Resources and Support

Topic: The Pixel Art Tutorial (Topic Closed)

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Topic: The Pixel Art Tutorial
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Purpose:
This tutorial is designed to explain what pixel art is, what pixel art isn't, how to get started making pixel art and how to make your pixel art better. It is an attempt to consolidate the information scattered throughout the "noobtorials" thread and elsewhere. For more advanced information on what makes pixel art tick, the reader is advised to read the less general tutorials found elsewhere, as well as the Ramblethread! found over at Pixelation, which offers a more in-depth analysis of pixel clusters, banding, and anti-aliasing, and is the source of much of the information found in this tutorial.

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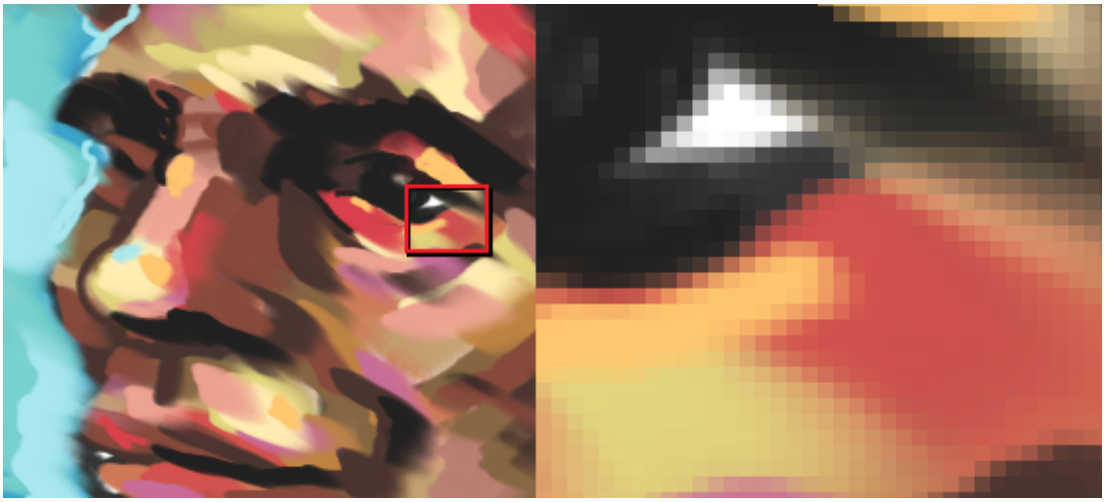
I. What is Pixel art?

Judging by the name, we might assume that pixel art is any art that's made up of pixels. But not every digital image is pixel art.
This photograph is made from pixels, but is not pixel art:

Alright, so no photographs. But if I make my art on the computer, then it's pixel art, right?
No. Pixel art is a very specific sub-category of digital art. It isn't what it's made of so much as how it's made.
For example, this digital painting is art made on the computer, and it is made of pixels, but it is not pixel art:



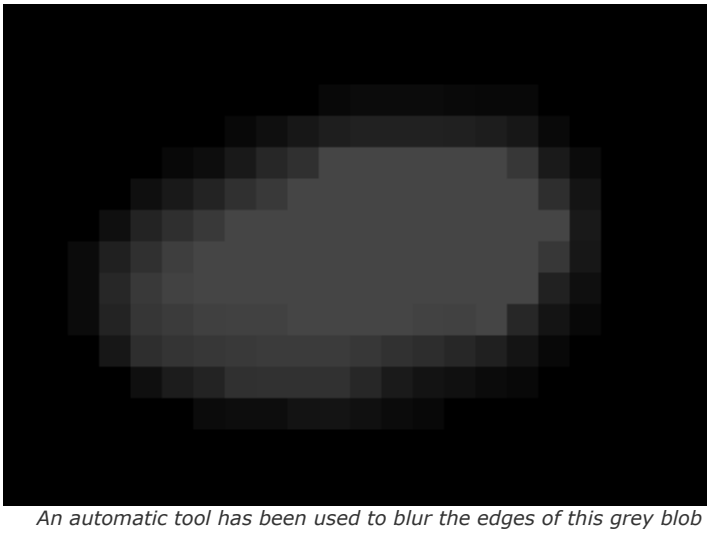
If the pixel art loses the sense of the importance of the pixels which construct it, then I don't think it can be called pixel art. It is when the pixels hold importance to the nature of the work which defines it as pixelart. - Alex HW

Why not all digital art is pixel art

Pixel art is set apart from other digital art forms by its focus on control and precision. The artist has to be in control of the image at the level of the single pixel, and every pixel should be purposefully placed.
When pixel art is done purposefully, offsetting just a few pixels can have a dramatic effect on the image:

The features of this parrot change drastically, but only a few pixels are different.

Other digital art forms use many tools you won't find in pixel art. The reason pixel artists don't use these tools is because they place pixels in a manner that the artist can't predict. These **automatic tools** blur, smudge, smear or blend the pixels. Any tool that places pixels automatically (which means the computer makes decisions about the placement of pixels rather than the artist), is generally frowned upon in pixel art. Remember, pixel art is all about control.



An automatic tool has been used to blur the edges of this grey blob

You'll often hear people complaining "*This isn't pixel art, it has too many colors*!" This isn't because there's some unwritten rule in pixel art that says "It's only pixel art if it has [X] number of colors", you're allowed to use as many colors as you want. The main reason that people complain about color count is that a high amount of colors can indicate the use of dirty tools. Dirty tools create a lot of new colors in order to achieve their blurring, smudging, or transparency effects. People also mention high color counts because larger palettes are more difficult to control, but we'll get to that later.

Why it's not just about the tools

So if I don't use any blur effects or filters or fancy tools, it's pixel art, right? Anything made in MS Paint will be pixel art?
No. It's not the program that determines whether or not it's pixel art, it's how it is made. For example, this image was made in MS Paint, without any fancy tools:

But it isn't pixel art. This is what we call **oekaki**. If you can create the image without zooming in, chances are it isn't pixel art. If you're using the line tool and flood-fill most of the time, you're not paying attention to the individual pixels, just the lines and shapes that the pixels make up. The same goes for rough sketches made with the pencil or brush tools. These methods ignore the importance of careful, deliberate placement of the individual pixels.

While the most common misconceptions about pixel art are due to too loose of an

interpretation of the medium, there are some who have too strict a definition of what makes pixel art.

Every pixel does not literally need to be placed by hand
The job of the pixel artist is not to manually place each and every pixel. You aren't expected to behave like a robot, filling in large areas with thousands of single-clicks of the pencil tool. The **bucket tool** is fine. The **line tool** is fine. What's important is that the artist has control of the image *at the level of the single pixel*, not that you create the image one pixel at a time.

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II. Where do I start?

Pixel art is about the pixels- that's as simple as it gets. These tips share a common goal: to make sure your focus is on the pixels.

Start small- The larger the image you're trying to make, the more time and work it's going to take to complete it. Don't make this tough on yourself, use a small canvas. Pixel art can convey a lot of information for its size, you'd be surprised how little room you need if you control the pixels properly.

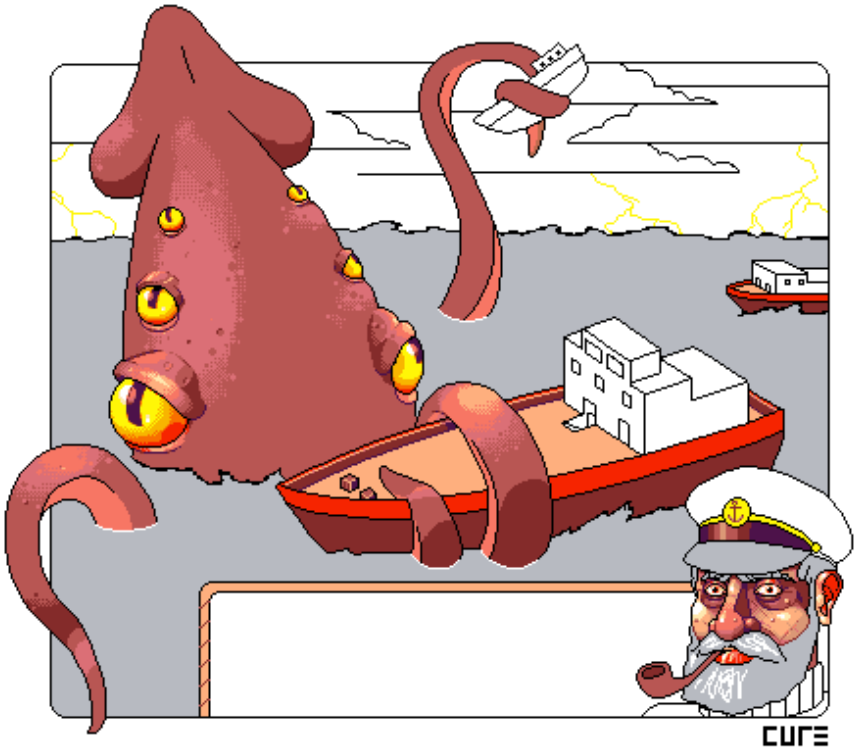
Use a limited palette- If you can't make a good sprite in 4 colors, using 40 colors isn't going to help. Using a small palette is especially good for beginners because it forces you to focus on pixel placement and the relationships between groups of pixels.
The original, 4-color GameBoy palette is a good choice for beginners, as you'll only have to worry about value, and not hue or saturation.

Programs
There are plenty of good programs out there for pixel art, many of which are free. I use Grafx2, but GraphicsGale, Pro Motion, Photoshop, Pixen, and MS Paint are all common choices. Some are more user friendly than others, which is why I choose something with keyboard shortcuts like Grafx2 over MS Paint, it has saved me many trips to the toolbar (and makes for much easier palette management).

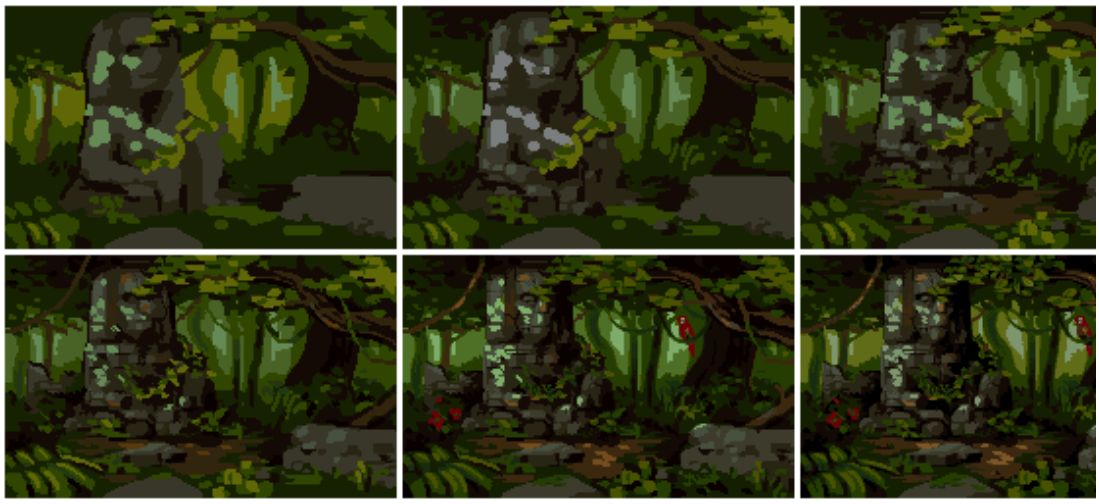
File type
A common mistake that new pixel artists make is saving their art as a JPEG/JPG. While this file type might be fine for other types of images, it causes compression, which destroys the quality of a piece of pixel art.

Never, ever save as JPG. Instead, save as PNG or GIF. Be careful though, as some programs (such as MS Paint) don't properly support the GIF format, and will ruin your image. In these instances, you'll need a file converter (such as Giffy) if you want to save your image as a GIF.

But how do I *start* the image?
It's completely up to you. Some artists prefer to create the line art first, then go in and add color:



Other artist prefer to 'block-in' the major forms with a larger brush, then continue by refining the image until it has a pixel-level polish:



Both methods are fine, it all depends on what you're comfortable with, or the specifics of the project. Line work might be a good method if you're tracing a scanned image (such was the case for the sea monster example above). If you're beginning the image in your pixelling program, and it isn't a tiny sprite, blocking in the forms with a larger brush may prove more useful.

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III. Terms to know

Anti-aliasing (AA):

[In addition to the information found in this section, check out this image by Ptoing.]

Anti-aliasing is the method of making jagged edges look smooth. You may be familiar with anti-aliasing already, because a lot of programs and tools do this automatically. When we're talking about pixel art, however, anti-aliasing means **manual anti-aliasing**. Manual AA means smoothing the jagged areas by hand-placing pixels of a different color to ease the

transition. Here's an example:

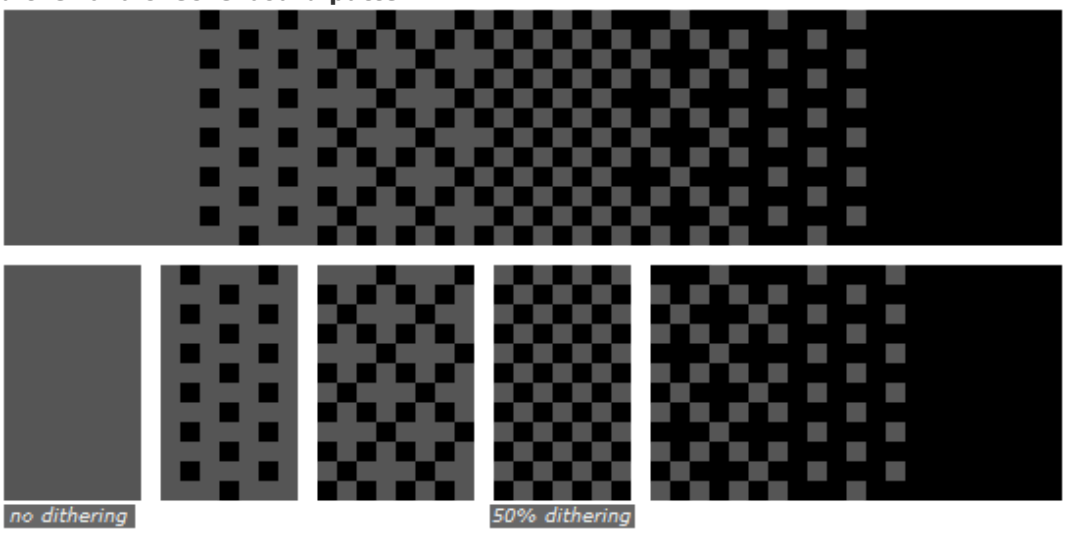
without AA *with AA added*

There are several pitfalls often encountered when applying anti-aliasing, which are discussed in the "Things to avoid" section.

Dithering:

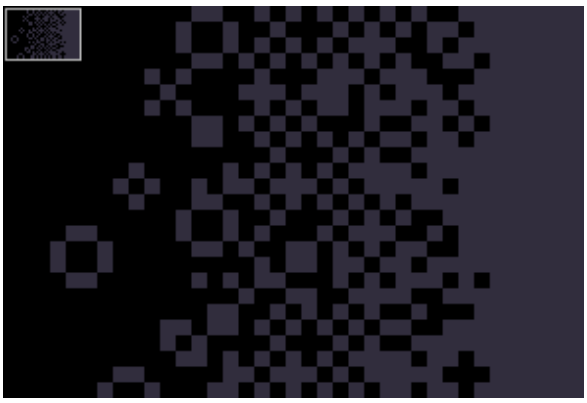
Dithering consists of different patterns of pixels. It's typically used to ease the transition between two colors, without adding any new colors to the palette. It's also used for creating texture. In the days of CRT monitors, dithering was especially useful as the screen would actually blur the dithered area and obscure the pattern. Now that crisp LCD monitors are the norm, the patterns are no longer as easy to hide, meaning dithering is not as versatile as it once was. Even so, dithering still has its uses.

The most common form of dithering you'll see is a **50/50 dither**, also known as a **50% dither** or a **checkerboard pattern**.

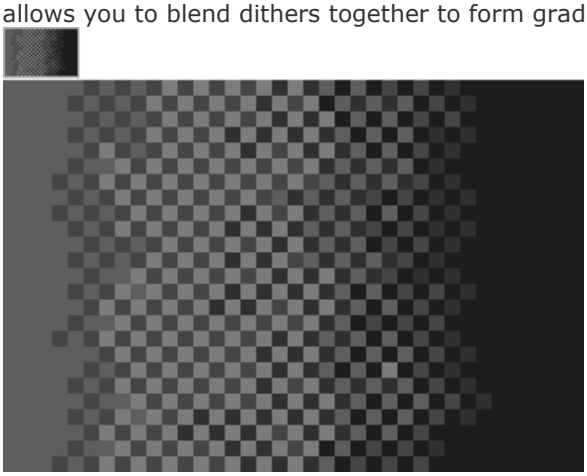


As shown in the example above, you can create various other patterns to further buffer between a full color and a 50% dithering pattern.
These patterns are often easier to spot than a 50% dither though, so be careful!

Stylized dithering is another technique, and is characterized by the addition of small shapes in the pattern.



Interlaced dithering allows for two dither regions to hug each other. It is called interlaced dithering because the two dithers weave together at the borders. This type of dithering allows you to blend dithers together to form gradients.



Random dithering is a less-common form of dithering, and isn't generally advised, as it adds a lot of single-pixel noise to the image. While it has some usage in very small doses, random dithering is something you'll often want to avoid.

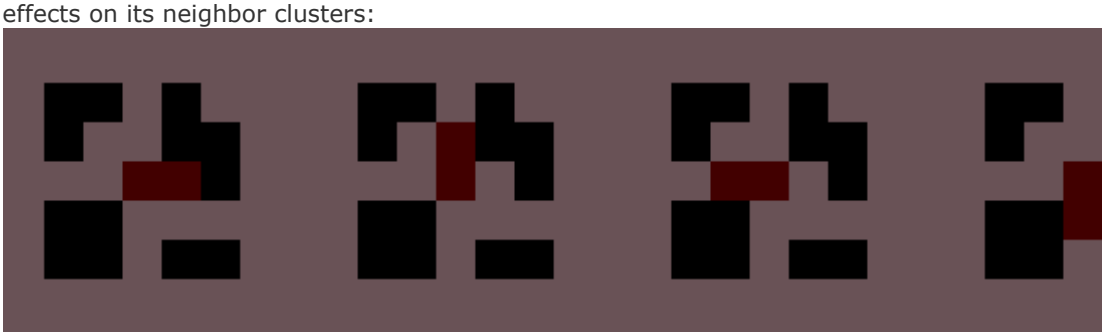
As useful as dithering is, it's often misused by inexperienced artists. **Bad dithering** is discussed further in the Things to avoid section.

Pixel Clusters:

The cluster of pixels is made from single pixels. However, a single pixel is most of the time near-useless and meaningless if not touching pixels of the same color.
The pixel artist is concerned with the shapes that occur when pixels of similar color touch each other and convey an opaque, flat, shape.
Most of the defeats and possible triumphs of pixel art occur in that exact moment where the artist makes a cluster of pixels.
-Ramblethread

I stress the importance of placing individual pixels, but these are rarely independent pixels. A single pixel, isolated, is a speck on a screen- it’s noise. But pixels aren’t usually found alone, instead they exist as part of **pixel clusters**- groups of pixels of the same color that together produce a solid color field. While the single pixel is our basic building block and smallest unit, the pixel cluster is the unit on which much of our decisions about pixel-

placement will be based. And while it's important to realize individual pixels aren't independent, it's just as important to realize pixel clusters aren't independent. Like puzzle pieces, the borders of a pixel cluster determine the shape of the pixel clusters it borders. Here is an example of how rearranging the shape of a pixel cluster can have dramatic effects on its neighbor clusters:



While lone pixels often read as noise, a lone pixel of a color different than the field it touches, *if used as a buffer* (AA), reads as part of that cluster, and is thus unproblematic:

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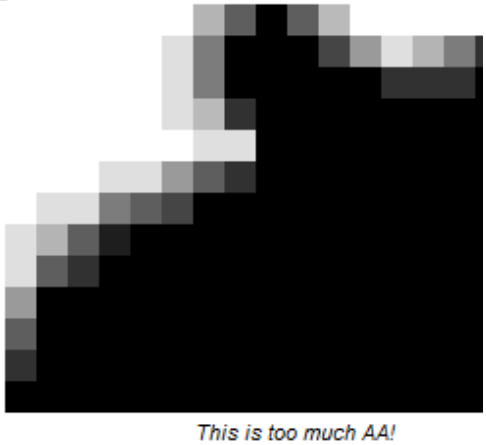
IV. Things to avoid

Bad AA:

Too much AA (over-anti-aliasing)- You only want to use as much AA as is necessary to smooth the edge. If you use too much, the edges can look blurry, and you lose the crispness of the line.

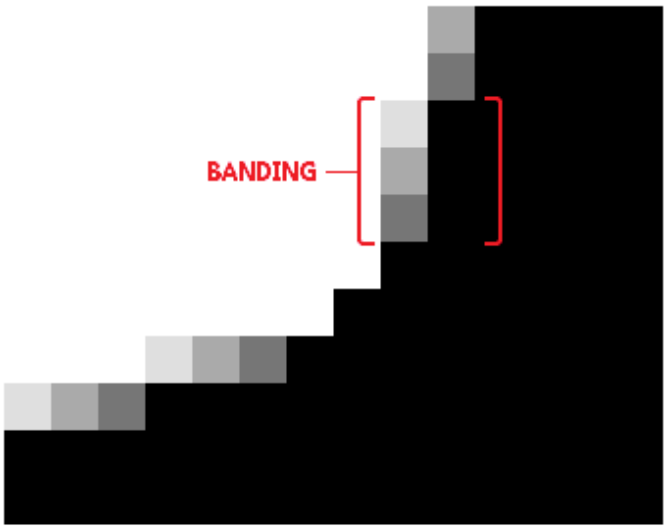
The AA smooths the edges but doesn't add blur



This is too much AA!

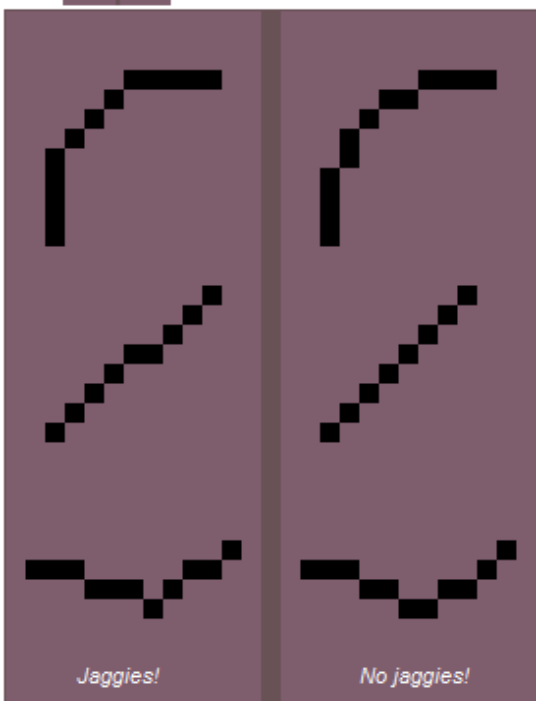
Too little AA- Here the artist has used single pixels to ease the transition, but he has only succeeded in blunting the jagged edge a bit. He could have made a much smoother transition by using longer lines of pixels to show a more gradual transition:

AA banding- When segments of AA line up with the lines they're buffering, AA banding occurs. For a better understanding of AA banding, be sure to read the section on banding.



Jaggies:

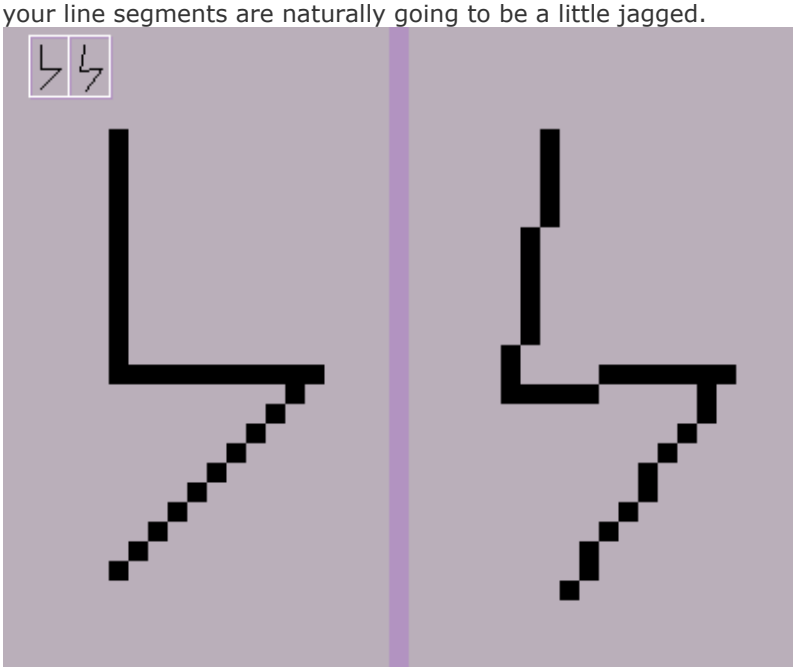
Jaggies occur when a pixel or group of pixels are out of place, interrupting the flow of a line. Jaggies can also occur when a line lacks anti-aliasing. Jaggies get their name from the jagged lines that they create. More broadly, jaggies are the result of any bad pixel technique, but they are most often discussed in reference to line work, so that is the context in which they will be discussed here.
How to fix jaggies:
Changing the length of the lines



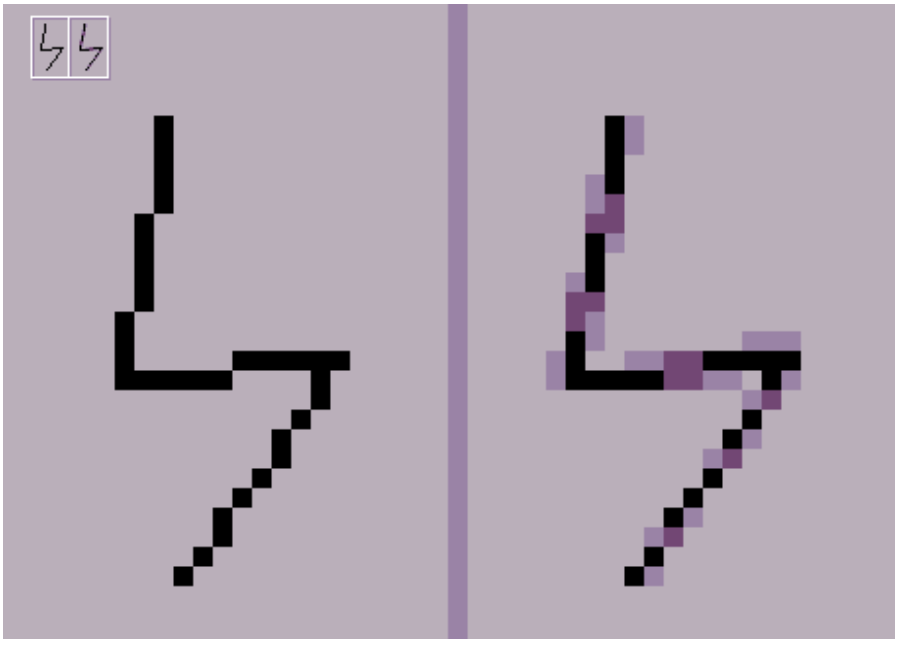
often times the problem is just that a segment of the line is too short or too long, and it creates an awkward jump. Using a more uniform length of pixels to smooth the transition is the solution here.

Anti-aliasing

Unless your line is perfectly horizontal, perfectly vertical, or at 45 degrees, the edges of your line segments are naturally going to be a little jagged.

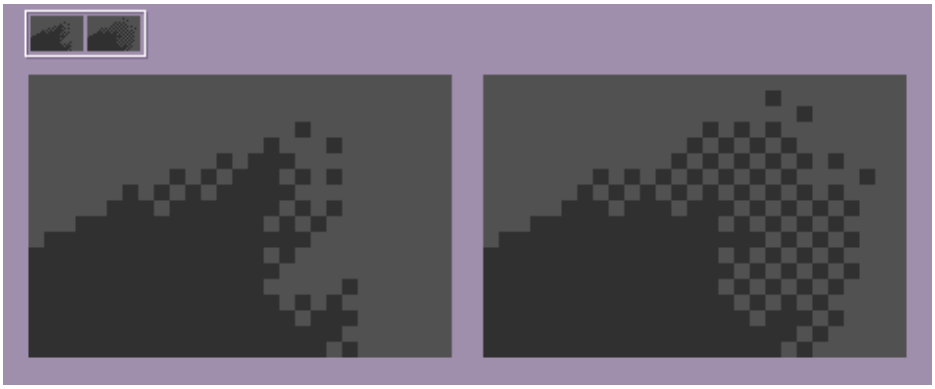


This is because the square nature of the pixel and the grid pattern we're restricted to makes angled lines and curves difficult to portray. AA is the correct counter-measure in these situations.



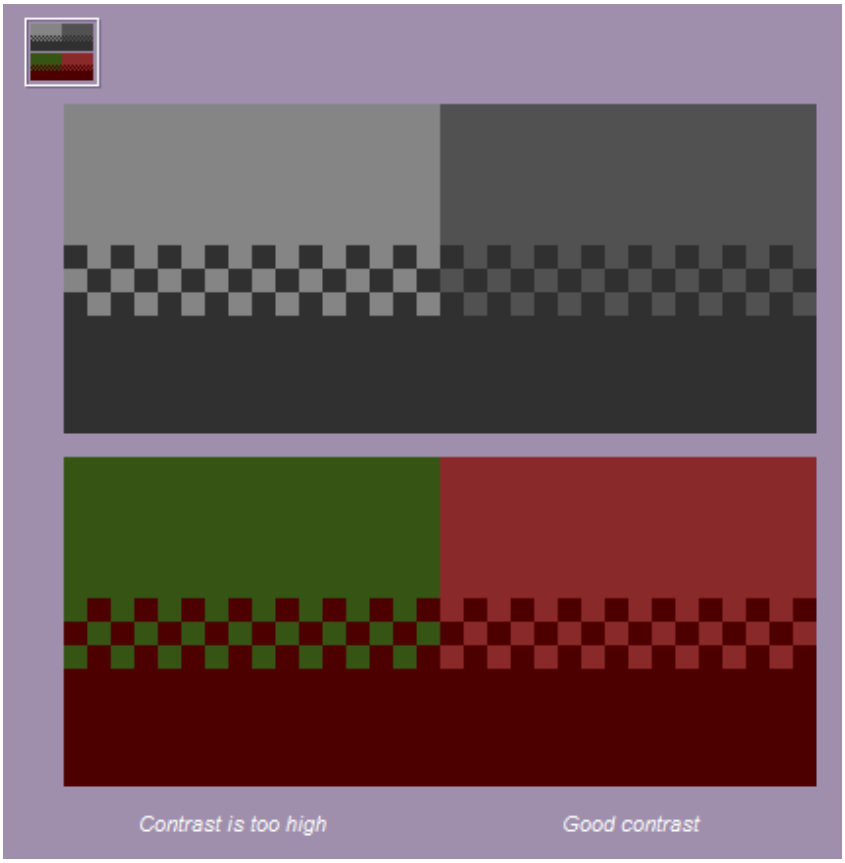
Bad dithering:

There are several common ways dithering is misused. The most common mistake is simply using **too much dithering**. If dithering is covering half your sprite, it'd probably just be better if you added a new color to the palette. Dithering should ideally be used to taper the ends and edges of an opaque field of pixels. When too much dithering is used, the dithered area turns into a field itself:



At this point dithering is no longer serving as a buffer between colors, but creating unwanted texture. Creating texture can be a useful aspect of dithering, but only when used correctly. If you're trying to buffer and are instead adding texture, then dithering isn't working out.

So how much dithering should you use? Well, it depends on how big your palette is really- or more precisely, the contrast between the two colors you're trying to dither with. The lower the contrast is between the two (in hue or in value), the less harsh the dithering will be:



Banding:

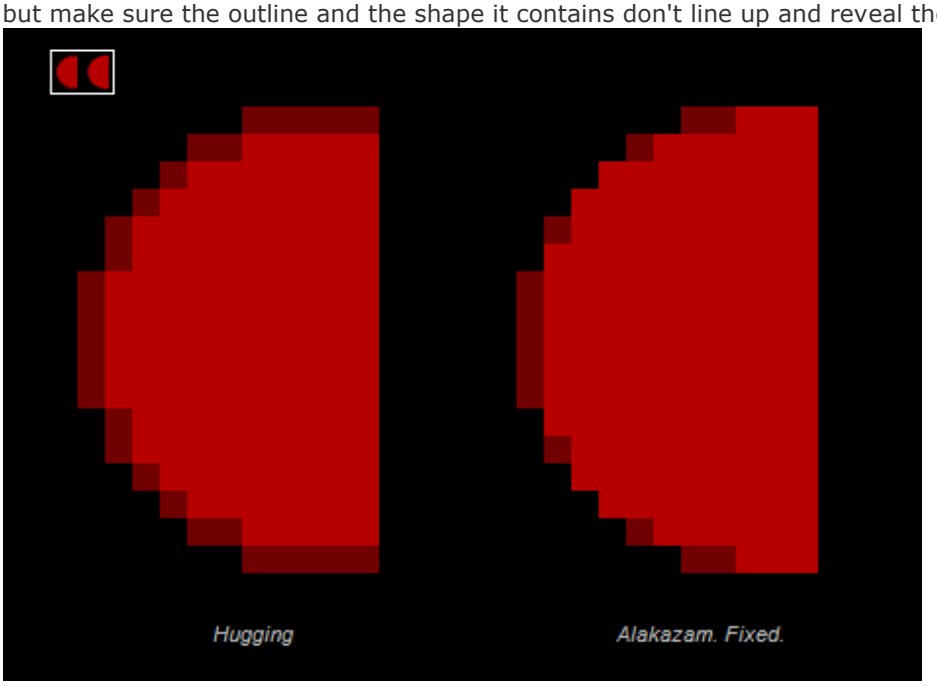
Banding, most simply, is when pixels line up. When neighbor pixels end at the same x or y

coordinate on the underlying grid, the grid immediately becomes more evident, the pixels are exposed, and the apparent resolution becomes less fine.

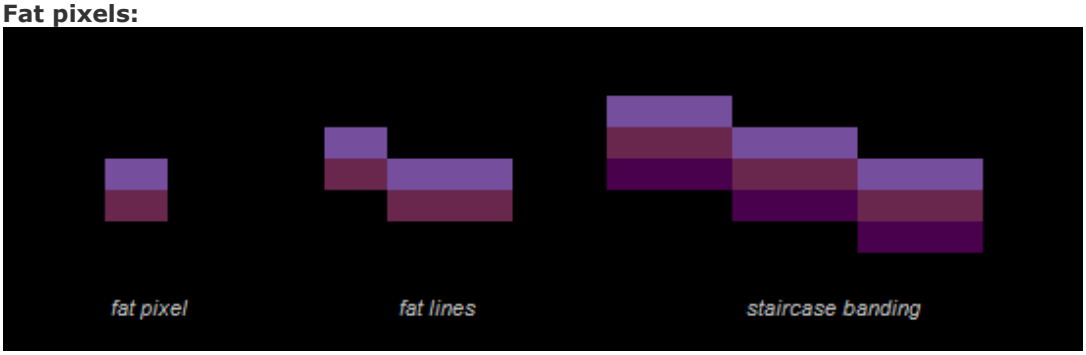
Here are several instances of banding, all of which occur because the pixels have lined up. These names aren't common lingo, but will work for the purposes of this tutorial:

Hugging:

Here an opaque field of color has been outlined by a row of pixels. It's fine to use outlines, but make sure the outline and the shape it contains don't line up and reveal the grid.

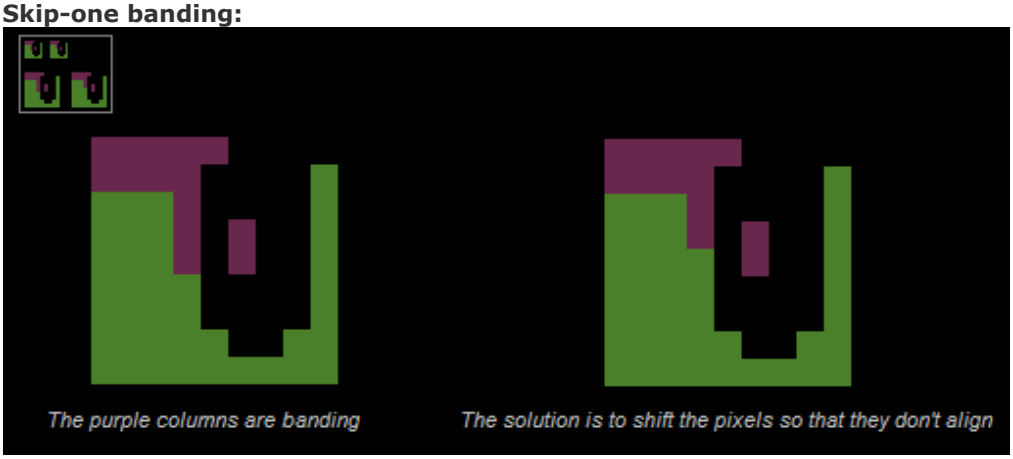


Fat pixels:



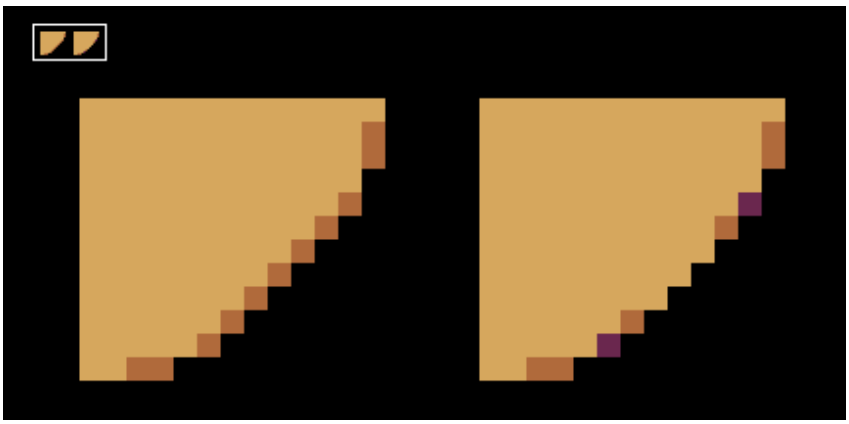
Fat pixels can occur alone in small squares, together as fat lines, or multiplied as large bands (staircase banding).

Skip-one banding:



Even if there is a negative space between two bands, the mind will fill in the gap and banding will remain.

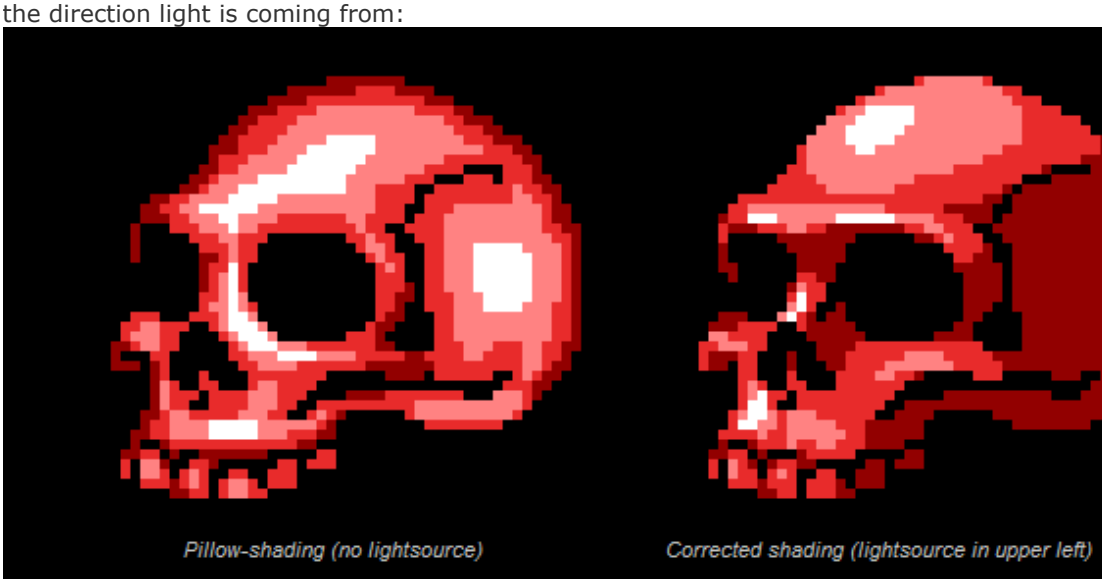
45 degree banding:



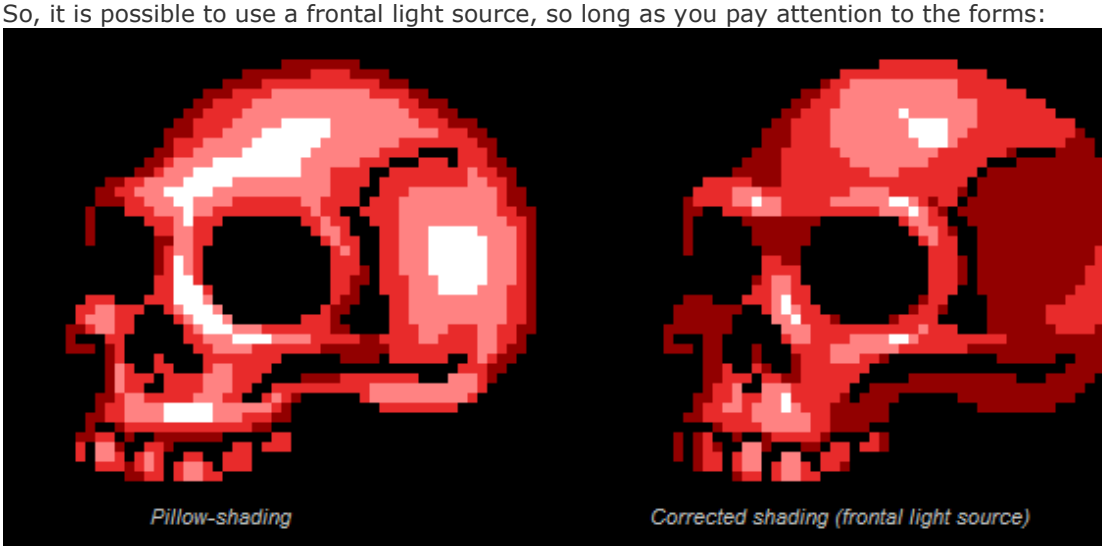
Though the rows of pixels lining up are only 1 pixel thick, banding is still present.

Pillow-shading:

Shading by surrounding a central area with increasingly darker bands. Pillow-shading is bad because it pays no attention to the light source, and conforms to the shape of the area rather than the form it represents of how light affects it. Pillow shading is often, but not always, combined with banding. The way to fix pillow-shading is simply to pay attention to the direction light is coming from:



The reason pillow-shading is wrong is not because the light source is frontal (from the viewer's direction). You don't have to place the light source in the corner. The reason pillow-shading is incorrect is because it follows flat shapes rather than focuses on how the three-dimensional forms are lit.
So, it is possible to use a frontal light source, so long as you pay attention to the forms:



Noise:

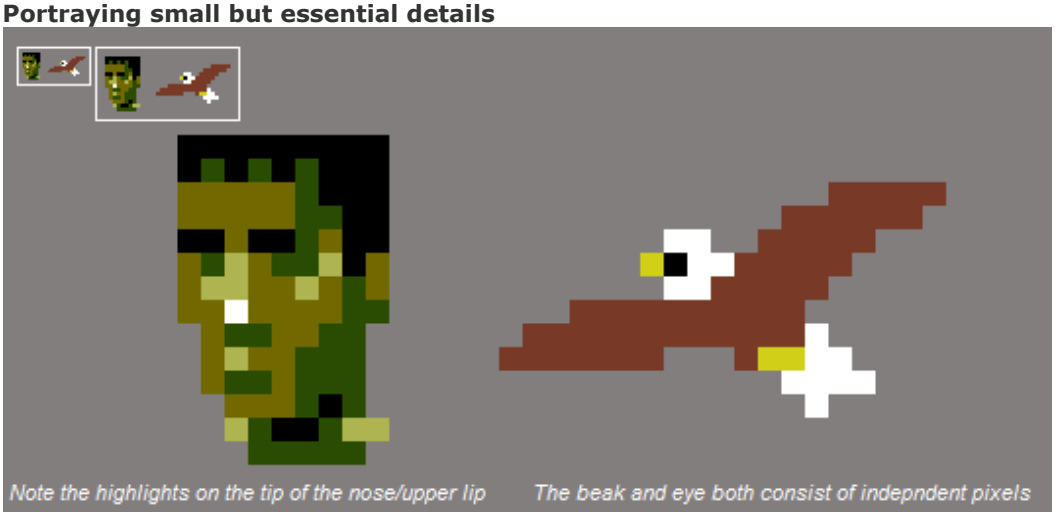
Much of the time, **independent pixels** (pixels that do not belong to a pixel cluster) are unable to convey sufficient information by themselves, and their inclusion usually only creates noise. **Noise** is any sort of information that does not contribute to the piece and serves only to interrupt the area it inhabits and distract the viewer. In pixel art, noise is often composed of independent pixels. For the purposes of this tutorial, single-pixel noise will be what I'm referring to when I use the term "noise". The reason one must be careful when using a 25% dither (or any dithering, really) is because of the noise all the independent pixels create.
Single pixels expose the underlying grid by revealing the resolution of the image. Remember, in the wild, pixels travel in packs. It's the nature of a pixel to long for a place in a pixel cluster. For this reason, independent pixels should only be used for very specific and purposeful reasons.

Justifiable instances of independent pixels include:

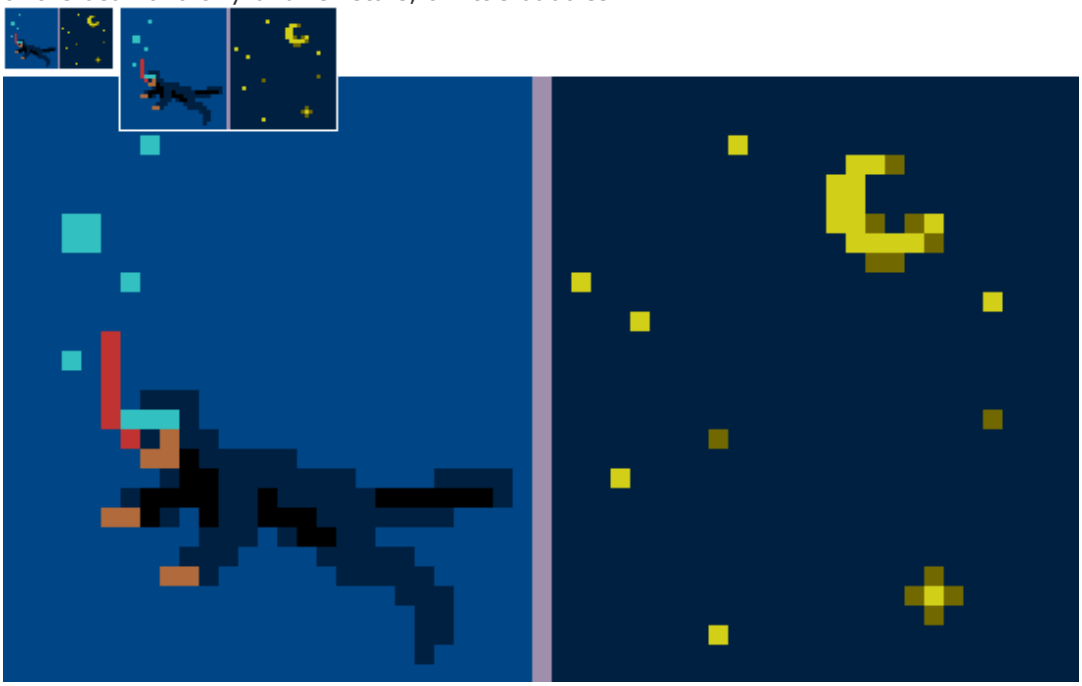
Use as specular highlights

Independent details call a lot of attention to themselves, but sometimes this is precisely what you want. For bright specular highlights, single pixels will often work just fine. For an example, see the white pixel used on the monster's nose below.

Portraying small but essential details



Usually this will only matter for details on very small images, like the eyes on a small sprite, or the beak of a tiny bird. Or stars, or little bubbles.



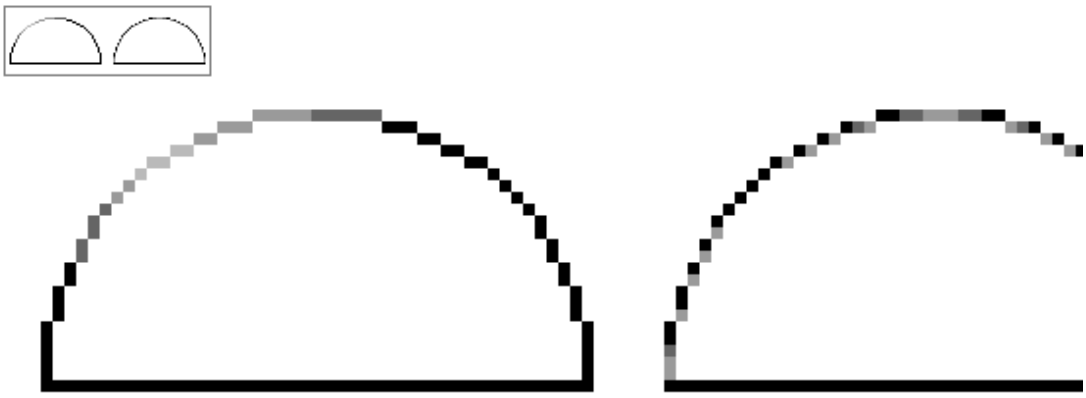
Sel-out (broken outlines)

Sel-out (short for **selective outlining**, also known as **broken outlines**) is **anti-aliasing** an outline to a background color. This means sel-out is really a type of **bad AA**, but the

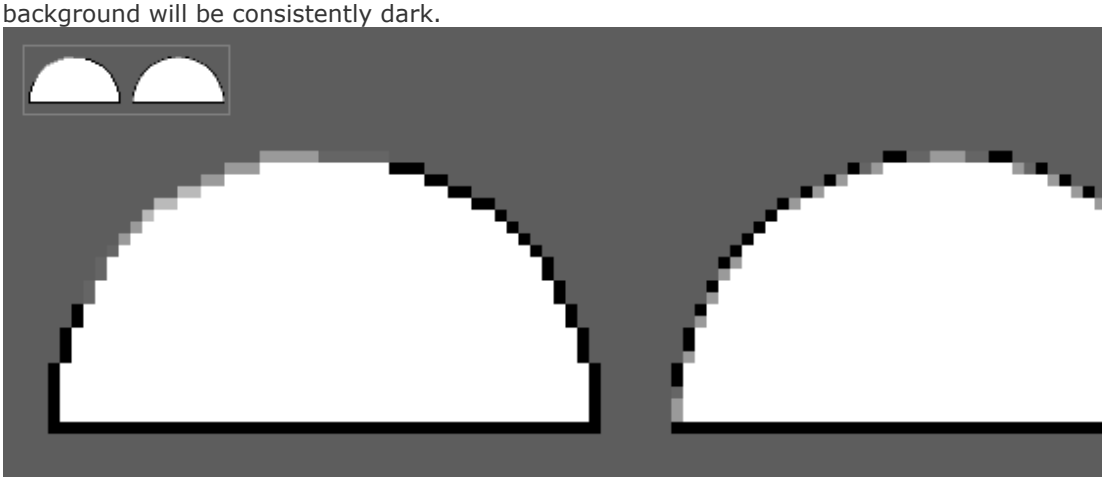
term has become popular enough to warrant its own section.

The idea is usually to darken the outline at the contours to approach a darker color, so that the sprite will read well on any background, instead of melting into a similarly-colored background. Sel-out is **not** shading an outline according to a light source. A full outline with light variation won't create **jaggies** as badly as a broken outline will:

Perhaps this is a simpler example. The half-circle on the left is shaded according to a light source (again, coming from the top left corner). The top of the half-circle on the right has sel-out applied:



Sel-out works if it is created for specific scenarios, such as in a game where you know the background will be consistently dark.



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V. Creating a palette:

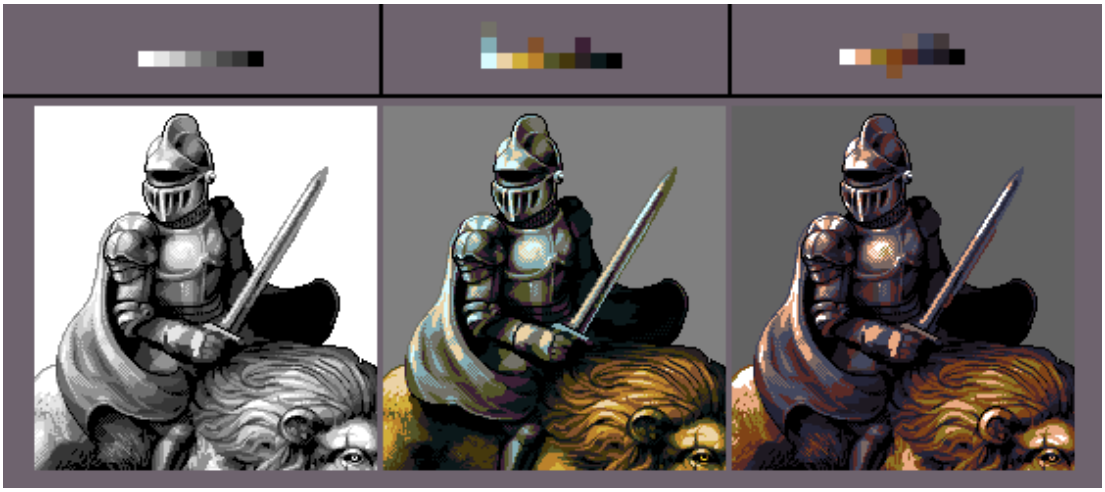
When should I worry about colors?

Well essentially what it comes down to is, what colors does the piece need to have? then, as I go, how far can I get with those (until of course I need to add more shades). That's when the mixing occurs.
-Adarias

This is a common method of creating a palette for a piece. Here's an example of what he's talking about:

As the piece gets more complex, it becomes necessary to create additional colors to achieve more advanced shading, or to color new image elements or details.

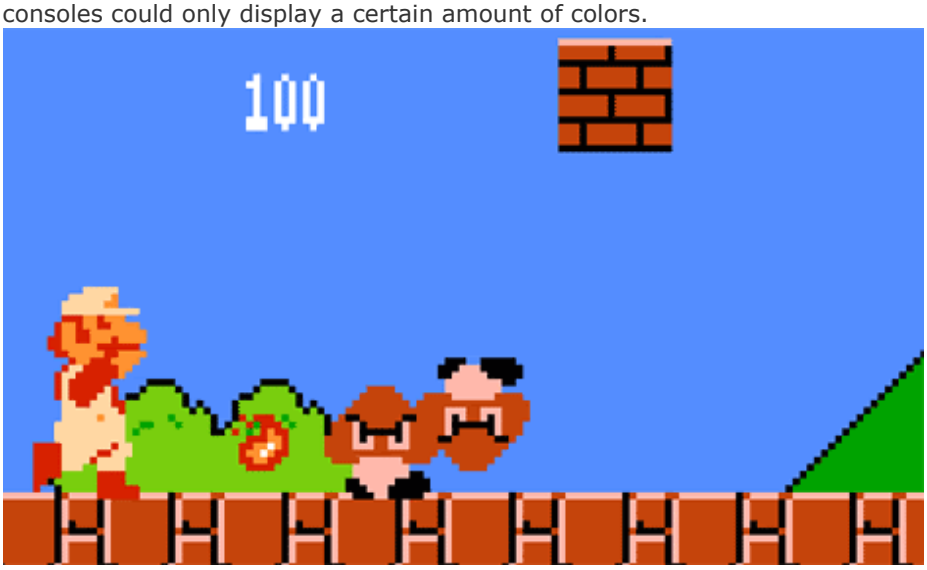
Another method is to create the piece in shades of grey, then add color later. This is possible because relative **value** is a greater concern than **hue**, because hue can be more easily altered later on, after value relationships have been established.



Personally I find it easier to keep up with colors as the piece progresses, so I prefer the first method.

Color count

You may find that pixel artists often advocate a low **color count**. You might assume that this is just a tradition leftover from the olden days of pixel art, back when video game consoles could only display a certain amount of colors.



If modern computers can easily display hundreds of colors, why shouldn't you use them all? In truth, using small palettes isn't an outdated tradition of pixel art, and there are very logical reasons behind this practice.

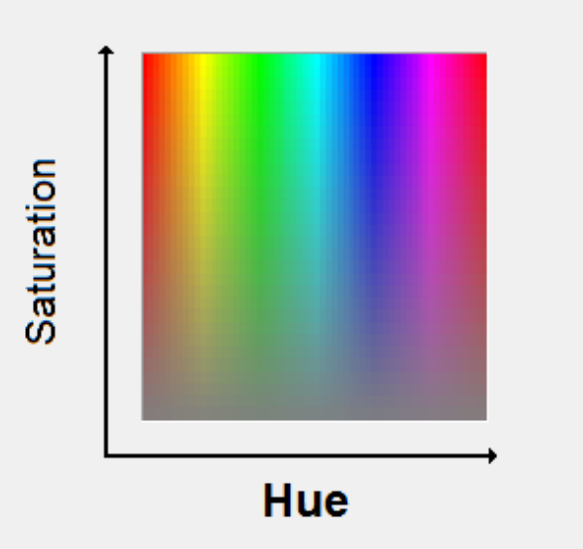
Cohesion- When you're using less colors, the same colors will reappear throughout the piece more frequently. Since the different areas of the work share the same colors, the palette ties the piece together, unifying the work.

Control- The smaller the palette, the easier it is to manage. You may, and probably will, want to change adjust a color later on. If you've got 200 colors, it's going to take you a lot longer to make the adjustments, because by changing one color you've thrown off its relationship with the colors neighboring it on its color ramps, and adjusting them means changing the relationships between those colors and their neighbors! You can see how this quickly adds up to a lot of work. With a smaller palette, the effect of changing a single color is more substantial, and there are less micro-relationships to worry about.

Hue, Saturation, and Luminescence

Hue:

Hue refers to the identity of a color. Whether a color is defined as blue, red, orange, etc. depends on its hue:



In the above picture, hue is represented along the x-axis.

Just as you can change how bright or dark a color appears by surrounding it with lighter or darker pixels, the perceived hue of a color depends on its environment. Here we have a completely neutral, medium grey:

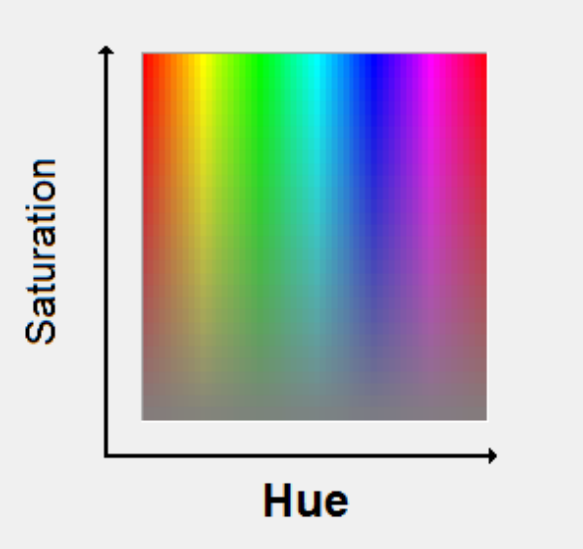
In this picture (a detail of this piece by iLKke) the green in the trees is actually not green at all, but the same grey as the previous picture:

Because the background is so purple (which is the opposite of green on the color wheel), the grey looks greener than it actually is.

Hue will be an important concept later when we discuss hue shifting.

Saturation:

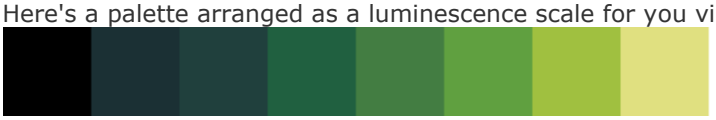
Saturation is the intensity of a color. The lower the saturation of a color, the closer the color gets to grey:



The most common problem new artists encounter is regards to saturation is using colors with too high of a saturation. When this happens, the colors start to burn the eyes. This can be a problem in any media, but because the colors in pixel art are made up of light, instead of pigment as in paint, the potential for colors being too bright or irritating is much higher. Notice how the colors in the second image are much easier on the eyes:

Luminescence (brightness):

Luminescence (also known as **brightness** or **value**) is how dark or light a color is. The higher the luminescence, the closer the color gets to white. If the luminescence is 0, then the color is black.
Here's a palette arranged as a luminescence scale for you visual learners:



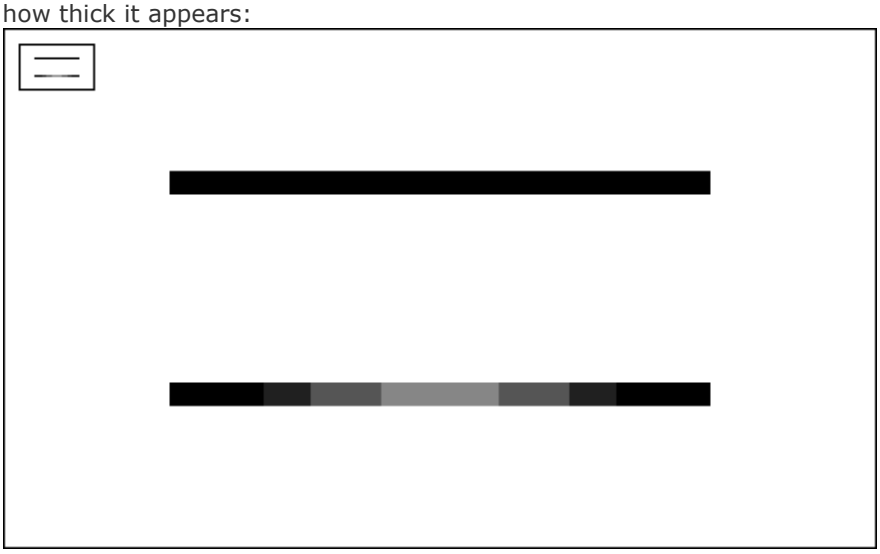
low luminescence (darker colors) on the left, high luminescence (brighter colors) on the right

In a given palette, you'll want to have a wide range of values. If you only have colors in the same range of luminescence, then you won't be able to create good contrast- a full range of values allows you to use highlights, mid-tones, and shadows. The difference between the brightness of two colors is known as **contrast**. A common problem newer artists exhibit is not having enough contrast. Here's an example of an image for which the contrast is too low:

And that same image, adjusted so the values are spread out more evenly from light to dark:

The value of a color is a set number, but colors can appear lighter or darker depending on their background. For this reason, you won't always want to use your brightest color for every highlight. A color that makes a good highlight on one object might be too bright to use on a darker object.

Luminescence is especially relevant to pixel art: The brightness of a pixel or line determines how thick it appears:



The first example is a simple black line. The width of the line looks consistent. Below that is a line with pixels that vary in brightness. Notice how the line appears thinner toward the center at 1x.

Color Ramps

A color ramp is a group of colors that can be used together, arranged according to luminosity. A palette can consist of a single ramp of many different ramps.
Here's a palette:

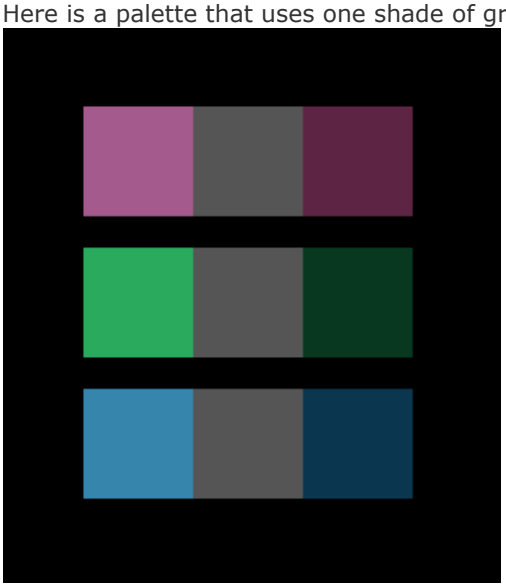
And here's that same palette, arranged according to its color ramps (of which there are two):

It isn’t necessary that you actually create a model like the one above (though some artists find it useful). What is important is that you understand what your color relationships are- that is, what your ramps are.

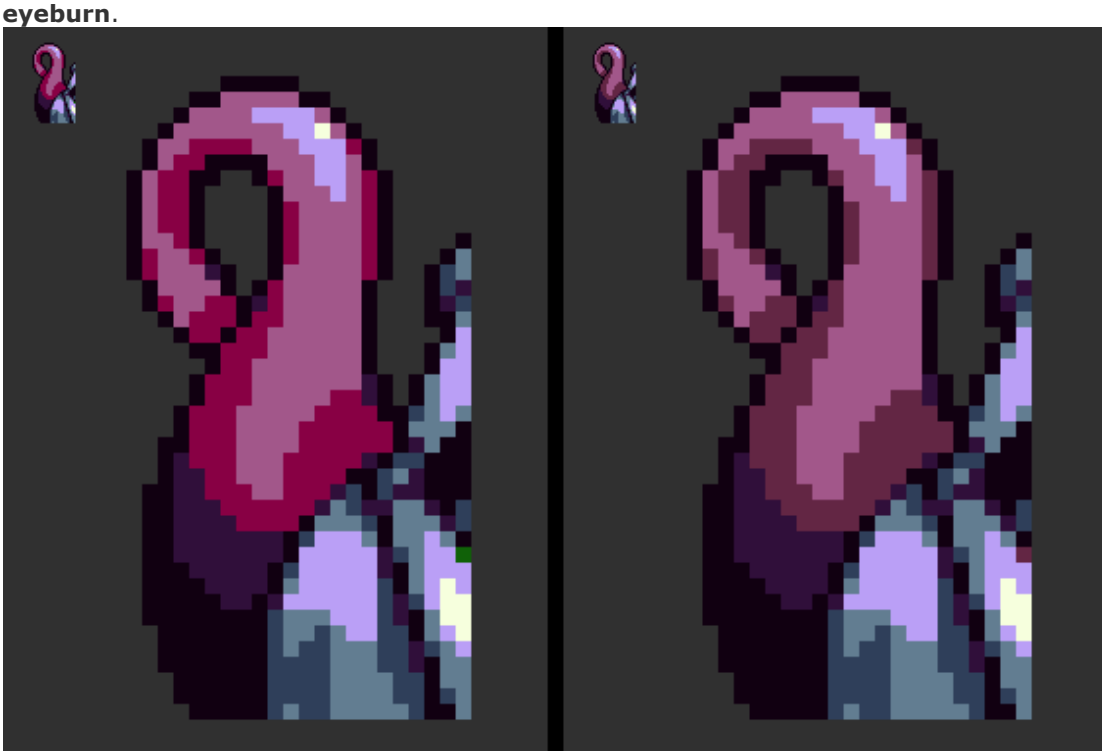
It isn't necessary that a color be restricted to a single ramp. Often, ramps will share colors. Frequently, the darkest or lightest color will belong to most or all of the palette's ramps, as in the example above, in which both ramps share the same darkest and lightest shades.

It’s also possible for mid-tones to work in multiple ramps. In these cases, the versatile color takes the place of two or more separate colors, aiding in palette conservation. In the case of multi-ramp shadows and highlights, the extremes in luminescence allow the color to be flexible (because they approach black or white). Since mid-tones are not afforded this advantage, they are often more neutral colors, meaning they are closer to brown or grey.

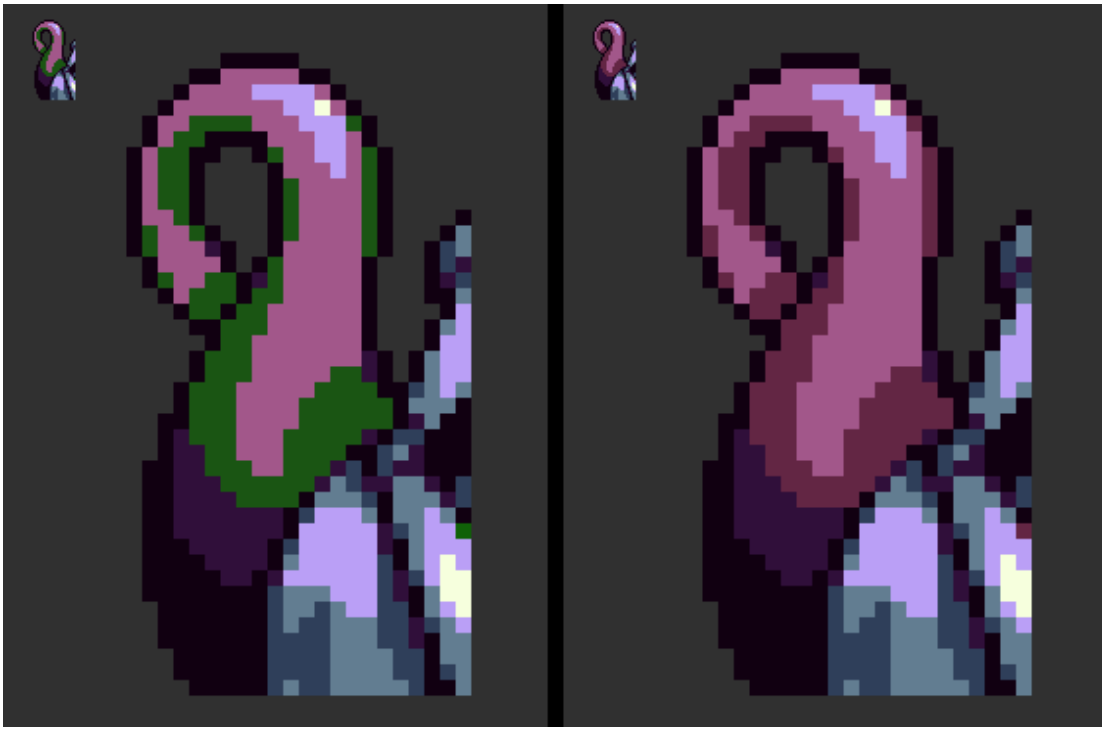
Here is a palette that uses one shade of grey to bridge the gaps in several ramps:



You also have to be careful about having colors in a ramp that don't fit. If a color doesn't belong in the ramp, then it has the potential of **punching through** the image, which is a priority issue in which the color, rather than work as part of the image, seems separate from it, and looks almost like it is sitting on top of the image. This is usually due to the saturation being too high, or because the hue clashes with the neighboring hues, and thus creates **eyeburn**.



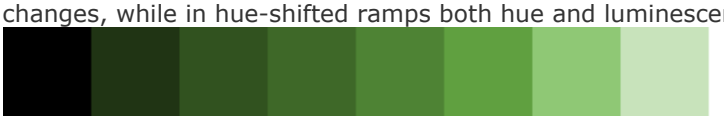
The above image shows eyeburn created by a color with too much saturation.



...and in this image, eyeburn is created by the green clashing with the purple. The hue should logically follow its neighbors in the ramp.

Hue shifting

Hue-shifting refers to having a transition of hues in a color ramp. A color ramp without hue-shifting is known as a **straight ramp**. In straight ramps, only the luminescence changes, while in hue-shifted ramps both hue and luminescence will (usually) change.



The first color ramp is a straight green ramp. The second image is a green ramp with hue-shifting applied. When using hue shifting, bend your highlights toward a certain color (yellow, in the example above), and move the darker colors toward a second color (I chose blue in the above example). Hue-shifting is used because straight ramps are usually boring and don't reflect the variety of hues we see in reality, and hue shifting can add subtle color contrast within a ramp.

Edited by jalonso - 28 July 2014 at 6:49am

IP Logged

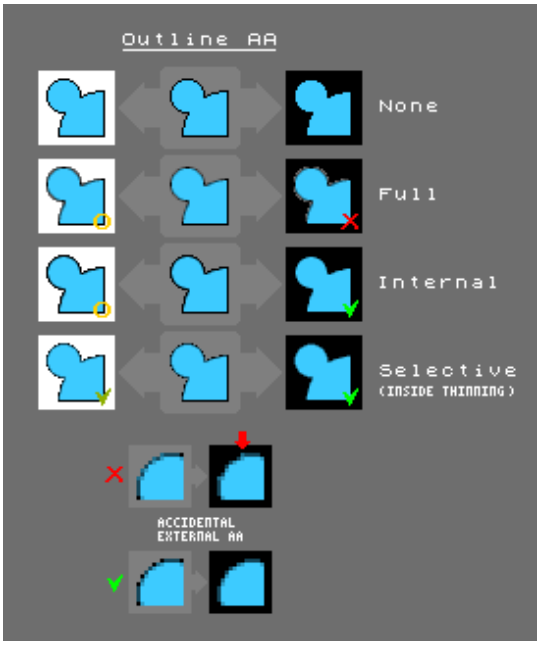
jalonso
Admiral

Joined: 12 August 2021
Online Status: Offline
Posts: 13537

Posted: 28 June 2014 at 9:01am

By DB:
Selective AA is the process of pushing/moving the internal AA into the outline...without ever making the (easy) mistake of doing external AA. "Internal thinning".

If you want strictly pixelart (and no semitransparancy) and have sprites that should look decent on all backgrounds; then "selective AA" is the best method (I don't know if there's an accepted term for it, however it has a close relationship with Selout). Although it's a very advanced pixelart technique, and may not be suitable for beginners..so try working with just internal-AA if you wanna play it safe.



Edited by jalonso - 28 July 2014 at 7:08am

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Joined: 12 August 2021
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Posts: 13537

Posted: 20 July 2014 at 6:48am

Link to waybackmacine's backup of the original SEL-OUT tutorial
https://web.archive.org/web/20130602163317/http://pixel-zone.rpgdx.net/shtml/tut-selout.shtml

~~*If anyone has a way to backup this tutorial PM me~~
~~By this I mean copy all pages, images in a way that requires little but uploading to a server.~~

*Tutorial collected by Uncle_B . I'll post asap.

Edited by jalonso - 15 January 2015 at 6:31am

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