

Lecture 4

The Asset Pipeline and You

98-127: Game Creation for People Who Want to Make Games (S19)

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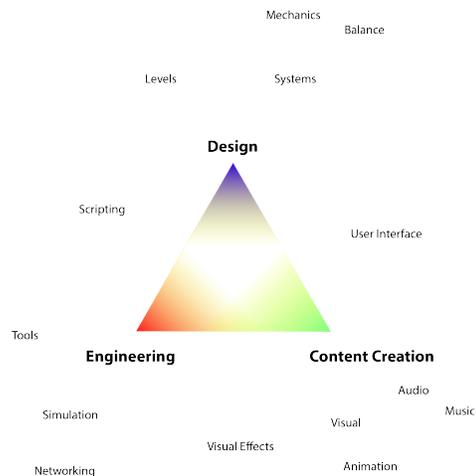
1 Objectives

By the end of this lesson you will be able to:

- Become familiar with image manipulation through Gimp
- Perform basic tasks like re-sizing, removing backgrounds, and importing / exporting
- Become familiar with audio manipulation through audacity
- Perform basic tasks like trimming, amplifying, and stretching sounds
- Find both image and audio assets for free on the internet through libraries

2 Some Motivational Ideas

So we've talked a little bit about *scripting* and *game design* in **Unity**, and that leaves us with a missing corner in the *Game Creation Triangle*. Today we are going to take a look at Content Creation. This covers everything from creating sound effects to character animations. These are piece of the game that players most directly observe, and everyone involved with the game creation process will have to handle them at some point.



The Game Creation Triangle

3 Image Manipulation in Gimp

Gimp is an open-source image manipulation tool that can function as a free alternative to **Photoshop** with more features than **Paint.net**. You can download it here <https://www.gimp.org/downloads/>.

Download the installer and install with the default settings. Now you can edit images either right clicking on the file and selecting `Open With >> Gimp`, or you can create a new file by selecting `File >> New` from the Gimp program. A menu will appear where you can specify the dimensions of your image. For now, pick 2000 by 2000 pixels and click `Advanced Options`. From here we can set the resolution, color space, and background color. In general, you want your resolution to be as large as the largest image you are using. This can always be reduced later. Similarly, you should always select `Fill With: >> Transparency` because you cannot add transparency to an image with a background color. Once you've done this you can hit `Ok`.

Now we have a blank work space. The key concepts we want to cover are *Tools*, *Selection*, *Layers*, and *Transformations*. You should be able to find the icons from the *Toolbox* somewhere.¹ Left click on the *Paintbrush tool* and the current tool will become a paintbrush. If you left click and drag the mouse on the *Canvas* you will draw some lines. The color of those lines will be determined by the *Foreground Color*. The *Color Area* should be at the bottom of the *Toolbox*. The color that is in front is called the *Foreground Color* and the other is the *Background Color*. You can switch the two by left clicking the curved arrows in the top right corner. You can change them by left clicking the color and selecting a color from the resulting window. In addition to changing the color, you can change other settings by selecting `Windows >> Dockable Dialogues >> Tool Options`. This window can help configure whatever tool you are using; be sure to play around with it.



The Toolbox


Paintbrush Tool


Color Area


Fuzzy Selection Tool


Free Select Tool


Crop Tool

Next, we are going to bring an image in from the internet. Go to http://bit.ly/GCS_gimp_ex_1 and right click on the image and select `Copy`. Go back to **Gimp** and select `Edit >> Paste` to the canvas. This new layer is "Floating" right now, which will prevent us from making a selection, so we can change that by "anchoring" it. You can do that by pressing `Ctrl + H`. To get a closer look at the image you can select the magnifying glass tool.² You can see in the *Tool Options* window an option to zoom in or zoom out. You can either change this directly or by just holding *Ctrl* while clicking with the zoom tool. Our first task will be to remove the background and text from this image. There are several ways to go about this but the easiest will be to use *Fuzzy Selection Tool*. Selection tools are used to mark certain areas of the canvas as selected, so that your actions will only affect selected areas. Our goal is to delete everything that isn't sonic. The *Fuzzy Selection Tool* selects parts of the image based off of similarity to where you click. The threshold for similarity can be increased in the *Tool Options* window or by dragging the mouse to right or down while clicking.

Use the *Fuzzy Selection Tool* to select the white background around sonic. This can be done with a *Threshold* of anywhere from 15 to 80 as the background is a solid color. If you

¹If you cannot see a toolbox window anywhere, select `Windows >> Toolbox` and it should appear. In general, the `Window` menu will help you find windows that are missing and `Help >> Help` will open up a documentation window that is very helpful.

²you can select this quickly by pressing *Z*

accidentally select something, you can unselect everything by hitting **Select > None**. Once you have the white background you can remove it by simply pressing delete. You can also remove the the background between Sonic's legs and between his arm and chest. The *Fuzzy Selection Tool* is also a good way to remove that yellow triangle in the top left corner of the image.

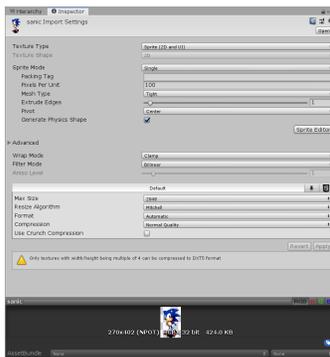
You could use this tool to individually select all of the letters to remove the text, but that would be tedious and it would leave small borders behind. Instead, lets use the *Free Select Tool* (AKA the Lasso Tool). To use this tool, you will place a sequence of points on the image that define the shape of your selection³. Try to create a selection polygon that captures all of the text and none of Sonic. To finish your selection, click directly on first point that you made, which will complete the shape. Then press **enter** to turn the shape into a selection. Once you have done this, you can delete the text and you have now have picture of just sonic. As a last touch, let's crop the image. Just pick the *Crop Tool* and draw a box around Sonic. Again, press **enter** to apply the crop. Lastly, Export the image by selecting **File > Export** and accept the export settings as they are.



Free Selection

One of the beautiful things about **Gimp** is its extensibility. If there is ever feature that you think GIMP ought to have, you might find a plugin for it⁴. If you ever find yourself applying the same effect to many different images, you may wonder if there is a way to automate the process. Go to http://bit.ly/GCS_gimp_batch and download the installer. To install plugins that don't have installers go to https://en.wikibooks.org/wiki/GIMP/Installing_Plugins. Once you run the installer for **BIMP** hit **File > Batch Image Manipulation** to open the plugins window. From here you can apply a crop to series of images, instead of doing it one at a time. If you want, you can explore this on your on your own time and find other plugins to install⁵.

4 Importing Images into Unity



Import Settings

Importing 2D images into Unity is actually really simple. Make a new *Unity Project* to test some imports. First, let's bring that Sonic picture into project by dragging it from a file explorer window into a the *Project Window*⁶. It should import with the correct settings to be used in a sprite. You can test this by dragging the image asset into *Scene Window*. It should automatically create a *Game Object* with the name of the asset and a *Sprite Renderer* component with your image as the Sprite field. If it doesn't let you do this, it might be because the import settings are wrong. You can look at the import settings by selecting the asset and looking into an *Inspector Window*. For now the only setting we care about is the

³You can also click and drag to draw a selection, which can be useful if you have a careful hand and a need for a more interesting selection

⁴or you might want to write one yourself

⁵As an extra resource for gimp see <https://docs.gimp.org/2.10/en/gimp-getting-unstuck.html>

⁶if you don't have one of these you can make it by hitting **Window > General > Project**.

Texture Type. Make sure it is set to *Sprite (2D and UI)*. This is the setting you will use for all sprites and images.

Now let's import a more complicated image. Go to http://bit.ly/GCS_gimp_Frames and download the sprite sheet. Drag it into the *Project Window* just like before. Now if we drop this into the *Scene Window* like before we'll get a sprite that looks like the image. If we want to create an animation out of the sprite sheet, you'll have to look at the import settings. Here we can change the *Sprite Mode* to multiple. This is the setting to use with sprite sheets where one asset represents multiple sprites or images.



The Sprite Editor

How that sprite is divided or "sliced" can be controlled by opening the *Sprite Editor* from the *Inspector Window*. In the new window select the *Slice* button in the top left. The default slice type is automatic; we'll try it first. Hit and examine how the results on the image. If you click on any of the characters, the border of the slice will become easier to see. You can also see and move the pivot point. The key to slicing is really to get the pivot point to remain in the center of gravity on the character in each image. If it's in a different position in two images, then the character will jitter around in the animation. You can see this in action by hitting and then closing the window and dragging the asset into the *Scene Window*. You will be prompted to save the animation that has been generated. Now there is a *Game Object* in the scene with an *Animator* that has a new *Animation Clip*, which cycles through the images in our sprite sheet. That's a lot of terminology, but it won't be important until later. Hit window to open the *Animation Window*. This window is fairly complicated and will similarly be explained in the animation lecture, but for now just hit the play button and watch how the character animates. Notice how it wobbles around? That's because it's sliced poorly. Let's reslice it. But this time change the *Slice Type* to grid by cell count. Set the column count to 6 as there are 6 images. When you hit slice, it will change the slices to an even row of 6 rectangles with the pivot points in the center of each by default. If you apply this and create a new animation, you can similarly examine this animation. It's better, but the pivot points aren't perfect. If you wish, you can place the pivot points by hand in the *Sprite Editor*. That's enough playing with import settings for now. Let's move on to sound.

5 Sound Manipulation with Audacity

Good audio design is the final bridge to be crossed before *suspension of disbelief* is reached. Any convincing horror game relies heavily on its eerie soundtrack and any punch that lands without a satisfying "SMACK!" will feel hollow and flimsy. All too often novice game creators will neglect audio design until the end of project or even worse leave it out all together. If you take anything away from this lecture, I hope it is that you learn a few quick and easy ways to get your players across that bridge.

In our first example, our voice actor, Adrian B, just sent us a clip for our narrated experience. Download it here http://bit.ly/GCS_audacity_clip_1. Unfortunately, something went wrong and the clip is super quiet! To fix this, we're going to need a tool called **Audacity**. **Audacity** is versatile

and powerful tool for mixing and editing sounds. Just like **Gimp**, **Audacity** is free and open-source.⁷ You can download it here <https://www.audacityteam.org/download/>. Once that's installed let's open that clip by right clicking on it and selecting **Open With** **Audacity**. You might be prompted with a warning about how to open the file. You can read the prompt or just ignore it and click okay.



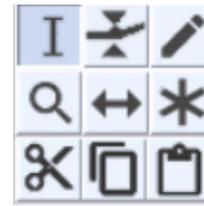
The Transport Toolbar

Now we can see our clip as a waveform. To listen to the clip hit the big, green triangle in the header. Let's make that louder. Just like in **Gimp** we need to select part of the waveform to edit it. And like most programs, we can select the whole space by pressing **ctrl** + **A**. Now that we have the whole clip selected, we add an effect to it picking one out of the **Effect** tab. To change the loudness of the selection hit **Effect** **Amplify...**. As with all effects, this will bring up a configuration menu. When you hit **Ok** the selected audio will be modified destructively. In the case of amplification, if we place the slider in the middle of the bar, no effect will be had. If we slide it to the left, the audio will get quieter, and if we slide it to the right, we will get the desired result of making Adrian audible. You will notice a little check box that reads "Allow Clipping". Unchecking this box will prevent us from raising the volume outside of the range of the sampling format. Doing so will make your audio sound objectively bad, so you ought to try it sometime. For our purposes we will keep that box unchecked, and we'll write 20 decibels into the top box. Now when we play the clip we can actually hear Adrian's beautiful voice.

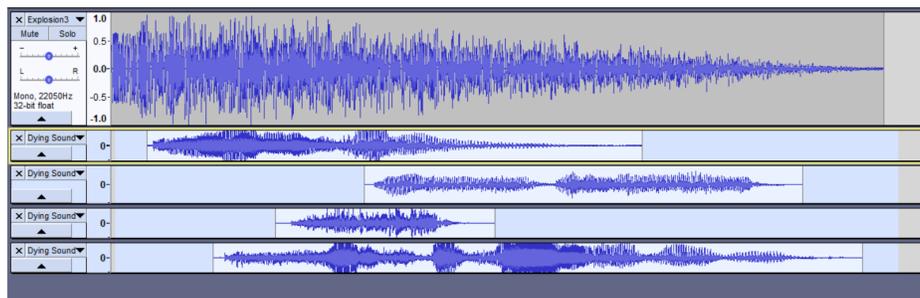
Before moving on, let's examine some of the tools available to us. If we want to select only part of the clip, we can use the *Selection Tool* to click and drag over a portion of the waveform. When you hit the play button, only the selected area will play. See what happens if you click without dragging and hit the play button. Next we can grab the *Time Shift Tool*. This tool allows us to move clips around in a track (or between them). To do so, click anywhere on the waveform and drag it left or right. Let's make a new track to transfer it to.

Because this clip is in Stereo format, click **Track** **Add New** **Stereo Track**. Now you can drag the waveform from the top track to the bottom with the *Time Shift Tool*.

Tracks are similar to layers in Gimp in that they allow us to work on separate elements in the same file without mixing them destructively, but Audacity's tracks differ in that all tracks will play over each other where Gimp's bottom layers only show where the top layers are transparent. The last tool we'll look at also had a Gimp equivalent. That would be the *Zoom Tool*. With this selected clicking on the waveform will magnify the clip's appearance around the position of the mouse. To reverse this, hold shift while clicking.

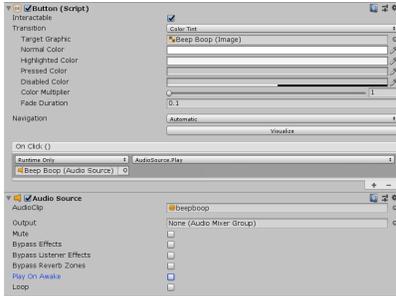


The Tools Toolbar



⁷Audacity was actually made right here at Carnegie Mellon

In our next task, we'll use Audacity to combine multiple audio clips into one. Head over to http://bit.ly/GCS_audacity_clip_2 to pick up some new sounds. We'll start off with the *Explosion* sound effect.⁸ Open it with Audacity, then select **File** **Import** **Audio**. From this menu, navigate to the other wave files and import them together by control-clicking each of them. Now we have all five tracks together. If we hit play, they'll all play at once. Instead let's use the *Time Shift Tool* to spread the screams out a bit. Now I want to apply an effect to all of the screams, but not the explosion. To do this I'll hold shift while selecting the bottom four tracks. Now I'll apply an echo by hitting **Effect** **Echo**. You can export this as a wave file by selecting **Export** **Export As WAV**.



Button Fields

button to create a button and canvas. We don't need to worry too much about how buttons and the canvas work for now because we'll go over them in a later lesson. To play a sound, we'll need an *Audio Source* component. To add one to our button click **Add Component** **Audio Source** in the inspector panel while the button is selected. You can now drag the audio clip we brought in into the *AudioClip* field on the new component. We'll ignore mixing and effects for now, but let's look at the play settings. If *Play On Awake* is enabled then the clip will automatically play this sound when it is active. That option is useful for music if you don't want to make a music manager yourself. The next option is *Loop*. This is also useful for ambient effects or music. As much as I'd like to loop the beep boop sound, we'll disable both settings. After that, we'll hook the button up with to play the sound. Buttons can call a variety of functions from different components that are in the same scene. You can attach these *listeners* via script or in the editor. Go to the *Button* component in the inspector and click the plus below the **On Click** event. This new row represents a *Listener* that will react to the button being pressed. We want the *Audio Source* to react to the button by playing its sound. To do this, we will drag the *Audio Source* component into the box that currently reads "None (Object)". Then we'll select **No Function** **Audio Source** **Play ()**. This will make the *Audio Source* play whatever clip it has with whatever settings its set to when the button is pressed. If you wanted to play a different sound, you need to use *PlayOneShot*. How you want to use *Audio Sources* and play them will come down to how you organize your audio system, but it's pretty easy to just make an *Audio Source* for each clip you want to play and use the *Play* function to play them. Now you can run the game and click the button!

Before we finish and move on to the assignment, I'll show one more tool to create sound effects. It's called *bfxr* and you can use it online at bfxr.net. I'd recommend downloading it and playing around with it locally. You get a ton of options to customize your sound, but the best part of this tool are just the

⁸\$5 to anyone who can guess where that's from.

presets and randomize button. This is only helpful if your game's tone can play in the 8-bit feel.

6 Assignment

Use Gimp, Audacity, bfxr, or your favorite content creation tool to make something interesting. This can be visual art for your game, a meme, or a some sound that will impress me. If you're using Gimp, checkout some plugins. If you're using Audacity, try reversing something or see what *Paul Stretching* is.

7 Appendix: Where to find content in a pinch

If you aren't an artist, you'll find yourself using libraries for prototype art and quick fixes. Here are some that I use.

- Sprites: <https://opengameart.org/content/library-of-2d-game-art>
- Geometry: Unity let's you create Sprites with simple shapes via the `Create` menu. Don't be afraid to make games that look like **Thomas Was Alone**.
- A bit of everything: Unity Standard Assets in the Asset Store
- Sound effects: <https://sonniss.com/gameaudiogdc19/> (This is super useful)
- Music: <https://ocremix.org/> and YouTube. YouTube is incredibly useful for finding specific sounds and generic music.