Vector Graphics: A Crash Course

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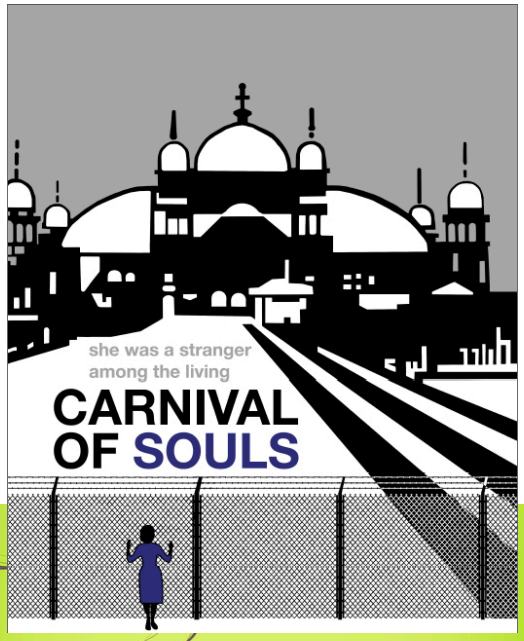
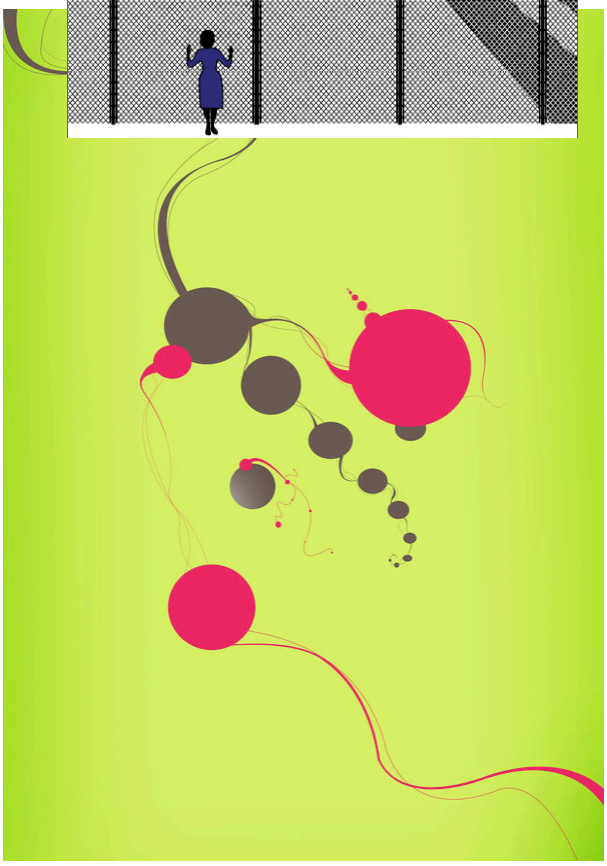
Your guide to Illustrator.

Introduction

What are vector lines, and how do you make images with them?

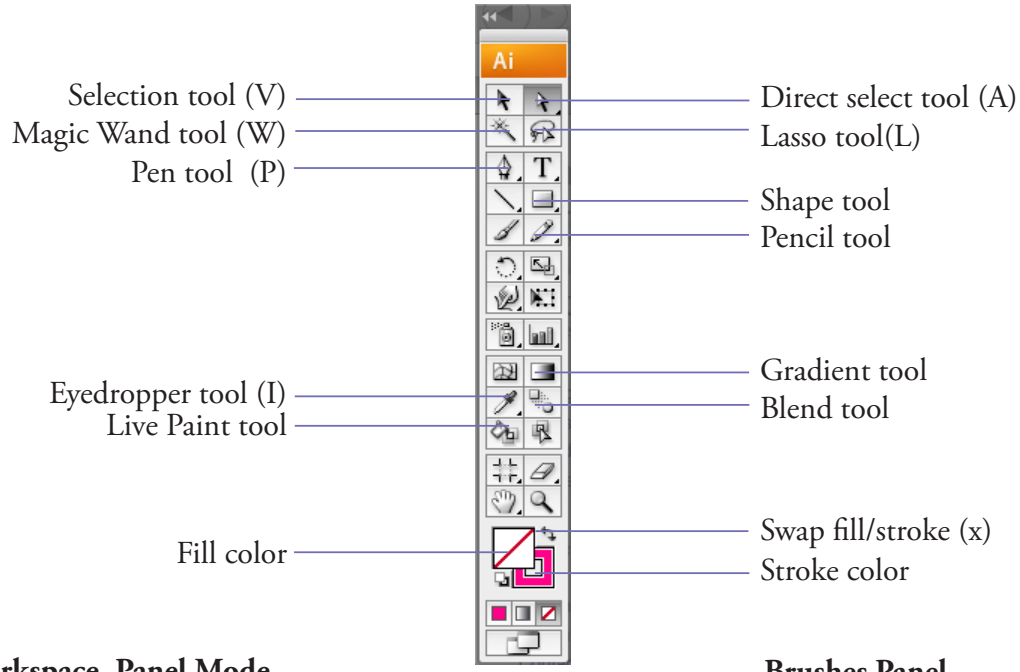
Vector illustrations are images made using vector lines in programs like Adobe Illustrator. **Vectors** are a type of graphical representation that use straight lines to construct the outlines of objects; manipulating the angles of the lines allows the illustrator to move the curves that compose illustrations. The program's use of vectors creates images that can be enlarged to massive sizes without losing any detail.



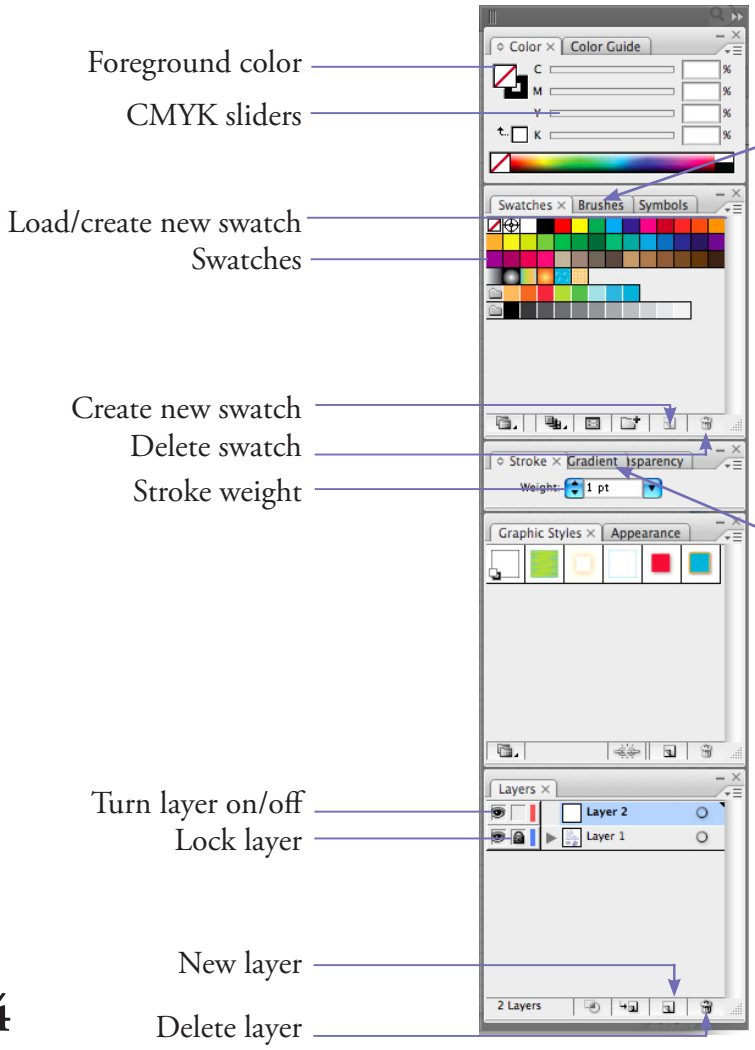


Your Friend Illustrator

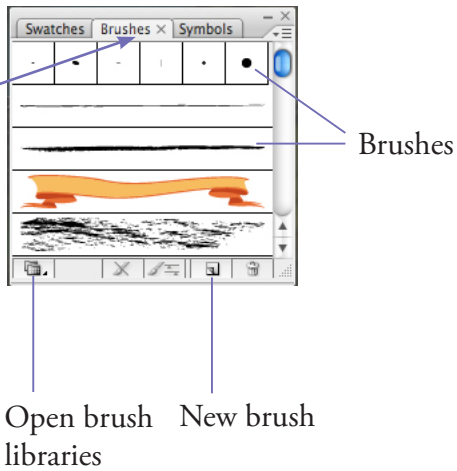
The appearance will vary slightly from version to version



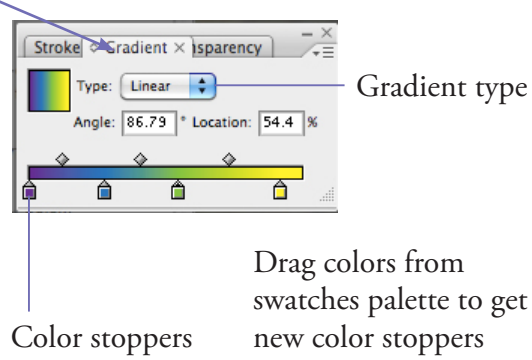
Window, Workspace, Panel Mode



Brushes Panel



Gradient Panel



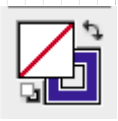
The Pen Tool: Straight Lines

Starting simple by making only straight lines

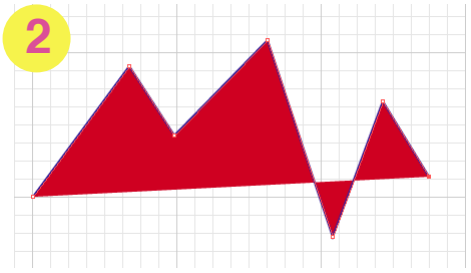
With InDesign open, go to **File, New** to create a new document.

To create vectors, use the pen tool by clicking around in your workspace. If you use the tool and simply click to create anchor points, you get a line that looks like this 1 Note that this line's color is the dark blue indicated in my stroke color on the main toolbar.

Stroke and fill options with a stroke color, but no fill color

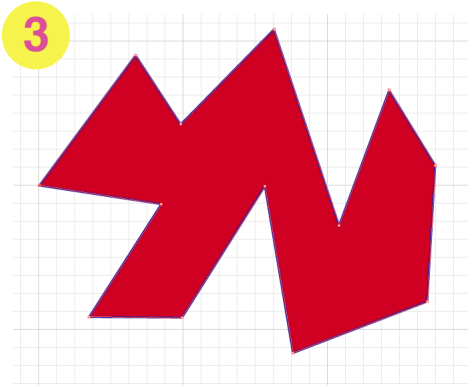


Presently, the fill color is on "**no fill**," the white box with the red stripe through it. If I click on the fill color box, then click on a color from the swatches menu, this 2 is what happens.

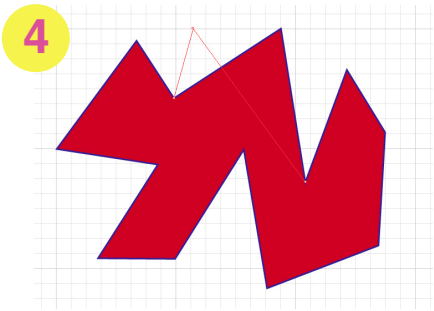


Stroke and fill options with a fill color selected

Let's close this shape off. If you go to the last point you created with the pen tool selected, you should see a little angle appear next to your cursor's pen tool icon . Click once, then you should be able to continue making parts of your pointy shape. To close the shape off, continue making points on your way back to your very first point. When you get there, your pen tool will have a small circle next to it, indicating that you can close the path, making a solid shape. 3



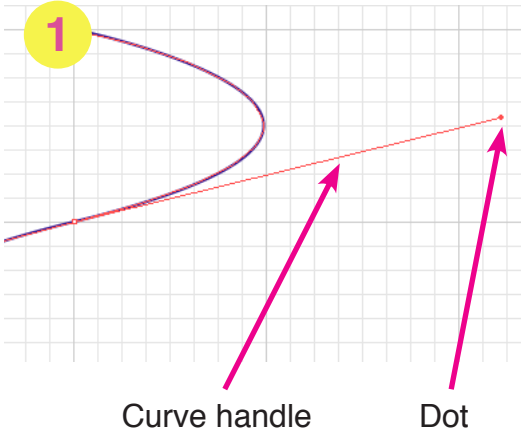
With your direct select tool, click on an angle of your shape. You should now be able to click on the points and manipulate them by clicking and dragging the points. 4



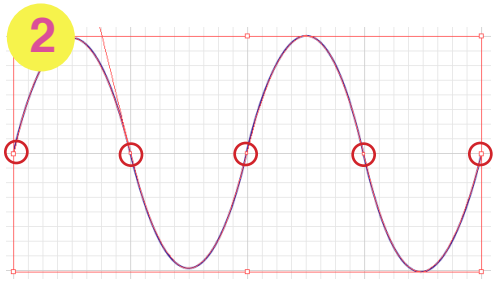
The Pen Tool: Curves

More than just straight lines: curves are where Illustrator shines

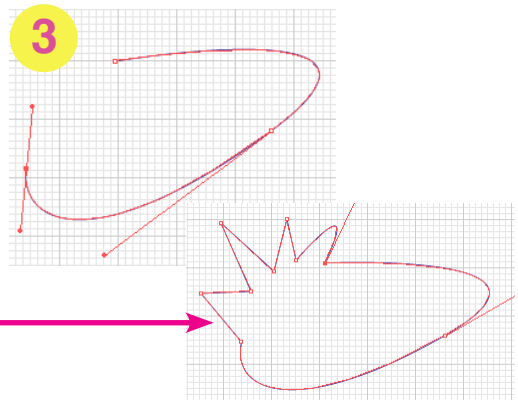
Start the same way as last time: click to create one point. However, when you go to make your second point, click and drag - your straight line is now a curve! Manipulate it around a bit to get used to the basic curve functions. You'll notice **handles**, the long, straight lines that move as you manipulate the curve 1 . After you have finished with the pen tool, you can go back and move these around independently by clicking on the small dot at the end of the line.



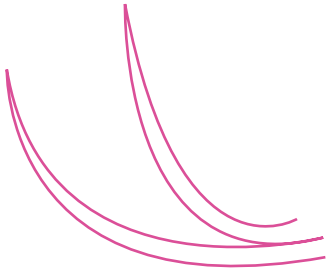
Here 2 I have created a simple set of curves. Circled are the points where I clicked, then dragged the pen tool. Without dragging out these curves, this would have just been a straight line. I used the grid in Illustrator (**view, show grid**) to help me keep the curves the same size.



You might notice that, if you keep creating curved lines, you can't really get sharp angles 3 . If you want to get a sharp angle after you've made some curves, hold down **alt** while clicking the last point that you made. Now you can make sharp angles.



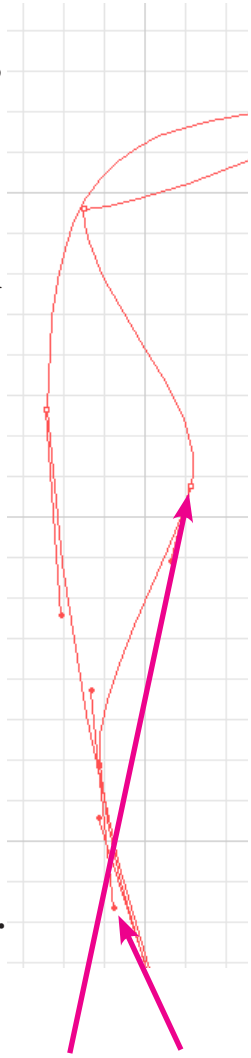
If you're trying to trace an image, or follow a line exactly, you'll probably be using handles on each and every point you make, because rarely will something have extremely straight lines - but you probably will want to use the "alt" method if you are making tight corners, like the tips of eyelashes.

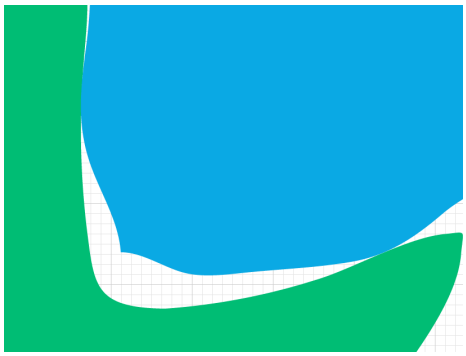


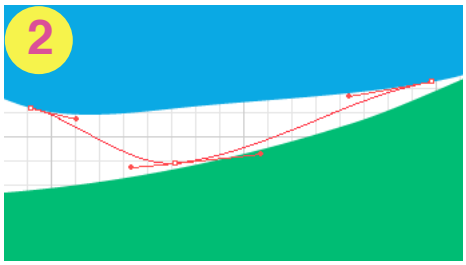
The Pen Tool: Fixing Things

Sometimes, things look fine until you zoom in

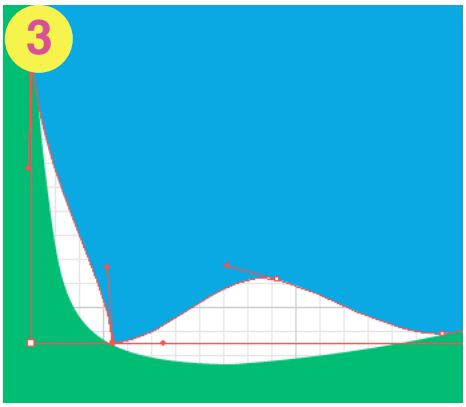
In order to get these shapes to match, we will have to do some more precise moves with the handles. After you have made a shape, go back with the **direct select tool** and click on the edge of the shape. On 1, I have removed the fill color on the shapes so you can see the outlines. You will want to click on one of the small white boxes on the line to get a hold of that point's handles.



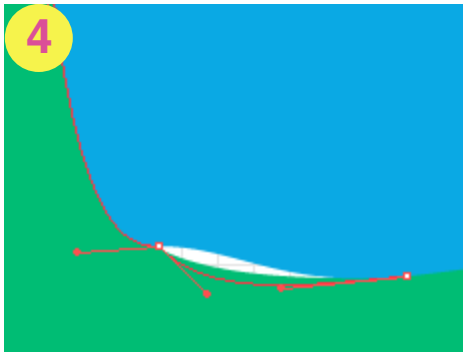


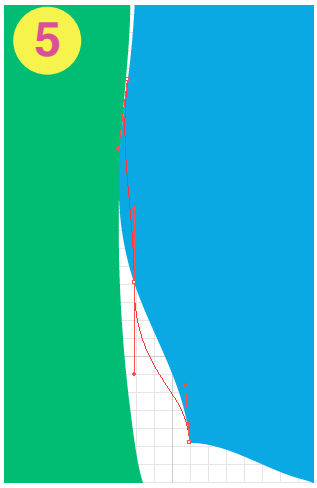


You can manipulate the area by dragging a single point around 2, or by dragging the handles of that point to change the orientation of the curve to meet whatever form it needs to fill.



In examples 3, 4, and 5, you can see where I was tightening up the curves of these two shapes so that they meet each other evenly. However, you can see in the last image that I still didn't quite get these shapes completely together - something you could only see with a lot of zooming in (**Ctrl-]**). Of course, if accuracy isn't a concern, you can always right click the object and **Arrange, Send to Back**.





The Pen Tool: Pencil

Actually, this is a separate tool, but with a similar function

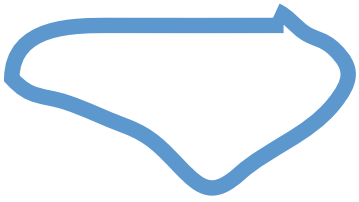
The **pencil tool** is an interesting approach to creating vectors in Illustrator. To use this tool, simply click and drag to draw. When you release, you will see a path roughly similar to what you drew. Here, I have a poorly drawn cat head.

If you want to continue drawing with the pencil tool like I have here, you have to *make sure that the pencil tool has a small "x"* next to the pencil icon where you're about to draw. Otherwise, it will just append whatever you're about to draw to the lines already there.

Now, for the drawbacks of the pencil tool. While it does a pretty good job of figuring out what you wanted to draw, it still very much simplifies your brush strokes. This is especially true if you are trying to draw with a mouse instead of a stylus. Notice that the cat head here has a good many "blobs" hanging off the main part, especially where I added eyes and the nose.

Converted to outline view for better blob viewing

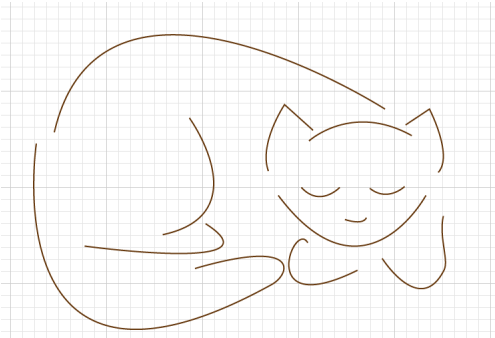
Additionally, you do not determine how many anchor points are made when you are drawing with the pencil tool. However, you can go back with the add anchor point tool to create more anchor points, delete anchor points to get rid of "blobs," or just use the direct select tool to move things.



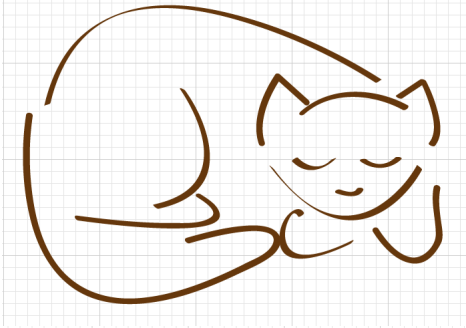
This "nose" is in desperate need of some more anchors

The Pen Tool: Strokes & Brushes

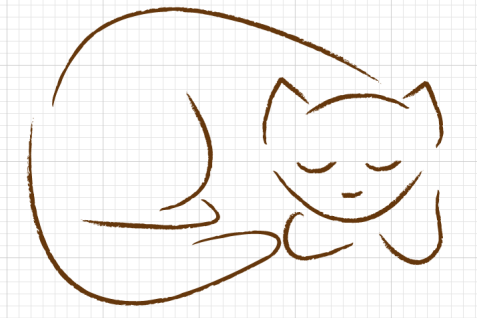
Strokes and brushes make more simple designs and patterns interesting



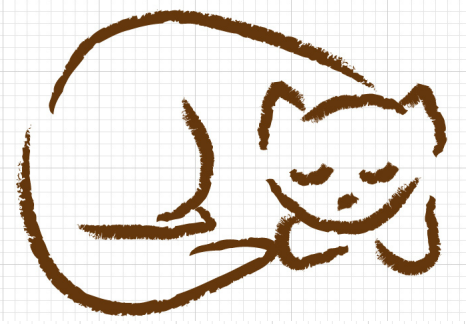
The brushes panel is a tab next to the swatches panel, as seen in "Your Friend Illustrator." In this top image, I have a very, very simple image of a cat that I drew using only the pen tool. This is what the pen tool defaults to - a one point thick, straight, untapered line.



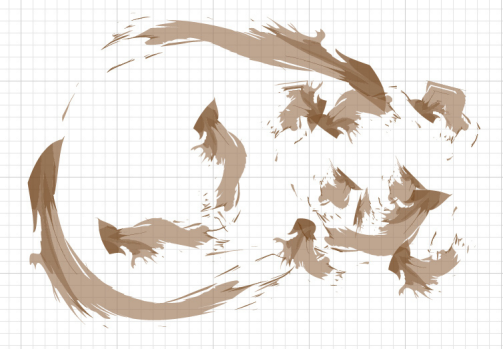
Here, I used the **5 Pt Flat** brush at the very top of the standard brushes panel. This brush gives the impression that something like a calligraphic pen has been used, since it has some thick/thin contrast and tapers as it goes around curves.



This is back to a 1 pt thick line, but I clicked on the **Charcoal** brush in the brushes panel - the second one down on the standard panel. This makes a rough, segmented line that gives the impression of being done with charcoal.



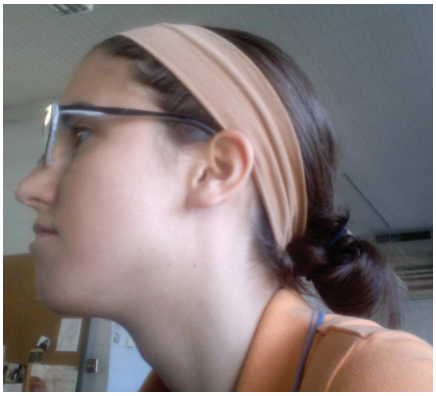
This is the same charcoal brush as the previous example, but I changed the line thickness to 3 pt by using the **Stroke** panel right below the Swatches/Brushes/Symbols palette. Changing the line thickness changes the brush effect as well.



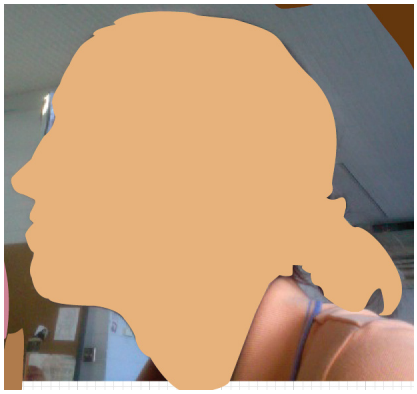
There are a whole lot more brushes than the ones in the panel! I clicked on the icon at the bottom left of the brushes panel, selected **Artistic**, then **Artistic_Paintbrush**, then used **Splash** to get this rough, wet look.

The Pen Tool: Tracing

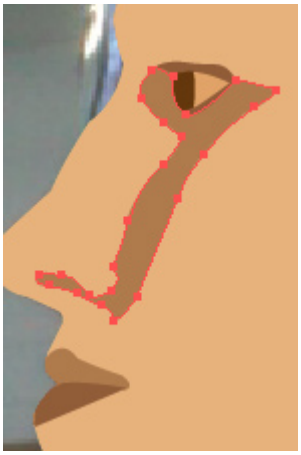
Using the pen tool to create actual images, rather than shapes



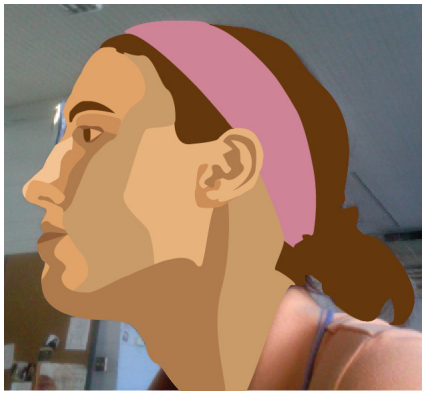
I chose a very simple picture of me in profile to demonstrate practical use of the pen tool. The first thing I did here was trace the outline of my head with a fill color selected. I simply used curves; since I'm tracing an organic shape, I didn't need to have sharp angles anyway.

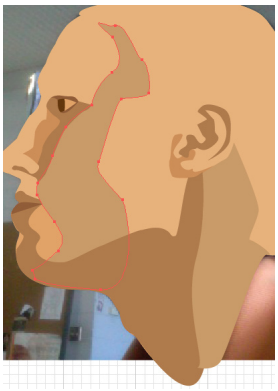


In order to see what I'm working on, I selected my head outline, then **lowered the transparency** so I could see through the shape and tell what I was doing. If you're in panel mode, transparency is under the swatches window and next to stroke and gradient tabs.



I did the darkest, most detailed shapes first - the inside of my ear, my eye, the shadow next to my nose, and my lips. I then moved to larger, lighter shapes, like my cheek and chin. I left the hair for last because I knew it would cover up a lot of my "weird" edges.



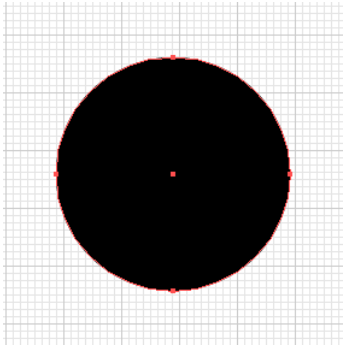


After I traced the basic shading lines on my face, I went back, zoomed in, and used the direct select tool to drag around some of the points and lines to get them to fit with each other better. If necessary, you can hold down the pen tool to get the add or delete anchor point tools, in case you need more or less handles in a certain area.

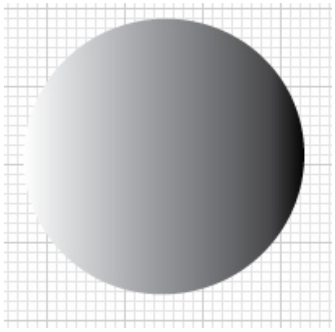
Effects: Gradients

The gradient tool allows you to make smooth transitions between colors

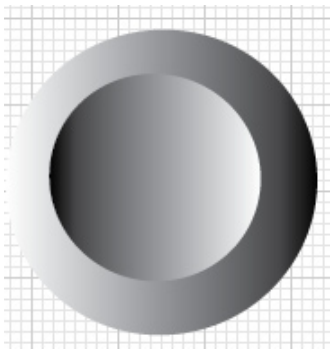
To start, I'm going to use the shape tool to create a shape - I held it down to get a circle, and then held **shift** as I dragged the tool to get a perfect circle. My fill color was on black for this circle.



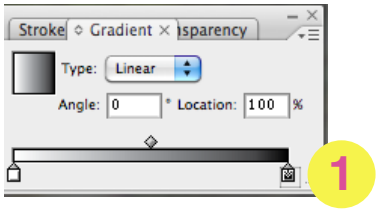
Instead of having a fill color on black, I went to my swatches palette and selected the linear gradient while the circle was selected. I adjusted the gradient using the gradient tool by clicking and dragging to change the gradient's direction and orientation.

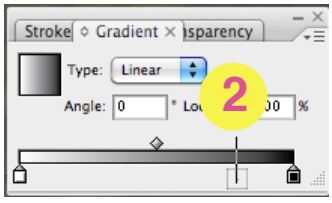


I copied my circle, then held shift as I dragged inward to proportionally shrink this circle. I then used the gradient tool to make the shading go in the opposite direction, giving this circle the appearance of a button.



Remember - with the gradient panel selected, you can change the colors of your gradient by dragging colors from the swatches panel to the gradient levers. You can replace a color by directly placing a color over one of the existing levers 1 , or by dragging a color to an entirely new location on the gradient panel 2 .

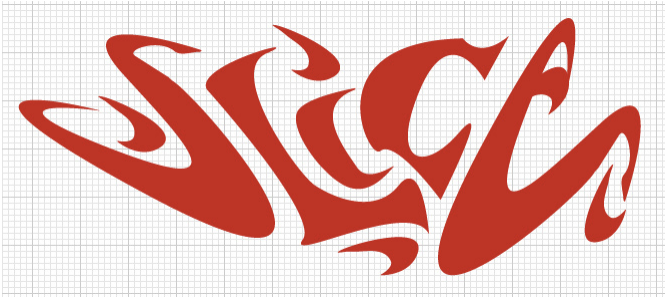




Effects: Illustrator & Photoshop

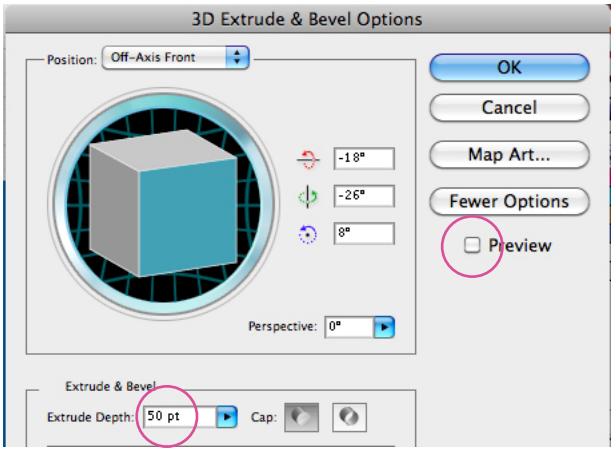
Some of these require your image to be rasterized, others don't

This is my initial image - I drew a graffiti tag using the pen tool, then used copy-paste to duplicate the "s" to use for the "e," and copied the small elements and rotated them for repetition.



Filter, Distort, Free Distort. Using this, I tweaked in the bottom of the tag, and stretched the top. A very simple effect, but certainly usable in a lot of circumstances.

Effect, 3D, Extrude & Bevel. This is an amazing effect in Illustrator that allows you to turn flat line art into 3D work without having to do a lot of guesswork about angles. After you select "Extrude & Bevel," you will get this menu screen. From here, you will have a hand tool that you can use to manipulate the cube, which represents your art's orientation in the XY plane of Illustrator. Checking **"Preview"** will let you see the changes you are making as you do them, and changing **"Extrude Depth"** will make the effect more extreme. There are even more specific options you can mess around with, but I opted for a simple tilt and extrude.

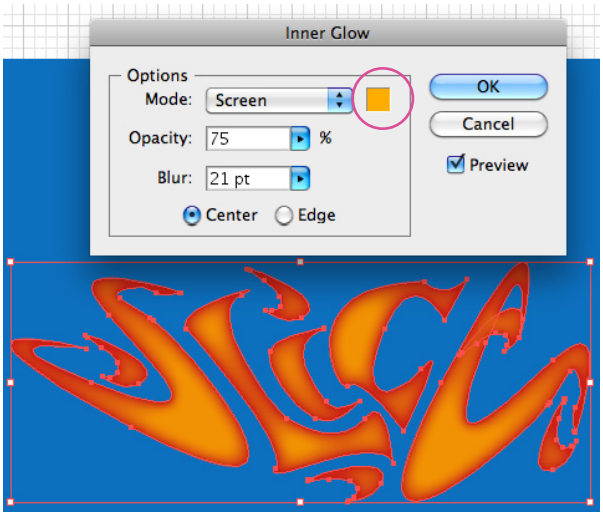


Effects: Illustrator & Photoshop

Some of these require your image to be rasterized, others don't

This does not even have an effect - this is simply my original image copied with a yellow fill color that was then **right click, arrange, move to back.** It is on a blue rectangle also in the back.

Effect, Artistic, Plastic Wrap. This is a filter from Photoshop, and therefore the image must be rasterized for it to work - meaning that it will take a while to load, and that your image won't be infinitely resizable. There are other Photoshop filters that work well too, I just chose this one.



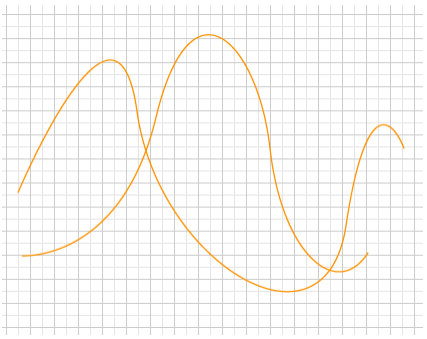
Effect, Stylize, Inner Glow. Selecting this will bring up this dialogue box that allows you to change the size, position, depth, effect, and color of a glow. Double-click the color (circled) to change the color of the glow, and click "preview" to see the changes you are making as you do them.

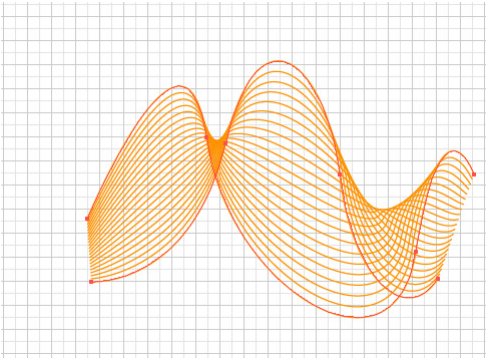
Effect, Stylize, Outer Glow. I applied this effect after the Inner Glow, so Illustrator took quite a while to load this one. This dialogue box works exactly the same as inner glow, except this time it is applying the changes to the outside of the letters rather than inside them. **Beware!** The more filters you use, the slower it will get, and the more likely it will crash. Save often!

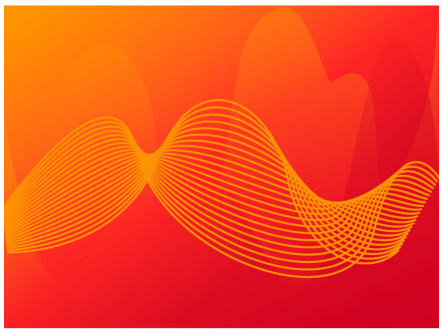
Tools: Blend

The blend tool transitions between both shapes and colors

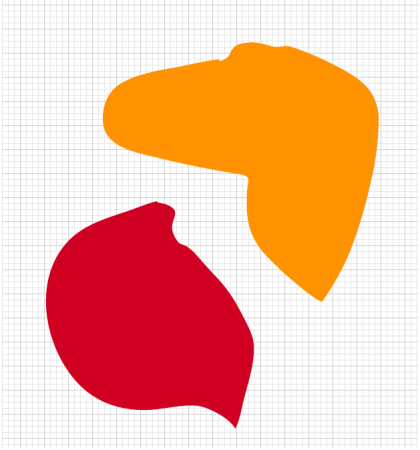
The **blend tool**  allows you to create transitions between two objects, whether they are lines or shapes. In this first example, I simply created two lines with the pen tool, selected both of them (click and drag over both), then clicked on each one with the blend tool. I then placed them on top of an image I already made of several different gradient shapes on a square gradient. If you go to Object, Blend, Blend Options, you can change the number of "steps" between your two objects - mine is on 20.

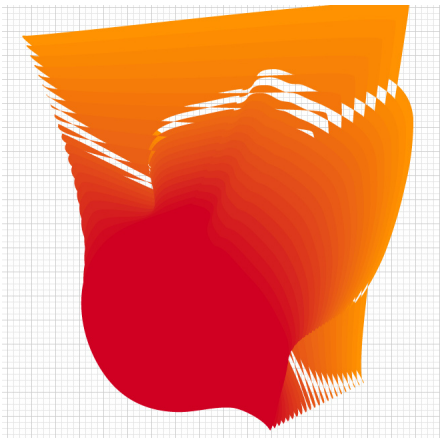






This is the exact same process, except I used two shapes I created with the pen tool instead of two lines. Again, select both of the shapes, then click each shape (preferably on the line) with the blend tool. After you have made the blend, you have the option of getting your direct select tool and manipulating the shapes even further, making for some interesting results when combined with the blend tool results.

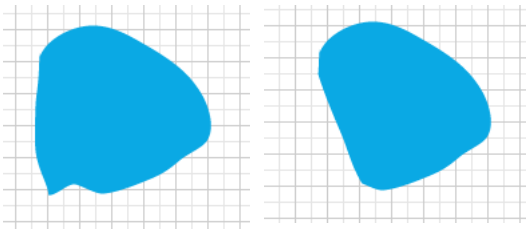




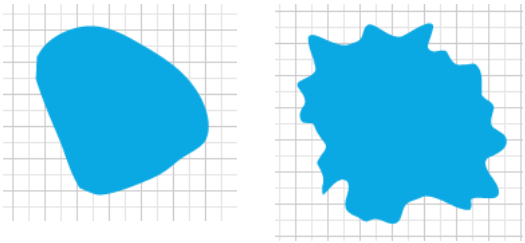
Tools: Eraser, Warp, Twist, Bloat...

These allow you to edit a shape you already made by "sculpting"

Eraser Tool : As the name implies, this tool erases parts of vector lines or shapes. You can use the brackets [and] to shrink or grow the brush. This tool is excellent for "trimming" any of your drawings of odd lumps or sharp corners. Simply click and drag to erase.

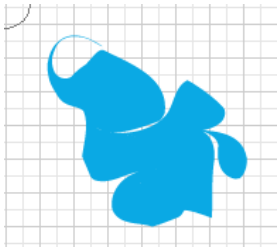


Warp Tool : This is another brush that allows the user to "push" the vector outline of a line or shape, from the inside or the outside. Just click and drag either from within the shape outward, or from the outside pushing in.

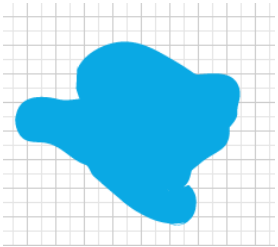


If you hold down the warp tool button on the main panel, you will also see options for the **twirl, pucker, bloat, scallop, crystallize,** and **wrinkle** tool. Experiment with these functions; below are some outcomes. These tools' functions rely not only on where you click and drag, but also for how long you hold down the mouse button.

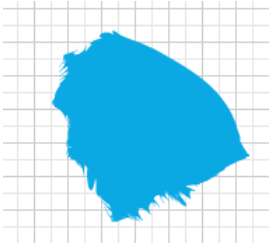
Twirl



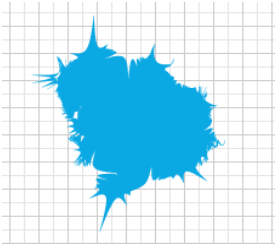
Pucker



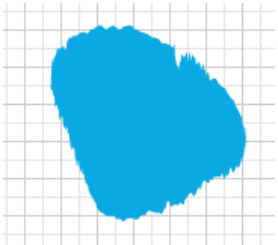
Bloat



Scallop



Crystallize



Wrinkle

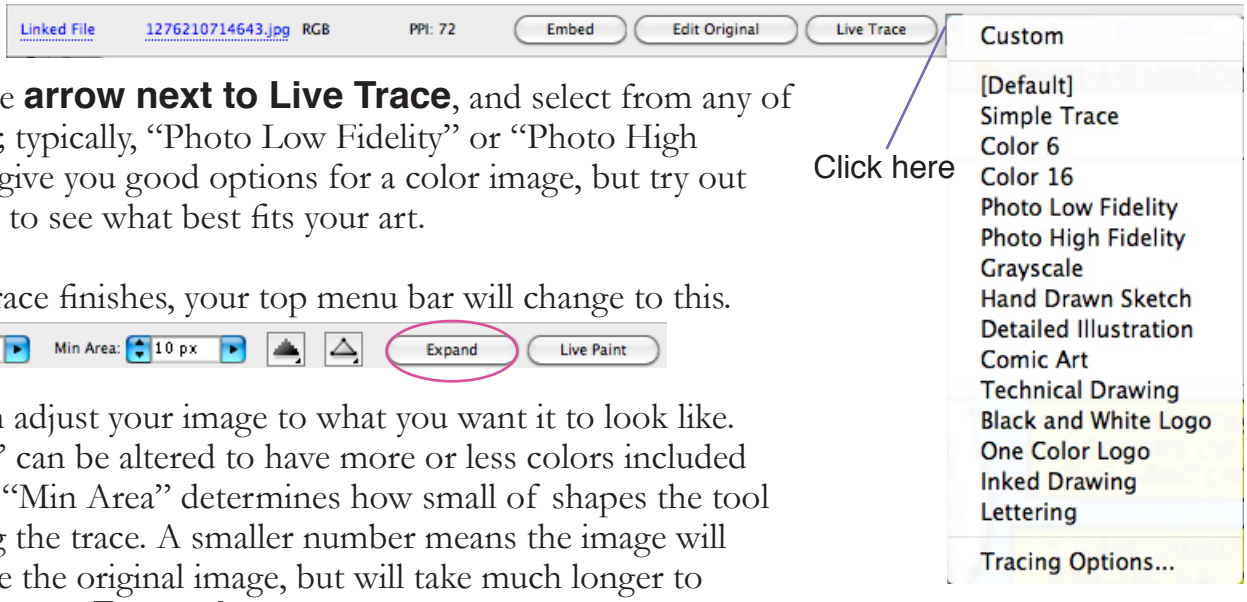
Live Trace

Arguably the most powerful function in Illustrator

1. Go to **File**, select **Place**.

2. Select image from file, it should show up with a red "X" on it.

3. Click on your image, you'll see a menu like this:

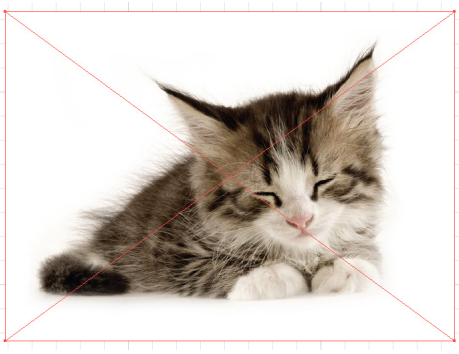


4. Click on the **arrow next to Live Trace**, and select from any of these options; typically, "Photo Low Fidelity" or "Photo High Fidelity" will give you good options for a color image, but try out other options to see what best fits your art.

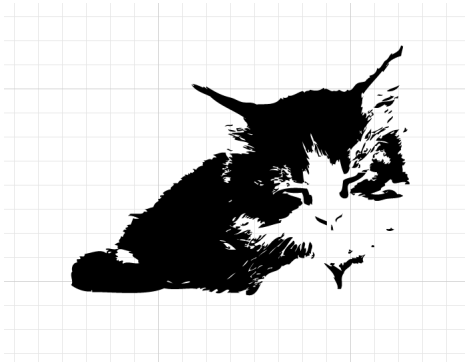
5. After the trace finishes, your top menu bar will change to this.

Here, you can adjust your image to what you want it to look like. "Max Colors" can be altered to have more or less colors included in your trace, "Min Area" determines how small of shapes the tool creates during the trace. A smaller number means the image will look more like the original image, but will take much longer to finish tracing. Click **Expand** to finalize the vectors.

Basically, what this tool is doing is trying to create shapes that roughly resemble the image, and using your requirements (either from one of the presets, or from a set number of colors and pixels) to replicate the image using vectors. So, whatever result you end up with, it is now infinitely expandable, just like any other vector image in Illustrator. Experiment with the number of colors for very different results, but be patient - this tool takes its time with larger images.



Original image



Simple trace: one color

Photo high fidelity: many colors

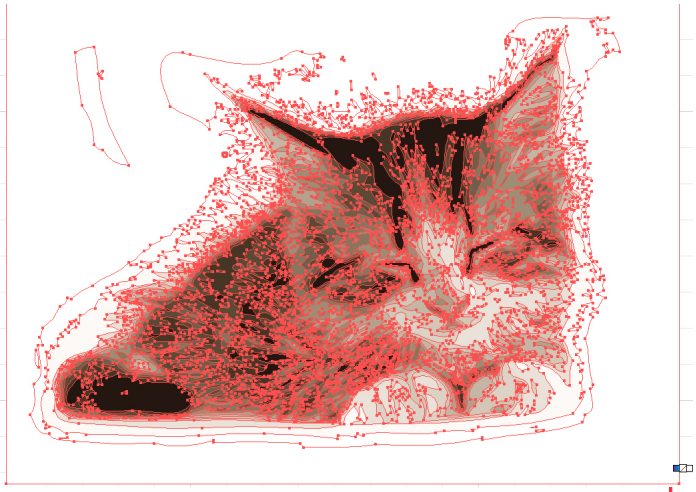
Live Paint

An infinitely easier way to color line art, or recolor kittens...

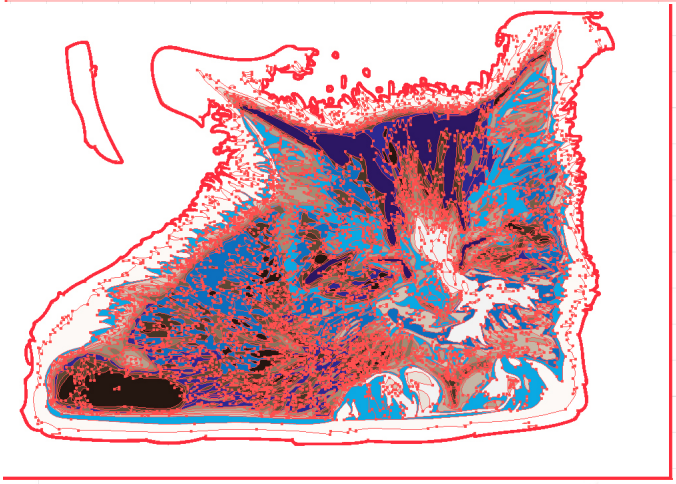
1. Follow the steps for Live Trace, but after you have made your trace, **instead of clicking Expand, click Live Paint.**

2. After clicking Live Paint, your image might look like a mess of nothing but outlines. You may want to go back to your Live Trace options and lower the number of colors and raise the pixels.

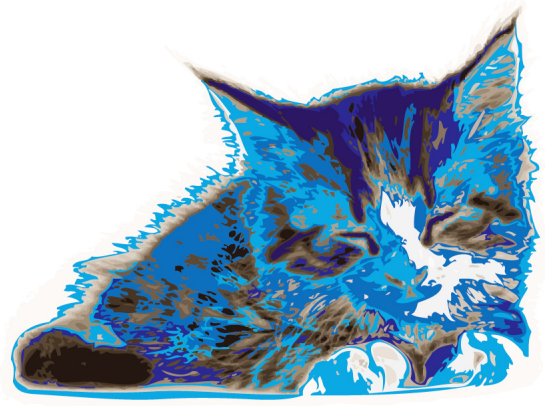
3. If your image looks like this, you're on the right track, although this is probably still too complicated for a first try with live paint. When your image is like this, you will select the **live paint tool**  to begin your painting. You will notice three colors above the tool - these correlate with your swatches panel, and you can use the left and right arrows to navigate through the colors to select your "active color" (the one in the middle). Your active color is what the selected area will be painted; any area lined off by the pen tool is game with live paint.



Here, you can see where I have already done some painting. When I took this screen capture, the mouse was over the largest white area - when you have the live paint tool out, the area that will be painted if you click will have a thicker outline than the rest of the image. Clearly, I am sticking to blues and whites for coloring this kitten.



This fellow isn't quite done yet, but I'm impatient. If you ever want to check on your progress for live paint, just click off the image with the direct select tool. To get back to painting, just click and drag over the image to select the whole thing again, and get your live paint tool back out.



You can live paint anything - it does not have to be a traced image, just something with vector shapes and lines.

Helpful Hints

Do Sketches: Even if you're working on a computer, it's best to start with some kind of hand-drawn sketch so you're not flying into something totally blind. This is especially important for type or logo design. If you have a scanner, you can then bring your sketches into Illustrator and trace right on top of them!

Use the Grid: View, Show Grid will bring up a grid like the one you see in the background of most of my examples. If you're doing super-precise drawing, you may even want to turn on Snap to Grid, which will only allow you to plot pen tool anchor points on grid intersections.

Zoom In: This is especially important if you're planning on enlarging an image. Sometimes, your paths will look nice and smooth from far away, but when you zoom in, you'll see white spaces and weird points everywhere. Fix them!

Beware the Live Trace: As I have mentioned before, Live Trace is a powerful tool, but be careful about how you use it. More often than not, it will make your image a lot more complicated than it needs to be. After you're done, go and clean up lines with the eraser and direct select tools.

Convert Your Anchor Points: Remember holding "Alt" and clicking your previous point before making a new one? I actually do that with every single point I make, especially when I'm doing something like a logo design. Converting anchor points gives you a lot more flexibility than simply letting the pen tool dictate your curves, and keeps you from getting weird, loopy, curves (use the pen tool for a while and you'll know what I'm talking about).

Save Often: The general advice for any Adobe program, but very important if you plan on using any effects. Save! Save!

Vocabulary

Vector: A type of graphical representation using straight lines to construct the outlines of objects.

Logo: A company, partnership or corporate creation (design) that denotes a unique entity. A possible combination of letters and art work to create a "sole" entity symbol of that specific unit.

Raster: A raster or bitmap image is made out of pixels. Raster images are typically photos, but they can also be illustrations that have been turned from vectors into pixels.

.JPEG: A file format used for photographs or images that have gradients. JPEGs do not support transparency, unlike GIF and PNG, and cannot be animated, unlike GIF.

.GIF: A file format used in web graphics best for images that are made of solid colors, like logos. GIFs support transparency and they can be animated. GIFs are also considered a lossless format–meaning they do not suffer compression artifacts.

.PDF: Portable Document Format. This file type is often used to send print materials to a print shop.

.PNG: Portable Network Graphics are the ideal web graphic file types. They are completely lossless and they support alpha transparency.

Compression: The process of an algorithm making file sizes smaller by combining similar data. Most of the time this is a good thing, but it can also cause severe loss of quality, especially in regards to images.

Lossless: The opposite of lossy, lossless describes file types where there is no image data deleted or erased when that data is stored. Image formats like GIF, PNG and TIFF (without compression) are considered lossless.

Lossy: Describes file types where compression is applied and image data is deleted or erased in order to decrease the files size. JPG is a file format that is lossy.

Gradient: A fade from one color to another. There are many shapes a gradient can take, but generally it is either linear (straight) or radial (round, where it fades from the center outwards).

Anchor Point: Points connecting the segments of a path. Anchor points on curved paths have direction lines and points associated with them which determine the shape of the segments adjoining the anchor points.

Closed Path: A path with its first and last anchor points connected.

Open Path: A path with its first and last anchor points unconnected.

Troubleshooting

NOTE FOR MAC USERS - Replace all "Ctrl __" commands with "⌘ __"

When I bring in a picture, I'm getting an error message instead of the image.

This probably means you tried to copy-paste an image into Illustrator. Unlike InDesign or Photoshop, you actaully have to go to **File, Place** to bring in most image files.

I can't click on the thing I want!

Make sure you ahve the right selection tool - selection tool for grabbing a whole object's bounding box, or the direct select tool to get the object's outlines. Otherwise, if you're trying to get a specific piece of something, I would suggest clicking and dragging with the regular selection tool over the whole object, then hold "Shift" while clicking the outlines of what you don't want.

I'm trying to draw a line: it keeps making this giant fill space where I just want a line.

Look at the bottom of your main palette for the fill/stroke colors. Whichever "box" is in front is the feature you can change. If you want to take off the fill, make sure your fill color is the foremost box, then click the little white box with a red dash through it. This will turn off the fill, but make sure that the stroke color has a color assigned to it, otherwise you won't be able to see what you're doing. And, of course, the opposite applies - you can turn off the stroke color, too.

I keep losing track of shapes that I drew for an illustration.

The easiest fix here is to do everything, and I mean EVERYTHING, on its own layer. Make sure you label them!

Illustrator keeps crashing.

While there are a lot of reasons this might happen, there are two main functions that make the program crash. Live Trace, particularly for large images, is a massive memory hog. If you are using it on a large image, just let the computer sit for a few minutes. Don't try to use the internet, don't do anything else - just let the trace run. The other culprit for crashes is using any of the effects that require re-rasterizing. My only suggestion here is to only use these effects when you are absolutely done with everything else, because every time you try to change anything after using a filter, Illustrator will have to re-rasterize the whole image.

I can't create a new gradient.

Early versions of Illustrator have bad gradient creation. What you have to do is select one of the premade ones so that it is your fill color on the main toolbar, then click "New Swatch" at the bottom of the swatches panel. Now you should be able to open the Gradient panel, then drag and drop colors from your swatches on to the gradient. Remember - drag on top of the colors to replace them.