in a tangle with other parts of the model. If you're designing as you go, work the model up as you would a sketch, simple blocks to start with, more detail later. You can easily replace a crude chunk of model with a more refined version of it once you have refined the design more.

IMPORTED CAD STUFF

It's tempting to import a 2D CAD plan, spend a little while tracing over edges here and there to fill in faces, then hope to push-pull an entire model up from it in seconds. How well this works in reality depends on the drawings.

Imported 2D CAD drawings can be the cause of a LOT of headaches. Simple outline drawings with well-organized information are best, excessively detailed drawings by inexperienced drafts people are the worst. Extruding your model off a drawing containing small crumbs of line, corners not meeting and lines slightly off parallel will lead to complications further into the process and could cost you more time than it saves.

Most finished CAD drawings will contain more info than you'll need in a typical model, and the way the information is drawn (too much info per layer, overlapping objects etc) is often not ideal as a starting point for push-pulling. If the information can't be readily separated it is probably a waste of time to try to sort it out, better to use it as a basis for tracing.

Even a well-layered 2D CAD drawing is not without its problems. Remember that SketchUp's layers do NOT isolate geometry, they merely control its visibility. This applies to imported CAD drawings too. Any lines on one layer which lay directly over lines on another layer will have merged during import and will be missing from one or other layer. For this reason it can sometimes be useful to import CAD drawings one layer at a time, each layer comes in intact and grouped so it won't merge with those already in your model.

Walls in a typical CAD plan already have doors and windows cut out, if you extrude the walls upwards you'll need to spend time filling in above and below every window. Elevation drawings are usually not useful as a single surface for push-pulling, but can be very useful if you stand them up beside the model and snap directly to them while working on the model (and while using inference locking, of course).

I generally find it best to sidestep potential problems by tracing instead of extruding directly. I make a group of the imported drawing (so my model won't stick to it), then trace over what I need as I need it, simplifying if necessary as I trace (for example omitting openings in walls, I'll be inserting window components later). I use the rectangle tool wherever possible and inference-locking the rest of the time to make dead-sure things are square. Don't just assume that snapping to corners will give you a nice square model (unless you drew it yourself and you are sure you didn't leave 'crumbs' lying around).

If you decide to include the drawing itself in your model by extruding it directly, be aware that any weird stuff in that drawing (off-axis lines, short lines, multiple lines, crumbs etc) is now part of your model, you may only find it somewhere down the line so be prepared for fun and games.

Also bear in mind that if the whole model is push-pulled up from a single plan layer, ALL geometry in the model will be connected. It will be difficult to edit one part without affecting other parts and difficult to separate geometry into groups.

SOME MODELING POINTERS

Until you are familiar with the way SketchUp works, turn off snapping (the jerky grid-type snapping) unless it is essential that you stick to a grid of some sort for EVERY point in the model. Instead allow inferencing to guide the pointer. I find that snapping (particularly at coarse settings) seems to make it more difficult to get a feel for how inferencing works.

Use construction lines. Lots of them. Make a shortcut to erase them all at once when the place gets messy. They have all kinds of uses. Like when you are building a model off imported bitmap images: if you place a few construction lines on important lines in the image you'll have something to snap to when push-pulling etc. Inference locking works really easily along construction lines too. It's often quicker to 'slide' things along a construction line than it is to move them through space in the same direction.

The eraser tool isn't just for fixing mistakes, it's a cleanup tool for removing geometry that was a step in the process but which isn't needed anymore. Be prepared to draw temporary lines and erase them later, it's often the quickest way to get things done. Like drawing a line segment the length and direction you'll be moving multiple objects. Then you can snap to the 2 endpoints of the line instead of typing in the distance each time. Aim to use tools and methods that will get the task done in as few clicks as possible. Sometimes the quickest path is to use a method that does more than you need and then to backtrack a little. For example the quickest way to select all the edges of a face is to select the face and its edges in one go (by means of a double-click) and then to unselect just the face itself.

Tools like push-pull, move-with-autofold and move-and-copy can generate new geometry faster than you can draw it. Find opportunities to use them wherever possible, even if it means they generate a few lines or faces too many and you need to remove a few to finish up with what you want.

The rectangle tool is often quicker than the pencil tool and has the advantage of creating nice square, closed-corner geometry by default. Find ways to use it to draw complex shapes, (twice to draw an L-shaped plan, 3 times for an H-shape and so on) then erasing a line or 2, rather than drawing the whole perimeter with the pencil tool and inference locking. Take advantage of the ease with which SketchUp 'heals' edges and faces after you erase a line.

Push-pull is the quickest way to get from 2D to 3D, it creates additional faces effortlessly. Look for ways to incorporate it into your process whenever possible, drawing extra lines if necessary to turn something into an extrudable profile, push-pulling it, then erasing any unwanted faces after.

The offset tool is also very fast, but sometimes you'll need to help it along a little to get the most from it. You may need to add a temporary line or 2, fill in a temporary face or make a temporary group of a face to give the offset tool ideal conditions to work in. Having said all that, there are times when the quickest way to make something is to draw each edge with the pencil tool rather than saving 5 minutes with a quick method and then wasting another 15 while you try to figure out how it went screwy.

INFERENCING AND INFERENCE LOCKING (the snapping thing)

Is the cursor's tendency to leap from one point on the model to another frustrating your effort to build your model? Do you wish you could turn it off so you can just draw in peace? Well you can't turn it off, SketchUp wouldn't be SketchUp without it, so embrace it, it really is the best thing since sliced bread.

Here's how it works for simple operations like drawing a line or moving stuff :

Establish DIRECTION first by moving the pointer boldly into open space where there's no model for it to latch onto (often WAY beyond where it needs to go), move it around until the correct axis color shows, hold shift to lock that direction. Then establish DISTANCE or POSITION, often this will be by picking a point on the model but sometimes, particularly for very short distances and when you don't wish to align with anything on the model, the best place for the cursor is out in open space, not over the model (again this is often WAY off to one side of the movement path).

In other words often you don't move the cursor directly to the point you're aiming at because it will jump to nearby things, you move it somewhere else first to get direction,

shift then somewhere else again to set distance. It seems weird at first but it's dead-easy.

So if 'the annoying snapping thing' is getting in your way you're doing it wrong. If it's taking you AGES to get the cursor onto the spot you want because it keeps snapping to other things you're doing it wrong. Change your approach and use inferencing and inference locking whenever you can, it makes modeling phenomenally fast.

LAYERS

In my opinion while you're getting the hang of things stay away from trying to use layers to separate and order your geometry. I believe that the simplest way to model in SketchUp is to ALWAYS keep Layer0 as the active layer and to draw EVERYTHING on Layer0. To keep geometries from sticking to each other use groups and where something will be repeated more than once in the model, use a component.

If you want to be able to show/hide stuff easily then make named layers and move the group itself (just the yellow bounding box thing) to the named layer. The edges and faces inside that group are still on Layer0 but their visibility is now easily controlled by turning the named layer on/off.

I have found no real advantage in drawing on named layers (in other words changing the active layer to something other than Layer0) and the complications that can arise from it have to be seen to be believed.

GROUPS AND COMPONENTS

It's never too early to group things. You can make a group from one line, then you can edit that group and add more lines and faces to it. On the other hand, it can sometimes be too late to group things. Once a model is well under way you can really complicate your life by selecting geometries already attached to the rest of the model and grouping them to another layer. A face in one group might have one of its edges in another group, it becomes difficult to edit.

I find the easiest way to separate complex existing geometry into groups is to start with a copy of all of it in each group and then delete what isn't required in that group.

If all the geometry in your model is grouped you can ungroup a selection at any time because it won't stick to adjoining geometry isolated in its own groups.

There are a few ways of moving geometry from one group to another. Easiest is probably to ungroup, unselect the geometry to be moved, then regroup everything else. Now ungroup the destination group, select everything including the new stuff to be included, regroup.

I favor using cut and paste. I open the first group for editing, select and cut the geometry to be moved, close the group, open the destination group, paste, close the group.

Note that SketchUp doesn't paste-in-place, when you paste the selected stuff arrives wherever your cursor is and then you have to place it where you want it. If it'll be tricky to position the geometry correctly in the destination group I Copy from the original group, past in the second group directly on the original geometry to get the correct position, then go back and delete the originals.

Use components for repeated objects. Don't fuss over making the object perfect before you put multiple copies of it into the model. Make a simple, blocky component, place it wherever it needs to occur, then come back to edit it later to refine it and add detail. All instances of it will update automatically. This is particularly useful when designing in

SketchUp. Repeated items like columns, windows or stair treads can be shown as simple rectangles in the initial massing model and later worked up in detail.

Identical components don't have to be identical. They can be individually scaled in one or more directions. eg gutters can be different lengths or trees different sizes. Changing the cross section of the gutter will still update all of them, changing the color of the tree will change all of them.

You can make a copy of a component and then mirror that copy. Changes made to one copy will appear reversed in the other. Use this when modeling anything symmetrical so you only need to model half of it, the other half is modeled automatically.

THE AXES

Many tools and operations are related to the axes. Change the alignment of the axes to make things easier in a given situation, change them back after.

Use 'Color by direction' while modeling to check that the colored edges in your model are square and parallel to the axes. Black edges are not. If a portion of your model has a different orientation (so all its edges are black) reposition the axes so you can check all those edges.

REMEMBER, IT'S A MODEL

Work in 3D perspective view. Turn the model often to check your progress just as you would a physical model in your hands. In SketchUp there's little advantage to always working in a 'flat' ortho view (as required by many other modeling programs).

Unexpected things can happen when in a 'flat' view: has your line attached to the top or the bottom corner of a wall? In plan you can't tell.

Sometimes you need to draw on one 2D plane in space and it's difficult to stop SketchUp from drawing above and below that plane. Draw a big rectangle and work on it as you would a sheet of paper (keep an eye on the little blue 'on face' inference indicator as you draw), then erase it when you're done.

Because you are working in 3D space it's important to relate everything to the axes so you (and SketchUp) can keep track of where the cursor is in space. For example it's best to move things in 2 stages (once along one axis then again along another axis) rather than in one diagonal movement where you'd lose track of your position.

Move around the model as you work. Start a line, move the model, finish the line. If the cursor keeps snapping to stuff in the background, turn the model so there's nothing in the background. If the cursor won't align with the green axis and keeps snapping to the nearby blue axis instead, rotate the model until they don't appear so close together.

You can't change the shape of the 'Select by Area' window, it's always rectangular, so move around the model until the things to be selected can be contained within a rectangle. After a while it'll be second nature.

And remember that Zooming with the scroll-wheel only works when the pointer is over part of the model. Zooming over blank space has no effect. This is good because when zooming closer the zoom will be towards the thing you are pointing at, which need not necessarily be in the middle of the screen.

VIEWING AIDS

SketchUp has some cool-looking display options. Most of them are useful modeling aids in disguise, make use of them.

Use the transparent (X-ray) view as a drawing aid. Start a line, switch to transparent view (using a keyboard shortcut of course) to see objects obscured by parts of the model, attach the endpoint of your line, switch back to shaded view. When selecting stuff switch to x-ray view to see if you accidentally snagged any background geometry.

Use 'Profile lines' as a drawing aid to tell you when a line across a face has not merged with that face (it's thick until it merges, thin when it has merged).

Use 'color objects by layer' and 'use object color for edges' together to help you locate geometry hiding on the wrong layer. Works best if you have nice contrasting layer colors. Make use of the "Hide rest of model" option while you're editing groups and components.

Make a keyboard shortcut for it so you can switch between views during an editing operation. For example with the rest of the model hidden you can select a face to push-pull, then unhide the rest of the model so you can see the point you need to pull it to. Adjust the fade-out of the stuff outside the group you are editing. Sometimes it's good to have everything else very faint to lend focus to the bit you're working on (particularly when using x-ray view), sometimes you need to refer to the other geometry and you need to see it clearly.

Save jitter and line extensions for the finished model, turn them off while you're building it, they look cool but they can make life more difficult.

Wire frame view can be useful when you want to select only edges in the model and ignore all faces. Turning off Show edges allows you to select only faces and no edges.

Delay painting your model with fancy textures for as long as possible. The default front/back colors are easier to keep track of during major editing operations (like push-pull and erase) where new faces are emerging and others merging, reversing etc. Painting too early can mean at best having to re-paint many faces later anyway, at worst puzzling complications like materials that can't be purged, faces that won't 'take' a new color etc.

Remember your hidden geometry when editing. Because parts of your model can be hidden from view, they will be excluded from certain editing operations. This is a good thing most of the time - when you want to 'mask' or protect certain things from an editing operation you can hide them while you carry it out. But it can also result in complications if things like softened edges should have been included in an operation (such as moving between layers or repainting with a different material) and you forget to include them because they are hidden. Remember that you are only selecting everything when you can see everything, so turn on 'Show hidden geometry' to be sure.

USE AUTO-SELECT

The Move tool and the Push-Pull tool have an auto-select feature. With nothing selected move either of these tools over the model you'll see it at work highlighting parts of the model automatically. Using the delete key in conjunction with Move's auto-select is a very quick way to select and erase things. Push-Pull's autoselect only looks for faces while ignoring edges and endpoints. It can be very useful in conjunction with a keyboard shortcut for 'Reverse face'.

WHEN IN DOUBT, RIGHT-CLICK

Right-click often, you'll find all sorts of interesting things in the right-click context menus. Did you know there is a powerful 'divide' tool? You can select it after right-clicking a line. The 'unglue' command is handy when an object will only move along the plane of a surface and you want to move it away from the surface.

SET UP KEYBOARD SHORTCUTS OR HOT KEYS

As soon as you realize that selecting a particular tool or function is becoming tedious, set up a custom shortcut to take you there directly. Make them as you need them so you don't have a whole lot to learn all at once. Then once in a while look over your hot keys and toss the ones you never seem to use and add ones which might save you time.

In addition to all the obvious ones I have for the tools themselves, here are some well-used ones:

Group/Ungroup

Reverse face

Show/Hide rest of model

X-ray view on/off

Perspective on/off

Erase all construction geometry

Show/hide hidden geometry

Rendering preferences

Layer palette show/hide

Paint palette show/hide

Try working on a model while you're talking on the telephone. If not having a 'spare hand' available to work the keyboard makes no difference to the way you work, you are probably working inefficiently. Your keyboard hand should be at least as busy as your mouse hand, calling tools by means of hot keys, using modifier keys in conjunction with the mouse clicks and drags.

SAVING PAGES

When saving pages, remember that a saved page will CHANGE all your current display properties to those saved with the page. In other words your model might evolve, with new portions added, old portions hidden, you may fine tune your display settings, but every time you go back to a particular page everything is reset back to how it was when you made the page. This isn't always useful.

For example: You save 12 pages of different views with all properties checked, now you decide that darker shadows would look better and you forgot to hide the sketch axes. You have to select each page, change the shadow settings and turn off the axes, then 'update' the page to save your new settings. Now you realize you need to hide a few ugly lines in your model. Every saved page will try to unhide them, so to get them to stay hidden you need to update every page again. You decide that your profile lines are too thin, you change the setting but every saved page tries to make them thin again. Get the picture?

I feel it's best to be clear on why you are making a page, then uncheck EVERYTHING except the property you specifically want that page to change. Make a few pages which save only different graphic styles, a few which save only camera positions, a few which save sun/shadow positions, a few which just hide and unhide layers and objects/levels of detail etc.

You get greater versatility with pages dedicated to changing specific properties. Now you can pick a page to establish a graphic look, then pick one to hide/unhide a particular design variant, and then cycle through a series of camera positions. Or you could pick a viewpoint page, then cycle through graphic styles or variants from that viewpoint.

If you want to make a change to what is hidden and what isn't, you only have to do it once or twice on the pages dealing with hiding/unhiding, no other pages are affected. Same for hiding axes, thickening profile lines etc.

You can easily combine these to make additional dedicated pages for slideshows. If you have major changes to the display or the model which render your slideshow pages obsolete, just delete them and make a new set.

WHEN THINGS GO WRONG

When a model goes bad and won't do as it's told the sooner you can track down the problem the sooner you can fix it. Typically faces won't fill as they should, faces and edges seem to vanish, the move tool won't move something, the push-pull tool can't budge the selected face or an inserted component won't cut a hole in a particular face. To find lost geometry turn on all layers, turn on 'Show hidden geometry' and your lost sheep should appear. Click on them to see which layer they are on and move them to where they should be. You'll be amazed how far they can stray.

Many other problems are related to out-of-square geometry. This is usually caused by sloppy drawing, not paying attention to the axis color indicators (or lack thereof) while modeling, modeling off a sloppy CAD drawing, or not using inference locking enough. When a face won't fill try drawing a diagonal between 2 corners. If it fills try erasing the diagonal. Sometimes it will stay filled but usually it won't, indicating out-of-plane edges. If adding the diagonal causes it to fill on only one side of the diagonal it usually indicates an open corner on the other side.

When the push-pull tool won't push-pull it's usually because something's not parallel in the model and you're trying to push the thick end of a wedge towards the thin end (or a variation on that theme) - you just can't. You need to get rid of the out-of-parallel wedge shape.

Turn on 'color by direction' and x-ray view to help you spot black edges. If you find any you can often move their endpoints into alignment using inference locking (you figure it out, it's easy) or a bit of erasing and redrawing (though it can be hard to know where to stop erasing when the problem is in a busy corner).

When the move tool won't move you can often tell why if you invoke autofold (look it up). The model will crease and you'll usually see that you should have given it a natural fold line there.

Sometimes a model gets into such a mess that it's quicker to start from scratch than to fiddle about in the mess. An advantage of starting again is that you get to try the better method you thought of when you were almost through doing it the dumb way last time (yes, there's always a better way and you always think of it too late).

If you have used groups and components to keep different parts of the model separated you might find that the mess is limited to only a group or 2 and you can remodel only those parts. If you didn't use groups and all the geometry in the model is sticking together in one huge pile spread over many layers, treat it as a learning experience.