

DIGITAL ILLUSTRATION OF INSECTS USING ADOBE *PHOTOSHOP CS*

Introduction

The purpose of this tutorial is to demonstrate the use of *Adobe Photoshop* to produce a full habitus (i.e., general form and appearance), color illustration of an insect. As a bitmap or raster-editing application, *Photoshop* offers an incredible diversity of tools, filters, masks, etc. to subtly change the color value of individual pixels in bitmapped images (digital photographs, scanned images). A **bitmap** is a grid (or *raster*) of small squares, **pixels** (or picture elements), used to represent an image, much like a mosaic of tiny colored squares. Each pixel has a specific size, location, and color value and is individually editable. Perhaps *Photoshop*'s most common application is in enhancing and retouching digital or scanned photographs, but its tools can be used to create digital art from scratch. *Photoshop* can represent subtle gradations of color and tone that are not possible in vector or object-oriented applications such as *Adobe Illustrator*. In *Illustrator*, **objects**, specifically lines and curves, are independently defined by mathematical equations called **vectors**. *Illustrator* produces drawings with smooth curves and sharp, crisp edges. It is **resolution independent** - the image can be scaled up or down and printed at any size with no loss of sharpness. On the other hand, *Photoshop* is **resolution dependent** - the resolution of the working image depends on the resolution of the display or capture device (monitor, digital camera, scanner) **and** the inherent resolution of the bitmap image. Printing or viewing at a larger resolution results in pixelation. File size also differs between the two types of applications. *Illustrator* files are small (several kilobytes), while *Photoshop* files can be quite large (10s of megabytes). The two applications are really complements of each other. For graphs or illustrations with sharp edges and smooth transitions — such as weighted line drawings of insect structural details — *Illustrator* is the preferred application, but for photo-realistic or true-to-life drawings, *Photoshop* is the application of choice.

How to Approach a *Photoshop* Illustration

The purpose of a *Photoshop* illustration is to portray a lifelike, yet accurate depiction of the insect, incorporating subtle changes in color, depth, light, shadow, texture, and realistic poses. Insects mounted on pins, squashed on slides, or stuffed in vials rarely maintain their natural color or posture. The *Illustrator* must “reconstruct” the specimen artistically on paper in a lifelike arrangement of appendages. Keen observation of living specimens or photographs of specimens in the field should be consulted for recreating a lifelike representation. The *Photoshop* illustration is not meant to capture small structural detail such as that of the male genitalia. While still accurate, the full habitus should capture the overall appearance of the specimen at a “macroscopic” scale, which itself could have taxonomic importance. To depict specific structural taxonomic detail, views that magnify and focus on desired characters should be done as separate illustrations, perhaps best as weighted line drawings in *Illustrator*.

Scanning the Pencil Sketch in Adobe *Photoshop*

As stated earlier and often, the **anatomical accuracy and detail of the pencil sketch** is the start of a professional scientific illustration. For a full habitus illustration, you should consider how to orient the drawing to create a more lifelike, yet balanced and symmetrical position. Depending of the insect order, this is most commonly done is dorsal (beetles, bugs, butterflies) or lateral (grasshoppers, wasps, caddisflies) views, but for other groups or purposes a skewed perspective might be appropriate (flies). Once you scan the pencil sketch into *Photoshop* (or even later in *Illustrator*) you can adjust it further to create the desired overall effect, but getting it close to a desired position at the start in the original pencil sketch is essential.

1. Place your pencil sketch face down on the scanner bed. Launch **Adobe *Photoshop***. Choose **File**
Import
[your scanner's name] TWAIN...
2. Each scanner is slightly different, but general scanner settings should be more or less the same across different brands. Choose these scanner settings:
Flat bed, non-reflective
BW, Photo (or your scanner's setting to scan as a grayscale image)
300 (here a higher scanner setting than used for an *Illustrator* drawing alone is better)
size 100%
3. First run a **Preview** scan, adjust the dimension box if appropriate, and then **Scan** the image.
4. Save as a *Photoshop* (.psd) document in **grayscale**.

“Placing” the Pencil Sketch in *Illustrator*

The process of scanning the pencil sketch in *Photoshop* and “placing” it in *Illustrator* was described in the document *Adobe Illustrator: a Tutorial for Entomologists*. Also, the use of *Illustrator*'s pen tool to produce a weighted line drawing was described in the *Tutorial*. The tools and techniques for preparing an *Illustrator* drawing as a precursor for a full habitus rendering in *Photoshop* are the same as treated in the *Tutorial*, with one major difference as described in the next section.

Creating the Vector “Puzzle Piece” Drawing in *Illustrator*

Unlike a **weighted line** or **stipple drawing** done in *Illustrator*, which is primarily composed of **open** vector paths, an *Illustrator* drawing destined for full habitus rendering in *Photoshop* should be composed mostly of **closed** vector paths. As such, these closed paths are analogous to the individual pieces of a jigsaw puzzle. The “puzzle pieces” will be copied and pasted into *Photoshop* as “paths.” The paths will be organized and separated into *Photoshop* layers, filled with color, and rendered with other tools to give a realistic image.

When drawing the *Illustrator* “puzzle” use the pen and pencil tools as you would in an *Illustrator* line drawing, but the stroke weight and cap style are not important (you can even turn off the stroke later if you wish), nor do you have to worry about weighting the line using “outline stroke”. Also, don’t worry about setae. These will be added in *Photoshop* using a *Photoshop* setal brush. Simply “trace” your scanned pencil sketch, but be sure to close the path. Think carefully about how best to render your illustration into “puzzle pieces.” This takes some forethought and experimentation. You want to strive to get the individual pieces to fit together like jigsaw pieces. While this is not critically important it will save time later when you are filling the paths with color in *Photoshop* layers. I use the cut, copy, paste in front, and join functions to aid in getting the puzzle pieces to interlock. On the other hand, not all pieces may need to be interlocked; some pieces may best sit on top of other pieces. Finally, there may be occasion where a few open curves and lines are appropriate; these can be “stroked” in *Photoshop*. Again, you will have to experiment and learn as you proceed through the illustration.

Note that *Photoshop* comes with path creating and editing tools (pen tool, free form pen, magnetic pen, add anchor point, delete anchor point, convert anchor point, and selection and direct selection tools). You could render your “puzzle” completely in *Photoshop*, but the pen tool and its associates in *Illustrator* are much more powerful and easier to use. I prefer to render the paths in *Illustrator*, then copy and paste them into *Photoshop*. If any fine tuning or editing needs to be done later, it can be done in *Photoshop*.

For most purposes all of the paths you draw in *Illustrator* can be in the same layer. You can separate and sort paths into different path layers later in *Photoshop*.

REMEMBER!!: There is one important preference that needs to be set in *Illustrator* so that the paths can be copied and pasted into *Photoshop*. We set this preference earlier during the *Illustrator* tutorial, but if not, you need to do it now. The setting needs to be done in Adobe *Illustrator*’s preferences, not in *Photoshop*’s preferences! On the main *Illustrator* menu select:

Illustrator

Preferences

File handling and Clipboard...

Then under **Clipboard on Quit** make sure **Copy As: PDF and AICB Preserve Paths** are checked.

Creating a *Photoshop* Document for the Habitus Illustration

Your *Photoshop* Document will consist of both *Photoshop* Paths and *Photoshop* Layers. Think of layers as transparencies one on top of the other. Each transparency (layer) will have something different painted on it. Transparencies (layers) must be stacked in the correct order for the image to be seen correctly. First, however, the different vector paths you drew in *Illustrator* need to be imported into *Photoshop* and for that you need to create a new *Photoshop* document.

1. Open a new *Photoshop* document.
1. Set the new *Photoshop* document to the same size (dimensional size, not pixel size) as the *Illustrator* document. We usually work in Letter size in the US. [Of course, you would have predetermined the size requirement of your illustration, set the dimensions of the *Illustrator* document before hand, and scaled the *Photoshop* scan of your pencil sketch accordingly, just as you would have done with an *Illustrator* line drawing.]
1. Unlike *Illustrator*, *Photoshop* will ask you to set a resolution for your new document. Select 300 pixels/inch for Resolution (600 ppi for high end art, but the file size will be much larger and slower to edit and save).
1. Select RGB Color for Mode
1. Select White for Contents
1. Name the file and select **OK**.
1. Alternatively, you may wish to paste your *Illustrator* “puzzle pieces” on top of your original scanned pencil sketch or other resource file (e.g., a digital photograph). First make a copy of your original scan (use **Save as...** and give it a different name) and put the original away in a folder on your hard drive. Open the copy in *Photoshop* (your pencil sketch or digital photo will appear as a locked *Background* layer in this file; you can adjust the opacity of the *Background* layer, if necessary). As mentioned in step 2 above, your original scan, the copy you made, and your *Illustrator* “puzzle piece” file should all be maintained at the same scale. If you have to scale images to fit the page, do this in your *Illustrator* document before you start “drawing” the puzzle pieces (see the *Adobe Illustrator: A Tutorial for Entomologists* document).
1. Make certain this *Photoshop* file and your *Illustrator* document are both open and accessible on the desktop; you will begin pasting your *Illustrator* paths into it.

Now you are ready to begin transferring your *Illustrator* “puzzle pieces” into *Photoshop*.

Copying and Pasting Paths from *Illustrator* to *Photoshop*

This procedure is really quite easy.

1. If you locked the *Illustrator* layer containing your paths, **Unlock** it.
1. **Select All** (Command A), then **Copy** (Command C). Your paths have now been copied to the **Clipboard**.

1. Return to the *Photoshop* document (you should already have created it and it should be opened on the desktop), and **Paste** (Command V) the clipboard contents into *Photoshop*. You will be presented with a dialog box asking if you want to paste as **Pixels, Paths or Shape layer**. Choose **Paths**.
1. Open *Photoshop's* **Paths palette** (docked with the Layers and Channels palettes). You will notice that a new "**Work Path**" was created. Double click on the words "Work Path" and rename the path. This also saves it.
1. You can now save and close your Illustrator file. It is no longer needed.
1. That's it! Now comes the hard part!

Arranging and Organizing the *Photoshop* Paths

The rendering of your Photoshop illustration will begin with creating **layers**, making **selections** from the **paths** you copied from *Illustrator*, **filling** the selections with color. Here a full understanding of layers and layer organization is critically important. To help the process of organization, it might be useful to first organize your paths into separate path layers to aid in the creation and organization of the new layers you will create.

Fortunately, the insect body is itself organized into discrete segmented body regions (head, thorax, abdomen) which bear appendages. Body regions and appendages exist in directional polarities (anterior to posterior, dorsal to ventral, proximal to distal). Use the structural and directional polarity inherent in the insect to organize your many paths into separate path layers.

The procedure:

1. Open the **Paths** palette and **select** the path you saved and named from the Workpath originally created when you pasted the paths from *Illustrator*. (The black cursor arrow turns to a pointed finger when you move it over the path layer in the paths palette. Click on the path with the finger to select it.)
1. *Photoshop's* toolbox contains the path creating and editing tools. Select the black **path selection arrow** and drag across or shift-click all the paths destined for a new path, for example all the paths making up the head. Then **Cut** (Command X).
1. From the Paths palette option button select **New Path. . .**, name it thereby saving it, and **Paste** (Command V) the paths to this new path layer.
1. Return to your original path and cut and paste to new paths as appropriate to organize your many paths.

You can also use *Photoshop's* path tools to edit paths or add new paths. These tools work essentially the same as they do in *Illustrator*. You can draw new paths with any of the pen tools. However, when you select the pen tool, be sure to click on the "Paths" icon (the little square with a pen in the middle) in the pen tools option menu at the top of the screen. Before you start drawing paths, deselect any selected path layers before you draw. When you begin to draw a

new path, a new Work Path is automatically created. Be sure to name and save this work path as soon as possible, otherwise it will be lost.

Creating *Photoshop* Layers, Making Selections from Paths, and Filling with Color

Each *Photoshop* **Path** should contain all of the *Illustrator* vector paths (puzzle pieces) that you created in *Illustrator* as well as any new paths you drew in *Photoshop*. Now it is time to separate the individual components (again, the puzzle piece stencils) of the *Photoshop* paths into separate layers in *Photoshop*. To have the greatest flexibility and control of editing, it is probably best to place each of your individual stencils (made from the individual puzzle pieces) into separate *Photoshop* layers. **Here good organization and attention to Layer management is essential!** Organize your layers again into **Layer Sets**; you may want to assign colors to aid organization. Try to mirror the organization you gave to the paths in your *layers*. You may have many, many puzzle pieces and while it might seem too much, it is best to create new layers for each of these. Your final *Photoshop* illustration may contain 100s of layers, but this is what gives you great control and editing flexibility (you can merge layers along the way and eventually you will flatten your image before printing or sending to the press).

The process of creating layers goes hand in hand with filling them with color. When all of the layers are filled with color, your *Photoshop* illustration will look like a child's coloring book drawing or a paint-by-numbers painting (without the numbers!). Then you will apply light and shadow to the fills to render 3D images. The rest of the illustrating process, and the most time consuming part, will add textural detail. We are beginning the creative process!

1. In the **Paths** palette select (i.e., highlight) a path layer. With the black selection arrow select the first closed subpath you want to fill with color. For example if your path layer contains all the parts of the head, select that subpath that represents the eye or eyes (shift-click to get both).
1. In the **Layers** palette open the layers palette options button and create and name a new **Layer Set**. Use the same name as the Path name (e.g., Head). Choose a color to help with your organization. Within that Layer Set create a **New Layer** and name it for the particular puzzle piece you selected above (e.g., eyes).
1. With the target **Layer** selected (eyes), return to the selected **Path** (the "eyes" subpath should still be selected, but if not, reselect it with the black arrow). At the bottom of the path palette click on the little dotted circle icon (**Load path as a selection**) or, from the paths pallet option button, select **Make selection. . .** (settings should be Feather radius 0 pixels, anti-aliased, new selection).
1. Select a fill color by clicking on the Foreground fill icon (or Background fill icon) in the tool box and select a color from the **Color Picker**. Then, to fill the selection with the foreground color, hold down the Option key and hit the Delete key (to fill with the background color, hold down the Command key and hit the Delete key). You can use the **Eyedropper** tool to sample a color and use this as the foreground or background color. This is especially useful if you are sampling colors from a digital reference photograph.
1. To deselect the selection, choose **Deselect** from the main **Select** menu or, *much more easily*, use the keyboard shortcut Command D. You deselect a path by clicking in the

white space below the path in the path palette (drag in the lower right to expand the path palette or any other palette).

1. Continue to select and fill all the *Photoshop* Paths and their included subpaths, creating, naming, and organizing new Layer Sets and Layers along the way. After this stage of the process, your illustration will look like a coloring book drawing with each separate patch of color in a separate layer.

Adding Light on Form — Highlights and Shadows

Up to this point, the process of rendering a *Photoshop* illustration has largely involved creating, organizing, selecting, and filling paths and layers. No artistic or creative processes have occurred yet, other than the original pencil sketch, drawing the “puzzle pieces” in *Illustrator*, and deciding which colors to fill the selections. Now, once your illustration has reached the “coloring book” stage, real artistic skills and techniques come into play. The process now shifts to rendering light on form and adding textural detail to the individual colored anatomical shapes in your various layers. A sound understanding of the effect of light on form is critical at this stage. Read the chapter in the GNSI handbook on Light on Form for review of the subject. Remember the convention of light striking the subject from the upper left at about 45° from the page. Think of each puzzle piece as a geometric object, such as a sphere, cylinder, cone, etc., and calculate the effect of light falling on that form. Remember the importance of reflected light. Use models of insects and their structures, shine a light from the appropriate direction, and record the location of highlights and shadows. Small handmade clay models or children’s toy insects placed in a “shadow box” will aid this process. A sound understanding of the effect of light and shadow on **color** is also critically important at this stage. With experience, the nature of light on form will become intuitive, but until then special care must be paid to getting the correct effect. The beauty of working in the electronic medium is the endless flexibility of experimentation.

1. Select a layer containing one of the anatomical structures you wish to work on. Notice the pointed finger cursor. If you hold down the Command key the pointed finger gets a little dotted box in the lower right corner. This selects the pixels in the layer (the colored pixels you added earlier). You should see the so-called “crawling ants” (flashing dashed lines) around the colored shape. If crawling ants also appear around the border of the page (you may have to zoom down to see this), go to **Select** in the main menu, and then choose **Inverse** (or, much more easily shift + Command I). Now, only the shape is selected. Watch that only the shape is selected; sometimes, depending on what I haven’t figured out yet, the inverse selection occurs when the finger selection is used.
1. This shape was filled with color earlier. If you are not satisfied with the original fill color, you can change it now that it is selected. Double click on the Foreground color square on the tools palette, choose the new color from the color picker, and hit the Option and Delete keys. Choose a color in the mid-range of tonal values; later you can add lighter tones in the highlights and darker tones in the shadows. You can also pick a color

from another part of the image or from a digital photograph of the specimen using the **Eyedropper** tool (shortcut key I) and fill with that color.

1. Create a new layer for the highlights and shadows and name it appropriately. This layer should be in the same set of layers with the “base” layer. You may wish to create more than a single layer for rendering light and shadow, for example you may want one layer for the shadows around the far side of the structure (don’t forget about “reflected light” on this side of the structure) and a second layer for the extreme lighting of the “crest light.” More layers give you more editing flexibility, but use more RAM. You can link and merge layers later (but then you lose the flexibility).
1. Choose a color to begin rendering highlights/shadows. Select the **Brush** tool (shortcut key B). Here you will have to experiment and try out different brush diameters, brush types, modes, opacities, and the **Airbrush** and its flow rate. The Brush is a powerful tool and offers a very diverse set of options. There are no hard and fast rules here; you simply need to experiment to get the effect you want. When you select the Brush tool, notice its Option bar at the top of the display. If you click on the small triangle in the blue bar next to “Brush:” you will get the “Brush Preset Picker” where you can load other brush types in the picker as well as edit the contents and view of the picker. Likewise, if you select Brushes from the Windows menu, you get the brush palette with a diverse set of options for modifying brushes (note that the preset picker is also available on this palette by clicking the small triangle in the upper right). When you find the “perfect” brush and effect, make a note of it and its parameters so that you can recall it later (you can actually save it as a new custom brush). It is **highly recommended** that you review the chapter on *Painting* in the *Photoshop’s Help* guide *Working with Brushes*.
1. You can also use the **Eraser** tool (shortcut key E) to take away color. Set the eraser on the brush mode, then set the brush type and its size, opacity, etc. to fit your needs.
1. Not only do the brushes give you almost limitless choices, but you can also try **Render**, **Lighting Effects** from the **Filter** menu as well as the other filters, especially **Blur** . . . , **Gaussian Blur**. Also try different effects from the **Layer Style** options under the **Layer** menu. And try the different **blending modes** options on the brush tool option bar and different layer **blending modes** (see the separate handout on this). When you master a particular technique make a note of it and share it with others. I think it is counterproductive to go through set by step instructions on how to use these various tools and filters. By doing so would lock you into a particular technique. Besides, the options are almost limitless and could fill countless pages of handouts! In fact, they do! Note all of the books and websites on Photoshop techniques, tips, and tricks, not to mention the Photoshop Help guide. **Experiment, be creative, share ideas, ask questions!**

Adding Texture (Noise) to the Surface of Structures

The cuticle of an insect is rarely perfectly smooth, but contains microscopic pits, ridges, grooves, hairs, etc. Simply filling with color and adding highlights and shadows doesn't capture this surface complexity. You will want to add some of this surface detail to make for a more realistic illustration. Look closely at the texture of the surface under the microscope and experiment with different **Filters** and their settings to mimic the texture. Place the texture in a different layer(s) so that you can easily experiment and edit. It is probably easiest to duplicate the layer in question and run the filter on the copy. Some useful filters for applying texture include, among others, the **Noise** and **Clouds** (under **Render**) filters. However, be careful with filters as they apply the effect across the entire opaque part of the layer and can appear mechanical.

You can also use brushes to apply surface texture. Experiment with the many preset brushes or use Marie Metz's **Pile Texture Brush** (on the class website) to add texture to the surface of structures. You can change the size, opacity, and color of the brush to get the desired effect. Also, **Gaussian blur** is a great tool for smoothing and blending as is the **Blur** and **Smudge** tools (if you hold down the Option key when using the Smudge tool you get the "finger paint" effect with the foreground color).

The key to applying surface detail is to experiment on a copy of the layer to find the correct effect. Make notes about the effect of different filters for use in future work.

Making Setal Brushes and Other Brush Techniques

1. Select a "**hard round**" brush from the brush option bar and size it appropriately. Generally, you will want a low pixel number (from 1-5 or so depending on your illustration). A small "**flat calligraphic**" brush also works well; in fact, it gives you a little more variation in setal width over a round brush. [You may have to append the calligraphic brushes to your brush selections. Go to the palette options menu (the little triangle in the upper right), select "Calligraphic Brushes" from the list, and "Append" the brushes to your selection of brushes.]
1. Select the **Brushes** palette from the **Window** menu (it may already be "docked" in the brush option bar menu). Select **Shape Dynamics**. Leave the Size Jitter at 0%, but change the Control to **Fade**. "Set the steps for size fade" to the desired number of pixels to fade. This will give you the "length" of the brush in pixels. Leave all of the other settings turned off and/or set to 0% and unlock any locked settings. You will have to balance the size of the brush diameter with the length of the fade to get the desired effect. Experiment a bit to get the effect you want. If you select a new brush type or size, you may have to reset the shape dynamic settings. Keep the general opacity of the brush at 100% to get the darkest setae.
1. Open a new layer, name it accordingly (e.g., "pronotal large setae"). Make sure this layer lies on top of the layer containing the setal bearing structure. Stroke out the setae in the

position and direction you want with the brush. Set the foreground color to black if the setae are black or to the color to match the color of the setae.

1. To darken the setae, duplicate the Layer once or twice by dragging it to the **Create a new layer** icon at the bottom of the Layers palette. It is probably best to link and merge these into a single setal layer.

1. To create a highlight along the upper left edge of the setae do the following:
 - a. Go to the layer containing the setae. Hold down the Command key and select the layer (the pointed finger with the little square icon will appear). All and only the setae should be selected. Do not deselect!
 - a. Open a new layer and name it accordingly (e.g., “pronotal setae highlights”).
 - a. Grab and move this layer **below** the layer containing the setae.
 - a. While still in the setal highlights layer, fill the selection with white (Command and Delete keys if the background color is white or select whatever color you want for the highlight.)
 - a. Select the Move tool from the Toolbox and using the keyboard arrow keys, nudge the highlight layer to just peek out from under the upper left edge of the setal layer. Then **Deselect** (Command D).
 - a. If you are doing highlights over a white background, you will not be able to see the highlights. Create a temporary background layer and fill it with a color easily contrasted against white. You can hide or delete this layer later.

6. Saving setae as **Brush Presets**:
 - a. Create a seta to your liking based on the instructions above. I start with a hard edged (100%), very small, short fade setae at 1 px diameter and 10 px for the fade. Remember to turn off or deselect all the other brush settings.
 - a. In the brush preset picker within the brush options bar **or** in the Brush Palette (from the Window menu or it may already be docked), open the little right facing triangle option button and select **New Brush Preset. . .**, name the brush (e.g., Setae 1 px, 10 fade), and click OK. A shortcut is to simply click on the New Preset icon (the page icon with the dog eared corner in the lower left) below the options button in the brush preset picker or at the bottom of the brush palette.
 - a. Whenever you need a seta, you can select this preset, change its diameter from the preset picker and its length from the Brush Palette, Shape Dynamics, Control: Fade and set the length as described above. Or you can make lots of preset setae, all of different diameters and lengths and save them in a preset library.

7. Saving setal brush presets in a new setal **Preset Library**:

New brush presets are saved to the default preset library currently displayed under the brush preset picker in the brush tool options bar. If you replace that one with a different library, your setal brush presets will be discarded. To permanently save your setae in a Preset Library do the following:

- a. If the default library has setae in it that you created above, go to step b. If the default library is not already displayed, go to the brush tool options bar and select **Reset Brushes. . .** from the options button. When asked to “Replace current brushes with the default brushes?”, click OK.
- a. Create additional seta to your liking as described above and save them as presets in the default library. Continue to create, name, and save setae to create a library of differently sized setae.
- a. When finished creating a many setae as you wish, go to the **Preset Manager** under the options button and rename, delete, and/or organize (drag the brushes to different positions) the presets as you like. I recommend that you delete the default preset brushes and just keep the setal brushes you created.
- a. Then click **Save Set. . .** and name the set Setal Brushes or some similar name. Keep the **.abr** extension. The setal brushes should be saved in a folder called Brushes which resides in a Presets folder within the Photoshop application folder on the hard drive.
- a. **Quit** Photoshop and then relaunch the application. The setal brush library will now appear in the pane with the other preset libraries in the Brushes palette and the brush tool options bar. You can append as many of the preset libraries to the preset picker as you like or replace one set for another. The libraries are permanently stored in the Presets folder in the Photoshop applications folder.

Other useful tips when working with brushes:

To see a preview of the brush preset’s stroke characteristic as well as its diameter (but not its name), choose **Stroke Thumbnail** from the options button.

To quickly get the preset picker, **Control-click** (or right click on a two button mouse) when in the brush tool to get the “**context menu**.” You can then change the brush type, diameter, or hardness “on the spot.” FYI: you can Control-click (right click) with any tool to get in context menu.

When in the brush tool, holding down the **Option** key gives you a temporary **eyedropper** to sample colors “on the fly.” Releasing the Option key returns you to the brush, set to the color just sampled.

Remember, that many of the brush tool options (diameter, hardness, opacity, strength, etc.) also apply to the other “brush-like” tools, i.e., those docked with the brush tool in the Tool palette (pencil, eraser, smudge, dodge, burn, sponge, etc.).

One way to paint just on the opaque pixels in a layer is to select the pixels by holding down the Command key and selecting the layer (the infamous pointed finger icon with the square in the corner – why doesn’t this icon have a name!) and then painting (or performing any other kind of editing), preferably in a new layer or a copy of the layer. Your brush will just paint within the outline of the selection. Another way to paint in the opaque parts only is to **Lock Transparency**

on the Layer palette for that layer. In fact, this is a useful command, but with it you can only paint in the layer selected, not in a new layer, so in some respects selecting the opaque pixels and painting in a new layer offers greater flexibility. On the other hand, you can always duplicate the layer, lock its transparency, and paint in that layer.

Also try the various brush **blend mode** options. We will get into blend modes later, but you can experiment with them now – some have subtle, others have dramatic effects; the only way to find out is to experiment. One mode that is unique to the brush (also the pencil, clone stamp, pattern stamp, history brush, and paint bucket tools) in the “**Behind**” mode. This only paints (with the foreground color) on the transparent parts of a layer (equivalent to the opposite of Lock Transparency on the Layers palette) with the effect of “under painting” the image on the layer. Notice that **behind** doesn’t work with the layer transparency locked.

And don’t forget that you can lower the **opacity** of the paintbrush, and duplicate the layer as many times as necessary to increase the opacity of the paint.

Stroking a Path

Laying down a highlight along a long, gently curved surface with the brush tool takes control. You have to be careful not to waver too much or the stroke will look sloppy. One way to get more control is to lay down a **path** and then **stroke the path**. You have much more control in laying down a path along the exact contour of the shape you want to highlight. Remember that the pen tool in Photoshop work exactly the same as the pen tool in Illustrator. Here's how it's done:

1. Use the **Pen** tool (make sure the **Paths** icon is selected in the pen tools option bar) to lay down a path along the contour you want to highlight. Open the **Paths Palette** and name and save the newly created **Work Path** by clicking on the words "Work Path."
1. Select an appropriately sized soft- or hard-edged brush the color you want for the highlight (generally white).
3. Create and select a **New Layer** for the stroke you will create over the path.
4. Return to the Paths palette and select the path with the black **Path Selection** arrow (if there is only a single path in the paths layer, you need only select the path layer). Click on the "**Stroke path with brush**" icon (the circle icon) at the bottom of the Paths palette. The path will be stroked with the current brush characteristics and it will lie in the layer you created for it. Command-Z to get rid of the stroke if its size or other characteristics are not right, change the brush settings, and click on the "Stroke path with brush" icon again to get just the stroke you want.
5. Duplicate the layer to intensify the stroke if necessary. After you get the highlight just right, you can trash the paths.

Compound Eyes in Photoshop

Creating an "eye facet screen"

1. In *Illustrator*, open a new document, 8.5" X 11" or smaller in size.
2. Create a rectangle about 8" X 10" (or some dimension smaller than the size you created for the artboard - these sizes aren't critically important). Vertically and horizontally center the rectangle on the artboard (**Align to Artboard** under the option button on the **Align** palette, then select the proper **Align Objects** icons). **Turn off the fill**. Stroke the rectangle at 1 pt or less.

3. Select the rectangle (Selection tool) and fill it with one of the Hexagon swatches that I gave you earlier. You should have loaded these into the Swatches folder in the Presets folder in the Adobe Illustrator CS application folder. If the hexagon file was properly loaded into the application, you can get to it under **Window, Swatch Library**.

There are several sizes of hexagons, from large to very small. You will have to choose a size to match the size of the ommatidea (the individual eye facets) of your insect's compound eye. You will probably have to experiment to get the correct hexagon swatch to match the size of the eye facets of your specimen.

Make sure the all important preference in *Illustrator* under **File handling and Clipboard..., Clipboard on Quit, Copy As: PDF and AICB Preserve Paths** is still in effect (AICB Preserve Paths needs to be checked!).

4. Return to *Photoshop*, open a new document the same dimensions as your *Illustrator* document and the same color mode and resolution as your full habitus Photoshop illustration, except select **Transparent** as the background.
5. Return to the *Illustrator* document containing the hexagon filled rectangle. **Select All, Copy**.
6. Now, go back to your new *Photoshop* document and **Paste as Pixels** into this layer. Double click inside the rectangle or choose any other tool. When prompted to "**Place the File?**" select **Place**. Save and name the document "**Eye facet screen**." At this point you have 3 documents on your desktop. The Illustrator document containing the hexagon filled rectangle. A Photoshop document you just named "Eye facet screen" that contains the rasterized version of the hexagon fill. Your full habitus, Photoshop color illustration of an insect. You can now close the Illustrator document; you will no longer need it, unless you picked the wrong sized hexagon and need to refill with a larger or smaller hexagon. You could go ahead and rasterize a set of eye facet screens representing the differently sized Illustrator hexagon swatches. Save these for later use on your hard drive, but **do not** save them in the Presets folder within the Photoshop application folder.

Creating the compound eye

1. Select the layer containing the compound eye or eyes on your *Photoshop* habitus illustration and fill with a color if you haven't already done so, add highlight, crest light, shadow, reflected light, etc. to create a realistic 3D shape of the eye. These highlight and shadow effects should best be done in a new, separate layer (or layers) so that the base layer for the eye only contains a solid fill.
2. Return to the base fill layer of the eye and select it with the Command-click method (the ever popular pointed finger with the dashed square icon!). Keep the file open and the selection active.

3. Open the “Eye facet screen” *Photoshop* file.
4. With the **Marquee** tool, drag the selection of the eye from your habitus file into the “Eye facet screen” file. Recall that dragging within a selection with one of the selection tools (Marquee, Lasso, Magic Wand) moves only the selection, not the pixels within the selection.
5. From the **Select** menu in the “Eye facet screen” file, choose **Modify, Expand**, and enter 10, 20, or 30 pixels (you’ll have to experiment – after you do this a few 100 times, it will become second nature!). Don’t deselect during this process
6. Then from the **Filter** menu, choose **Distort, Spherize, 100%, Mode: Normal**.
7. Return to **Select, Modify, Contract** by the same amount you expanded. (This expanding and contracting removes any unusual or distorted edge effects from the spherize distortion).
8. Return to your *Photoshop* habitus illustration file and create a **New Layer** to contain the distorted eye facet screen you just created. Still keep everything selected!
9. Go back to the eye facet screen document, use the **Move** tool (make sure **Auto Select Layer** is **unchecked**) and drag the selected spherized facet screen into the new layer (created in step 8) in your illustration. Moving with the **Move** tool moves the pixels within a selection. Drag this layer on top of the other layers of your compound eye and with the eye facet screen layer highlighted, use the **Move** tool or the keyboard arrows (more precise) to position the eye facet screen exactly.
10. The eye facet screen layer will probably appear quite light. Copy once or more times to darken it (drag the layer down to the “Create a new layer” icon on the bottom of the Layers palette).
11. Select one of the copied eye screen layers and move it with the keyboard arrows a little down and to the right to produce a 3D moiré effect. You could run a slight Gaussian blur on this layer to enhance the effect.
12. If one or more of the eye facet screens hangs outside the edges of the eye, select the base fill layer of the eye, inverse the selection (**Select, Inverse**), locate and highlight the offending facet screen layers and hit the **Delete** key.
13. After you have the eye facet screen layers copied sufficiently to give you a dark enough effect, you can link and merge them. Select the first one you want to merge, click to the right of the Eye icon of the others to “link” them (the little chain link icon), then under the layers palette option button, choose **Merge Linked**.

Adding a Drop Shadow

For technical taxonomic illustrations, even of whole specimens, shadows are not appropriate. However, for a showpiece or frontispiece illustration, shadows can add a dramatic effect, bringing out the vitality of the image and lifting off the page.

To add a drop shadow, your illustration should be near completion, or at least to the point where you have a layer containing a fully filled image of the specimen. You do not need fine details, but any large setae, spines, etc. that would cast a shadow, should be included. You may have to merge layers to get a full “silhouette” of the specimen. These could be all the base fill layers for all your separate filled “puzzle pieces.” Before merging (see below for details) make sure you will no longer need to edit separate layers! We’ll call this merged image the “composite silhouette” even though it’s not a true silhouette.

1. Choose the layer containing the composite silhouette in the Layers palette.
2. Under **Layer** in the main menu, choose **Layer Style, Drop Shadow. . .** You can also get to the Layer Styles by clicking the Layer Styles icon at the bottom of the Layers palette to get a pop-up of the layer styles (it’s the little circle with the *f* on it).
3. Adjust the settings on the Drop Shadow menu to the following:
 - a. **Blend Mode:** **Normal** or **Multiply** (default).
 - b. Color black, but reduce the **Opacity** to about 75% (you’ll want a darker shadow at this point, but can lighten it later. (The opacity you set now will show up as the Fill opacity when you create a new layer for the drop shadow in step 4).
 - c. **Angle** 135°, with **Use Global Light** checked.
 - d. Adjust the **Distance** (in pixels) accordingly. If your specimen sits close to the ground (e.g., ground beetles, even though they have long legs), you will need a low number, if your specimen has long legs and sits high off the ground (some long-legged flies), you will want a higher number. Adjust the slider to get the distance that matches the specimen’s distance off the ground.
 - e. Leave the **Spread** at 0%.
 - f. The **Size** should only be around 2-5 pixels at this point.
 - g. Leave the **Contour** at the default setting (or change to the straight slope contour if the contour is different), check **Anti-aliased**, do not add **Noise**, and make sure **Layer Knocks Out Drop Shadow** is checked. Click the **Preview** box on and off to see the effect and when satisfied, **OK**. A drop shadow!
4. The drop shadow was created as a layer effect within the composite silhouette layer. To edit it further, choose the silhouette layer, then under **Layer** in the main menu, choose **Layer Style, Create Layer**. Click OK if you get the warning box. Now the drop shadow is in its own layer and even named for you!
5. Go to the drop shadow layer in the Layers palette.

6. Command-click on the drop shadow layer to make a selection of the shadow. Fine-tune the selection to just the leg by taking the Lasso tool, holding down the Shift + Option keys and looping a selection around a leg. Just the leg should now be selected. Now, under **Edit**, choose **Transform, Distort** (or try one of the other Transform options) to select and manipulate the leg and or other body parts into their correct positions for a more realistic effect. Remember that you can anchor a corner or side of the selection's bounding box so that it's not moved during the distortion. To disregard the transformation or to escape from a transform mode hit the **Escape** key. To finish or complete a transformation double click within the bounding box or select **Apply** when the dialog box appears (the dialog box will appear when you choose another tool). Continue to select and distort the shadows for the other legs and appendages (you're lucky insects only have 6 legs!).

Study the shadow carefully to get it in the correct position. Most books on perspective also deal with shadows and their perspective in relation to an object – study these or make models of your specimen and use a shadow box. Remember that objects touching the ground (like insect tarsi and tarsal claws) have darker and sharper-edged shadows than those farther off the ground.

Areas that don't quite match or if small cracks occur in parts of the shadow they can be eliminated using the Healing Brush or Blur tool. And since the shadow is in a separate layer, you can change its overall opacity if it is too dark. But you're not finished yet! You need to lighten and blur those portions of the shadow that are farther from the surface. There are a number of ways to do this, but I like using the **Gradient** tool.

7. First, we'll make a **Layer Mask** for the drop shadow layer to protect the drop shadow [You don't have to add the Layer Mask. Instead you can skip to step 7c to use the gradient directly. However, this gives me the opportunity to introduce you to Layer Masks. Layer masks are important because they allow for **non-destructive** editing. They work especially well when adding gradients or erasing parts of the layer. I recommend that you use a layer mask.]
 - a. Select the drop shadow layer and under **Layer**, choose **Add Layer Mask, Reveal All** or click on the **Add Layer Mask** icon at the bottom of the Layers palette (the rectangle with the circle in it). The layer mask will protect the drop shadow from any editing will do to the gradient. Notice that a second thumbnail, representing the layer mask, appears next to the drop shadow's thumbnail with a "link" between them. If there is an extra frame around one or the other, it is the "active" one; to further help, if the layer is active the "paintbrush" icon appears in the space next to the "eye"; if the mask is active the "layer mask" icon appears next to the "eye." You can temporarily turn off the layer mask by Shift-clicking on its icon (a big red X appears over the icon).
 - b. Activate the layer mask thumbnail. You may want to turn off the overlying layer containing the image of the specimen casting the shadow.
 - c. Now select the **Gradient** tool from the Tool Box (it is docked with the Paint Bucket tool). Set its parameters to: **Radial**, Mode: **Normal**, **Opacity**: 100%,

- (or less, the nice thing is that you can experiment) and **Reverse**, **Dither**, and **Transparency** all checked. Drag the gradient tool across the shadow from left to right starting at about the upper left to center-left of the shadow. Experiment to get the effect you want. You can drag the gradient across the whole layer or only across a selection of the shadow (Command-click on the layer's thumbnail to select it; this works if you added a layer mask as well, simply Command click on the layer's thumbnail, then return to the mask to add the gradient).
- d. Adjust the opacity of the shadow from the Layers palette if desired. Or you can use **Image, Adjustments, Levels. . .** to really refine the shadow. Keep the gradient in the mask - you can always return to it and edit it differently. If you are satisfied, you can choose **Layer, Remove Layer Mask, Apply** (or **Discard** if you want to trash the mask) or drag the layer mask's thumbnail to the trash icon at the bottom of the layers palette (make sure you drag the mask's thumbnail, otherwise you will discard the whole layer).
8. Whether or not you choose to add a gradient, you can lighten portions of the shadow by painting in white with a large, low opacity, soft-edged brush or you can lighten with the **Eraser** tool (likewise a low opacity, large, soft-edged brush). The **Dodge** tool can also be used, but you'll have to find the correct Range and Exposure setting. (You can't darken with black paint or the Burn tool, because you are already painting on a low opacity layer - get the correct darkness when you set up the drop shadow.) Alternatively, you can select certain parts with the Lasso tool, feather the edges of the selection and adjust only the selected areas. You can also Blur the edges with the **Blur** tool if necessary or add a slight Gaussian blur.

Blurring Selected Edges

After the illustration is completed, you may want to soften certain edges. This gives the image a more lifelike appearance. Take into account the rules of atmospheric perspective, especially for structures in the mid- to background. The **Blur** tool is probably the easiest to use for this purpose. You can adjust its strength, brush type, and size in the Blur tool option menu. Experiment and use the **History** palette to backup if you blur too much. Leave prominent setae and bristles un-blurred so they stand out sharp and clean. Again, experiment to get the correct effect and don't over do it.

Linking and Merging Layers

As you work through your illustration you can selectively link and merge layers along the way. You can also discard any unused or unnecessary layers as well. This helps remove clutter in the layers palette and also reduces the file size of your illustration. However, think carefully before merging layers; after merging, the layers become one and are no longer individually editable.

1. Select one of the Layers to be merged (when a layer is selected it becomes "highlighted" and the brush icon appears).

2. **Link** the other layers to be merged by clicking in the box next to the eye icon (a little chain icon will appear indicating that the layers are “linked”).
3. In the Layers palette option menu select **Merge Linked**. The merged layer takes the name of the originally selected layer.

Flattening the Image

Photoshop files with many layers can get very large. As such, they can be slow to save, edit, print, and transfer over the Internet. When your illustration is complete to the last seta or scale, you will “flatten” the image. However, **ALWAYS SAVE AND ARCHIVE A COPY** of the finished, but **un-flattened** illustration in the **native Photoshop format** (the extension **.psd**). Once you flatten an image all the layers are merged and no longer individually editable. To flatten all the layers simply choose **Flatten Image** from the **Layers** menu or from the Layers option button. Note how much the file size is reduced. To further reduce the file size you can save the document as a **.tif** file (lossless compression) or as a **.jpg** file (lossy compression). We’ll discuss file types and compression later.

Printing a Hard Copy of the Digital Illustration

Keep in mind that printed, hard copies of your digital illustration may not be fully “archival.” Light, especially sunlight, dust and other impurities in the air, humidity, and temperature changes affect color inks and the chemistry of the paper itself. Inform the end user that the printed hard copy may not retain its permanency. A 600 to 1200 dpi laser or inkjet printer is more than adequate to print out black and white line drawings as proof or final hard copy. Color inkjet printers, such as an Epson Stylus printer, ranging from \$300 – \$400, are recommended for printing high quality color proofs or “final” copy. Be wary of cheaper inkjet printers offered “free” with the purchase of a computer or at special “bargains” for about \$100. While these produce very good copy, the need to frequently replace the color ink cartridges at about \$35 each quickly surpasses the cost of the printer. Cartridges on the “more expensive” printers are larger, last longer, and are proportionally less expensive. Furthermore, individual color channels can often be replaced or refilled avoiding the waste of replacing the whole cartridge if only one color runs out. Shop around and ask before buying a printer. Kodak and other companies produce high quality glossy photographic paper for color prints that will reproduce Photoshop images very nicely.

However, the professional illustrator will stay in the digital medium all the way to the final version from the press. Images can be saved in the appropriate format (ask the printer what he wants) and then burned on CDs. In fact, the manuscript can also be submitted electronically. CDs are cost effective, efficient, accurate, and fast. There is no reason that images and manuscripts should not be submitted for publication fully electronically.