NEMETSCHEK
Vectorworks

Vectorworks® Fundamentals

2012 Getting Started Guide

The contents of this guide
and accompanying exercises
were originally created by
Nemetschek Vectorworks, Inc.

Vectorworks Fundamentals Getting Started Guide

Created using: Vectorworks Fundamentals 2012

For additional Vectorworks training information, or to purchase copies of this book, please call us, in the United States at (410) 290-5114 or visit Vectorworks.net/training online.

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Section 1
Preface

Welcome to the Vectorworks Fundamentals 2012 Getting Started Guide! This guide is designed to provide you with a strong base as you learn to use Vectorworks Fundamentals to design, communicate, and document the designs that you are passionate about.

This guide cuts to the heart of Vectorworks, explaining the concepts, and methodologies needed to develop improvisational skills so that you can be efficient, and perhaps most important, you can be successful at *realizing your most inspired* visions.

This guide presents the tools, commands, and other details of the software in the context of *workflows* which are the discreet steps taken with the software that accomplish a specific architectural or design task. A workflow takes a familiar design task, such as creating a massing model from a series of planar elements, and present commentary, demonstration, and example steps to accomplish the task in a way that can be mastered, and used to accomplish real tasks that you encounter in the course of your practice. This concept forms the bridge from traditional design processes to the software implementation details, and best practices used to model these processes in Vectorworks Fundamentals.

The workflows used in this guide are selected for the learning opportunities they present. There are often multiple workflows that deliver the desired result. A unique feature of this guide is the examination of the benefits, and drawbacks of alternate workflows. This discussion will help you develop workflow strategies of your own.

The Vectorworks Fundamentals Getting Started Guide is essential required reading for all design professionals; from first-time users to the most experienced.

How this guide is organized

As with most tools this capable, a familiarity with multiple disparate topics is needed before enough skills can be mustered to work effectively with Vectorworks Fundamentals. This guide has several features that make it unique in it's ability to deliver information about these skills.

The topics are integrated into the exercise so that the workflow can be seen as a whole. But it is also necessary to factor out each topic at times so that it can be examined on its own so that it's purpose, and benefits can be recognized as it is used throughout the exercise.

The benefit to you is that if you want to focus on any of this topical material, you may work through the guide by following the topic that interests you using a system of linked icons. We will explain these in the next section. Of course, we recommend that you work through this guide straight through at some point.

This guide explains the hows, and whys of Vectorworks Fundamentals in the commentary through the Example. The heart of the Guide is the *Example* section which puts into context usage of the tools with the emphasis on best practice workflows in a complete project. Embedded videos follow each group of written steps exactly, but without the important tips, and notes in the text. In case you have ended up with an unexpected result after one of the steps, you can review the video immediately. At the end is the *Further Exploration* section which highlights common workflow variations which may not have been encountered in the Example.

This Guide is written as a companion to the help system, which does not contain step-by-step procedures. The help system serves as a comprehensive reference for the tools, commands, and dialog boxes that you will encounter here in this guide, and layer as you use Vectorworks Fundamentals for your projects. Indeed, you are encouraged to read through the parallel material in the Vectorworks 2012 Help application when you want more information about a specific element being used in this guide. A link to the help system is provided at each tool, and command for this purpose.

The workflows in this guide have been developed to give you the experience of using Vectorworks' Fundamentals integrated snapping, hybrid, cursor, and other systems to draw fast, and accurately as you solve visual, and geometric design problems. It's a lot to digest all at once, yet it can be quite unsatisfying if you aren't using these features in concert. So, as you practice with Vectorworks, imagine improving a solution to the tasks before you using various combinations of these features together. Those who succeed always embrace the tools to enhance their personal approach.

Still, it often is quite overwhelming to beginners at first, so take it in small pieces: Watch the videos that accompany the steps to see a practiced hand doing them. Then try the step over again so you'll get the sense of how the different parts are used together.

Also, it may help to think of using the various features linearly to get the job done. For instance, drawing a few extra guidelines can go a long way toward building the workflow in your mind as you work. The main thing is to understand, and embrace the goal of using Vectorworks' Fundamentals systems efficiently.

So, from *where* did you come to Vectorworks?

This guide provides distinct paths through the material for use by different types of learners as well as by individuals who want to explore certain facets of Vectorworks separately. Of course, you can start at the beginning, and traverse sequentially until you get to the end, the necessary commentary will be presented at the appropriate time in the workflow; but your situation may be different.

You may be a user coming to Vectorworks Fundamentals from another software, who simply would like to know what's different. Or perhaps you are a self-taught Vectorworks Fundamentals user who would like some insight into well-established best practices so that you can consider updating your use of the software.

What if I don't understand one of the steps?

After each chunk of steps there is a video thumbnail that shows a movie of the steps just explained. Just click on the thumbnail, and watch the movie. There is no audio on these clips.

Terms Used in this Manual

Cursor, and Pointer

The **cursor** is the mark on the display that indicates where the next thing will happen. Most of the time the cursor looks like a skewed arrow. The cursor location is controlled by you with an input device. We use the term **pointer** to collectively refer to your mouse or any other device that you might be using for input. These would include the track-ball, tablet, track-pad, etc. Fingers may well be the only commonly used pointer, eventually; just as they were originally, before computers.

In Vectorworks, the cursor icon changes according to the context, so as you move the pointer, the cursor will change its form to give you information about any objects nearby. Each icon tells you something very specific. Although the cursor seems to change constantly as you move it around, we will only point out particular cursor icons when we need them. Just watch the cursor as we go, and you will learn to use the information it displays to create fast, and accurate models.

Pointer Gesture Terms

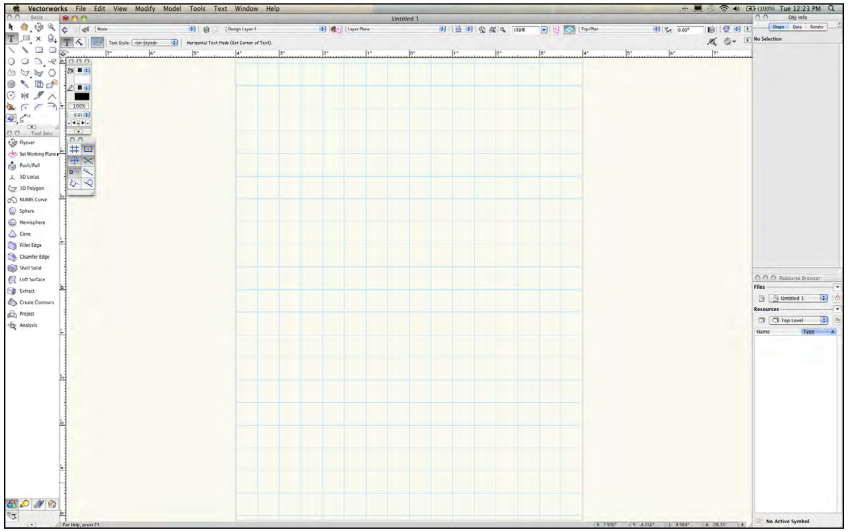
Pointer gestures are the ways that the pointer is used in Vectorworks to position the cursor, and issue commands.

- **Point**-To move the cursor over an object, usually to acquire a smart point. We'll get to this in a bit.
- **Press**-Hold the pointer left button down without releasing it. This is sometimes necessary when there is a short delay
- **Click**-Press the left pointer button, and immediately release it. In this guide, when you see the instruction to 'click' without modifiers, it means to click the left pointer button.
- **Right-Click**-Press the right pointer button, and immediately release it. If you have a single button mouse, this is done by pressing the Control key down on the keyboard before you click, and holding it down as you click the mouse button.
- **Double–click** To press, and release the pointer button twice quickly in rapid succession. Be sure to hold the pointer absolutely still while you are clicking.
- **Drag**-point the cursor, press the button, move the pointer to another location with the pointer button held down, and then release the button in the other location. There are only a few circumstances that this is done in Vectorworks.

Section 2
Commentary

Interface Elements

Lets begin with a quick description of the interface elements in Vectorworks Fundamentals.



Document Window

The largest region in the center of the display is the *Document window*. The Document window is tinted with subtle colors to indicate the projection. For example, the Document window is cream for Top/Plan, and light green for 3D views. You'll see a pure white background for sheet layers. The Document window also (optionally) displays various types of *coordinate grids*, which identify working planes as they are projected in the Document window. The *print page boundary* is shown as a light gray rectangle, and can show additional divisions to indicate the tiling that will be performed when printing an area that is too small to fit on a single page.

Menu Bar, View bar, Tool bar, and Message bar

Immediately above the Document Window are three horizontal control strips. At the very top is the *Menu bar*, and below that, the *Title bar*, which displays the file name of the *Document window* contents.

Below these two bars is the *View bar*, which is the "status dashboard" of Vectorworks Fundamentals. Always check the View bar to help understand the context of what you're looking at in the Document window. The visible controls in the View bar are shown with a checkmark in the list of View bar elements under the small arrow in the right-most position of the View bar. You can customize what is shown in the View bar with this list, but for now, we'll leave it alone.

Below the View bar is the *Tool bar*. Whenever a tool is selected, the Tool bar offers mode buttons that control how the active tool will work. In addition, check for instructions to the right of the mode buttons, which explain what to do before each step as you use the tool.

Framing the Document window vertically to the left, and horizontally below the Tool bar, are *rulers* to help you understand the size of the area displayed in the Document window as you zoom, and pan about within the Document window. The rulers can be hidden with a preference setting to save screen "real estate."

Across the bottom of the Document window is a gray strip where general help appears to the left, and the coordinates of the cursor, to the right. Watch the right part of this bar for minor alerts in red, and the progress bar to estimate time remaining during long operations such as rendering, and importing.

Tool Hot Keys/Menu Shortcuts

Tool hot keys are listed in the tool tip that appears when you mouse over any tool. A hot key is one or more keys without the command key (Mac) or Control key (Windows) modifier. For example, to activate the rectangle tool, simply press the "4"; to activate the selection tool press the "x" key. (This is the "4" key in the row of numbers across the top of the keyboard, *not* the "4" in the numeric keypad, if you have one.

Menu shortcuts are listed across from the menu name each time you issue a command in the menu bar. Similar to the tool hot keys, are the menu shortcuts which can be entered on your keyboard to invoke menu commands without moving the cursor.

In this guide, the term *pointer* is used to select the menus, and tools throughout the instructions. We feel that this method gives you more obvious feedback as you become acquainted with the software. Even self-taught folks generally start out with the interactive input methods used in this book. You can use the tool hot keys, and menu shortcuts interchangeably with the pointer methods described in this guide.

Many hard-core users incorporate the menu shortcuts, and tool hot keys at some point along the way, once they are more familiar with the software. Either way, or a mixture of each method, can be best for you. The results are identical.

The complete list of all the shipping tool hot keys, and Menu Shortcuts can be found in the User Guide located in the Vectorworks Help menu.

Workspace

The general look of the controls around the document window is determined by the workspace. In Vectorworks, a workspace is an arrangement of tools, menus, and perhaps most importantly, the customizable shortcuts, and hot keys assigned to select menus, tools, and certain other functionality, without having to use the pointer. For some users, using the keyboard more can streamline many tasks. You can customize your workspace with the Workspace Editor, so you can adapt parts of Vectorworks' interface to suit.

We will be using the shipping workspace throughout this guide, however, so please don't change it at this time. It is worth noting that the shipping workspaces have been developed over time, and have been given a substantial amount of thought by folks who are intimately familiar with the use of the software. Therefore you might want to continue using your workspace for a while to discover the logic behind its layout.

If you are coming to Vectorworks after using other software, you will find that, while the result that you expect from either product is identical, ideally the way that you use Vectorworks to achieve this result is substantially different. This is because Vectorworks, as with any software, presents a unique user model. This makes applying the approach of other software inefficient at best. A classic notion is to come to Vectorworks expecting to use the methods learned on other systems. So, bring your high expectations, but make sure you leave your old methods behind while you get up to speed in Vectorworks.

Palettes

The figure at the beginning of this section is a screenshot of the Vectorworks Fundamentals workspace. To the far left are the *tool palettes* where you'll see rows of tool icons. All those little tool icons can be intimidating when you're first starting out, but we'll get you up to speed in short order.

At the top is the **Basic Tool** palette. This is the palette that we'll be using mostly, at first. Notice the black arrow in the upper left of the **Basic Tool** palette, which when you click on it, makes the cursor look like the normal system cursor. This is the **Selection** tool. Vectorworks always has a tool selected, even if it is the **Selection** tool. The modes of the selected tool will be visible in the Tool bar. Below the **Basic Tool** palette is a special palette called Tool sets, which is a pallet of pallets organized by task. We will visit this palette occasionally in the Exercise. Which palettes, and tools that you see here depends on which Vectorworks product is installed.

To the right of the drawing window is the *Object Info* palette. This palette reports the *parameters*, such as the size or location of the selected object(s). You can edit the parameters of a selected object with the **Object Info** palette as well, which causes the selected objects to adjust according to the new values.

Preferences

In Vectorworks, you can use a category of preferences called **Vectorworks Preferences** to change the way the program interacts with you. In fact, many of the settings, are used to let Vectorworks work the way it used to work in previous versions. It is worth noting that the shipping preference set has been developed over time, and has been given a substantial amount of thought by folks who are intimately familiar with the use of the software, so you might consider using most preferences the way they are installed, at least for a while, to take advantage of this collective experience. Nevertheless, these preferences are provided so that you can adjust them to your **preference**.

All Vectorworks Preferences apply to your account on a specific machine. Vectorworks writes separate preference sets for each account on the same machine.

Another category of preferences is *Document Preferences* that apply to individual files. This preference set has items that you may need to adjust so that certain special purpose files behave appropriately. Once you have identified the need for any of these preferences, you can make a template or stationary file with any document preferences, which opens a copy of the template with the document preferences already applied.

Common Computer Conventions in Vectorworks

Many conventions common to most software are found in Vectorworks. As in word processors, email clients, and spreadsheets everywhere, these functions work as expected in Vectorworks Architect, as well:

- Delete: Select an object, and press the backspace or delete key.
- Undo: If you make a mistake, choose Edit->Undo
- Copy, Cut, Paste: All of these conventions are present, and work in Vectorworks in a familiar, reassuring way.
-

Common CAD Concepts

Selection: Use the **Selection** tool to select objects, to move, and resize objects in any view, and to insert objects in or next to a wall. From the **Basic Tool** palette, select the **Selection** tool, move the cursor into the document window, and click on an **edge** of an object. While you are puttering about in the Document window, each time the cursor crosses the edge of a selectable object, *Pre-selection Highlighting* indicates any objects that would be selected. To deselect or select more than one object at a time, click the pointer while holding the Shift key.

An additional method, marquee selection, allows you to select any number of objects within a region on the screen. Press the Option (Macintosh) or Alt (Windows) key while dragging with the pointer button depressed. This will toggle the selection state of all objects that are within the region or that intersect the marquee.

- drawing navigation; zoom, pan; flyover, walkthru, views, etc.
- Layers, and other drawing organization tools
- snapping, constraints
- xyz coordinate space
- duplicating, processing, pattern creation

Vectorworks Key Concepts

Container Objects

Container objects make creating, and editing some types of representations more flexible because the simpler defining objects that comprise the container are stored as part of, *or within* the container. The benefit of the container concept is that you can revise or later replace simple defining objects inside the container without having to rebuild the object represented by the container from scratch. So, container objects store easy-to-edit objects as *parameters*, that can be used to refine or redefine the container at any time.

For example, to make a curb around a patio, you might imagine creating straight lengths of stock, and somehow mitering the strips at each bend. Following a curve presents a challenge, as does the prospect of making a change later to the shape of the patio.

Instead, a container object called **Extrude Along Path** can be used to store a *path* representing the shape that the curb follows, and a *profile*, which is a planar object in the form of a section through the curb. The Extrude Along Path container object uses these definitions to compute how the section looks as it follows the path. At any time later, you can access either the path or the profile independently to greatly simplify making design changes that the container will subsequently use.

This concept is incorporated into all sorts of objects in Vectorworks, and once you become familiar with the behavior of one type of container object, you'll know what to expect whenever you encounter other types.

Stacking Order

As objects are drawn, the program keeps track of their stacking order within the design layer. The first object created is at the back of the stack, and the most recent object created is at the front of the stack.

The send commands change the stacking order of objects within a layer. Objects can be sent forward to be in front of an overlapping object or sent backward to be behind an overlapping object. Also, objects can be sent all the way to the front or back of the stack in one step.

Although this applies to all objects, the stacking effect is only seen when the projection is Top/Plan, and only with *planar* objects having a fill attribute other than none. Nevertheless, this feature is used to great effect throughout the design process to construct, create, and edit figures for details, plan projections, and viewport annotations

Working, Automatic, and Layer Planes (Screen)

In Vectorworks, when manipulating objects in space, snap points of existing 3D objects always override the other alignment, and positioning mechanisms described here. This is desirable most of the time, so this is the default. Otherwise, Vectorworks requires a plane in space so that clicking on the “flat” display can be calculated to intersect somewhere before infinity. Therefore, all object creation, editing, and moving is aligned to a *working plane*.

A working plane is an elevation of any height on a plane of three points at any orientation defined by the user. Often, the user will define a working plane to make aligning, and positioning tasks easier, and more accurate. If the working plane is not explicitly defined by the user, then the location of the working plane defaults to that of the *Active Layer plane*.

Every Vectorworks layer has a horizontal plane, and elevation associated with it that you can set relative to the internal fixed plane known as the *Ground Plane*.

The Ground plane is a fixed horizontal plane with its origin at the center of the drawing space, and at the level of the printed paper. Ultimately, the Ground plane determines how the location of any point is listed.

There are several functions that can affect this behavior, however. Objects in layers with an offset to the ground plane report their height relative to their layer plane whether or not the layer plane is offset from the ground plane. So, when not defined by you, the working plane defaults to the Active Layer plane, which may be 0, when the working plane is called the Ground plane.

As you are working in Vectorworks, you may want an object to respond to a working plane that is not horizontal or defined by any other saved planes. For example, you may want to align solar panels to a sloped roof. In this case, you can define a working plane that is parallel to the roof face, and when it is active, all creation, editing, and movement is observed relative to the active working plane. Once it has been defined, it can be saved, and reused later. Working in 3D requires a plane in space so that clicking on the “flat” display can be calculated to intersect somewhere before infinity.

So, in summary:

- All editing, and creation in 3D space happens in the Working plane.
- The Working plane may be aligned with an Active Layer plane or the Ground plane
- Snap points of existing 3D objects always override the Working Plane, otherwise, there will always be an active plane.
- Working in 3D requires a plane in space so that clicking on the “flat” display can be calculated to intersect somewhere before infinity.
- All 3D tools, and most planar tools can dynamically set working planes for the next drawing operation. This makes controlling the working plane very manageable.
- The Screen plane is a legacy concept that continues to have narrowly defined uses, but is not used in the everyday modeling workflow.

Section 3 Example

Initial Setup

To ensure consistency when doing these exercises please take a movement to setup your workspace, and Vectorworks Preferences. This way we can all start with the same base line.

Click the play button below to view a video of the following steps.

1. First, open a new blank document by going to **File > New.** Choose Create Blank Document, and click OK.
2. Go to **Tools > Workspaces** and select Fundamentals.
3. Go to **Tools > Options > Vectorworks Preferences**, and click the **Reset** button. Accept the “Are you sure…?” dialogue box, and select **General** in the Category list on the left.
4. Next return to the Vectorworks Preferences (**Tools > Options > Vectorworks Preferences**), and choose the Display tab. Then check the option **Center on objects after view change**.
5. Click OK to close the Vectorworks Preferences.
6. Now we’ll adjust the constraints categories. Go to **Tools > SmartCursor Settings.**
7. Dismiss the “Did you know…?” dialogue box, and click the Reset button. Accept the “Are you sure…?” dialogue box, and select **General** in the Category list on the left.

8. Uncheck **Snap to Combined Page Area**.

9. Click Ok to close the **SmartCursor** setting dialogue box.

10. Go to **File > Page Setup**, and uncheck the option **Show Page Boundary**, and click Ok to close the **Page Setup** up dialogue box.

11. Set the document units. Go to **File > Document Settings > Units**…

12. Set the Units drop down menu to **Inches** and also check the **Show Unit Mark** option.

13. Enable **Fractional** for the Rounding Style.

14. Set the **Fractional Display** for Dimensions to the second style by ticking the second button.

15. Choose **1/16** from the **Fraction Precision** drop menu.

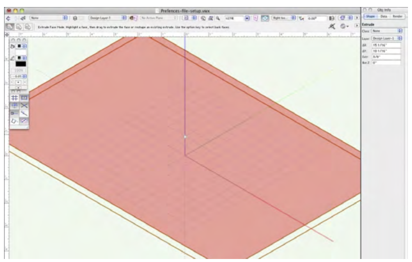
16. Then set the **Units** drop down menu under the Area section to **Square Inches.**

17. From the **Volume** section set the **Unit** drop down menu to **Cubic Inches**, and click OK to close the Units dialogue box.

18. Go to **File > Save**, and save this file to your desktop (or wherever you would like) with the name **"Preferences-file-setup"**

CPU Case

Now that the file is setup properly, we'll create the bottom portion of the clamshell. From this point forward we'll refer to it as the CPU case.



Click the play button below to view a video of the following steps.

1. In the **Basic Tool** palette, double click the **Rounded Rectangle** tool. This will open the Create Object dialogue box.

2. Input **15 1/12** for the Width, and **10 1/12** for the Height.

3. Be sure **Position At Next Click** is checked, and choose **Symmetrical** from the **Corner** drop down menu.

4. Set the **Diam X**, and **Diam Y** fields to **1"**, and then click OK.

   This rounded rectangle is the overall size of the CPU case. Now's lets add some depth.

5. Since **Position at Next Click** was checked you will need to click somewhere near the origin (0,0) to create the **Rounded Rectangle**.

This rounded rectangle is the overall size of the CPU case. Now's lets add some depth.

6. Go to the **Standard Views** menu in the View Bar, and choose **Right Isometric**.

7. From the **3D Modeling** tool set select the **Push/Pull** tool, and be sure the first mode, **Extrude Face** mode is enabled in the tool bar.

8. Move the pointer towards the center of the rounded rectangle.

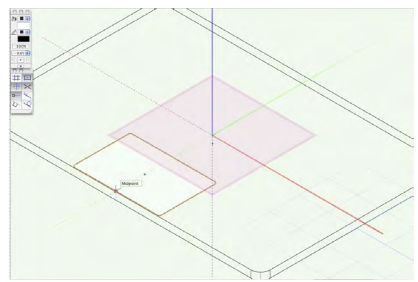
9. Once the rounded rectangle is highlighted click to begin extruding the rounded rectangle face. Notice the pointer has changed to a double-headed arrow.

10. Now press the **Tab** key to enter the Distance field in the floating data bar, and input **3/8**. Press enter to lock in the value.

11. Then click anywhere in the drawing area to create the extrude.

Trackpad

With the overall shape of the CPU case completed, we can now add the overall shapes for the trackpad, keyboard, and speakers.



Click the play button below to view a video of the following steps.

To do this we first need to create a working plane on the top face of the CPU face.

1. From the **3D Modeling** tool set, select the **Set Working Plane** tool. Be sure the second mode, **Planar Face** mode, is enabled in the tool bar.

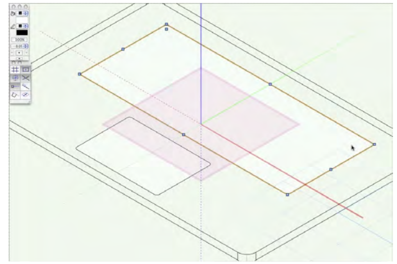
2. Move the pointer to the center of the CPU case. Once the cursor cue **Center** is displayed, click once to set the working plane. Use the blue highlighting as a visual reference so as to not set the working plane to the bottom face of the extrude.
3. To create the trackpad, double click the **Rounded Rectangle** tool in the **Basic Tool** palette.
4. In the **Create Object** dialogue box, set the Width field to **4.5”**, and the Height field to 3”
5. Notice the box position control is rotated to reflect the current view (Right Isometric). Choose the bottom center point from the box position controls, which is the center point closest to the **W**.
6. Then, choose **Symmetrical** from the corner drop down menu. Set the **Diam X field to .25”**, and the **Diam Y** value will update to match it, since the corners are set to be symmetrical.
7. Check **Position At Next Click,** if it is not already selected, and click OK.
8. To place the rounded rectangle, move you cursor along the bottom left edge on the top surface of the CPU case until you see the **Midpoint Cursor** cue.
9. Click to set the rounded rectangle. This is the overall shape for the trackpad.

At the moment the trackpad, and the CPU have a common edge but realistically the trackpad bottom edge would be offset from the CPU case’s edge. So lets move the trackpad away from the edge some.

10. Switch to the **Selection** tool in the **Basic Tool** palette, and select the trackpad if it is not already selected.
11. Now move the pointer along the common edge of the CPU case, and trackpad until the pointer changes to a cross, and the cursor cue **Midpoint** is displayed.
12. Press, and hold your mouse button to pick up, and move the trackpad based on the selected point.
13. We are going to move the trackpad **1”** away from the CPU case edge. With the mouse button still depressed press the **Tab** key until your enter the ∆**Y** field. Then enter **1”** and press **Enter** to lock in the value.
14. Move the pointer along the green dashed axis (Y Axis) until the cursor cue **Object / Y / Align Y** is displayed. Release the mouse button to move the trackpad.

Keyboard

Create the Keyboard Based on the Geometry of the Trackpad.



Click the play button below to view a video of the following steps.

1. Move your pointer along the trackpad edge located closest to the working plane origin (point where the red, blue, and green axis meet) until the cursor changes to a cross, and the cursor cue **Midpoint** is displayed.
2. Press, and hold the mouse button to pick up the **Rectangle** by the selected point.
3. Press, and hold the **Option** key (Mac) or **Alt** key (Win), and drag the rectangle along the **Y** Axis (green line). Be sure your cursor stays on the top surface of the CPU case.

Notice there is a small plus (+) beside the cursor when the Option or Alt key is held. This indicates that you will be creating a duplicate.

4. When you reach the top edge of the CPU case, the cursor cue **Midpoint** will be displayed.
5. Release the mouse button to create the duplicate. Release the **Option** key.
6. In the **Object Info** palette choose the top center point from the box position controls, which is the center point opposite of the current point.
7. Now change the **Width** field to **11 3/8”**, and the **Height** field to **4 ¾”**. Then press **Enter**.

It is important to choose the position point from the box position controls before changing before entering the new width, and height as the set point will be constrained during the resizing of an object. In this case it keeps the rounded rectangle centered.

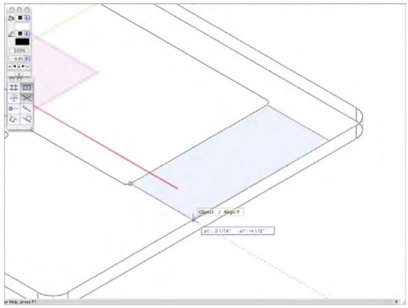
8. Choose **Symmetrical** from the Corner drop down menu, and set the **Diam X** field to **¼”**, and press **Enter**. Remember the **Diam Y** will update automatically because all corners are set to be symmetrical. This rectangle is the overall shape for the keyboard.

Just as with the trackpad, realistically the keyboard should be offset slightly from the top edge of the CPU case. Let’s do this now.

9. With the keyboard selected go to **Modify > Move > Move 3D**. Since we are currently using a working plane, tick the **Working Plane** option.
10. Input a value of **-1 ¼”** in the **Y’ Offset** field, and then press OK. The keyboard will be moved from the CPU edge along the same green axis as the trackpad.

Speakers

Create the Speakers.



Click the play button below to view a video of the following steps.

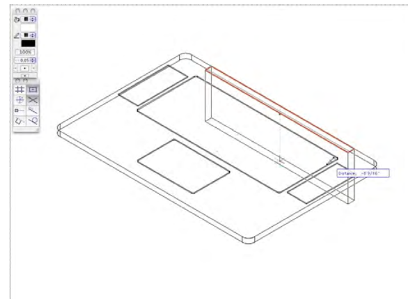
1. Select the Zoom tool from the **Basic Tool** palette.
2. First, click near the center of the keyboard. Then move your cursor downward, and to the right until the right side of the keyboard, and part of the CPU are inside the marquee.
3. Click once, to zoom in on the area inside the marquee.
4. Select the **Rectangle** tool from the **Basic Tool** palette. Be sure the first mode **Rectangle** mode is enabled.
5. Move the cursor upward along the right edge of the keyboard until the cursor cue **Arc** is displayed. If you still have not zoomed in close enough press the **Z** key to evoke the **Snap Loupe**, and find the **Arc** point.

The **Snap Loupe** feature zooms in temporary on an area around the current mouse position, to make snapping more precise. Regardless of the tool once the mouse button is depressed the **Snap Loupe** revoked.

6. Click to set the first point of the rectangle.
7. Move the mouse cursor along the right edge of the keyboard, but this time move downward until you receive the **Arc** cursor cue near the bottom right corner. Again, use the **Snap Loupe** if necessary.
8. Do not click on this point, but hold your cursor over the point until the smart point is acquired. Once a small red box appears around the point the smart point is acquired. You can also manually acquire the smart point by pressing the **T** key.
9. Now, move your cursor away from the smart point horizontally towards the right edge of the CPU case. Notice the red dashed line extending from the smart point. This is called the extension line.
10. Continue to move along the extension line until you reach the CPU edge. Once the cursor cue **Object / Align Y / Align Start Z** is displayed, click to set the rectangle.

Next, we need to decrease the size of the speaker slightly, and also offset it from the CPU edge.

11. Switch the Offset tool in the **Basic Tool** palette. Be sure the first mode, **Offset by Distance,** and the fourth mode, **Offset Original Object** mode is enabled in the tool bar.
12. Input a value of ¼” in the **Distance** field located in the tool bar.



13. Click once inside the selected rectangle to create the offset. This is the overall shape of the right speaker.

The left speaker can be created quickly by using the **Mirror** tool.

14. First tap the **X** key twice to deselect the right speaker, and switch to the **Selection** tool.
15. Go to **View > Zoom > Fit to Objects** or click the **Fit to Objects** shortcut in the View Bar. You should now see all of the CPU case in the drawing area.
16. Re-select the right speaker, and then choose the **Mirror** tool from the **Basic Tool** palette. Be sure the second mode, **Duplicate and Mirror** is selected.
17. Move the cursor to the top edge of the CPU case at the point where it intersects with the working plane **Y** Axis (Green Axis line).
18. When the cursor cue **Midpoint** is displayed, click to set the first point of the mirror axis line.
19. Hold the **Shift** key, and move the cursor along the Y-axis.
20. Once the cursor cue **Y** is displayed, click to set the mirror axis. The speaker is then mirrored to the left side. Now we have our overall shape for the left speaker.

CPU Detailing

The shapes we’ve created to represent the trackpad, keyboard, and speakers would not set flush against the CPU top surface, on most laptops these objects are indented in the CPU case. So we’ll do this now, and create a cutout for the display hinge as well.

Click the play button below to view a video of the following steps.

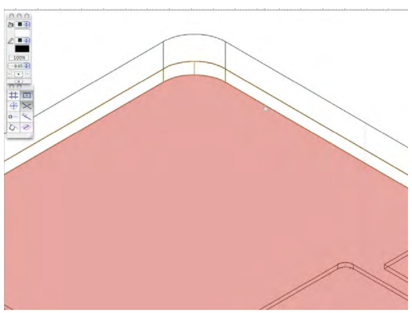
Cutout Trackpad, Keyboard, and Speakers

1. First, select the **Push/ Pull** tool from the **3D Modeling** tool set. Be sure the first mode, Extrude Face mode is enabled.
2. Then click the left speaker to start extruding the object.
3. Press **tab** so enter the **Distance** field in the floating data bar.
4. Input **-1/16”**, and press enter to lock in the value.
5. Click to create the extrude.
6. Repeat these steps for the right speaker, trackpad, and keyboard.

Now we are going to subtract these extrudes from the CPU case.

7. Tap the **X** key once to switch to the **Selection** tool.
8. Go to **Edit > Select All**. Now all of the objects are selected.
9. Right click on the CPU case, and choose **Subtract Solids**.
10. In the **Select Object** dialogue box, use the arrows to highlight the CPU case. Click OK.

This means the other extrudes will be



subtracted from the highlighted object. After clicking OK, notice the CPU case which was an extrude is now a solid subtraction. Let’s cutout a space for the display hinge.

11. Select the **Rectangle** tool from the **Basic Tool** palette. Then select the third mode, **Side Center and Opposite Corner Rectangle** mode.
12. Now choose **Automatic** from the **Layer Plane** drop down menu in the View Bar.
13. Then move your cursor to the **midpoint** of the top edge of the CPU case.
14. Once the top face of the case is highlighted blue, and the cursor cue **Midpoint** is displayed click to start drawing the rectangle.

We need the width of the hinge to match the keyboard width, which is **11 3/8”.** With the current mode we are using to draw the rectangle we need to input half of this width.

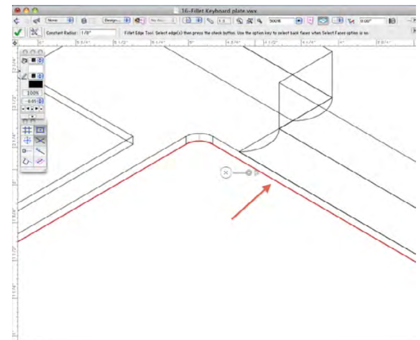
15. Press the **tab** key to enter the ∆ **X** field, and input **(11 3/8)/2**.
16. Press **tab** key once more to enter the ∆ **Y** field, and input **-1/2**, and then press the Enter key.
17. Click in the drawing to set the rectangle.
18. Move your cursor inside the newly created rectangle, and once the rectangle is highlighted red click to start you extrude.
19. Since we need to subtract this rectangle from the CPU case, hold the **Option** key (Mac) or the **Alt** key (Windows), and move the cursor downward.
20. Be sure the solid is extruded past the bottom surface of the CPU case, and while still holding the **Option** key (Mac) or **Alt** key (Windows) click to subtract this solid from the CPU case.

CPU Case—Fillets

Add a Few Fillets to the Corners to Give the Case a Sleeker Appearance.

Click the play button below to view a video of the following steps.

1. Change the view to the **Lower Right Isometric** by choosing this option from the **Standard Views** drop down menu in the View Bar.
2. Choose the Extract tool from the **3D Modeling** tool set. Be sure the Extract Surface mode is enabled in the Tool bar.
3. Click the **Extract Preferences** button in the Tool bar.
4. Check the option **Select Faces**, and click OK to close the dialogue box.
5. Now select the bottom face of the CPU case. Use the red highlighting a visual reference to verify you are selecting the bottom face, and not the top face.
6. Once the correct face is selected, click the green checkmark in the tool bar to complete the action. There should now be a NURBS surface on the bottom of the CPU case.
7. Select the **Push/Pull** tool from the **3D Modeling** tool set. Make sure the first mode, **Extrude Face** mode, is enabled.
8. Then move your cursor to the NURBS Curve at the bottom of the CPU case, and click once it is highlighted to start the extrude.
9. Press the **Tab** to enter the **Distance** field, and input a value of **3/16”**, and then press the **Enter** key to lock in the value.
10. Now click anywhere in the drawing to complete the extrude. This is the part of



the CPU case we are going to fillet.

11. Use the **Zoom** tool in the **Basic Tool** palette to zoom in on one of the corners of the CPU case.
12. From the **3D Modeling** tool set, choose the **Fillet Edge tool**, and click the **Fillet Edge Preferences** button in the Tool bar.
13. In the **Fillet Edge Preferences**, check the options **Select Tangent Entities,** and **Select Faces**.
14. Also change the **Radius** field to **3/16”**. Then click OK to close the dialogue box.

15. Select the bottom face of the latest extrude we created.
16. Once the surface is highlighted, click the **green checkmark** in the Tool bar to complete the operation. The **Object Info** palette should now display **Fillet.**
17. Press the **X** key twice to deselect the **Fillet**.
18. Then click **Fit to Objects** in the View bar (Or use the Cmd + 6 (Mac) or Ctrl + 6 (Windows) keyboard shortcut.) to view the whole CPU case in the drawing area.
19. Go back to the View bar, and select **Right Isometric** from the **Standard Views** drop down menu.
20. Again use the **Zoom** tool in the **Basic Tool** palette to zoom in on any corner of the keyboard.
21. Next, select the **Fillet Edge** tool from the **3D Modeling** tool set, and click the **Fillet Edge Preferences** button in the Tool bar.
22. This time, make sure **Select Faces** is unchecked, but **Selected Tangent Entities** is checked.
23. Set the Radius field to **1/8"** to as well, and then Click OK to close the Preferences.
24. Select the bottom edge of the Keyboard.
25. Now click the **green checkmark** in the Tool bar to complete the operation.

Display Case 2D Geometry

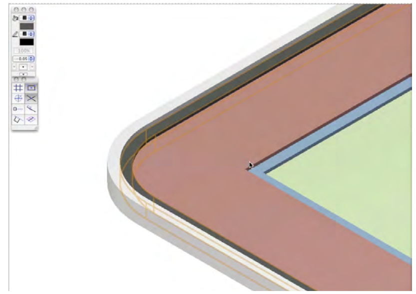
The CPU case is nearly complete, with the exception of the keys, which we'll come back to later. Let's move on to creating the general shapes for the display case.

Click the play button below to view a video of the following steps.

Creating the Display.

To keep things organized we're going to create the display on a separate design layer.

1. Go to Tools > **Organization** and choose the **Design Layers** tab or select the **Layers** button from the View bar.
2. Also to help with organization let's name the active layer. Select **Design Layer-1**, and click the **Edit** button.
3. In the **Edit Design Layers** dialogue box type "CPU laptop" in the **Name** field, and click OK.
4. Now let's create a new design layer. To do so, click the **New** button in the **Organization** dialogue box.
5. Name this layer "Screen laptop", and Click OK once to return to the **Organization** dialog box.
6. Change the visibility of the CPU laptop layer by clicking the middle visibility column to the left of the design layer name. The icon will change to an **X** to indicate the layer is invisible.
7. Click OK to close the **Organization** dialog box.
8. Go to **View > Standard Views > Top/ Plan.**
9. Select the **Rectangle** tool, and create a



rectangle of any size anywhere in the current drawing area.

10. Go to the **Object Info** palette, and input a value of **15 ½"** in the Width field, and **10 ½"** in the **Height** field.
11. Click the **Fit to Objects** button in the View Bar
12. Select the **Fillet** tool in the **Basic Tool** palette, and select the third mode, **Trim, and Fillet** mode.
13. Set the **Fillet** Radius to ½" in the Tool bar.
14. Since all of the corners have the same fillet radius, we can just simply double click the **Rectangle** to fillet at 4 corners at once. Normally you would need to select the intersecting lines to indicate what corner to fillet. Notice in the **Object Info** palette the Rectangle is now a **Polyline**.
15. Now switch to the **Offset** tool in the **Basic Tool** palette. Be sure the first mode, **Offset by Distance** mode, and the third mode, **Duplicate, and Offset** mode are selected.
16. Additionally, set the Distance field to **1/16"**.
17. We need to create two offsets, so move your cursor towards the center of the polyline, and **click twice**. You should now see three polylines.
18. If the smallest offset polyline is not already selected, press the **X** key to switch to the **Selection** tool, and select it now.
19. In the **Object Info** palette, select top center point in the box position controls.
20. Change the ∆**Y** field to **10"**, and press enter.
21. Switch to the **Zoom** tool, and draw a marquee around the top left corners of the three polylines.
22. With the smallest offset polyline still selected, choose the **Offset tool** from the **Basic Tool** palette.
23. Set the **Distance** field to **½"** in the Tool bar, and click in the area inside the selected polyline.
24. With the next offset selected, return to the **Distance** field in the Tool bar, and input **1/16"**.
25. Click anywhere inside the current offset polyline to create one last polyline.

Display Case 3D Geometry

Convert the 2D Geometry for the Display Case into 3D Geometry.

Click the play button below to view a video of the following steps.

Before we begin, to make things easier to see, we'll apply some colors to the current 2D geometry.

1. Press the **X** key to activate the **Selection** tool, and the select the smallest polyline, if it is not already highlighted.
2. Click the **solid fill color box**, and select any shade of green to apply to the polyline.
3. Select the next closest polyline, and apply a shade of blue.
4. Continue in sequential order with the polylines, and apply any shade of the following colors in order: red, dark gray, and then light gray.

If this display were to remain in 2D the visual representation seen here would be fine; however in 3D we will need to apply each colored polyline a different thickness. For this reason we cannot have the polylines overlapping each other. So, next we'll clip the polylines to remove any unneeded or hidden geometry.

5. Hold the **Shift** key, and select two largest polylines (light gray, and dark gray polylines). Then go to **Modify > Clip Surface.**

The Clip Surface command trims the bottom object in a selection so that any areas overlapped by the top object are cut out of it. To see how the dark gray polyline was clipped from the light gray polyline, click, and drag the light gray polyline to left. Then press **command + Z** (Mac) or **Control + Z** (Win) to undo.

6. Hold the **Shift** key, and select the dark gray polyline, and the red polyline.
7. Go to **Modify > Clip Surface**.
8. Hold **Shift**, and select the red polyline, and the blue polyline.
9. Then instead of using the menu command, **right click** on the red polyline, and choose **Clip Surface**.
10. One last time, hold **Shift**, and select the blue polyline, and the green polyline.
11. **Right click** on the blue polyline, and choose **Clip Surface**. Now each polyline has its own defined space without any overlapping.

Creating the 3D Geometry.

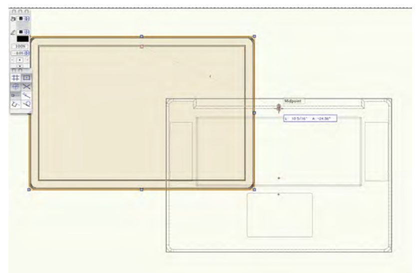
1. Select the light gray polyline, and go to **Model > Extrude**.
2. In the **Create Extrude** dialogue box, set the **Extrusion** field to **1/8"**, and then click OK.
3. Select the green polyline, and go to **Model > Extrude.**
4. Set the **Extrusion** field to **1mm**, and then click OK.
5. Select the blue polyline, and use the keyboard shortcut **Command +E** (Mac) or **Control + E** (Win) to extrude the polyline.
6. Input **1.5mm** in the **Extrusion** field, and click OK.
7. **Extrude** to two remaining polylines. **Extrude** the red polyline **2mm**, and extrude the dark gray polyline **2.5mm**.

Now lets see the display in a rendered 3D view.

8. Tap the **X** key twice to deselect all objects. Then press the **Fit to Objects** button in the View Bar or use the **Cmd+6/Ctrl+6** keyboard shortcut to fit the view to the whole screen.
9. Go to the **Standard Views** drop down menu, and choose Left Isometric.
10. Use the **Zoom** tool, and draw a marquee around one of the display corners.
11. To render this view, go to **View > Rendering > Open GL**
12. You can also improve the quality of the rendering by going to **View > Rendering > Open GL Options.**
13. Change the **Detail** drop down menu to **High**, and the check the option **Use Anti-Aliasing.**
14. Click Ok. You should notice the rounded edges appear much smoother.

Positioning the Display Case

Line Up the Display Case with the CPU Case.



Click the play button below to view a video of the following steps.

1. First, return to a **Wireframe** rendering by going to **View > Rendering > Wireframe**
2. Go to **Tools > Organization**, and select the far left visibility column for design layer "CPU laptop" to make this layer visible again. Click OK to close the dialogue box.
3. Go to **View > Standard Views > Top/ Plan** to change the view of the active design layer, Screen laptop.

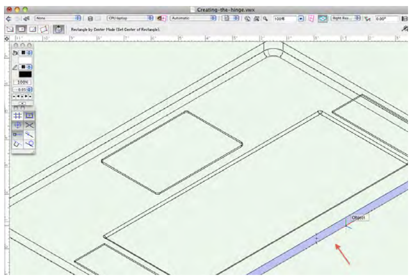
4. Go to **View > Align Layer Views** to change the CPU laptop layer to match the Screen laptop layer.
5. So that we can see the entire CPU case, and Display case, click the **Fit to Objects** button in the View bar.
6. You should see that the Display case, and CPU case, and are not lined up properly. To fix this, go to **Edit > Select All** to select all parts of the Display case.
7. Go to **Modify > Group**. As a group all of the parts of the display case can be moved much easier.
8. Switch to the **Selection** tool in the **Basic Tool** palette.
9. Move the pointer to the top center of the smallest offset. When the cursor cue **Midpoint** is displayed click, and hold your mouse button to pick up the group by this point. You may need to use the **Snap Loupe (Z key)** to acquire this point.
10. Then drag the group along top edge of the CPU case that is closest to the keyboard.
11. When the cursor cue **Midpoint** is displayed, release the mouse button to complete the move.

Now we need to line up the CPU case, and the Display case properly in the **Z** direction.

12. Choose **Right Isometric** from the Standard Views drop down menu in the View bar.
13. Go to **View > Align Layer Views** to align the CPU case layer to the same view.
14. Press **Fit to Objects** in the View bar.
15. Use the **Zoom** tool to the zoom in on the laptop corner closest to you.

The CPU case, and Display case are overlapping. In reality, only the top surface of the CPU case, and the bottom surface of the Display case should be touching.

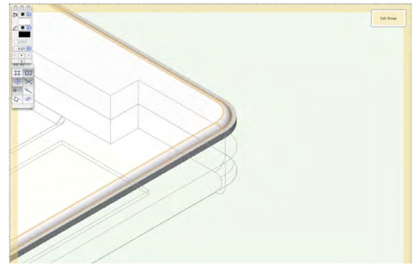
16. To fix this, with the group still selected, go to **Modify > Move > Move 3D**.
17. In the **Move** dialogue box, set the **X'**, and **Y'** fields to **0**, and the **Z'** field to **3/8"**. Remember **3/8"** is the thickness of the CPU case was originally extruded.



18. Click OK to complete the move.

Display Case Fillet

We're almost done with the display case, but just as we did with the CPU case, let's fillet some of the edges for a sleeker appearance.



Click the play button below to view a video of the following steps.

1. Click the **Fit to Objects** icon in the View Bar so that the entire laptop is in the drawing area.
2. Switch to the **Zoom** tool, and draw a marquee around the top right corner of the laptop to zoom in on this area.
3. We'll need to use the existing the geometry of the Display case to create the fillets. Press the **X** key to switch to the **Selection** tool, and **double click** the display to enter the **Edit** mode for this group.

So that we can see the different display case parts easier. Render this view in Open GL.

4. Select **Open GL** from the **Render modes** drop down menu in the View bar or use the keyboard shortcut **Command + Shift + G** (Mac) or **Control + Shift + G** (Win).
5. Now choose the **Extract** tool from the **3D Modeling** tool set.
6. Enable the second mode, **Extract Curve** mode in the tool bar, and then click the **Extract Preferences** button.
7. Check the options **Select Tangent Entities,** and **Create Planar Objects**.
8. Uncheck **Select Faces** if it is checked, and then click OK to close the dialog box.
9. Select the top outermost edge of the dark gray extrude.
10. Then click the **green checkmark** in the tool bar to complete the operation

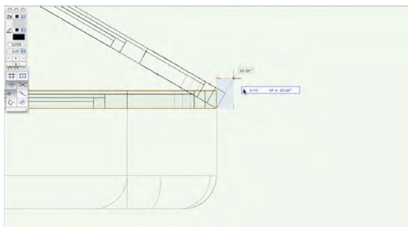
The resulting object should be a group. Since Create Planar Objects was checked in the Extract Preferences this group consist of objects like lines, and arcs to create this one shape. Will need to compose objects into one polyline.

11. Go to **Modify > Ungroup**. Notice the **Object Info** palette shows eight objects are selected.
12. To compose these objects into one polyline, go to **Modify > Compose**.
13. Now switch to the **Push/ Pull** tool in the **3D Modeling** tool set. Be sure the first mode **Extrude Face** mode is enabled.
14. Then move your cursor over the newly created polyline. Once the surface is highlighted click to start extruding.

15. Press the **tab** key to enter the **Distance** field, and enter a value of **1/16”**. Then press the Enter key to lock in the value.
16. Click anywhere in the drawing to create the extrude. This will be the top of the display case.
17. To fillet this extrude, from the **3D Modeling** tool set select the **Fillet Edge tool**, and set the **Radius** field in the Tool bar to **1/8”**.
18. Click the **Fillet Preferences** button in the Tool bar, make sure **Select Tangent Entities** is checked. Click OK.
19. Select the top edge of the highlighted extrude.
20. Click the **green checkmark** in the Tool bar to complete the operation.
21. To return to the design layer click the **Exit Group** button.

Rotating the Display Case

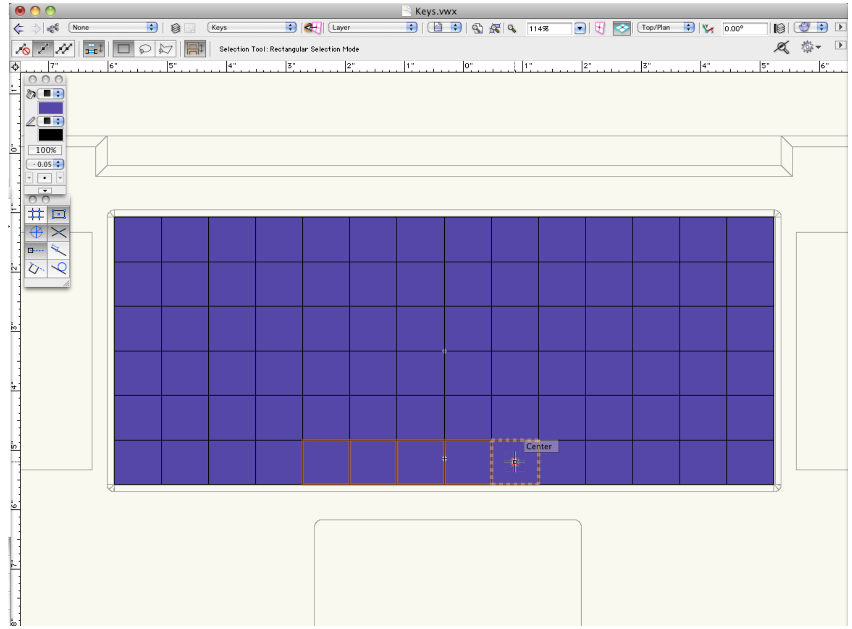
The Display case is completed, so its time to rotate it an open position.



Click the play button below to view a video of the following steps.

1. So that the entire laptop is visible in the drawing area, click the **Fit to Objects** icon the View bar.
2. Next, choose **Right** from the **Standard Views** drop down menu in the View bar.
3. Go to **View > Align Layer Views** to align the CPU laptop layer to same view.
4. Select the **Zoom** tool, and draw a marquee around the right corner of the laptop.
5. Now switch to the **Selection** tool, and select the Display case if it is not already highlighted.
6. Then select the Rotate tool from the **Basic Tool** palette. Be sure the first mode, **Rotate** mode is enabled in the tool bar.
7. Move your cursor to the bottom right corner of the display case, and click when the cursor cue **Endpoint** is displayed to set the point for the rotation axis. Hold the **Shift** key move your cursor upward, once the cursor cue **Y** is displayed click again to set the rotation axis.
8. To rotate the display to an open position, hold the **Shift** key, and move cursor to the right until you see the cursor cue **X**.
9. Click once to complete rotating the display case to an open position.

The laptop is opened to the correct angle but it sitting above the hinge location. The bottom



edge of the display needs to be move down to match the bottom edge of the hinge.

10. With the display case still selected, go to **Modify > Move > Move…**
11. In the **Move Selection** dialogue box set the **X** Offset to **0**, and the **Y** Offset to **-3/8”**, and click ok to move the display case.

Creating the Hinge

Click the play button below to view a video of the following steps.

The Display case is rotated in reference to the hinge, so we need to return to the CPU case to create the hinge quickly.

1. In the View Bar click the **Layers** icon to open the **Organization** dialogue box.
2. Click in the blank area just to the left of the CPU laptop design layer to make the CPU laptop layer the active layer.
3. Click in the middle visibility column for the **Screen laptop layer**, so that is invisible. Click OK to return to the drawing area.
4. Now choose **Rear Right Isometric** from the Standard Views drop down menu on the View Bar, and click the **Fit to Objects** icon in the View Bar as well.

5. We need to be a little closer on the hinge area so manually input **100%** in the **Zoom** field in the View bar. This will give us the best angle of the CPU case to create the hinge.
6. Choose the Rectangle tool from the **Basic Tool** palette. Be sure the second mode, **Center, and Corner Rectangle** mode is enabled in the Tool bar.
7. Set the **Active Plane** drop down menu to Automatic if it is not already set.
8. Click OK to the **Did You Know** dialogue box.
9. Move your cursor to towards the center of the open face for the hinge cutout .
10. Click once the face is highlighted blue, and the **Center** cursor cue is displayed to start the rectangle.
11. Move the cursor to the right along bottom edge of the highlighted face until the **Endpoint** cursor cue is displayed.
12. Click once to set the rectangle.
13. Move the cursor towards the center of the newly created rectangle, and click once the face is highlighted to begin the extrusion.
14. Press the **tab** key to enter the **Distance** field for the floating data bar, and input a value of **½”**, and then press the Enter key to lock in the value.
15. Click once to complete the extrusion.
16. With the hinge still selected, click the **Fill Style** color box in the **Attributes** palette, and apply a medium gray color to the hinge.
17. To see how the hinge looks, choose **Open GL** from the **Render modes** drop down menu.

Keys 2D Geometry

Click the play button below to view a video of the following steps.

The laptop is almost completed but we need to add actual, and speakers to the CPU case.

1. From the View bar choose **Top/Plan** from the Standard Views drop down menu.
2. Press the **X** key twice to deselect all objects. Click the **Fit to Objects** icon in the view bar as well.
3. Click the **Layers** icon in the View Bar to access **Organization** dialogue box.
4. We will be putting the keys on a separate design layer, so click the **New** button.
5. In the **New Design Layer** dialogue box, name the new layer **Keys**, and click OK button twice to return on the drawing area.
6. Select the **Zoom** tool, and draw a marquee around the cutout for the keyboard on the CPU case.
7. Select the **Rectangle** tool, and be sure the first mode, **Rectangle** mode is enabled in the Tool bar.
8. Next, move your cursor to the top left corner of the keyboard cutout.

9. Press the **Z** key to evoke the **Snap Loupe**, just inside of the actual corner of the keyboard cut out should be find an **Arc Center Snapping** point.
10. Click once you have located this point to start the rectangle. Notice the **Snap Loupe** is revoked as soon as the mouse button is depressed.
11. Move your cursor to the bottom right corner of the keyboard cutout, and repeat the last two steps to find the **Arc Center** point. Once you click on the **Arc Center** point the rectangle is created.
12. Choose the **Fill Style** color box in the **Attributes** palette, and apply any shade of purple to this rectangle.

The majority of the keys on a keyboard have the same measurements so we can use the **Even Divide** command to give us a good starting point.

13. Press the **X** key, and select the purple rectangle if it is not already selected.
14. Go to **Modify > Drafting Aides > Even Divide**
15. Set the **Number of Divisions** in Width field to **14**, and the **Number of Divisions** in Height field to **6**, and then click OK. Notice the **Object Info** palette now displays 84 rectangles.

Now we can start to combine some of these rectangles to create the large keys on the keyboard.

16. Tap the **X** key twice to switch to **Selection** tool, and deselect all the rectangles.
17. On the bottom row of rectangles select the **fifth rectangle** from the left.
18. Hold the **Shift** key, and select the next four rectangles to the right of the rectangle you just selected.
19. Go to **Modify > Add Surface**. This is the space bar.
20. In the row that is second from the bottom, hold the **Shift** key, and select the first two rectangles on the left side.
21. Go to **Modify > Add Surface**.
22. Repeat the last two steps for the first two rectangles on the right side of the same row. These are the Shift keys.
23. Once more repeat these steps for the first two rectangles on the right side in the row above the Shift keys. This is the Enter key.

The basic shape of the keys is now defined but we need to add some spacing between these keys to make there look more realistic.

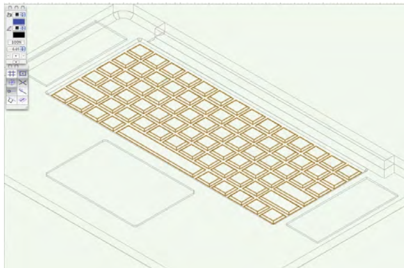
24. Use the keyboard shortcut **Command + A** (Mac) or **Control + A** (Windows) to select all objects on the active layer.
25. Now hold the **Shift** key, and click the space bar, shift keys, and enter key to deselect these objects. The **Object Info** palette should display 73 Rectangles. We are now going to add spaces for all 73 rectangles at once.
26. In the **Object Info** palette, be sure the **Center** point is the select point in the box position controls.
27. Next, input a value of **11/16”** in the **Width** field, and value of **5/8”** in the **Height** field. Then press the Enter key.

The measurements for the Space bar, Shift keys, and Enter keys must be set individually.

28. Select all four of the keys mentioned above, and verify the center point is selected in the box position controls.

29. Select each key individually, and input the following values in the **Object Info** palette: Shift keys, and Enter key: **ΔX = 1 1/2”, ΔY = 5/8”, Space bar: ΔX = 3 13/16”, ΔY = 5/8”**

Keys 3D Geometry



Click the play button below to view a video of the following steps.

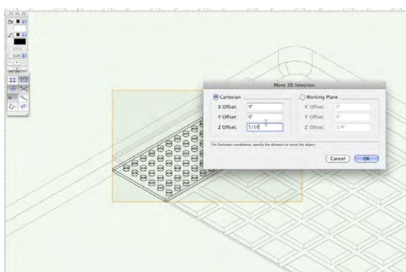
1. Press **Command + A** (Mac) or **Control + A** (Win) to select all of the keys.
2. Go to **Model > Tapered Extrude**.
3. In the **Create Tapered Extrude** dialogue box set the **Height** field to **1/16”,** and the **Taper Angle** field to **45** degrees. Click OK to create the tapered extrude object.

Notice that all of the keys are now one object. This is because all of the keys were selected at the time of the operation. That quickly we created the 3D geometry for the keys now we just need to move the keys to correct Z height.

4. From the **Standard Views** drop down menu in the View bar select **Right Isometric.**
5. Go to **View > Align Layer Views** so the CPU laptop layer is aligned with Keys layer.
6. With the keys still selected go to **Modify > Move > Move 3D**.
7. Input **0”** in the X’, and Y’ Offset fields, and **¼”** in the Z’ Offset field. Then click OK to move the keys into their proper position.

Speakers Detailing

The last thing that needs to be done to complete this laptop 3D model is create the speakers.



Click the play button below to view a video of the following steps.

1. First switch to a **Top/Plan** View by going to **View > Standard Views > Top/Plan.**
2. Go to **View > Align Layer Views** so that the CPU case is now in Top/Plan View as well.
3. Press the **X** key twice to deselect all objects, then click the **Fit to Objects** button on the View bar.

As we have done throughout this exercise we will place the speakers on their own layer to help with organization.

4. Click the **Layer** button in the View Bar, and then click the New button.
5. Name this new design layer, **“Speakers”**. Click OK twice to return to the drawing area.
6. Use the **Zoom** tool, and draw a marquee around the left speaker cutout to zoom to this area.
7. Switch to the **Rectangle** tool in the **Basic Tool** palette. Be sure the first mode, **Rectangle** mode is enabled.
8. Click the top left corner of the speaker cutout when the **Endpoint** cursor cue appears to start the rectangle.
9. Then Click the bottom right corner of the speaker cutout when the **Endpoint** cursor appears to complete the rectangle.
10. Now select Circle tool from the **Basic Tool** palette, and be sure the first mode, **Circle by Radius** mode is enabled.
11. Click anywhere in the inside the newly created rectangle to start drawing the circle
12. Press the **tab** key to enter the **Length** field, and input **1/16”**. Then press the Enter key to lock in the value.
13. Now click anywhere in the drawing to place the circle.
14. With the circle still selected, go to **Edit > Duplicate Array.**
15. In the **Duplicate Array** dialogue box, set the **Shape** drop down menu to **Rectangular Array**.
16. Set the **Number of Columns** field to **6**, and **Number of Rows** field to **15**.
17. Then input ¼” for the **Distance Between Columns** field, and **-1/4”** for the **Distance Between Rows** field.
18. Make sure **Retain**, and **Leave Selected** are both checked on the bottom right.
19. Then click OK to create the **Array**.
20. So that these Circles are easier to move as unit, go to Modify > Group.

Most likely at the moment your group does not sit inside the rectangle we drew earlier. It will only take a few steps to align these objects exactly.

21. Your group of circles should already be highlighted, so press the **X** key to switch to the **Selection** tool. Then hold **Shift** key, and click rectangle behind the group.
22. Go to **Modify > Align > Align/ Distribute**.

23. To the right of the Preview box check the **Align** option, and tick the option **Center**.

24. Below the Preview box, you also want to check the **Align** option, and tick the **Center** option.

25. Click OK to align the two objects.

26. Hold the **Shift** key, and click the rectangle to deselect this object.

27. With just the group selected, go to **Modify > Ungroup**.

28. Hold the **Shift** key, and re-select the rectangle.

29. Right click on any of the highlighted objects, and choose **Clip Surface** from the context menu.

30. Press the **Delete** key to remove the unneeded circles. Now we have just one polyline. Select this polyline.

31. Go to **Model > Extrude**, and set the **Extrusion** field to **1/16"** to add depth to the speaker.

Now the speakers just to need to be positioned properly on the CPU case, and mirrored to the other side of the CPU case.

32. Switch to a Right Isometric View by selecting **Right Isometric** from the Standard Views drop down menu.

33. Go to **View > Align Layer Views** so that the other visible layers are changed to a Right Isometric View as well.

34. Press the **X** key switch to the **Selection** tool, and select the speaker if it is not already highlighted.

35. Go **Modify > Move > Move 3D**, and set the X', and Y' Offset fields to **0**. Set the Z' Offset field to **5/16"**, and click OK to move the speaker to its correct position.

All we have left to do is mirror the speaker, and laptop model is complete.

36. Choose **Top/Plan** from the **Standard View** drop down menu.

37. Go to **View > Align Layer Views** to change the other visible layers as well.

38. Press **X** twice to deselect the speaker. Additionally click the **Fit to Objects** button on the View bar.

39. With the speaker once again selected, choose the **Mirror** tool from the **Basic Tool** palette. Be sure the second mode, **Mirror, and Duplicate** mode is enabled in the tool bar.

40. Now, move your cursor towards the center of the top edge of the CPU case.

41. Click once the cursor cue **Midpoint** is displayed.

42. Hold the **Shift** key, and move your cursor downward, and click again when the cursor cue **Vertical** is shown to place the duplicate speaker on the right side of the CPU case.

Viewports

That's it! Our laptop model is complete. Now let's make change the colors to something more appropriate for a laptop, and create one Open GL viewport, and one Hidden Line rendering viewport.

Click the play button below to view a video of the following steps.

1. Click the Layer button in the View bar.

2. In the Organization dialog box, set the "Screen laptop" layer to visible by clicking the far left visibility column for that design layer.

3. Next, click the New button, and the name this name Laptop complete.

4. Then click OK twice to return to the drawing layer.

5. Go to **View > Layer Options**, and choose **Show/Snap/Modify Others.**

6. Go to **Edit > Select All**

7. In the **Object Info** palette choose **Laptop complete** from the layer drop down menu.

8. Switch to a **Right Isometric View** from the Standard Views drop down menu in the View bar.

Lets see when our laptop looks like rendered, and apply some appropriate colors

9. Click **Fit to Objects** in the View bar.

10. Select **Open GL** from the Render Modes drop down menu in the View bar.

As you can see the display still has several colors to it. If you choose can keep these color or you may change the color of any of the part of the laptop using the attributes palette. Remember some of these objects are in groups so you will need to double click the group first to enter the editing mode, and apply different colors to different object within the group. Once you have your colors set. We can 2 quick viewports

11. Go to **View > Create Viewport**. Click OK twice to close the dialogue boxes.

12. You should one large viewport on a Sheet layer. This viewport is too large for the page boundary. So with the viewport selected, change the scale drop down menu in the **Object Info** palette to **1:4**

13. Then position the viewport so that it sits within the page boundary in the top half of the page.

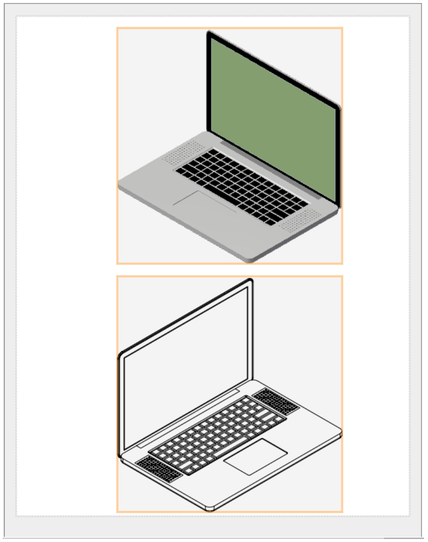
14. Now lets duplicate this viewport. Hold the **Option** key (Mac) or **Alt** key (Win), and click, and drag the current viewport downward, making sure its still within the page boundary.

15. When are happy with the placement, release the mouse button.

16. In the **Object Info** for the duplicate viewport change the **View** drop down menu to **Left Isometric**, and the **Background Render** drop down menu to **Hidden Line**.

17. Hold the **Shift** key, and select both viewports.
18. In the **Object Info** palette click the Update button.

Here's the final product.



Section 4
Further Exploration

Drawing Organization

Introduction

Layers, and classes provide a way to specify certain objects in a drawing to be members of a collection of related things. Once assigned, it's easy to make all the members of the group visible, gray, or hidden in a drawing.

Layers, and classes also help make a complicated drawing easier to use by distinguishing editable objects from those that are either only visible or snappable.

A drawing structured with layers, and classes makes it easy to produce various views suitable for printing or review. Each view can refer to different combinations of the data model parts without the need for duplication. This method can also be used to organize the project in other ways, such as to assign materials for 3D representation, and to extract quantities from a data model.

Layers as Pieces of Paper

When creating small projects in a CAD system, there's usually no need to pay much attention to layers, and classes because in a small project, you draw what you need, and then print it.

When transitioning from drafting on a board with a pencil to using a CAD system, some folks draw onto the screen as if it were an electronic piece of paper. They use line objects to represent the graphite counterparts from their real world days with a pencil, and a piece of vellum. One file produces one piece of paper.

Once they are drafting like this for awhile, some folks begin to store multiple drawings in a single project file by placing each drawing onto a new layer. At least initially, these folks might copy the parts of the drawing that repeat from one layer to the other to use as a base for the next drawing. Using this slightly more efficient approach, you can get more than one piece of paper out of a single CAD file, displaying one layer at a time while printing.

Systems Drafting Approach

For now, let's think of layers as clear sheets of paper that can hold scaled figures. Sometimes folks discover that you can use the layer feature like the clear mylar sheets of Systems Drafting, which promoted the reuse of common elements on more than one drawing by separating elements that repeated onto separate sheets of mylar.

Some folks use layers in their CAD drawings as clear sheets of paper. Using this strategy, you can reuse certain parts of your drawing that appear on more than one piece of paper. As an example, you can create layers for plan elements, overhead elements, and walls, which appear in both. By displaying the walls layer with the plan, and overhead elements in succession, you can represent two pieces of paper with these three layers.

Building on this strategy, you can structure files to represent the pieces of paper for the plan, and overhead of each floor of a three-level building; for example with a wall, plan, and overhead layer for each floor. In this case, you can get six pieces of paper from the various permutations of the nine layers used.

But wait a minute, Architectural projects often have fifty or more sheets! That would necessitate layers for HVAC, plumbing, electrical, fire protection, and so on. Using a one-dimensional structural scheme such as this for large scale projects could easily produce a list of 300 or more layers. In fact, some CAD systems with a one-dimensional layer system do just this, as you may have experienced if you ever imported a drawing generated in one of these CAD systems, and examined the layer list.

A Second Dimension

Enter Classes as a second dimension of organization. With an array of layers, and classes available for organizing a drawing, it is possible to create files equivalent to the organization of 300 layers with just 10 layers, and 30 classes. This dramatically reduces list management, and provides for some interesting additional efficiencies as well.

So, how do I decide on a scheme for structuring a drawing? One question I hear often is: Should I put this object in a Layer or a Class? This of course, is a trick question because each object in Vectorworks is always on a layer, and assigned to a class. But seriously, how do I decide on an organizational scheme? Well, one approach to use is to note that layers, and classes have slightly different properties.

Layer, and Class Attribute Differences

The feature common to both layers, and classes is object visibility. I can show or hide members of a class or layer with a click. I can also instantly set all members of any layer or class to a muted or grayed look. Let's look at the other properties to see how layers differ from classes.

We've already seen that layers can be assigned a scale. You can't do that with classes. So, if the layout of one of your printed sheets has figures in more than one scale, then you can show multiple layers, with each layer set to the appropriate scale. Layers also have a height in **Z** space. So, this suggests that layers can be a place to put things that all reference the same height. So when I set the height of a layer, the heights of all 3D objects on that layer are changed. In particular, they become an excellent way to represent architecture because I can divide it into floors or slices of **Z** space.

Since layers have this physical height quality, you can represent a myriad of over, and under relationships depending on the complexity of your project by stacking layers with the top of one layer exactly matching the bottom of the next layer. Remember, though, that layer heights can be specified in varying degrees of overlap. In fact, setting layer heights, and thicknesses to perfectly overlap is a common approach to structuring special types of projects, such as some of those in the landscape, and entertainment lighting industries.

Classes, on the other hand, don't have this physical height quality among their properties, but it does have the ability to display all of its members with the same graphic property, such as color or line thickness. This is not always needed, but as the project size becomes larger, it becomes more useful.

Showing all members of a class in a particular line size or color makes it possible to review a drawing visually for its structure. For example, if I see a green door, and my exterior door class is supposed to be displaying in blue, I can recognize visually that it is in the wrong class.

Putting the Differences to Use

A question that frequently comes up at this point is: Are classes part of a specific layer?, and the answer is No. While layers have a location in **Z** space, and can be considered a container for its members, classes are more like attributes that are assigned to each member. A class can be applied to an object that is in any layer. Class members on a layer are not visible if the layer is turned off, even if the class visibility is turned on.

Thus, a simple class, Door, for example, can apply to objects on the first floor, the second floor, and so on, instead of having to have a Door First Floor class, a Door Second Floor class, and so on. So, for larger projects, classes can differentiate among objects in the same layer in order to define the separation needed to display different pieces of paper referring to the same floor.

For example, in order to set up a drawing with a first-floor electrical plan, and a first floor mechanical plan, I would define a layer—first floor—to contain the objects, and one or more classes for each of the needed sheets electrical, and mechanical, plus one or more classes for the elements that are shared between sheets, such as the walls. If I need to add a floor to the package, I just add a layer—second floor—to the file, and now I have all of the structure that I need to produce a set of electrical, and mechanical sheets for the second floor as well.

Since class graphic attributes can also apply to the 3D representation of objects, classes become an efficient way to categorize objects in the file by material. Using this feature, I can define a texture to be used for each member of a class, for example, to represent the finish of all of the millwork in a project.

When structured this way, it becomes a simple matter to dramatically update the look of the 3D rendering, even late in the design process, by changing the classes' texture attribute, and having each of the members reflect that change after updating the images with Renderworks.

Adding on—A Scaleable Approach

This scheme is scaleable to describe more complex models or larger projects by dividing the floor volumes more finely. In a larger architectural project, for example, each layer representing the space between floors could be broken down into Slab, Walls, and Plenum.

This makes it possible to manage more types of drawings a little more easily.

Slab layers can be set up to handle space planning, egress plans, area calculations, usage analyses, and other schematic tasks.

If the size of the project warrants it, Plenum layers can be set up to handle drawings such as mechanical plans, lighting plans, fire protection plans, reflected ceiling plans, and so forth.

This can simplify the use of classes when used to separate project parts in a large drawing package.

How to Develop Standards

Review existing standards

The problem of drawing organization has been addressed in countless ways. Find out how others have approached this problem. There are a number of resources, and links provided in the Review the published standards, such as the AIA CAD layer guidelines to see how they might be adapted to your needs.

Conduct a needs analysis

- Determine what features you need
- Characterize the nature of your projects...
- Draft!

It may be that the easiest way for you to begin this process is to open up a blank document with Design layer 1, and class None, and start drafting. Once you run into the need for separation, add layers, and classes as you go. After the project is complete, there will be a valuable set of layers, and classes with which to start other projects.

This initial standard should be considered a work in progress in that regular review, and use of the template will improve over time, and in time, will become a perfectly tailored solution that represents all needed presentation, and is adaptable, and flexible for the future.

Creating Layouts with Sheet Layer Viewports

Introduction

One of the main purposes of drafting is to provide a way to describe a design to someone, who is not familiar with the project. With a 3D project, such as an architectural building, a landscape, or a scenic design, several views are necessary to adequately describe the project on a flat piece of paper. These views may include different types of plans, elevations, isometric views, and enlarged details.

When drafting was done with pencil, and paper, the required views meant that a completely independent drawing had to be developed for each of the views. Each view was, in essence, a duplication of some part of model. Anytime that a change was introduced, each of the affected views had to be corrected to accommodate the change. Correcting the same part of the model in multiple views is more work than changing the model once. Also, the possibility of coordination errors is present each time duplicated information has to be corrected. One of the reasons that drafting systems were developed was to reduce the amount of duplication that these traditional drafting techniques required.

Drafting with a computer makes it possible to describe a design once as a model, and project the information in various ways using the processing power of the machine to compute each view from the single model. Computers also build on this capability by providing efficient ways of organizing the model such as with layers, and classes. This brings us to the need for Sheet Layer Viewports, which are a way to present multiple views simultaneously as they are needed on a sheet of paper, ready to send to the printer.

What is a Viewport?

A viewport is an object that can present various views, and information on Sheet layers from a model on Design layers.

What are the benefits of Sheet Layer Viewports?

Sheet Layer Viewports allow us to create presentations that were difficult or impossible to create previously.

For example, two side-by-side views of a floorplan, and reflected ceiling plan almost certainly required duplication of objects.

Using Sheet Layer Viewports, it is possible to combine multiple views of the design, at different scales, different orientations, and with different graphical looks.

Viewports increase drawing efficiency, and reduce errors.

They are the perfect illustration of one of the basic rules of CAD, which is “draw it once.” Instead of creating an unconnected drawing for every view of the design, Sheet Layer Viewports allow us to project information from a single model in many different ways., and, because Viewports are dynamic projections, any changes that we make to the model are applied to all the Sheet Layer Viewports.

The provide a simplified drawing structure.

Sheet Layer Viewports can be embellished with annotations that are specific to the viewport. Without this method, information that is used only once in a viewport would have to be added to a Design Layer, and would have to be structured with additional classes to keep the information needed in each Viewport separately visible.

They provide a consistent place to manage your output

Sheet Layer Viewports, and Sheet Layers simplify the drafting task by providing a consistent organization for storing, and managing printed sheets. They also make it much easier for the software to provide features like the issue manager, and to batch print.

They provide better DWG compatibility

With Sheet Layer Viewports, and Sheet Layers, Vectorworks has an organization schema that maps well to AutoCAD’s model/paper space. The result is much better compatibility with AutoCAD.

Viewport Requirements

In order to use Sheet Layer Viewports effectively, the file must be organized so that the project’s parts can be displayed independantly from one another. This means projects should be built using layers, and classes to locate, and categorize parts of the model so that they can be displayed in all of the ways that are needed to produce the various required views.

To make the most use of the viewport feature, files should be modeled using 3D or hybrid objects.

Sheet Layer Viewports can still be used in files that have not been set up in this way, but some features demonstrated here might not be available.

Viewport Details

Sheet Layer Viewports reside exclusively on Sheet Layers, which are a new type of layer created to be a repository for Sheet Layer Viewports. Multiple Sheet Layer Viewports can reside on one sheet layer, and multiple sheet layers can be created in any file. So a single file can have enough sheets to produce an entire set of drawing plans.

Sheet Layer Viewports can display each of the required views of a project without duplicating the model. If the model changes, the Sheet Layer Viewports can be updated easily to reflect the changes.

Managing Drawing Resources

Basic Concepts of Resources, and the Browser

To increase efficiency, you can import resources into a file when it is first created. This increases efficiency because the resources are available for later use.

Instances, and Definitions

There are two parts to most resources, the **definition**, which is imported from file to file, and the **instance**, which is a reference to the definition, that is usually a part of the active file but also refers to a resource that is workgroup referenced from a different file.

Two Main Parts to the Resource Browser

The two main parts of the Resource Browser are (1) the part associated with the files, and folders functionality, and (2) the part associated with the resources functionality.

In the top part of the Resource Browser there are two labels corresponding to these two parts.

The Files, and Folders menu is used for navigation, and the Resources menu is used for viewing.

The Browser is a two-way concept. It imports from, and exports to library files.

Using the Resource Browser

Open the **Formatting Worksheets** file. The Resource Browser opens wide to show resources.

The Resource Browser brings with it the concept of **Favorites**, which are designated files also known as Libraries, which contain resources. These resources are available to any active file.

The top drop-down menu shows open files above the divider in a list, and below the divider are the designated favorites.

Select one of these files to make it current.

The second popup shows the hierarchy of resources within the current favorite or open file.

To quickly access a resource, click in the resource display window, and begin typing the resource's name. The resource display window scrolls to the first resource using the letters entered.

The currently active symbol is identified at the bottom of the Resource Browser. Be aware that the symbol highlighted in the window may not be the active symbol.

To make sure the selected resource activates double-click the **Resource** or right click, and select **Make Active**.

Once active, depending upon resource type, the resource can be inserted into an object or anywhere else in the drawing.

Resources can also be inserted without being the active resource. Simply click, and drag the resource to its desired location.

Editing Resource Definitions

Resources must be imported into the current document in order to be edited.

Once you have done so in the current document, right click the **Resource**, and select **Edit**. An Edit dialog will populate depending upon which resource type is selected.

Mapping Instances

Select the object(s) to texture. If more than one object is selected, only the texture resource can be selected. Mapping parameters can only be set for individually selected objects.

From the Render tab, select the desired Texture from either the default resources or the current file's resources, and then set the texture parameters, which apply only to the selected object. Because **Object Info** palette changes apply only to the selected object, one texture can be applied with different parameters to many objects.

Instances may also be mapped by simply clicking, and dragging the desired instance onto the appropriate object, and then making changes to mapping parameters as necessary through the Render tab in the **Object Info** palette.

Additionally, instances can be mapped by selecting the appropriate object(s), and right-clicking the desired resource, and selecting apply. Again changes can be made via the **Object Info** palette as desired.

The basic mapping parameters display in the **Object Info** palette. Click **Mapping** to access advanced mapping items, and dialog box.

Once a record format has been created, it can be attached to any object or symbol in the same drawing file as the record format. The **Data** tab of the **Object Info** palette indicates all record formats currently available to attach.

Methods

Attach a record format to a single symbol instance or to an object in the drawing without affecting previous or future instances.

With the desired object selected, click the **Data** tab from the **Object Info** palette. The **Object Info** palette lists all record formats in the drawing. Place an X in the desired record format box to attach the record.

The record can also be applied by selecting the desired objects, and then from the Resource Browser selecting the record format to be applied. From the context menu, select **Apply**.

Alternatively, double-click the record format resource to apply it to the selection or drag the record format resource onto a symbol or object.

Attaches a record format to a symbol definition that applies to each symbol added to the drawing afterwards. Existing instances remain unaffected.

Select a resource definition, and then select **Edit**. Select the symbol component to edit, and click Edit.

With nothing selected, click the **Data** tab in the **Object Info** palette. When no items are selected, the Data tab displays *SYMBOL DEFAULTS* at the top. Select the record to attach. Click on the exit symbol button when complete.

The attached record(s) is included with the symbol each time the symbol is placed in the drawing or imported into another drawing. Symbols already present in the drawing are unaffected.

.Creating a resource

Create from the resource browser

To create a new resource select **New Resource in <current document>** from the

Resources menu, or right-click in the Resource browser window to access the same menu.

Select the **Resource** type to make from the list, and the resource-type specific dialog box will open.

Once created, the resource appears in the Resource Browser.

For quick resource creation, right-click in an area of the Resource Browser that is associated with an existing resource type. The context menu contains an additional option for quickly creating another resource of the same type.

Symbols must be created by using the **Modify > Create Symbol** command with the desired object to be created into a symbol selected.

The Create Symbol command creates symbols from 2D, and/or 3D objects, including text. Symbols can also be created from other symbols, from plug-in objects, groups, and worksheets..

Special Cases

Hybrid symbols

A hybrid symbol contains both a 2D object, and a 3D component, and displays correctly according to the view.

To create a hybrid symbol, select both the 2D, and 3D objects. In Top/Plan view, align the objects first, and then select **Modify > Create Symbol**. The resulting symbols will be displayed in the Resource Browser.

Red symbols

A red symbol when placed is converted into a plug-in object. It has a specific insertion behavior, and set parameters, and it can be modified, with many variations of the same object in the file.

At symbol creation, select **Convert to Plug-in Object** in the insertion options to specify a red symbol.

Changes to a red symbol definition affect future instances, but not existing ones.

Blue Symbols

A blue symbol when placed is converted into a group.

Any changes made to the symbol definition later have no effect on the group.

At symbol creation, select **Convert to Group** in the insertion options to specify a blue symbol.

Green Symbols

Green symbols are designated as **Page Scale** when created. They display, and print the same size no matter the scale of the layer. They are used primarily to maintain consistency of page graphics such as drawing labels across the entire project.

Managing Resources

Getting resources into the active file

To move resources into the active file, right-click on the resource from the library file, and select **Import**.

Resources are also added to the active document as they are used in the document.

Getting resources into libraries

To add resources to a specific library, select the desired library to add the resource to from the Top drop-down menu. Select **Open current favorite** from the Files, and Folders menu.

Once the desired library file is open, resources can be imported from other libraries or documents or new resources can be created.

Once the changes are saved to the library file, the new resources are visible in the library.

Default content system

The more commonly used resources are available at the point of use while drawing, without having to first add them to the current file through the Resource Browser.

Default libraries are found at: **My Computer > Local Disk(C:) > Program Files > Vectorworks > Libraries > Defaults**, and **HD > Applications > Vectorworks > Libraries > Defaults** respectively.

The ability to use default resources is a preference contained on the **Session** tab of Vectorworks Preferences, and can be disabled if default resource use is not desired

Default resources are available from a variety of dialog boxes that contain parameters allowing resource access. They are also available from the Attributes, and **Object Info** palettes. Once a default resource is selected for use, it is automatically imported into the current file, and displays in the Resource Browser. It can then be shared among other drawing files.

Creating custom default content

To make a custom resource available as a default resource: Import custom resources to a default resource file, add a custom resource file to a default resource folder, or create a custom resource file, and place an alias of (Macintosh) or shortcut to (Windows) that file in a default resource folder.

Section 5
Glossary

Glossary

Planes

Any surface defined by any three points. In Vectorworks, plane is the term used to identify the surface where 3D operations take place.

Automatic Working Plane

Attribute of 3D, and most planar creation tools that identifies object faces as potential working planes for the next drawing operation. As the user gestures in the document window with a tool selected, faces under the cursor highlight as alignment candidates to be used if the user begins the tool operation. Active plane must be set to Automatic.

Container Objects

Hybrid (adj.)

Capability of certain objects to provide a distinct plan view graphic when the projection is Top/Plan. This allows, for example, a schematic representation of a door with the symbolic door swing arc graphic when displayed in plan view. A concept in Vectorworks in which objects have 2D, and 3D parts so that the same object can have a look in a 2D plan view that is different from it's look in 3D views.

Resource

A structured drawing component in the active file or in a library, which provides consistency across projects, and individual users as well as within large multiple-file projects. Resources provide a means of sharing objects to multiple members of a workgroup.

A shareable drawing component that can be imported to the active file with the Resource Browser from any Vectorworks file created with the same version. Resources can only be edited if they are part of the active file. Some resources specify actual objects, such as a symbol resource. Other resources are essentially attributes that define properties objects, such as hatch resources. Still other resources are a series of settings that can save time, and enable consistency.

Resource Browser

The central repository for all Vectorworks resources. It is a window into the resources in the active file, and any other Vectorworks files on a computer or network.

Sheet Layer Viewports

An object that can calculate various views of a model, by using layer, and class visibilities, projection, rendering, scale, and orientation parameters. Viewports are ideal for creating presentations from your model.

Viewport Annotations

Any viewport specific embellishment that is added to a special group within the Viewport. This can be notes, and dimensions specific to the Viewport, as well as graphic objects to clarify or correct the Viewport calculation.

Design Layer

A place to draw the model. Design Layers have height, thickness, and scale among their most important attributes. Multiple Design Layers are often used in the development of the project model.

Sheet Layer

Sheet Layers make it easy to create printable plates that make up a hardcopy project package. They are the place to put Sheet Layer Viewports along with pasted graphics, and Title Blocks in Vectorworks. Sheet Layers have an independent origin, an assignable resolution, and printer definition. Sheet Layers always display, and print in a scale of 1:1. The Sheet Layer Viewports residing on Sheet Layers each have their own independent scale, and other parameters.

Project

The design that you are developing, and documenting in Vectorworks. Anything that you are designing or drafting.

Model

n. All of the information you need to describe your project. v. The process of building a digital representation of your project that efficiently documents all aspects of your project, and quickly gives you flexibility, and accuracy across the entire timeline. The guiding principal for constructing a well-formed model is to use structures that ensure there are no duplications of model components or assemblies at any level. Vectorworks uses Stories, Design Layers, Sheet Layers, Classes, Viewports, and References at the conceptual level to organize the model.

The collection of objects, geometry, text, and other elements that make up a project. Generally, the preliminary purpose of the model is to eliminate duplications. When there are repeating elements in a project, the repeating elements are defined as instances, which reference a single element definition.

Presentation

The collective calculations of the model, created either with the aid of a computer or otherwise that, with value added clarifications, comprise the contracted specified deliverables among the project stakeholders. In Vectorworks, the presentation is made up of annotated Viewports on Sheet Layers. Lists, tables, and catalogs of parts, pieces, takeoffs, and details are similarly calculated from the model, and verified expert review. The model itself is not the presentation, although each of the stakeholders in a project readily share their parts of the model as a means of in-progress communication, and documentation. The presentation can resemble traditional plates in a drawing package, or may adhere to another standard as specified by the client.