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## CHAPTER 1: THE RIGHT TOOLS

*Bad news: you don't draw a single pixel in this chapter! (And this isn't a reason to skip it, right?)* If there's one saying I can't stand, it's that "there are no bad tools, only bad workers. Indeed, I think there could be nothing further from the truth (except maybe that "that which does not kill makes you stronger"), and the pixel-art is very good evidence. This tutorial aims to introduce you to various software used to make pixel-art and help you choose the right program.

## 1. Any old thing

When selecting software to make pixel-art, people often think: "Choosing software? That's crazy talk! All we need to make pixel-art is paint!" Tragic mistake: I was talking about bad tools, here is one. Paint has one advantage (and only one): you already have it if you're running Windows. On the other hand, it has boatloads of disadvantages. This is a (non-exhaustive) list:

- \* You can't open more than one file at a time
- \* No palette management
- \* No layers or transparency
- \* No non-rectangular selections
- \* Few keyboard shortcuts
- \* Terrible ergonomics

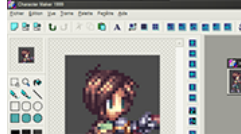
In short, you can forget about Paint. Now we'll look at some real software.

## 2. Eventually...

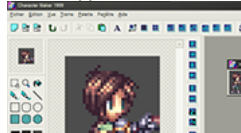
People then think: "Well ok, Paint is far too limited for me, so I'll use my friend Photoshop (or Gimp or PaintShopPro, it's the same thing), which have thousands of possibilities." This may be a good or a bad thing: if you already know one of these programs, you can make pixel-art (by disabling all the options for automatic anti-aliasing and shutting down most of the program's advanced functionality). If you don't already know how to use these programs, then you'll spend a long time trying to learn them even though you don't need all the functionality, which will be a complete waste of time. In short, if you've already use Photoshop / PSP for a long time, you can make pixel-art (I personally use Photoshop out of habit), but otherwise it's much better to use a program that specializes in pixel art. Yes, they do exist.

## 3. The Cream of the Crop

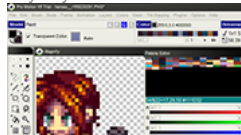
Programs dedicated to pixel art are more numerous than one might think, but we'll only cover the best here. They all have very similar features (palette management, preview repeating tiles, transparency, layers, etc, etc.). The difference lies in usability ... and price.



Charamaker 1999 is a nice program, but the distribution seems to have stopped.



Graphics Gale is a lot more readable and easy to use, and it comes for a price of around \$20, which isn't too bad. That said, the trial version isn't time limited, and comes with enough options to make perfectly good graphics. The only thing it leaves out is .gif image management, which isn't much of a problem, since .png is better anyway.



The software most often used by professional pixel artists is Pro-Motion, which is (apparently) more ergonomic and faster than Graphicsgale. Ah yes, it's expensive! You can purchase the full version for the modest sum of ... 50 € (\$ 78). Let us not forget our friends on the Mac! Píxen is a good program available for the Macintosh, and it's free. Unfortunately, I can't tell you more because I don't have a Mac. *Translator's note:* Linux users (and, for that matter, everyone else) should check out *JDrow*, and *GrafX2*. I urge you to try them all of the demo versions and see which one suits you best ergonomically. Ultimately it's a matter of taste. Just be aware that once you get used to a program, it can be very difficult to switch to something else.

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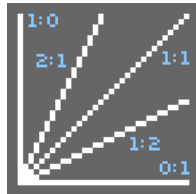
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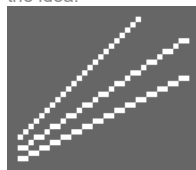
## CHAPTER 2: LINES AND CURVES

If you're not already an accomplished artist, the best way for you to start a drawing is to do it in pencil, the ink once you are satisfied, then color it. The same goes for the pixel-art: the first step in an image is the delimitation of its contours -- this step is called the "Lineart". Lineart is a very important step to achieve a good piece of pixel-art. A few pixels of your image can make up a large percentage of your image (as opposed to a drawing, where the scale allows for greater tolerance) so that an error of one or two pixels can give a make your character look really deformed. To be clear, lineart accuracy is C-R-U-C-I-A-L to the success of a pixel art.

## 1. Straight



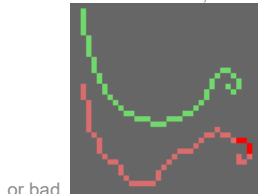
Lineart is composed mainly of lines and curves, and we'll start by talking about straight lines. Those of you who were listening in math class know that a line is characterized by its slope. It is the ratio of "change in y" to "change in x". For the purpose of this tutorial, we will represent this ratio as y:x. Thus, a perfect diagonal "bottom left" to "top right" line is a straight 1:1. Here are some simple guidelines and their coefficients to illustrate the idea.



In pixel-art, the lines that use these simple coefficients (0:1, 1:2, 1:1, 2:1 and 1:0), are called "perfect lines". They make your image look good because the eye can follow them without difficulty. They are not the only ones you can draw, you can for example make "intermediate" lines by alternating segments of length two with segments of length one (to simulate segments of length 1.5 -- see example image). The result is much less aesthetic (especially since the image is enlarged 4 times so you can see what happens) and shows why it's so important to use these kinds of lines sparingly. They still have their usefulness, though, and you will learn to embellish in a more advanced section of the course.

## 2. Curves

Well, now you know how to draw lines, but you won't get far with just straight lines. Let us therefore look at curves, which are a more complex matter. Unlike a line, a curve can be good



or bad. There is only one rule to follow to achieve a smooth curve: the length of the segments will vary in a progressive manner, and you should avoid right angles. Well okay, that's two rules, but in fact the second is included in the first. For example: In Green, a you can see a nice curve that follows this rule perfectly. (From left to right, the lengths are 5 4 3 2 2 1 1 1 2 3 3 3 2 1 1 2 2 1 2 1 1). The red curve, on the other hand, is flouting it shamelessly (note the right angle that appears in the curve). In the end, a good technique to draw a curve is to draw the curve by hand (we get something like the red curve) and then go back and the change it until it meets "the rule". This ensures in advance that the curve will have the look you want. Well, that's it for curves. In conclusion, I leave you with some small examples of this course. The first is a dragon with curves illustrating the principles of outlined above; the second is a sword that shows that sometimes more angular lines (look at the tip and the pommel) can also be useful in some circumstances.



I strongly recommend you practice some Lineart before you continue reading -- you'll need it to complete the rest of the course (as I will use the dragon above). If you have trouble, you can always use a scanned drawing.

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## CHAPTER 3: PERSPECTIVES

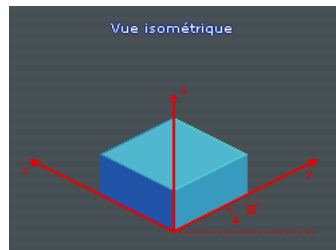
The issue of perspective in 2D games is a question that comes up frequently, and this is probably why so many amateur games have a lot of inconsistencies in this area. In particular, this chapter addresses typical RPG perspectives, so if you're looking for information about side views or first person, you'll want to check elsewhere. It's important to remember that perspective is "the art of representing three dimensional objects on a flat surface (in this case, your screen) as they would appear to the eye of an observer."

Before starting, I would like to thank Lunn, without whom this section would not be what it is today; it is actually an edited version of a conversation I had with him on the subject.

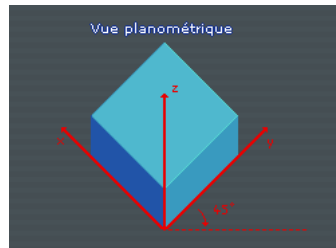
## 1. Perspectives -- and why the plural?

Because there are several different kinds! If you've read art books or taken classes, you are probably aware that there are 1, 2, and 3 point perspectives. This is not what we're talking about here, so you can forget it for now. =)

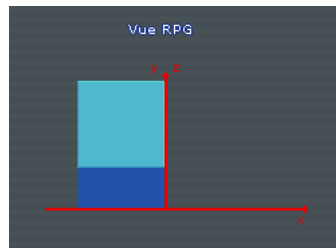
In 2D video games, the the simplest perspective used is called 'axonometric'. What is this beast, exactly? In an axonometric representation of space, an object is represented with 3 coordinates (X, Y and Z) which each increase steadily in a particular direction. In particular, this means that two parallel lines in reality are also in axonometric perspective, and an object's size doesn't change no matter how far it is from the observer. Finally, there are an infinite number of axonometric perspectives, since the artist is completely free to place the 3 directional axes in the directions of his choice. We will look at the 3 most commonly used axonometric projections (see image).



This is called the isometric perspective: the Y axis should be tilted 30° to match the definition of the isometric view, but since it is not possible with a simple pixel art, it is represented by a 1:2 line (see previous chapter) and the angle is only 26.5651° (I will spare you the calculation that leads to this conclusion). This view is particularly suitable for tactical RPGs, because it can represent a convincing depth and altitude. It is not suitable maps in traditional RPG creation programs (like RPG Maker) because of the shape of tiles.



This is the planometric perspective. This time, the Y axis is tilted 45 degrees from the horizontal and is a straight 1:1. Very few games use this (the best known of these is Boktai), yet it can be interesting and rich in volume. This perspective should be more widespread, and it is up to you to use it!



Finally, the last (and least attractive too) is the famous 3/4 perspective: the Y-axis has turned to the left, confusing it with the Z axis. This is the view that most RPGs use, and we will discuss it in greater detail.

## 2. Everything about the 3/4 view



In theory I could stop here, but I will assume that you're not very smart and will show you some examples to go with the words.

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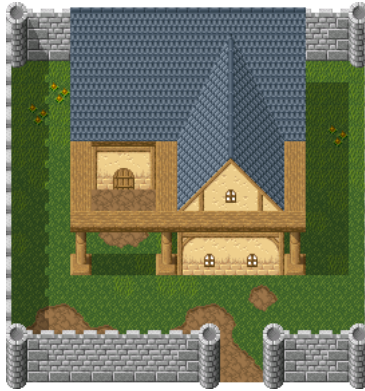
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Let's start with a simple example: a barrel (this element in any city tileset / town / abandoned mine / home / etc.). What is interesting about it? THE COVER IS A CIRCLE. Not an ellipse, as seen more often. It is like this for two reasons:

- It is a circle in the real game (the cover is round, what).
- It is parallel to the ground and thus viewed from above.

From above, there is no bias. You must apply this to all horizontal planes that are seen from above if you want to do 3/4 consistently.



We'll continue with a more comprehensive example, generously provided by Ody. Above all else, notice that the top of the tower is circular. Also, look at the door, walls and windows. They are, they are ... I'll give you a second ... they are? (No they're not ugly) They're 1 to 1. Again the magic of our 3-axis is at work: the vertical planes are represented as seen from the front, the same way the horizontal ones are.



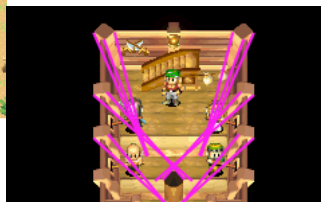
But then, what happens when we want to represent the vertical plane and horizontal planes? Nothing special. The interaction of the two poses no particular problem. Look at the stone walls by Ody, or the stairs (or the cabinet, or walls) and the superb screenshot Bahamut Lagoon on your left to be convinced. To be brief: the horizontal planes are seen from above the vertical planes are seen from the front.

### 3. Extension possible vanishing points underground



Well, I hope you have understood so far, because this will complicate things a bit. I told you in opening this chapter would not consider point perspectives. Well, now we're going to mix it up a little. One small visual reminder (see left) is probably sufficient for you to put ideas in place with regard to one point perspective. As you can see, there is a point somewhere (not in picture) that all horizontal lines in a region point to (as long as the picture is taken on flat land, from the ground) -- this is called a vanishing point. You do not need to know more than this for the purpose of this article, but if the topic interests you, I advise you to read [this course on perspective drawing](#).

Let us return to our tutorial -- how will we use these vanishing points? To improve our perspectives! In contrast to the image showing a the *château de Versailles* (did you recognize it?), the vanishing point will attract vertical lines. Ideally, we would like to fix the point somewhere and draw on top of our map, but this is not really compatible with systems used by tile-based RPGs. The solution is to assign an individual vanishing point to each object of our tileset. It's a bit less elegant, but the result is nice! Here are two screenshots of Golden Sun and Golden Sun 2, which are the only two games using this technique that I know. Shin kindly highlighted some vanishing points of these images.





Note that the vanishing points are all located under the objects (since the camera is facing down from above) and all at about the same "depth" (to keep things consistent). A final brief comment for the road: the further down your vanishing points are, the the closer you get to the standard 3/4 perspective, so that placing your vanishing point to "infinity", the closer you get to pure 3/4 (it's magic, huh?).

Now that you know a bit about perspective, you have no excuse to make mistakes, especially since errors aren't too difficult to correct, and you can draw lines (and vanishing points if you try the Golden Sun method) to help you.

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## CHAPTER 4: SHADOW AND LIGHT

Today we go from 2D to 3D while remaining in 2D. You will see (or not). With what we have discussed so far, you should be able to make pretty Lineart and draw things with correct perspective. It is a good start but it's not enough to make pixel art. In this chapter we'll take a look at shading. It's a set of techniques that will allow us to sculpt our scenery and our characters to represent volume (and I will spare you my long-winded speech on the traditional importance of this chapter, IT'S JUST SUPER IMPORTANT).

## 1. Why shade at all?

In fact, you probably already know the answer to this question. So that your brain can interpret the volume of objects, it we vary the colors on the surface, which result from differences in lighting between the parts of your object. You don't need a halogen spotlight to see this effect in real life; the slightest reflection defines a volume, look around you!



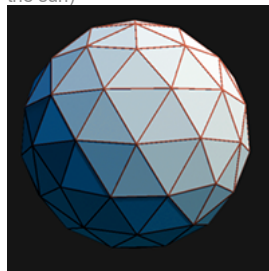
This sketch illustrates the concept simply: an object (a sphere) is illuminated by a light source (indicated by arrow) and this affects its color. The colors are more clear where the sphere is directly exposed to light and darker in the shade. Note: I speak here as light and dark colors, the next chapter will tell you more about how to choose them.



What is important to remember is that I chose a light source and I put the shadows and light (the highlights) as a function thereof. If my design were more complicated, I would have to pay attention to light source on the set so that everything remains consistent. Of course, you don't have to place the light source in the upper right; you can put it anywhere. That said, things are not always as simple as this sphere, for several reasons: - objects can be in the shadow of each other. - objects can have more complex shapes, and it's difficult it is to show their volumes accurately (especially in pixel art) - light has an unfortunate tendency to bounce back (!) onto the objects, walls and floors. In the end, the bottom of the sphere should look a little like this.

## 2. And how do I do it?

Ah, what a good question! As I'm nice, I'll even help you a bit. The first thing to do is to position your light source (this is most often at the top right or top left, as your light source is most often the sun)



From there, you must consider the volume of your object in 3 dimensions (as opposed to just a flat space on your screen) to successfully identify the areas "affected" by the light (and how intensely the light affects them), and then color them given that information. To simplify somewhat the problem you can think like a good old Playstation (Poupi, thank you for the image of a sphere in 3D on your right) and mentally divide the object in different polygons and look at the lighting of each of them. Broadly speaking, you must determine areas to be "generally in the shadows" and "generally bright" rather than directly addressing details (bad idea). Along the way, it's good to gradually replace your black lineart contours with useful colors, and leave space to add more details (a pixel can be priceless!).



For example, note the dragon back in Chapter 1 (and you will see him again later). I have applied the techniques of shading as described in this chapter to give him volume. My source of light is to the right and not very high; the entire left of the dragon is in shadow, except for the hand that is closest to you and part of the gray area created by the body. Not

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much else to report; this is just an upgrade of the line art.

### 3. Two mistakes to avoid

#### a. Pillow Shading

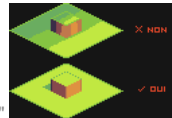
There is only one excuse to make the pillow shading: never having read all these theories about the shadows and lights. This is the approach used by people who have noticed that other designs use light and dark colors, but don't really understand how or why. Instinctively, they begin to put the bright colors in the middle and dark colors on the edges. The result is totally inconsistent and ugly.



The problem is obvious on simple shapes like a sphere or a cube, but be careful of what you do with more complicated images. If you are not accustomed to drawing shadows, you may have a natural tendency to do pillow shade without realizing it!

#### b. Understood without understanding

The second mistake to avoid is for people who read such articles (so you for example). The reasoning that leads people to make this error is: "Well, I put my light source at the bottom right and darker in top left and right. That's done. Now the color is clearer at the bottom right and darker in top left and



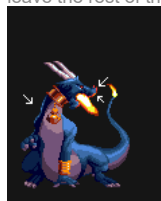
everything will be peachy." FAIL. In doing this, the result is disastrous (see picture below) and has no volume. Why? Because in three dimensions, flat surfaces are lit uniformly, unless it's a very dim light close up (such as a street lantern). Under normal circumstances, you'll be dealing with a far away light source, like the sun, which illuminates flat surfaces evenly.

### 4. Ambient Lighting

We'll conclude our tour with a nice technique. Now you are supposed to be able to handle a source of light. Well, ambient lighting is to add a second light source to give your object or character more color. It is preferable that the second light source is not in the same direction as the first, for two reasons: \* it would be "drowned" in the first source, and frankly would not be visible \* the charm of the second light comes from the fact that it illuminates the shadows and gives a very dramatic tone to the scene.



Caution, however: lightening the shadows does not mean that the shadows are more clear. For best results, just highlight the edges of the shadowed areas and leave the rest of the shadow dark.



That is what happens in the face of our dragon, lit by the flames (rawr!), and back-lit by a mysterious blue glow. Of course, this technique should be used sparingly. Don't over-complicate your first renders by introducing too many light sources all at once. Instead, add them after you've done your initial shading with the main light source.



Finally, as a small example of what technology can achieve on larger scale, here is a screenshot of Tales of Phantasia on the Super NES, in which the walls and columns lit by torches provide a beautiful demonstration of ambient lighting (the

sky is the "main" light source).

And we're already (well "already" is for you, it took me ages) at the end of this chapter. As with previous entries, if some of this seems unclear, it's because I'm not going into great detail about art in general, and instead I'm focusing specifically on pixel art. If you want to learn about light and you can speak English (*which is likely, since you're reading the English version of this tutorial*), you can [read this page](#) for further details.

[Chapter 5: Color Palettes](#) ›

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## CHAPTER 5: COLOR PALETTES

## 1. WHEN AND WHY TO CHOOSE A PALETTE?

Good question, after all why I bowl with that? Simply because the palette is 50% of the quality of your work. Throughout a game, it is important to have consistent palettes, because they contribute greatly to the overall atmosphere. In general, what makes the difference between fine art and graphics failures is largely the palette. "Okay it is important to have a nice range, I'll do it at the end." Tut tut tut, certainly not! The palette works from start to finish when you're designing pixel art. For me, this is the first and the last thing I do: I start by making a starting palette in the corner of my image, then I tweak as I advance, and then, once everything is finished, I spend time improving it. The improvements are mainly due to "feeling", what you will learn here can be challenged: it is just a starting point.

## 2. The Magic of HSL

## a. Overview

In a computer, all colors are represented by a hexadecimal code (ie which uses the characters 0 1 2 3 4 5 6 7 8 9 ABCDEF) 6 characters. For example, the code #000000 is black, white is #FFFFFF, and #FF0000 is pure red. Nothing very complicated so far. This code can be divided into three segments of two digits (the # is just decoration): the first two digits correspond to the red component of color, the next two are green and last two are last blue. By combining these three values, you get any color. For example, #FF0000 is pure red because the red part is maximized (FF) and the green and blue parts are both zero (00). Hexadecimal codes can be converted to decimal to facilitate more discussion (not everyone enjoys reading hexadecimal like you and me) -- each doublet between 00 and FF is a number between 0 and 255. Now I chose a color that I use in my pixel art, for example purple # 6A146A (Red 106 - Green 20 - Blue 106). Okay, this color is not bad but it does not suit me very well ... I want something more lively, more intense. I tell myself that to make it more intense, I just increase the 3 components ... pfff you speak, it's only make it more white and pale. Too bad, I will darken a little while, I will reduce each component of 10 ... missed again! I darkened my color but I don't want gray ... ouch ouch. It's difficult to choose colors with precision this way. But then comes Zorro to the rescue! (In this case, Zorro is the HSL palette). As you surely understand, it's not natural for your brain or mine to break color down into three color components (RGB -- Red Green Blue). The HSL palette is simply another way to identify a color: it no longer uses the RGB components, but three components visible and recognizable to the naked eye, the Hue, Saturation, and Brightness. Hue, between 0 and 360 is simply the color itself: red (0), yellow (60), green (120), cyan (180), blue (240), pink (300) and Red (360). If you are an observer, you will have noticed that the two extremes come together (as in politics). Of course, all the intermediate colors between the colors that I mentioned, do exist. The saturation, between 0 and 100, is the vibrancy of color. More color is saturated, it is more intense. A saturation of 0 corresponds to a gray. Finally, the brightness, between 0 and 100, is the simplest to understand: it determines if the color tends towards white or black. In all the pixel art programs presented in Chapter 1, you can choose your colors with HSL, so you have no reason not to use it. With a little practice, you can easily obtain a color that you imagine, while it would have taken hours using the RGB system.

## b. Ramps and hues

Now that you know the tools at your disposal to choose a color, enter the heart of the matter: the creation of a palette. A palette consists of multiple "ramps": ramp is a group of colors whose hues are adjacent. For example, a pallet may contain a red ramp, a green ramp, and a brown ramp. Let's take a look at an example.



Here is a bearded pixel art dwarf, and below is the palette that has been used to achieve it. This palette contains three ramps: one blue, one red, and one orange. (Small note in passing, it is not necessary to stage your palette as I did. Usually it's a lot more messy than that). In each ramp, I ranked the colors from darker (left) to lighter (right). Note that the pure white and pure black (large rectangles) are part of two of my ramps: Because these two colors have a saturation of 0 (white and black are pure gray), they can belong to any ramp, and this is the same for all other grays as well. The oldest of you may have already seen images of C64 games. The color palette displayed on this machine contained numerous grays to enable artists to create a variety of ramps. -- Now that we know the essentials, we're interested in the concept of FUNDAMENTAL hue-shift. We tend to believe that all colors have the same hue and saturation, and only the brightness changes depending on whether you're in light or shadow. But that's not actually the case! What I didn't say in the previous chapter, is that your objects are lit up by a blue sky and a yellow sun, which means that your hue varies a bit over your ramps. Most often the reality of things is very complex and requires knowledge of lighting that I have not mentioned, but in pixel art, you're safe with the following rules: - The darker it gets, the greater the saturation - The lighter it gets, the less the saturation - The darker it gets, the more blue your hue becomes - The lighter it gets, the more yellow your hue becomes

Luminosité	0	31	52	61	69	88	100
Teinte	-	314	328	336	347	358	-
Saturation	0	100	89	84	56	45	0

If you look in detail at the red ramp of the dwarf palette, we find these trends. The figures (see left) speak for themselves, you can check that everything is consistent with the principles above. You can reverse the rules concerning saturation for a more mild look.



We'll with a small example of our friends, the professionals: the

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classic "tree of Seiken Densetsu 3" which contains a huge palette of colors shifted from yellow to purple. The image below does not show the whole range, only the lightest color and the two darker.

c. Xenodrogen's Method

The Xenodrogen method, named after its inventor, is a method to choose the exact color of your ramp and without (too much) going wrong. This method is not an absolute rule to respect but if you have sense of color, it will allow you to make pretty ramps. This method is based on a complicated rule to make but easy to follow: "In a ramp, hue, saturation and brightness vary in a single direction. Their changes (second derivative, mathematically speaking) also vary in one direction." We have already discussed the first sentence, and we even said what direction the hue and saturation should vary in. The second sentence will allow us to quantify these changes: in a ramp, each component (hue, saturation and brightness) change must be more and more or less across the ramp. Imagine a 5-color palette, which we will refer to as A, B, C, D, and E. I can, for example, vary the saturation by 1 between A and B, and by 5 between B and C, by 5 again between C and D, and by 12 between D and E. On the other hand, it would be incorrect to do something like 2 3 2 1 4, which would result in kind of a "yoyo" effect. To summarize, I can change the rate at which I vary the hue or saturation, but I must change the rate in the same direction.

Tint	-1	-4	-4	-8
Saturation	+10	+10	+9	+5
Luminosity	+6	+9	+9	+12

Let's take the green ramp to the left as for example: Here, the color decreases by increasing the saturation increases less and less, and the brightness increases more and more. Note that as described in the previous paragraph, we can reverse the relationship between brightness and saturation for a softer (more pastel) rendering: on this ramp, it is the clearest colors that are more saturated. One last detail on the Xenodrogen method: the more colors you have in your ramp, the more you should make small changes. The green ramp above had 5 colors, so we made small changes. If we had only three colors, there would have been variations in the range of 15-20 units.

3. Good taste

a. Black and white

The problem with the use of black and white deserves a paragraph to itself. Generally, the use of these two colors in a pure state (#000000 and #FFFFFF) is discouraged. However, there are two exceptions (one for each color) and the dwarf at the beginning of this tutorial is concerned with these two exceptions. We can use pure white (# FFFFFFF) on very bright surfaces (effects and magic spells) or highly reflective (metal, precious stones). This is the case of the dwarf and his metal armor. The case of pure black (#000000) is more subtle: It can't be used for shadows, because in reality nothing is every completely black; there is usually a very subtle color there (sometimes purple). It shouldn't be used for decorations or contours. The only appropriate place to use it is as an outline to make characters more visible in a game, highlighting them above their surroundings. However, we strongly caution against using black "inside", as the black separates details inside the sprite, and makes it look like a rough draft.

Pitfalls

Beginners have two tendencies aside as soon as possible, namely: - Using over-saturated colors - Using colors based on assumptions instead of observation Remember that grass is not always green, water and sky are not always blue, and character color can vary depending on skin tone and light. Broadly speaking, the time of day and ambient light alter the color; look around you and learn accordingly. (Translator's note: If you look at your colors in RGB, your grass color (for instance) shouldn't have 00's for the red and blue components. By the same token, your sea and sky shouldn't be pure blue, and even stones, which we think of as grey, should have some variation in color, following the rules above. Using HSL can help you avoid falling into this trap.) -- I decided to conclude this tutorial as I started, and remind you that the rules set here are by no means set in stone, but rather simple advice. This chapter gives you many rules for making good color palettes, but the most important things are good taste and practice. Also, if you think you can improve your palette beyond the rules, do not hesitate to do so. Ultimately, it's the result that counts.

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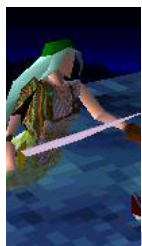
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## CHAPTER 6: ANTI-ALIASING

Where all your pixel art becomes beautiful. Or Not. Really, it depends how ugly it was before.

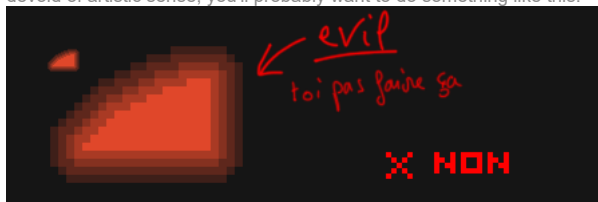
## 1. Plan of attack



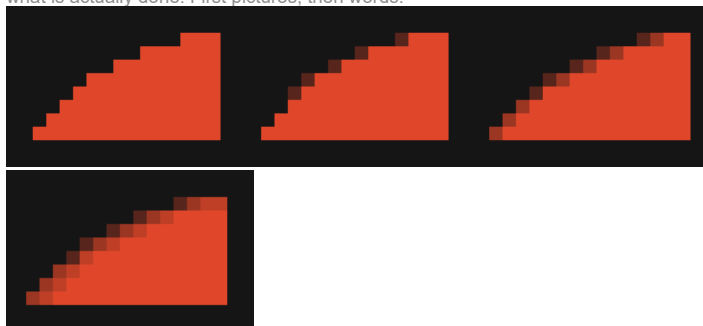
If you have the courage to read today's specialist video game news, you've probably already seen journalists complaining about aliasing in some games. Aliasing is the phenomenon that occurs when an object in the foreground is in front of a background color, and the border between the object and the background comes out as an ugly, sharp edge. 3D games are the main victims of the phenomenon (see left: Meremanoïd, a Playstation game which neither you nor I have ever heard of.), as automatic smoothing algorithms are expensive in terms of performance (for the original Playstation it was totally out of the question). 2D games are affected quite so badly because there is always good old pixel art anti aliasing to smooth out all those ugly contours and smooth transitions between objects and background. Indeed, here, no algorithm is required. You just have to think about it in advance. Think a little if you wish. We can distinguish three situations in which the aliasing phenomenon can occur, and we will take action accordingly. First case: I have two different colors on my sprite and the transition between the two colors is dramatic. In this case, we will be able to apply anti-aliasing at our leisure to soften the transition. Second case: the transition between one of my characters and the scenery behind him is all aliased (help!). Things can be complicated here, so we'll divide this into two cases: If I'm lucky: in fact "I'm lucky" means "I know the color of the background which will be shown on my sprite". In this case, you can anti-alias the edges of your sprite to make sure the transition with the scenery isn't too harsh. If I'm not so lucky: sometimes it's impossible to predict the color of the background on which your sprite will be displayed (eg, if the hero of your game goes through a variety of backgrounds). In these cases, DO NOTHING. That's all there is to it. It would be silly to change the edges of your sprite to smooth a transition, as you do not know what color you're transitioning to. Well, now you know why and when to use Anti-Aliasing ... all that remains is to find out how!

## 2. The attack!

Well. How do you make those famous smooth transitions between two colors? The answer is rather obvious, just use one or more intermediate colors (eg, gray to go between white and black), known as buffer shades. All the subtlety lies in how you use them. Indeed, if you're devoid of artistic sense, you'll probably want to do something like this:



Damn, that's just ugly. I hope that you remember as well as I do, not only does this but so-called "method" takes a long time to implement (the pixel art is quite tedious to do this) but it also does not solve our problem of transition. In short, it is not enough to do just anything with the buffer shades for anti-aliasing. Anti-aliasing is an UNASSUMING technique, keep that in mind. Now that you know what you must not do (in terms of these infamous contours), see what is actually done. First pictures, then words.



Let's take a look at a small arc of orange clashing violently with its dark gray background. On the left, the beast in its natural state. At right, the successive stages of the process of anti-aliasing. We begin by noting that the edge of the arc of a circle is a series of segments, they are one of length 1, there are then two of length 2 and two of length 3 (this should just remind you of the chapter on curves). We will take each segment separately, considering the lines of the image one after the other. In the case of vertical segments (ie not here), we consider the columns of the image one after the other. On each line, soften the transition on both sides of the border, BUT /!\ ATTENTION /!\: If you deviate past the "border" of your two colors, you will destroy the original form (and get closer to the example of what one should not do). Your buffer shades should not extend beyond the ends of segments of lines above and below, this seems very complicated but in fact not at all, look at the drawings at the last step, the segments of 1 pixel can receive only two pixels of AA because if they spill over to neighboring segments and create a very unpleasant effect called "banding" (and quite close to the example not to follow above). Do not make a "contour" around your shape. If necessary, we can make some adjustments if despite all the precautions taken by the AA slightly distorts the shape of the

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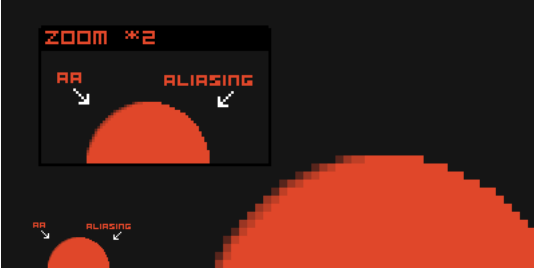
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adjustments it accepts on the production taken by the rendering elements and shape of the object but it was not the case here. Also, be aware that it is not necessary to anti-alias segments of length 1 (45°) which do fairly well on their own.

3. Total victory!

The results are immediately visible (or you immediately need a pair of glasses). Here's how this changes our orange circle, and also our good old friend the dragon.



Also note that I have calmed down a bit on the ambient lighting on the dragon. As previously announced, ambient lighting is a technique to be used sparingly. I'll finish with a small technical note for the most resourceful among you that I was not sure where to put: your shades buffers need not be the colors hue, saturation and brightness are between those of color smoothing. If you just want to optimize your pallet, you can try to exploit grays because they have the ability to be used in ramps of different colors and do wonders for anti-aliasing.



This piece of pixel art was generously provided by Panda, who controls anti-aliasing much better than me (and you too). Click on the image to view a larger version, and do not forget to wipe the drool off of your keyboard after observing the details.

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## CHAPTER 7: TEXTURES AND DITHERING

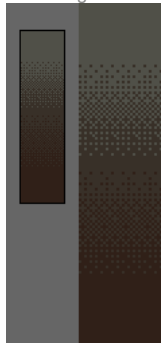
*Except that in fact we speak of dithering before talking about textures. But it sounded better in the other direction.* After stepping into the land of soft and sensual with anti-aliasing, we will now tackle techniques for creating areas that are wild and full of pixels - namely, textures and dithering.

## 1. Dithering

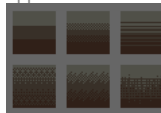
Dithering is an old technique invented in Malthusian times, when machines were too primitive to display more than a few colors at a time and where pixel artists had time to waste. Dithering is a technique that aims to achieve a gradient using a minimum of intermediate colors (ironic, yes, but not absurd.).

 Specifically, how does it work? The human eye is imperfect and can only distinguish the colors of pixels with questionable accuracy, so it tends to mix the color of a pixel with its neighbors. The green square to the left of this paragraph consists only of yellow and blue pixels interlaced, and your eye makes the mixture to give it its green color. Wonderful is not it? We will use this property to create color gradients (eg, from yellow to blue, using the above interleaving to create green between the two). There are 3 good reasons to do so rather than using a gradient, as a Photoshop user might suggest: the first is that by using few colors, you hold to the "pixel art" style of the rest of your game (as long as you do pixel art), the second is that it allows for more intelligent management of your palette; you can reuse some of your color palette in the gradient to make the image consistent. Finally, the 3rd and probably the best is that unlike a gradient automatically making a seamless but monotonous transition between 2 colors, you can choose intermediate colors (a little more saturation over the middle for example) to make things more interesting for the imperfect eye.

Note however that the heyday of this technique has been over for a long time and, misused, it is more likely to ruin your masterpieces instead of embellishing them. Furthermore, this technique requires a lot of space to be applied and it is completely unnecessary in the creation of a sprite. It's been used well to make the images of the demoscene or background of the sky in some games.



The image to the left is an example of a gradient made with 3 colors using dithering. It's easier to look at it than it is for me to describe it. The general trend is to increasingly use a particular color as you approach one side or the other. You shouldn't put two separate patterns to close to one another, or else when you zoom out, your patterns won't appear to follow any sense of logic.



Of course, there are many different patterns you can use to dither, some of which are more difficult than others. Here are some popular ones, although there's nothing preventing you from creating your own. You're not even obliged to create any pattern at all; sometimes a chaotic dither can work if you want to create a rough and dirty surface.

## 2. Lighting and materials

Achieving textures in pixel-art means knowing how to represent different materials regardless of their form. This allows your player to think "I'm crossing the little wooden bridge" rather than "I'm crossing the little plastic bridge". Indeed, all materials have a texture of their own, which helps to distinguish them. Two criteria are decisive in achieving a texture: the first is the pattern that covers your material. It is usually bumps on its surface (nodes on the tree, small scratches on the stone) to be represented by performing shading on a very small scale. The second criterion is how the material reacts to light (whether that material is bright, how it reflects, light, etc). Let's look at this small set of textures as an example:



Wood: For wood, everything depends on the surface pattern, which is a network of lines which are sometimes cut to form knots. It is insensitive to light, unless it was varnished (this is not the case here). Granite: The granite surface has much larger irregularities than wood, and a ball of granite doesn't act exactly like a sphere. To represent granite, you must add shadows to the surface -- small touches of color used to represent isolated holes and bumps on the stone: it is actually shading very small scale. Its reaction to light is a little less shy than the wood, but still very dull. Marble: The technique for marble is virtually the same as granite. The main difference is that the marble is generally smooth (use more colors and more antialiasing). Furthermore, it tends to receive brighter highlights than granite. The water (or glass): These two subjects are semi-transparent and thus tend to reflect the light within themselves, where the second highlight comes from the bottom left. In addition, a large part of the received light is returned and that is why the main highlight (top left) is very big and bright. Finally, water and glass are very smooth materials that require a

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lot of anti-aliasing. Clay: Clay is one of the most simple to represent. It requires few colors just because it is rough and un-detailed. The ball was made entirely with a size 2x2 pencil (ie, the details are unimportant). Copper: Copper, like all metals, strongly reflects light in the highlights and quickly becomes very dark in shaded areas. Do not be afraid to use a wide range of colors, not only to reflect the contrast, but also to give a smooth surface (antialiasing is the key). Please note, the shadows on copper tend to go in the green (yes, green. Do not ask me why, look at pictures to convince yourself of this). Metal (steel): As stated just above, metals explore the full range of values from black to white ... but without the gray. It is common for beginners to represent metals as grey, but it is a mistake. Metals are always colored, either intrinsically or by the ambient lighting, but it is never simply gray. Watermelon: Actually, watermelon reacts almost like plastic but I found it more fun to make a watermelon than a piece of plastic. The highlights are very plastic and quickly desaturate towards white, while the shadows are not very pronounced. Of course, there is are neither patterns nor bumps on the plastic. But for watermelons ... 3. HAIR! Hair, and fur are a special case and particularly difficult to treat (3D artists have at least as much trouble with this as we do, if reassures you). The problem is that hair is finer than a pixel and therefore is very difficult to represent. Sad, huh? I guess we'll have to give up. Or not. -- The solution is not to draw hairs individually, but to focus on highlights (and hair looks prettier with highlights anyway, so it's for the best). Each highlight can be represented by a line or triangle whose thickness depends on the length of hair (more hair give you longer ones, but most highlights are small), and whose orientation is used to define the volume underlying the hair is in the direction of the surface they cover, or perpendicular to that direction (whichever is closest to the vertical / what you think is the most logical). The solution is not to cover the hair or hair, but wicks (and there's more pretty than that wicks of hair, so it's all benefit). Each bit can be represented by a line or a triangle whose thickness depends on the length of hair (more hair is long, more bits are fine) and whose orientation is used to define the volume underlying the hair, either in the direction of the surface they cover, or perpendicular to that direction (whichever is closest to the vertical, or whichever way you think is the most logical). For example, the hairs on the back of an animal are horizontal, while they fall more vertically (but not entirely) along its flanks.



Finally, the hair texture is smooth (think cozy: 3) and this must be reflected in your choice of color for the drawing. The transitions between colors must be hidden as much as possible. Consider the fur coat layer that covers your creature: some hair falls lower than others and is thus in the shadows. You can use these shadows to allow you to transition between colors without having any sharp boundaries, and while maintaining the texture of the coat. This is precisely what I tried to do in the example of the lion on the left.



Finally, I leave you again with some pixel art to admire. Thank Ahruon, who generously provided "Moonlight Parade" to illustrate this section. I advise you to zoom in and take a close look.

In conclusion, restraint must be demonstrated with dithering and textures. It is often preferable to keep certain areas or objects in the dark or light enough that their texture is indistinguishable. This strengthens the depth of your image, it makes you work less, and it serves to define areas of emphasis (which are thus the most detailed). Note that the left rear paw of the lion is almost a solid color. Pessimistic note: If you're planning to animate, think twice before you add too much detail, or you'll be pulling your hair out.

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## CHAPTER 8: A WORLD OF TILES

If you have read this far, your theoretical knowledge in Pixel-Art is now almost complete. However, you are probably disappointed that I did not answer your most pressing concerns, such as "How do I make a grass tile", "How do I make my hero?", "How do I avoid making my trees ugly?", or "Where can I find a new girlfriend? ". In fact, you already know enough to do all this (except for the girlfriend, and in that case you're probably better off without my advice, I suspect). Without practice, we never get anywhere, and if you're asking these questions, you need to practice.

But for now, we'll go through a graphical history of RPG pixel art and review some of the basic elements that aspiring pixel artists have trouble with.

## 1. The fear of Pixel-artist: the GRASS TILE (\* cries and cries \*)

## a. Like the pros!

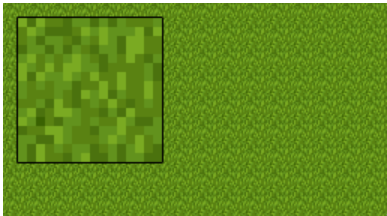
The problem with representing grass is the same as for fur in the previous chapter: the grass is too fine to be represented individually in Pixel-Art. We'll need to use a strategy similar to that of the tufts of hair ... I call this strategy tufts of grass.

What follows is in no way encouragement to copy; it is a collection of screenshots containing grass tiles that I suggest you observe closely (save and zoom as much as possible) by asking technical questions: how many colors are used? what patterns shape the colors? which way are the clumps oriented? The results here are very convincing. Without further delay, This is the collection in question:



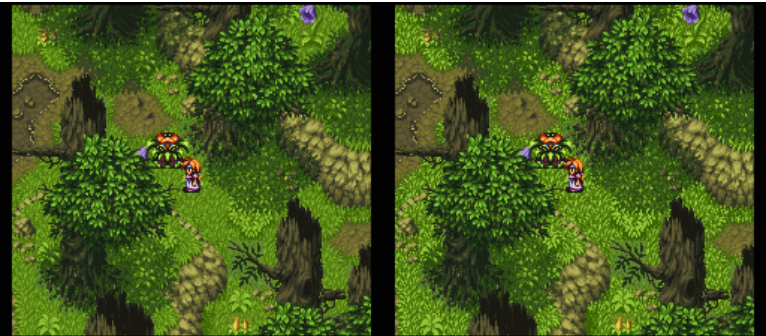
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The management of contrast is essential to make a tile of grass: the less contrast you use, the

The management of contrast is essential to make a tile of grass. the less contrast you use, the flatter your tile will look; conversely, the more contrast you use, the more more tile will show the volume and richness of local flora (thick layer of grass). We must strike a balance between a pattern of flat ground and "volume", because it can complicate the readability of the screen and draw unnecessary attention. Your grass tile shouldn't drown out more important things like houses, trees, and characters. For example, compare the original screenshot of Rudora no Hihou (left) with a modified version (with darker shadows and brighter highlights). On the right, there is more volume but less readability.



**b. Tips and Tricks**

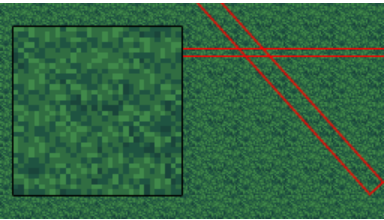
Here are two tips to help you better your grass tile (the latter also applies to non-grass tiles as well):

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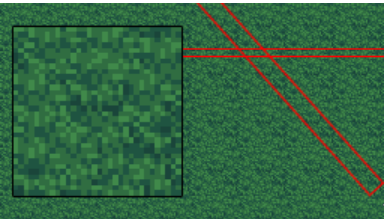
First, it is very advantageous not to use just one grass tile, but rather several grass tiles! If you examine the screenshots provided above you, probably noticed that every game uses several different tiles in order to have variations in soil texture. This allows you to limit the effect of the grid repeating the same pattern over large surface.

Most games use 4 tiles of grass (a square 32 \* 32), and variety of tall grass and flowers of different tiles. In addition, developers in general try not to have large grassy fields (even full of variation) and fill their maps with cliffs and trees to get rid of the problem once and for all.

--



Secondly, it is possible to eliminate the grid effect by correcting small, repetitive details by hand. Consider if you will the tile (32 \* 32 pixels, therefore 4 tiles) to your left (made specifically for this tutorial). It's not too bad, but I highlighted some obviously repetitive areas between some red lines. By addressing these areas, I can make my tiles a bit more uniform.



The diagonal problem tufts lie in the upper right of the tile, so it is enough to adjust some of the tufts to correct the problem. On the other hand, the horizontal lines are straddling the top and bottom of my tile (which loop and are therefore evil) and it requires a small trick to fix them. The trick is to glue together a second tile using the top and bottom halves of your tile (with the top on the bottom, and the bottom on the top) so you can see the seam. Then, correct the seam, and put the top and bottom pieces back in their original positions. Now you have a tile that patterns correctly. The result isn't perfect, but it's already a lot more convincing.

**2. Trees**

Well, now that you have the grass, it's time to make a tree. I am not going to insult you by explaining that a tree consists of branches and leaves, and these are usually green. I begin by letting you watch a parade of successful tree screenshots (or not! Chrono Trigger is not an example to follow in this case) to observe, the explanations are below. As before, it would be very good for you to spend time to analyze and dissect these screenshots in detail.









The games are represented here: Alcahest, Bahamut Lagoon, Chrono Trigger, Chrono Trigger encore, Rudora No Hihou, Seiken Densetsu 3, Sword of Mana, Tales of Phantasia

--

As you can see, there are many ways to represent trees, from the very realistic Tales of Phantasia to the exotic and stylized Sword of Mana. Here are some important tips to help you create a good tree:

The first is that the roots of a tree are embedded in the ground and we tend to forget this and make endless filaments running between the twigs. Trees are planted in the ground; take a walk outside and observe this.

As long as you are outside, take the opportunity to take a look at the foliage around you -- that's what is most important on a tree. There are two mistakes to be avoided on the leaves: the first is making a leaf flat, like a slice of cardboard. One should bear in mind that the foliage is an object in 3 dimensions, which means it is subject to the rules on light and shadow that have been mentioned previously. The second trap is to think about this too much and reduce the tree to an illuminated sphere. We must not forget that the foliage is made up of branches and leaves, which do not form a perfect sphere, but more often a pile of twisted or incomplete areas on which the leaves are fighting to receive the light passing one before the other. Look at the tree of Seiken Densetsu 3: it consists of 4 levels which are drawn on the leaves.

--

Let's look at a small example:



I begin by roughly drawing the shape of leaves (stage 1), before devoting 5 steps to creating the volumes of foliage. My source of light is to the left, and I add color after color of shadows and lights. Step 3 is where the process appears most clearly. With this done, I draw an outline of the trunk and found that my tree too much like a giant mushroom. I decide to cut some foliage off the top (and yes, a bit of work was done for nothing). I detailed the trunk and many leaves (that is VERY VERY VERY VERY long and boring. Be patient and concentrate) for the second to last stage.

Finally, I cut off the trunk to avoid the problem of "root tentacles" and plant my tree into the ground, and I adjust form of the foliage that the tree is less deformed (but not perfectly symmetrical so far), I change the palette of the trunk into something darker and more green (to fit better with the foliage), and I don't forget the foliage because of the shade to the trunk. I pasted one of my tiles herbs below to test how the colors work together, but I was too lazy to make the shadow of leaves on the grass (look at the screenshot Rudora no Hihou, they do it better than me anyway).

A final remark: here I am allowed work separately on the foliage and trunk because I had a very dense foliage that completely obscured the branches. Logic would dictate that you first draw on all the branches of a tree (its "skeleton") before adding the leaves, and this is what to do if your trees are bare.

### 3. Going to the beach!

Let's look now at some sunny tiles, starting with a sand tile. Keep the same approach as before look closely at the images below:





The games present this time are: Alcahest, Bahamut Lagoon, Rudora No Hihou, Seiken densetsu 3, Star Ocean, Sword of Mana

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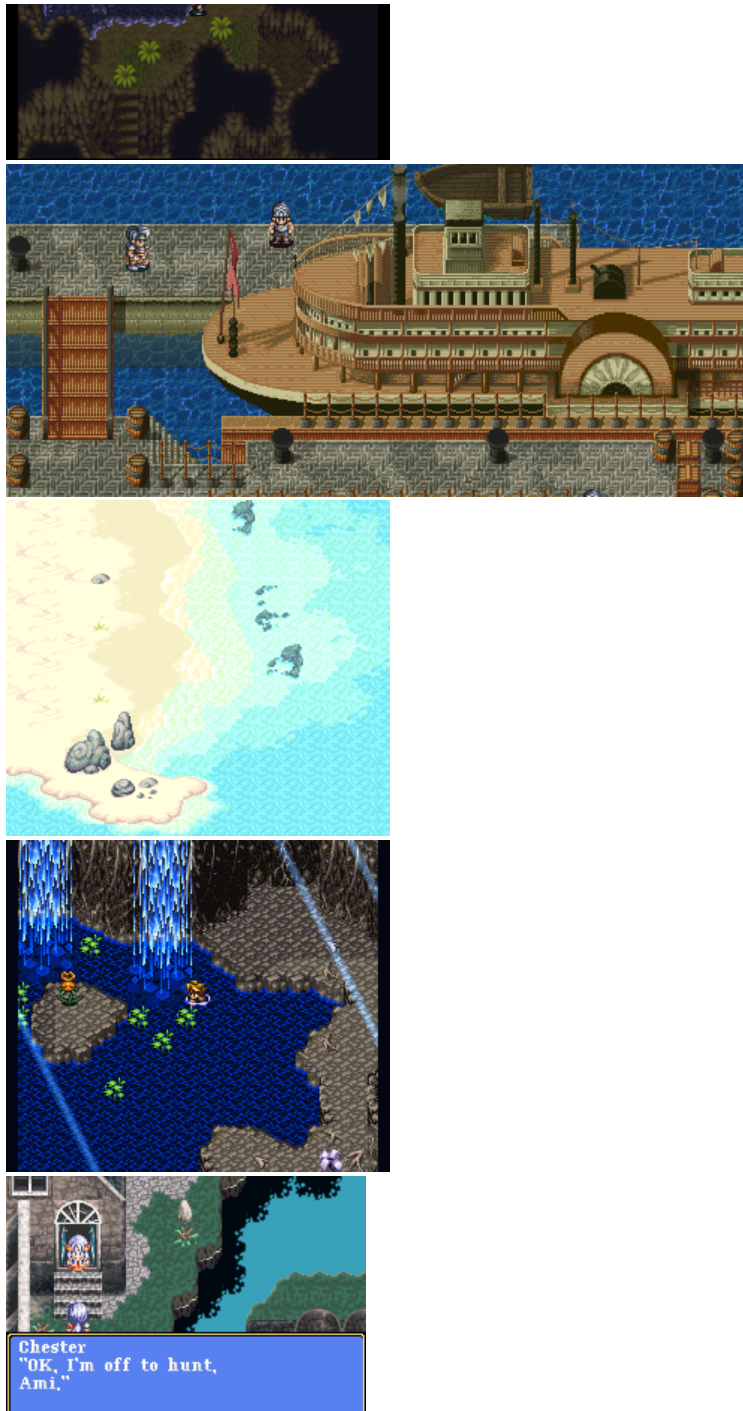
If your observations were successful, you will have noticed that the sand tile is much easier to achieve than the previous ones, and that most of the tips given for the tile of grass are also valid here (use multiple tiles, be careful to break the grid, and find a compromise between size and readability). Most of the tiles (especially the most successful, particularly those of Seiken Densetsu 3 and Sword of Mana) are mostly made of a solid one color, with small undulating dunes. Also note that small dithering patterns are fashionable for sand tiles to give a grainy texture.

As for palette, we must be careful to avoid retina-wrenching yellow, and not hesitate to use tons of creams (Seiken Densetsu 3) or brown (Rudora no Hihou). If you soften the reds in your paletter, you get a nice sand lit by the sun.

#### 4. Sea, Sex And Sun!

We'll conclude our short list with water tiles. There are lots of ways to deal with them (well, more than grass anyway) so you'll have a big job if you want to analyze them all. For me, I'll try and touch on the important parts. These are the images:





The games are represented here: Alcahest, Bahamut Lagoon, Chrono Trigger, Rudora no Hihou (2 times), Terranigma, Star Ocean, Sword of Mana, Tales of Phantasia.

--

The tiles and Sword of Mana Tales of Phantasia are the most minimalist of the lot. They make little use of color, and illustrate perfectly the first point I want you to notice: water almost transparent, generally the same color as the other objects in the scene. Let me explain: look at [this picture](#) of Lake Fabregas (in the Pyrenees). The surface of the lake primarily just reflects the mountain. You see a mountain's face down on the ground, so you conclude that there is a body of water where the mountain is reflected. Although it is difficult to reach such extremes in a map tile (although it should be tried), I think you understand the idea, seeing that water is Tales of Phantasia a blue one which spreads out the colors of the overhanging branges. Similarly, Sword of Mana has a whole range of different depths, by playing with the palette used. The more dark and opaque the water is, the greater the distance between the bottom and the surface. Finally, looking a little the other screenshots, you will notice that it is not uncommon to see reflections of cliffs, especially in Rudora no Hihou.

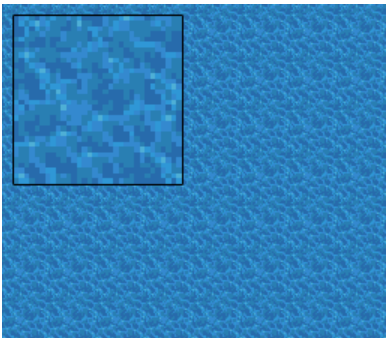
--

The tiles of Chrono Trigger and Bahamut Lagoon are the least successful of the lot, and are not examples of what not to do (except for the waterfalls). Their textures are weak on color and limited to smearing edge information, so that if the Bahamut Lagoon water was not blue, it would be very difficult to guess that it's water at all (your textures should be recognizable in

black and white).



In contrast, Alcahest, Terranigma and Rudora no Hihou (the one in the cave) are far more evocative textures, with soft, rounded, antialiased patterns. Look at this detail of screenshot Rudora no Hihou and watch how the curves of the texture undulate on the surface of the water.



I saved the best and the hardest part for last: sea water and waves. It is common to represent sea tiles using one or two very bright colors to draw the crests of the waves, forming a sort of framework that defines surface of the water. Then we must fill this frame using the darkest color, and do not forget to choose a light source (the waves are anything but flat!). Below, my personal attempt after an observation session. I tried to keep the system of discrete peaks, but I think the final result lacks some personality. The opposite extreme is [Zelda: Wind Waker](#), in which the sea is limited to just this grid system (but the result is excellent!).

5. The great secret of life and death

We have now finished with the tiles, and this course is nearing completion. I hope it has been helpful to you, and your games will now be a little more beautiful.

I would like to conclude by giving you one last piece of advice, and is undoubtedly the most important that you find in these 8 chapters: learning as you progress. Pixel-art is an area where you can become very good without any kind of talent and without being a very gifted artist with more traditional media (drawing, painting ...).

Perseverance and hard work are a winning combination every time, if you think a little and apply yourself. Laziness and inattention, on the other hand, are a losing combination. Only by doing tileset after tileset and character after character will you excel in this field. Do not expect miracles over night; it's a slow and organic process, but eventually you'll notice that your recent work is better than the work you did several weeks or months before.

For proof, I will leave you with a picture illustrating my own progress between 2006 and 2008. Practice is the key!



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