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Using 3D Graphics for 2D Animation Background Art

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ABSTRACT

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Background art is an important part of animation, even if it is not as noticeable as the animation itself. Without background art, the animations would not come alive as well as they do. It is an important part of building the world and the mood of the animation. Designing and drawing background art for 2D animation takes a lot of work, as it is often done by hand, which can take a lot of time.

This thesis explores what makes ~~a~~ good and effective background art, and how 3D programs can be used to make that process easier and faster. In the end these tools are used to design and create background art for an animated scene to see if they are a viable option for a large-scale animation production.

Key words: animation, layout, background art, 2D animation, 3D modelling, art, animation production

CONTENTS

GLOSSARY

3D Model	Three-dimensional object in a 3D program
Blender	Open-source 3D program
Digital drawing	Image drawn in a digital drawing program
Lighting	Arrangement of lights in 3D space or 2D image
Render	2D image or video generated from a 3D scene in a 3D program
Texture	The color, feel and overall appearance of an object
UV Mapping	Projecting a 2D image on a 3D model.

1 INTRODUCTION

When people think about hand drawn animated films, they often think about the characters and the great effort that goes into animating the characters to bring them alive. This is no wonder, as we as the viewers often tune in to hear the stories of these characters and are impressed by the skills of the animators, who can imitate movements and expressions just with drawings. What we don't always pay attention to is the backgrounds behind these characters, which creates the world around the characters we love. Background design is as important as the characters to create a breath-taking animated film, but people tend not to see the hard work that goes into creating these backgrounds.

Background designers can come from many different backgrounds, as the artists need to be skilled with drawing to create the world around the characters. Everything we see in traditional animated films that do not use computer-generated animations are often hand-drawn or painted by the background artist. Background artists can be illustrators, comic creators, or fine art painters, as they all often follow the same kind of principles of art that can build up a good background art.

2 What is layout and background art?

Background design sets the stage and atmosphere of the animation with the drawn and painted backgrounds created by the background artist (Criscuolo 2021). Background art is the backdrop of the animation, the world where the characters are located and where they interact with each other and the objects around them. It might not be as noticeable as the animated characters, but it is needed so the viewer can have the context for what is happening and where the characters are located. The background can be thought of as part of the characters, as it gives important information about the world and its characters.

Layout artists are responsible of creating layout art, which is the environment where the characters are moving, including the camerawork, and staging (Byrne 1999, 12). Layout artists need to be able to design many kinds of environments and must have the ability to draw any objects from different angles. Depending on the animation, there often needs to be many different layouts to represent different locations, so layout artists need to be able to draw anything from forest landscapes to characters' living places.

There is a difference between layout and background art, as layout artist are responsible of designing the camera angles and stage for the characters and background artists are often the ones who finalize and paint the background art based on the layout art. Layouts and backgrounds can be done by the same person if the animation project is small, but there can be separate layout artists and background painters.

PICTURE 1. Example of layout art

PICTURE 2. Example of background art

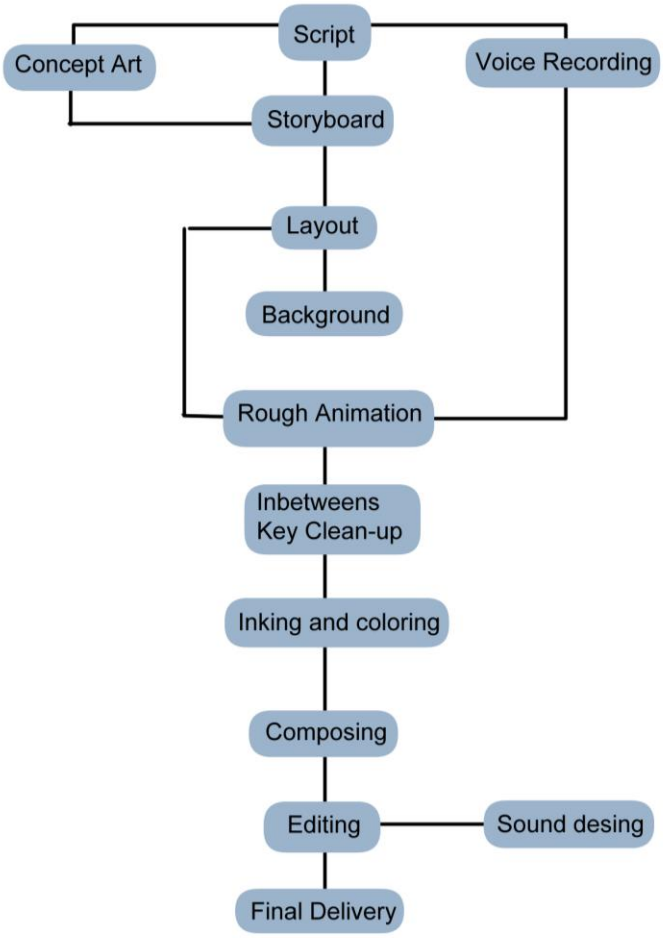
Over the years background designers have come up with many different methods to create background art. Nowadays artists do not need to draw with paper and pens, as they can use computers to draw digitally (Ghertner 2010, 2). With digital painting, the artist still needs to paint the layout by hand, but the many tools and advantages of digital mediums have made the process easier and less time-consuming.

Background designers work closely with the animation team to create environments that fit the style of the animation. The goal in animation projects is to create a coherent style that looks like it was created by one artist, even though there are often multiple different artists to create the animation.

2.1 Layout Art in Animation Pipeline

Animation pipeline is the structure of the process of producing an animation. Every animation project has some sort of pipeline that can change depending on the project, but often it follows the same kind of structure and steps.

Animation development is often started by writing the script for the animation. From the script, a storyboard artist creates comic book like visuals, that follow the story. (Byrne 1999, 12.) After the storyboard is finished, layout artists can start to design the layout based on the storyboard. The final painting and coloring of the layout art are often made near at the end when the animations have been finished. The final composing of animation and backgrounds are done as the final step.



PICTURE 3. Example of a 2D-animation pipeline

Having a good layout design helps with the overall animation production, as the animators can that way better see the environment the characters are moving in. The designs are often simple pencil drawings or greyscale paintings, as they are easier and faster to change than fully painted layouts. Layout designs and painting are sometimes done by different persons in the animation process, so it is important that the layout artists has made clear designs.

3 What Makes a Good Background Art?

Good background design is an important part of animation development, because it adds atmosphere to the animated scene (Criscuolo 2021). There are many ways of creating background art for animation. As every animation project is different and requires a different styles of background art, there is no one right way to create background art. There are however many tools and rules that artists have created to help them to create good designs. Many of these rules are often used in other types of art and design as well, for example, fine art, and graphic design. These tools help an artist to build their images – the fundamentals that work as the structure of the image. These fundamentals work in many different styles and mediums, so they are not restricted to only one way of making art.

In background art, many aspects are essential for building a good design that fits well for the animated scene it is intended for. Many of these are common rules that are also used in other visual arts, like composition and contrast. Perspective for example is an important tool, as it helps animators to place the characters in the scene and make them feel like they are moving in a three-dimensional world. Color and lighting are important parts for the background artists, as they can greatly affect the mood of the scene and help with telling the story of the animation.

The background art is more often than not meant to be just the backdrop for the characters. It is like a stage in a theatre where the characters are acting and interacting with the props. It is an important part of telling the viewers where the characters are and what their world is like, but it cannot steal the attention from the characters when they are meant to be in focus.

3.1 Focal Point

“The focal point is the center of interest or activity in a work of art.” (Swenson n.d.). In a picture, there can be multiple focal points, but often there is only one stronger focal point where the attention of the viewer should always return to. In animation, these sorts of focal points are important, as certain images could be

seen on the screen only for a small amount of time. In this time the viewer should be able to pinpoint the point of interest and be able to tell what is happening in the picture.

Everything in background art should support the focal point, by letting the viewer easily see what is happening and making the picture lead the eye towards the point of interest. The elements in the background shouldn't interfere with the focal point but make it clearer and stronger. The focal point should not fight for attention with other objects or elements in the picture. These kinds of compositions make the images harder to look at, as the viewer's eye will jump wildly around the picture, making it harder to understand what is happening in the picture.

PICTURE 4. Example of a strong focal point

In animation focal points are often the characters that move in the scene. The layout should not take the attention from the animation itself (Byrne 1999, 70). The background designer must design the background art around the characters so, that it supports them and does not steal the attention of the viewers.

There are many ways and tools to make sure the character or other focal point stands out from the picture. Firstly, it is important to know what the focal point of the image is before the background can be designed around it. This can be found by simply asking "what is the image trying to show to the viewer." The focus could

be some kind of object on the background or a character talking on the screen. When the focal point is known, it is easier to work towards making it stand out. To make the focal point most noticeable, there are many ways of using composition, color, and contrast to lead the attention of the viewer.

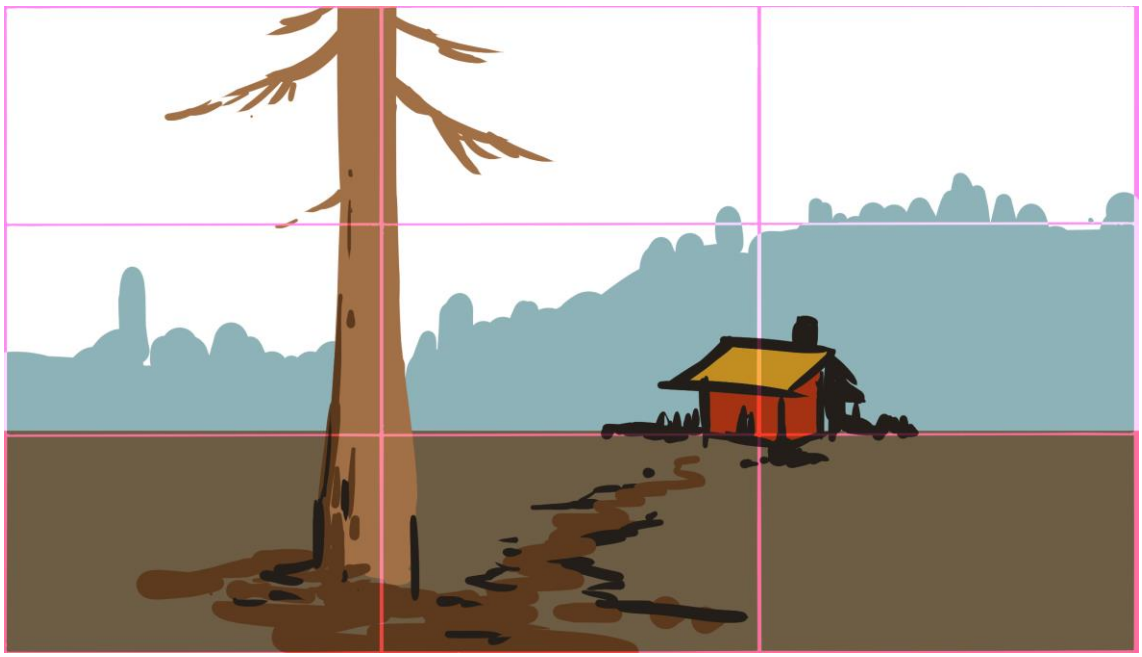
3.2 Composition

Composition can be considered as the foundation of visual communication, and it is essential in many different art forms (Dabner, Stewart, Zempol 2014, 32). In animation, the composition is how the background, characters, and the camera are positioned. It is like how a photographer would arrange and frame their shot or how a fine artist would position and arrange their still life. In animation, the layout artist needs to think composition like a filmmaker, as the camera often has movement also. In films, composition is used to direct the attention of the viewers (McCullagh 2018).

Composition is an important part of a good background design. It can greatly affect the mood of the scene and how the viewer is feeling. Good compositions are usually balanced, but not symmetrical and can be sometimes hard to arrange if there are lots of objects in the scene. Artists and filmmakers have come up with tools to help with this process. They can help designers to make compositions that readable and boost the mood the scene is trying to depict.

3.2.1 Composition tools

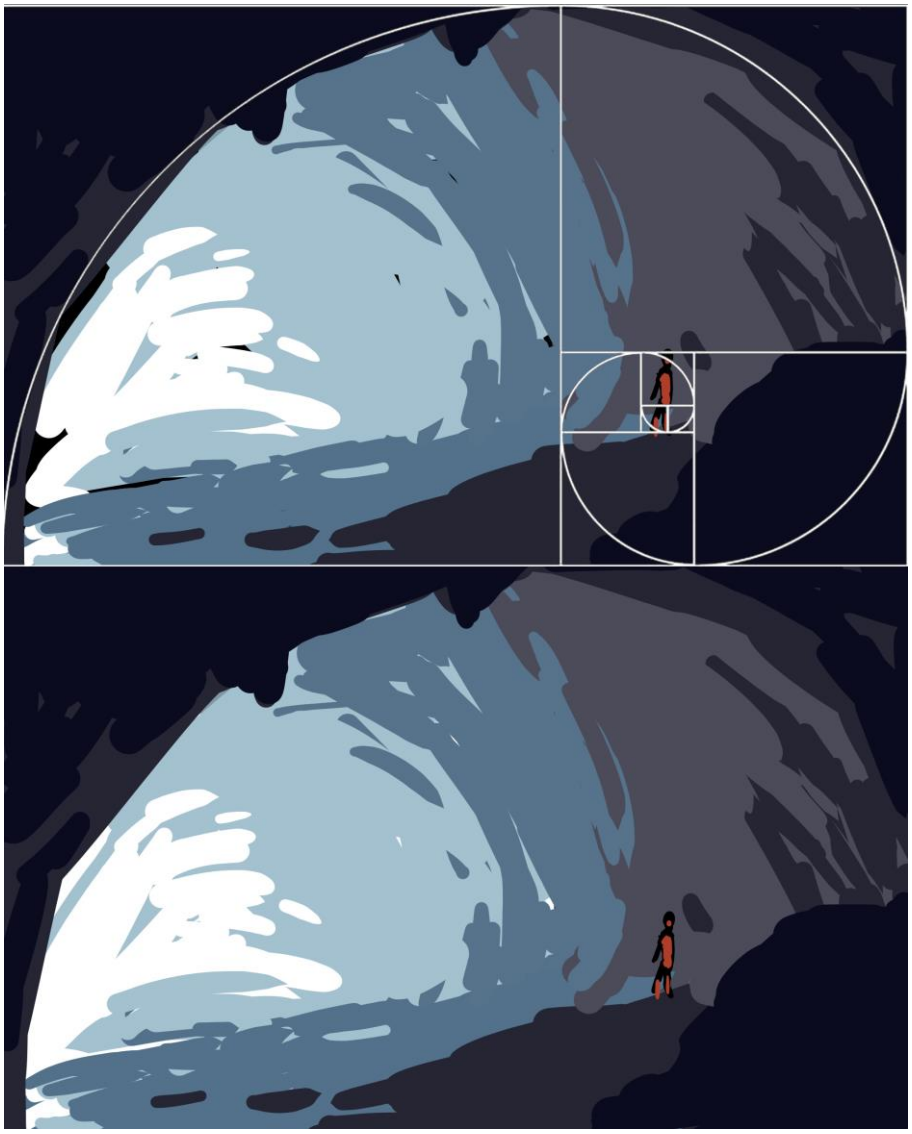
To create strong layouts, it is a good practice to place the focal point off the centre of the layout (Byrne 1999, 70). In the rule of thirds, the picture is divided by a 3x3 grid, making four connected dots around the centre of the picture. With this kind of grid, there are many ways to add points of interest and objects so, that they are not positioned straight in the centre.



PICTURE 5. Example of rule of thirds

Commonly with the rule of thirds, the points of interest are located on one of the four dots created by the overlapping lines. Other tall objects could be located on the vertical lines and the skyline might be located on one of the horizontal lines. With this grid, the composition won't get too centred, as that might make the picture too symmetrical or flat. According to Byrne (1999), when points of interest are placed off the centre, it can create more dynamic composition as a more centred composition would.

The golden ratio is a more complex and mathematical way of making compositions than the rule of thirds. The golden ratio can be found used in art and architecture, but it can also be found in nature and even in the human body (Bruchwitz 2019).



PICTURE 6. Example of the golden ratio

3.3 Perspective

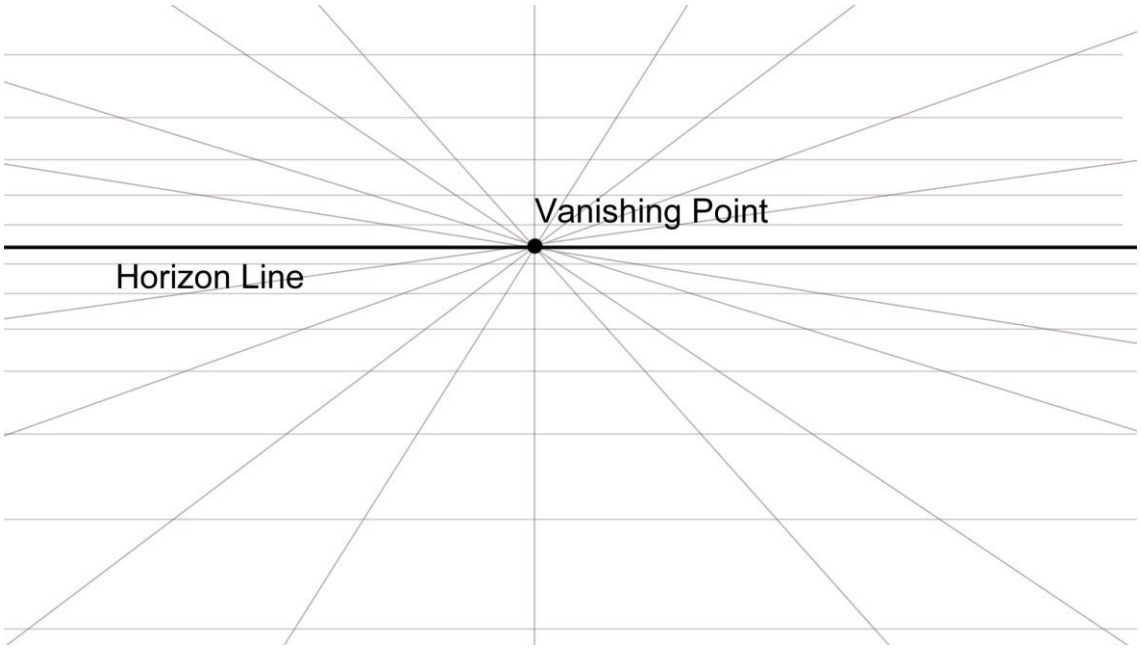
While working with two-dimensional surfaces like paper or computer screen, the artists have to create the illusion of depth and three-dimensionality (Byrne 1999, 18). We know the images are just flat surfaces, but our eyes are fooled to see the images with good perspective as real three-dimensional spaces. Artists have come up with tools to make these kinds of perspectives trick the eye to see depth.

In background art perspective is an important tool to make the scene look more real and believable. If the perspective is done incorrectly, it can make characters or objects look bigger or smaller than intended, or look out of place, too close, or

too far back. In most situations, a designer would want to avoid this kind of confusion, so they follow the common rules of perspective.

3.3.1 Perspective Grid

The perspective grid is composed of a horizon line and one or multiple vanishing points. It is a common tool to work out a perspective of an image. Horizon line could be seen as the line where ground and sky meet, but in layout art and art in general, it is seen more like the eye level of the viewer or the camera. Horizon line might not be always visible on the image as a clear horizon, because it might be hidden behind buildings or other objects in the image.



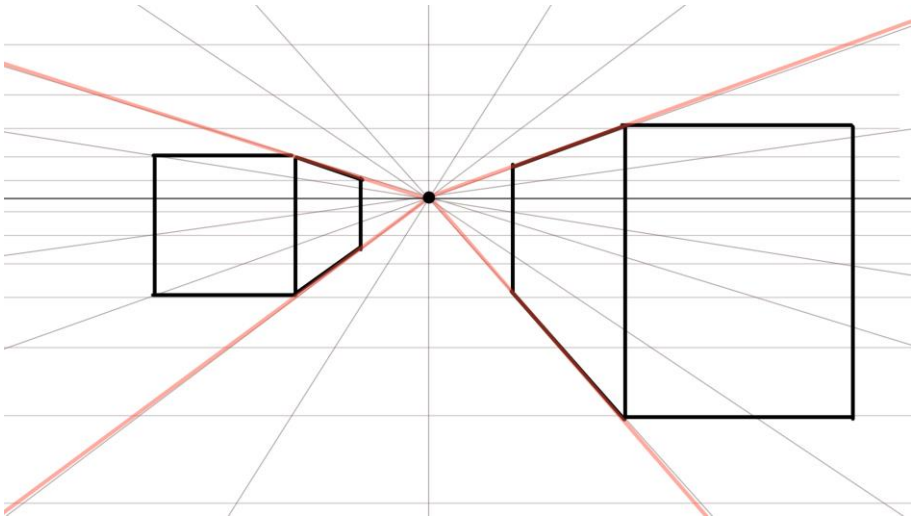
PICTURE 7. Perspective grid

The vanishing point is a point located on the horizon line. To create a perspective grid, horizon line and vanishing point are needed. The vanishing point is where all the other lines converge. With this tool, objects can be drawn in perspective, by using the lines from the vanishing point to determine the perspective of the object. With this kind of simple perspective grid, the vertical lines of objects usually go straight up and the horizontal lines follow the lines drawn from the vanishing point.

Perspective grids can have multiple different vanishing points, and different objects in the image might have their vanishing points. It is often however only limited to one to three points to create different kind of perspectives.

3.3.2 One Point Perspective

One of the most widely used perspective types in animation is one point perspective (Byrne 1999, 20). Like the name suggests, in one point perspective there is only one vanishing point on the horizon, where all the edges seem to converge. One point perspective can be seen easily in real life situation where one would stand on a straight railway track and look forward to see, how the tracks look like they are converging together in one point in the horizon (Byrne 1999, 20.)

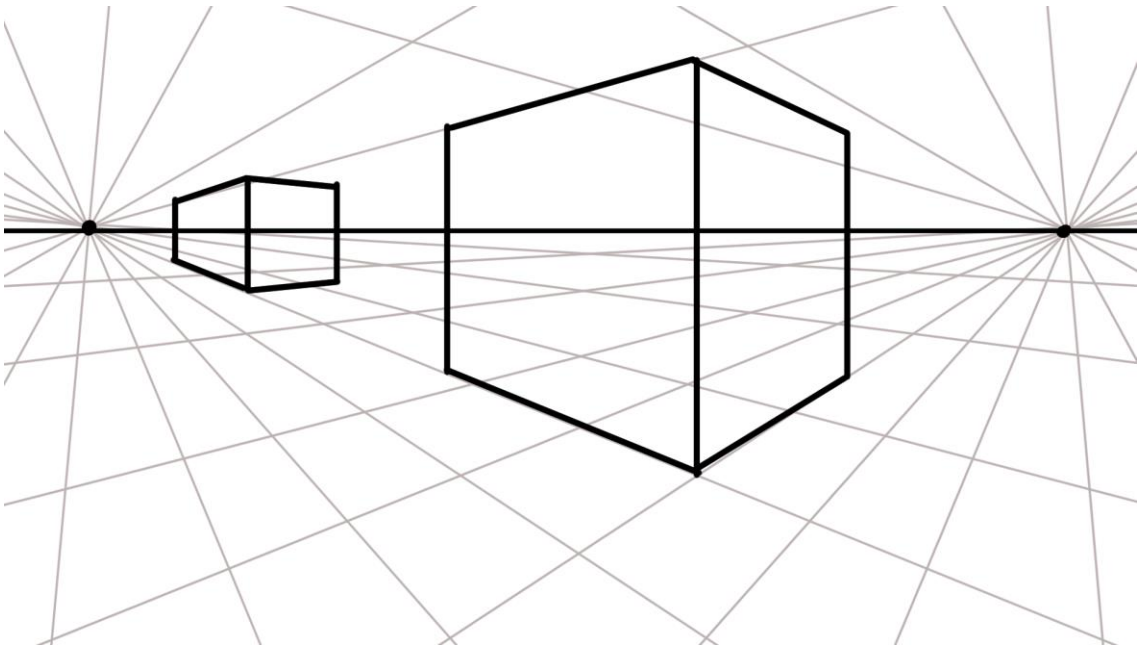


PICTURE 8. Example of one-point perspective

In a one-point perspective, none of the vertical lines are affected by the perspective lines. Only the horizontal ones seem to turn towards the vanishing point.

3.3.3 Two-Point Perspective

In the two-point perspective there are two different vanishing points at the horizon line, usually far apart from each one. A two-point perspective is more versatile than a one-point perspective, as it offers more options to change the perspective grid. It can be used for more angled shots, for example, down shots and upshots.

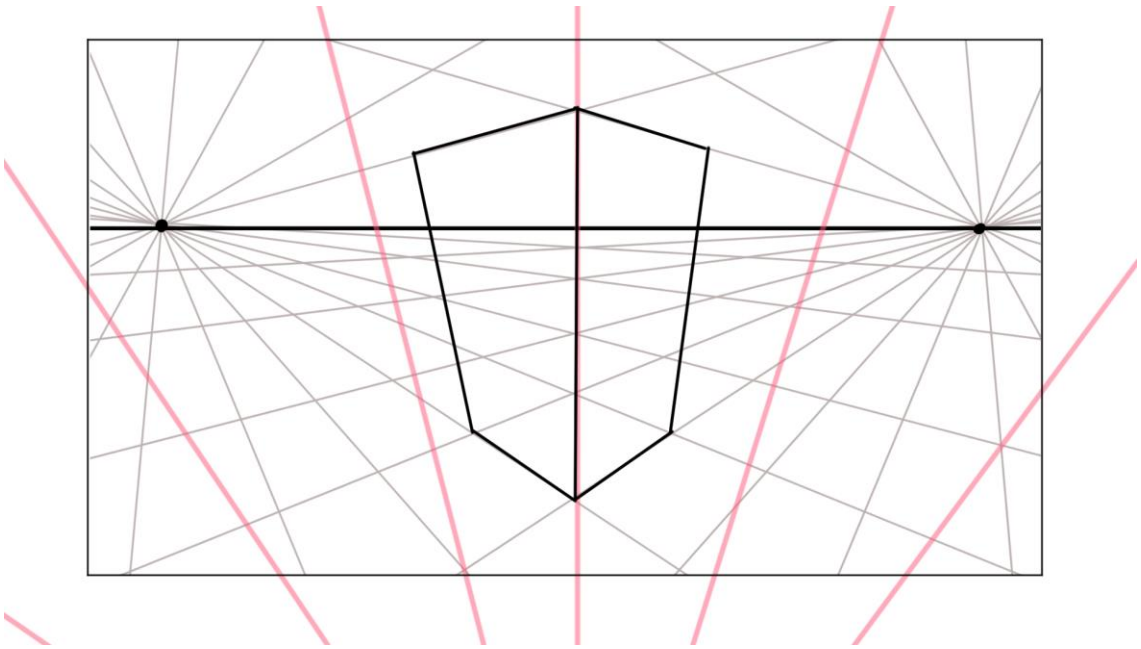


PICTURE 9. Example of two-point perspective

According to Byrne (1999, 23), the vanishing points may not always be visible on the page, as they can be positioned outside of the image. They can be positioned in different lengths apart, which will affect the perspective of the picture. If they are positioned very close to each other's, the objects in the picture can look distorted or wrong, as we are not used to such extreme perspectives. Horizon line can be also positioned out of the picture, which can then make the perspective feel like we are looking upward or downward in the scene.

3.3.4 Three-point Perspective

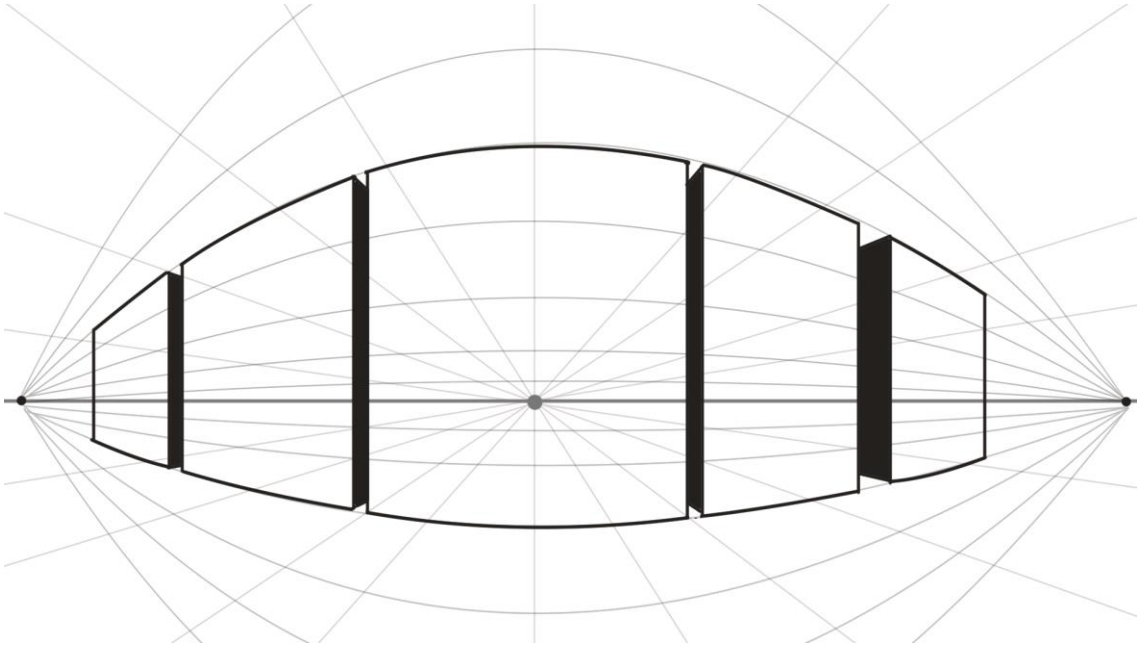
Three-point perspective follows the same kind of rules as two- and one-point perspectives, but it gives the possibility to use even more extreme point of views (Byrne 1999, 25.) In the three-point perspective, the third vanishing point is used for the vertical lines, which have been previously unaffected by the perspective grid in one and two-point perspectives. The third vanishing point is not located on the horizon line but is often positioned on the top or the bottom of the picture, often being completely out of the picture. This kind of perspective grid can be used for more extreme perspectives, such as looking up to a high skyscraper.



PICTURE 10. Example of three-point perspective

3.3.5 Forced Perspective

Forced perspective uses same rules as the previous perspectives, but the grid can be modified to fit different scenarios, where the perspective is wanted to be more distorted (Byrne 1999, 27). For example, forced perspective could be used to create wider panoramic shots, if the camera needs to pan across the background.



PICTURE 11. Example of forced perspective

Forced perspective can be used in scenarios, where there are transitions between two or more different point of views. This can take a lot of work for background artist to figure out, as the point of view can change from different viewpoint to another (Byrne 1999, 27). The transitions have to be made so, that the camera seems to move naturally in a three-dimensional space, even though the background is only two-dimensional. This kind of backgrounds can seem odd when they are viewed as a whole, but when the camera moves across the background, it will make the scene look like as if the point of view would change.

3.4 Color and Lighting

The use of light and shadow is important part of creating art, as it can be used to create the mood and drama (Mollica 2018). A sunny and saturated green background would be seen as joyful, whereas a dark and rainy blue scene would be more melancholic. Bold shadows make a more dramatic look and dark backgrounds might seem more mysterious or scary. Darker scenes can on the other hand be more peaceful, for example, night-time scenes where characters go to sleep might seem more peaceful than scary. It is all dependable on the lighting and color.

3.4.1 Lighting and Shadows

Lighting and shadow can be used to direct the eye to the focal point of the image (Ghertner 2010, 166). It is important as a background designer to know what the scene is about and what it is trying to communicate to design lighting that matches the mood of the scene.

Different times of the day will affect the lighting, as does the location and weather. A scene where it is a sunny day outside will have different lighting than a scene that is located inside with artificial lighting. Every scene has at least a single light source, where the light is coming to the scene. The greatest example of this is the sun, which is the most common and strongest source of light, which everyone

is familiar with. The position of the sun will affect how the shadows are formed and how strong the light will be. Overcast days have very different lighting than sunny days.

In scenes that are happening inside, the light source often comes straight up from the lamp. Other examples of different light sources are candlelight, campfire, moonlight, and modern items like flashlights, TV, and smartphones.

A scene can have multiple different light sources. For example, you can have a scene where the characters are sitting around a campfire at night. The strongest light source will be the campfire, but the moon in the sky will shine some light on the scene. The campfire will overpower the moonlight near the fire, but the farther you go from the fire, the moonlight will be stronger.

With the use of light and shadows, it is possible to create the illusion of three-dimensionality (Poulin 2011, 53-54). Together with perspective, this can be used to create depth to the background art.

3.4.2 Color harmony

Because color can influence moods and emotions, it is a strong communication tool (Cherry 2020). This is a useful tool for background artists to enhance the story of an animation to depict different moods and atmospheres.

As color is very subjective and everyone perceives color differently, it is hard to design things so that everyone will have the same kind of reaction to it. There is no simple answer to the question of which colors one should use, as everyone will have different opinions about colors and what they represent to them. According to Cherry (2020), colors have some universal meanings.

Red for example is often seen as a strong color, which can evoke many different emotions. Red can be used to represent vide range of contrasting emotions like love and aggression, but it can be also used to represent warmth and fire (Cherry 2020). The opposite of red, green, has also many different meanings. Green often

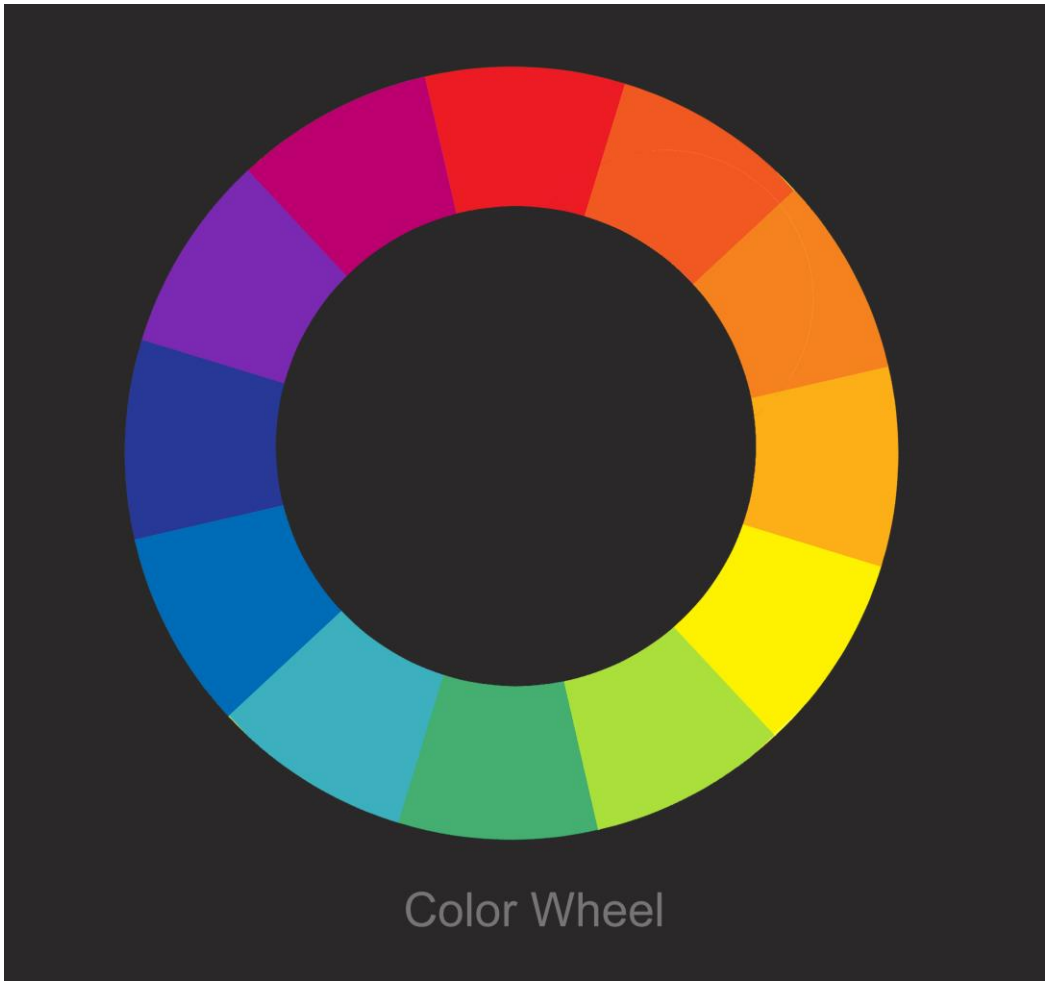
symbolizes the nature and health, but it can also symbolize more negative feelings like jealousy or envy (Cherry 2020).

“Color is differentiated in three main ways: hue, tone, and saturation.” (Dabner, Stewart, Zempol 2014, 88). Hue is the name of the color, for example, red and blue are hues. The tone is the value of the color and will change how light or dark the hue is. Changing how much grey there is in the hue will change its saturation, a low saturated color being almost grey and a highly saturated color having no grey at all.

PICTURE 12. Example of hue, saturation, and tone

In background art, to make different colors work together it is important to know about color harmony. In everyday life we see lots of different colors in our environment, but human eyes are good at spotting different kinds of colors in different

situations. For example, you can see a red apple stand out from the green leaves of an apple tree easily. This is an example of the contrast between complementary colors.

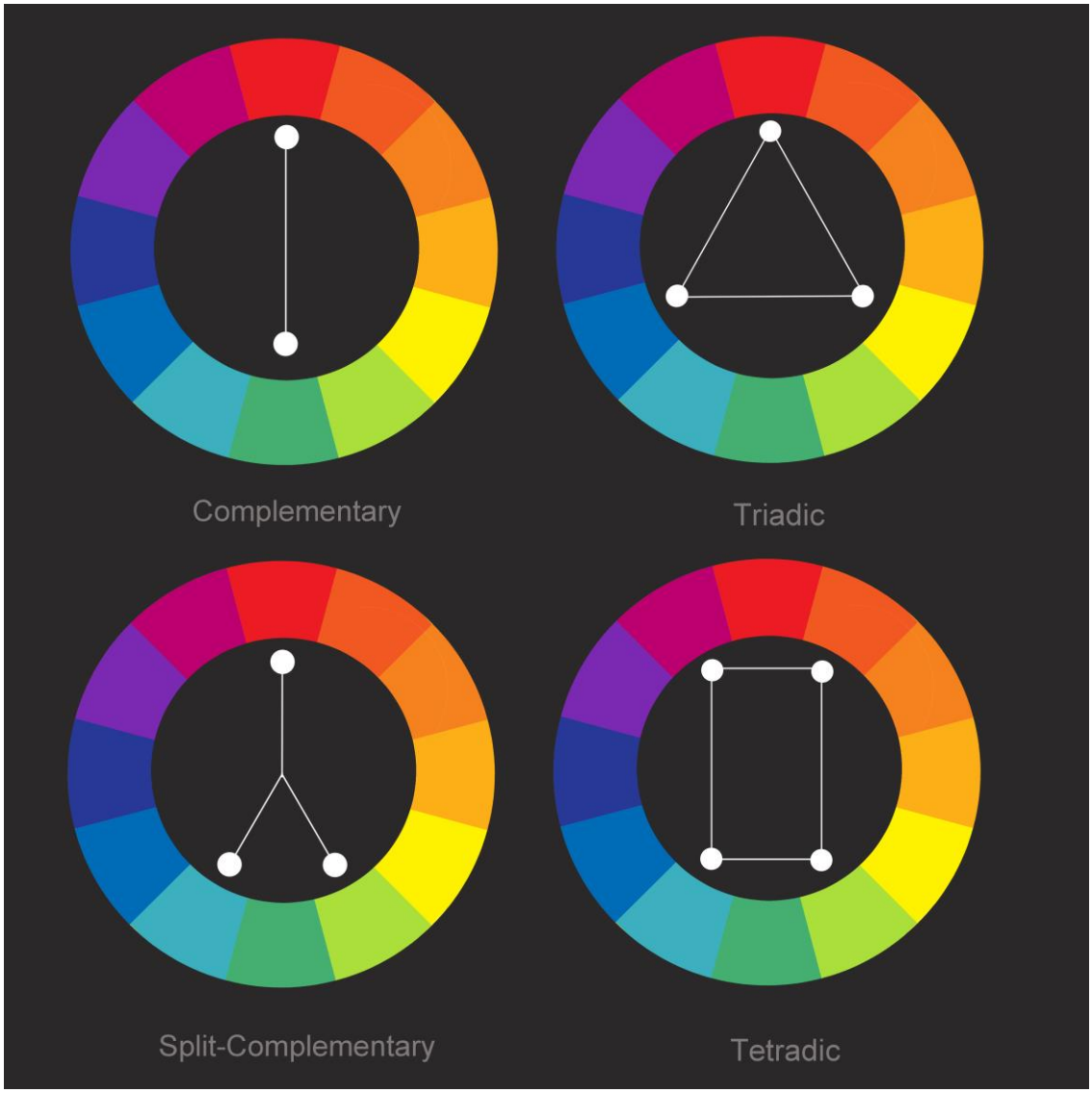


PICTURE 13. Color Wheel

One of the most common tools in color harmony is the color wheel and it is a base for many color schemes. Color wheel consist of three categories: primary, secondary and tertiary colors, making together a wheel of 12 colors (Mollica 2018). The three primary colors are red, yellow, and blue, and the secondary colors are orange, green, and purple. Tertiary colors are mixed from the primary and secondary color that are next together, for example, yellow and green make yellow-green.

Using the color wheel, one can create many different color schemes. Color wheel is often used as the basis for all the common color schemes. Most common are

monochromatic, complementary, split complementary, analogous, triadic, and tetradic color schemes.



PICTURE 14. Examples of different color schemes

A monochromatic color scheme is created by using only one color and its different values in an image. This kind of scenario rarely happens in the natural world, as in sunlight we can see all the colors that human eyes can perceive. Monochromatic lighting situations can happen in the real world if there is a light source that has a strongly colored light. This can for example be fire or manmade light sources, like neon lights.

PICTURE 15. Example of monochromatic picture

Monochromatic background art can work well for stylized backgrounds. Strong colors can imply strong emotions, so a monochromatic background might then work great in this kind of strong scene.

When two colors in a color wheel are opposites of one another, they are called complementary colors. Complimentary colors are one primary color and one secondary color opposite of each other in a color wheel. In complementary colors, the primary color is the one color missing from the secondary color when it is mixed with traditional pigments. For example, when mixing green, you need to use yellow and blue. If you try to add red to the mixture, it will create a brown or grey color.

Because of this difference between complementary colors, they make great color harmonies when they are used to contrast one another. As in our example, the orange boat will stand out in the blue ocean, because orange and blue are opposites of each others.

PICTURE 16. Example of complimentary colors

In animation, complementary colors can also be used to make the characters stand out of the bacgkround. If it is known that the character is mostly wearing orange clothes, then the character will stand out well from blue backgrounds.

Triadic color schemes are created by choosing three colors from the color wheel. The colors selected form a triangle on the color wheel and could be for example the primary colors or the secondary colors, like green, purple and orange. Triadic color schemes are versatile and can create colorful backgrounds.

Tetradic color scheme consists of four colors, that form a square between them on the color wheel (Mollica 2018). These four colors are two pairs of complementary colors, so they add more variation to a single complementary color scheme. Another way to add more colors to a complementary color scheme is to use a split complementary scheme. In a split complementary scheme, the second complementary color is replaced with the two adjacent colors next to it.

Neutral colors like grey and brown are not represented in the color wheel, but they are created by mixing all the primary colors together by varying amounts (Mollica 2018). They can be used alone or together in different colour schemes.

3.5 Contrast

“What is contrast? Contrast means difference.” (Block 2008.) In visual arts contrast can be created between the lightness and darkness, color intensity and other aspects like size, shape and texture. Great example of contrast is an image created only using black and white, as those two values have the greatest contrast there can be between values. You can get more sophisticated design with adding more grey tones, but balancing those tones is what makes contrast a difficult and hard subject to implement into design.

Low contrast could be seen as a grey image, where all the values are almost the same. This kind of images are hard to read and not often very interesting to look at. With low contrast there is not anything interesting to look at, as everything seems just the same or confusing. Often this is not what you would want to see in animation, as there is most of the time a limit how long an animation can be, so to have the most out of it, the designs should be clear and easily readable, not hard to follow and confusing to look at.

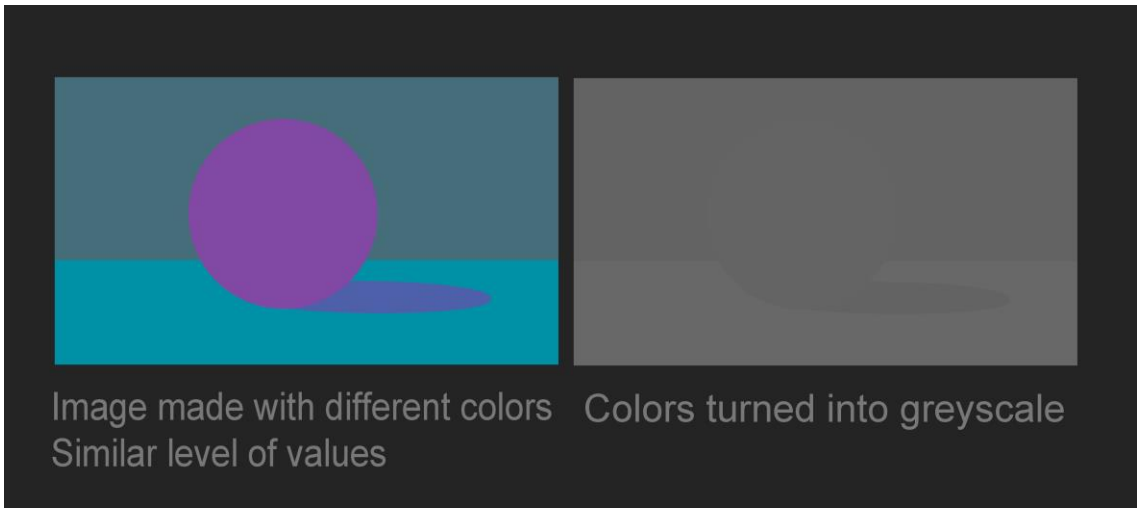
In background art, contrast is used to highlight the focal point of the image. It is important to differentiate between the character and the background, so the character in the spotlight doesn’t blend into the background. To make the character or other focal point stand out, the background artist can use many ways to build up the contrast and even mix these aspects together to make clearly readable compositions.

3.5.1 Value

Value contrast is the contrast between light and dark (Scott 2018). For example, a white box in front of a black wall will stand out from the wall, because it has a strong value difference.

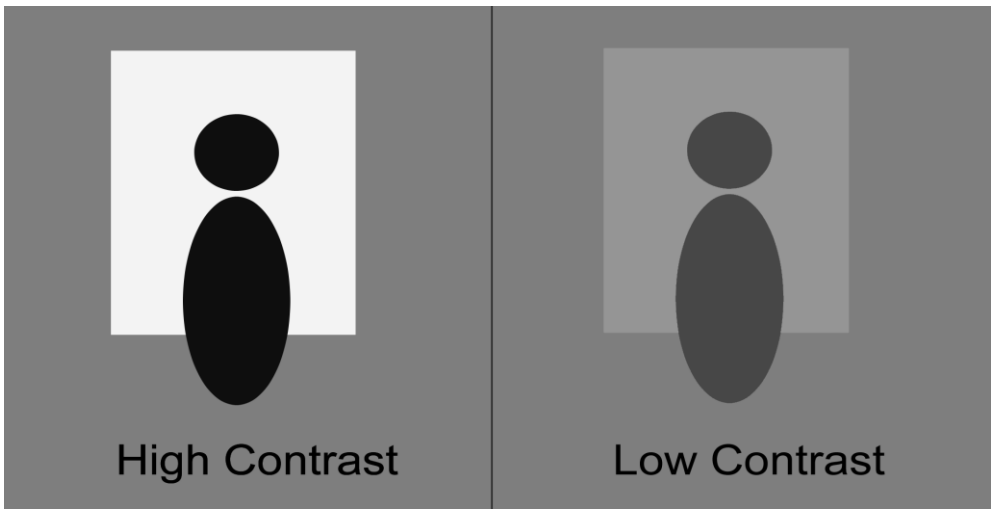
Most pictures have more than two values. It is easy to think about values as the different greys between black and white, but every color has its own value. This

can be seen if you turn a colorful image into a greyscale image. The use of different values is important because if there would be only one, it would be impossible to differentiate between different objects in the picture, even if there was color involved.



PICTURE 17. Example of image with low level of value difference

To use value to create contrast in an image, it is important to not use equal amounts of all values. Fine artists often limit their values to only a few different ones, and they use them in different amounts. This lets them make their focal point stand out when they assign a single value to it and place it against a value it has great contrast.



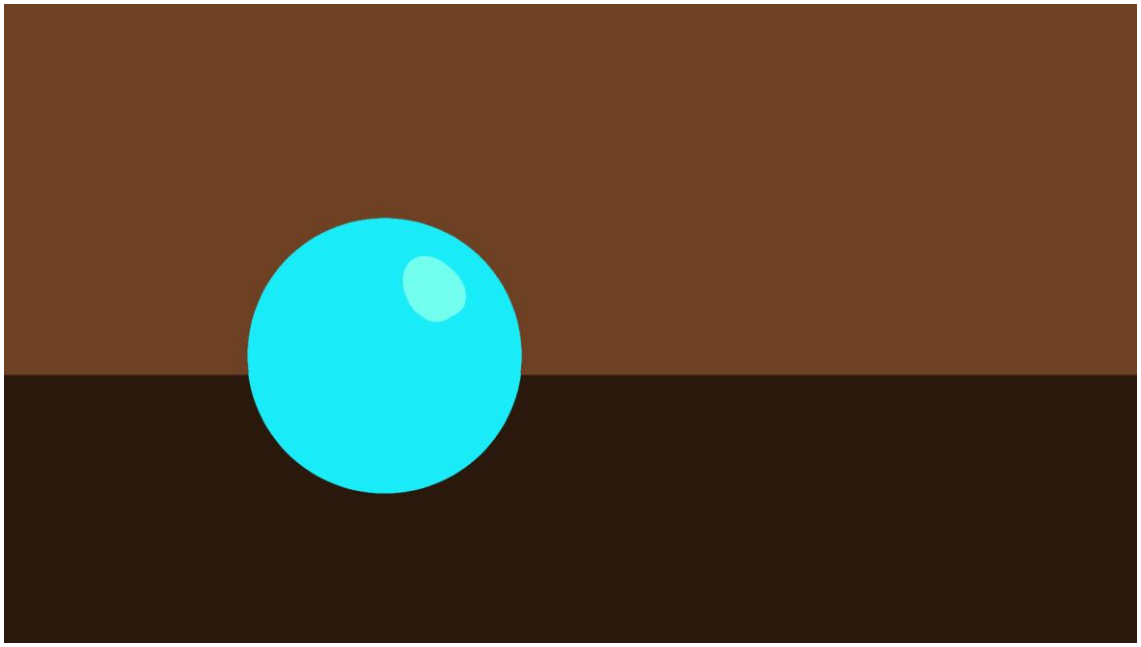
PICTURE 18. Difference between high and low contrast

Background artists in animation might not be always able to decide the values of the characters and they often have way more values than just a single one, so the artists have to work around the characters to make an environment that works for them.

3.5.2 Color Contrast

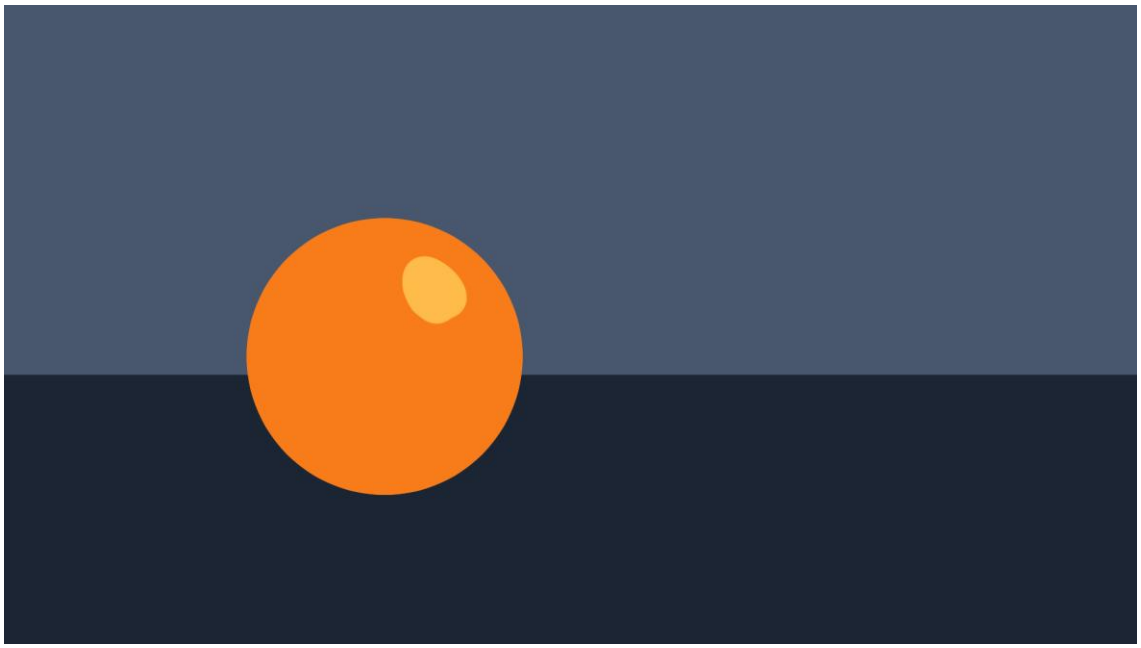
Color contrast can be divided in three separate categories: hue, value, and saturation contrast (Scott 2018). Hue contrast is greatest with colors like red and green, because they are complimentary colors and opposites of each other's.

Varying the intensity of the color can greatly affect what part gets the most attention – a bright red object on a grey background will be more noticeable than a grey object on a grey background. This is called saturation contrast, and it can be used in great effect with hue contrast. Intensity works both ways with color. From a brightly colored image, a grey object or character will stand out better than a brightly colored one. From a more toned down or grey background, a brighter colored character stands out. If everything is evenly bright or muted, then the value is the only way to make more contrast in the image.



PICTURE 19. Example of color contrast

Another way to use color contrast is to use the temperature of the color. A warmer orange object will stand out in a cooler blue background. When you combine this with the intensity of the color, you can make a cool blue object stand out in muted red background. Warm colors are often considered to be red, orange, and yellow, while the cooler ones are blue, purple, and green. These shades however can have cooler and warmer versions of themselves, for example, green can be warmer when it is closer to yellow and cooler when it is closer to blue.



PICTURE 20. Example of color contrast

3.5.3 Detail and texture contrast

Trying to capture all the details in a painting is a common problem artists face, because when everything has the same level of detail, it can be hard to see what the focal point is (Scott 2018). In animation, detail and texture contrast is most easily seen with the difference of between the background and the characters. The characters are easily differentiated from the background if the background is more detailed and has different kind of texture. In many animated films, the background can be made more detailed and textured, as they do not often need as much animating as the characters.

4 3D in Hand Drawn Animation

Because computer programs are constantly getting better, combining computer generated images with classical animation has become more seamless (Byrne 1999, 155). Traditional ways of making background art for animations are time-consuming and require a lot of planning and skill to be made right. Even a short scene in one environment might need multiple different background images from different angles. Every time there are changes in the environment, for example, the weather or time of day changes, new images must be made. The number of background images can easily grow very large, even if the animation itself wouldn't be very long. In 2D animation, all these backgrounds must be drawn by hand, which costs time or requires more artists to be part of the making of background art.

Throughout the years, animation artists have found ways to speed up the process. Now when new digital tools have gotten better and new ones are emerging every year, new methods can be used for animation. Computer animations have been popular for years and the tools for it have improved a lot, and more importantly, they have become more accessible to everyday people. This means that almost everyone with a computer can start creating animations on their own, without investing tons of money on expensive programs and materials.

The use of 3D graphics in 2D animations is not new. In DreamWorks Pictures' animated film Spirit: Stallion of the Cimmaron, most of the backgrounds were made in 3D (Robertson n.d.). The film is a blend between 2D and 3D animation, and at first glance it is easy to miss that the movie is partly made in 3D environment. To archive the painterly look for the backgrounds, the 3D models were textured with traditionally created paintings (Robertson n.d.).

PICTURE 21. Spirit: Stallion of the Cimmaron (DreamWorks LLC 2002)

Another film where 3D graphics were used was Warner Bros' The Iron Giant. It was the first movie that had completely computer-generated protagonist combined with traditional animation (Potter 2019). The Giant character was animated using this method, while the other characters were made with traditional hand drawn animation.

PICTURE 23. Iron Giant (Warner Brothers 1999)

To make 3D and hand-drawn animation fit together there are many things to consider. 3D is visually different from hand-drawn animation, so to make it not to steal the attention it must match the style of the 2D animation. This can be done in many ways – matching the texture of 3D objects to the hand-drawn animation, following traditional camera movements used in 2D animation, and using the same framerate.

In today's 3D programs it is possible to mimic two-dimensional styles by adding shading and textures that give the three-dimensional objects a more traditional two-dimensional appearance. In some 3D programs, it is possible to add outlines to 3D objects that mimic hand-drawn line art. 3D environments made like this can be used multiple times from many different angles for background art, which could make the animation production faster.

It is also possible to render three-dimensional environments as two-dimensional images, which one can then use as the background for the animation. These images can be painted over if there is a need for editing that could be difficult or too time-consuming in 3D programs.

4.1 Advantages of using 3D in 2D background art

The previous chapters portrayed all the important things that background artists need to consider when designing and creating background art. It needs a lot of knowledge about perspective, color theory, and lighting to make a two-dimensional drawing look like three-dimensional space. Painting and drawing take a lot of time when you need to figure out everything by hand, even with the help of digital tools.

With 3D graphics, however, many of these aspects are easier to manage. Three-dimensionality is easier achieved when everything is already happening in three-dimensional space. Different perspectives are effortless to create just by turning and moving the camera around and altering camera-settings inside the 3D program.

It is also more effortless to change the lighting of a scene in a 3D environment if that is needed. It can be simply done by moving around the light source and making it dimmer or shinier. One can add multiple different light sources, and the 3D program will calculate how those lights interact together with the objects in the scene.

One of the advantages of using 3D is that in complex backgrounds everything does not have to be drawn by hand. Even if the whole scene is not planned to being built in a 3D program, it can still be used as a tool to block out complex objects and paint over them.

5 The project

In this project, a 3D program called Blender was used to create a three-dimensional environment for short 2D animation. Different methods were used to create the 3D environment so that it would appear hand drawn. All the important aspects of background design like color, lighting, and composition were considered to make the background art visually pleasing as well. The environment was built so that it can be used from multiple different camera angles, and it will be demonstrated how the lighting can be modified by only changing the lighting setup inside the 3D software, without the need to modify the environment itself.

In this short animated scene, we follow a cat who is living in an alleyway. The animation shows the cat sleeping on top of a brick wall and how it wakes up and jumps down from the wall into the alleyway. We follow it to walk up to the entrance of the alleyway, curiously watching outside. It is just a singular scene, to demonstrate how the background can be made in 3D.

My approach to this animation project was different from the most often used pipeline for animation production, as I did not work with a team of people and did all the parts of the animation myself. The process has similar steps as the common pipeline, but the order of steps was changed for this project to fit the method of using a 3D environment as a background instead of the hand drawn backgrounds.

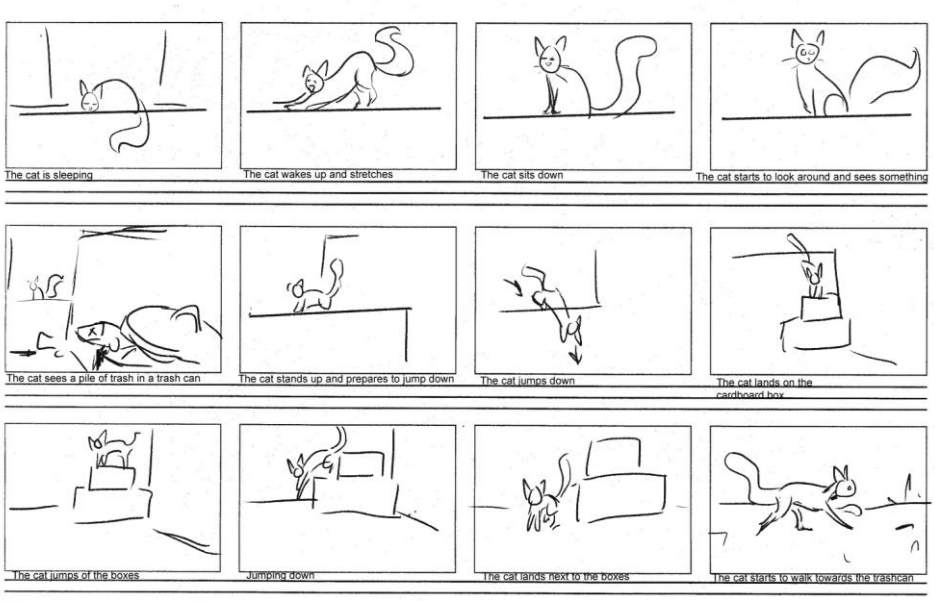
5.1 Preparation

Every animation project is different, so for every project, there have to be certain preparations before the production can start. For this project also it was important to first decide what sort of style it was going to have. For this part, it is a good idea to do benchmarking to see what has been done before to see what sort of solutions there has been used in other animations. Building a mood board can help with communicating the visual style wanted for the project, which is important when working in a team. It is also helpful when working alone, as it is important to decide a style and be consistent with it throughout the project.

For this project, it was decided to do digitally painted textures to give the background a more painterly look to balance the clean and sharp look that 3D can often have. Using this method, it was possible to create a clean background with painted elements to make it look more hand-painted, while still maintaining the ability to change the lighting. A simple style was chosen for the character, so it would stand out from the painted background with its simplified style.

PICTURE 24. Sketches of the cat character

Before the background art can be made, it is important to first have a storyboard of the animation. From the storyboard the layout artist can make sketches of the layout, which will help with the final background art. It is important even if the background will be made in 3D like in this project, as this way it will save time because you don't need to figure everything out in the 3D program. I could follow the drawn sketches to create the 3D environment and I didn't need to struggle to figure out what sort of environment I need to create while creating the environment. It is also good to have a visual reference before you start blocking the 3D shapes, as those can be more time-consuming to change afterward than redrawing a sketch. Sometimes changes are necessary when the plan changes, so the ability to quickly change things around is a great help.

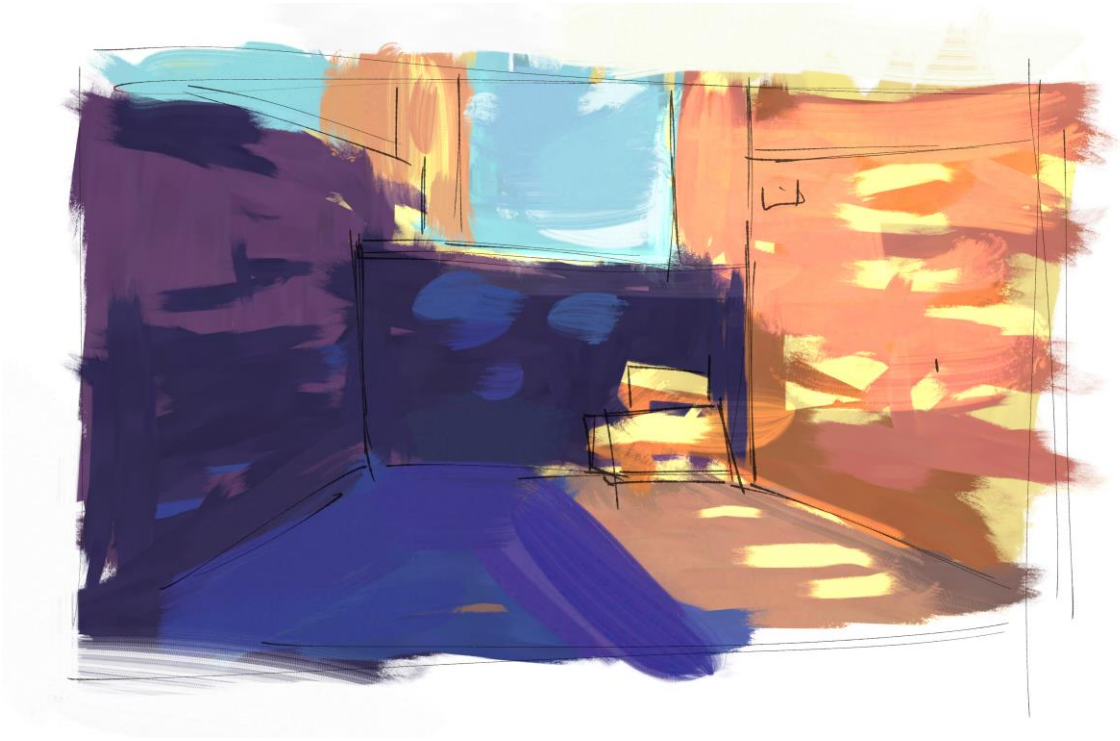


PICTURE 25. Part of the storyboard

Designing 3D environments can be very different from designing environments with pen and paper. It is important to know what are the most important parts of the scene, so the environment can be designed around it. The designer needs to know if the environment is going to be used in different scenes later and what kind of angles the environment is going to be viewed from. This will decide which parts of the 3D environment are the most important and need the most focus and which parts can be left simpler or even hidden.

PICTURE 26. Sketch of the background

It is a good idea to have an idea of what kind of lighting and coloring the scene is going to have. A simple colored sketch is better than not having any clue of what the scene is going to look like color wise. Good planning is often half of the work, as one does not want to be designing the scene while trying to produce a final version of it, as that leaves too much room for errors and needs for a change later. With these color sketches, it is also good to work on the contrast and value of the scene.

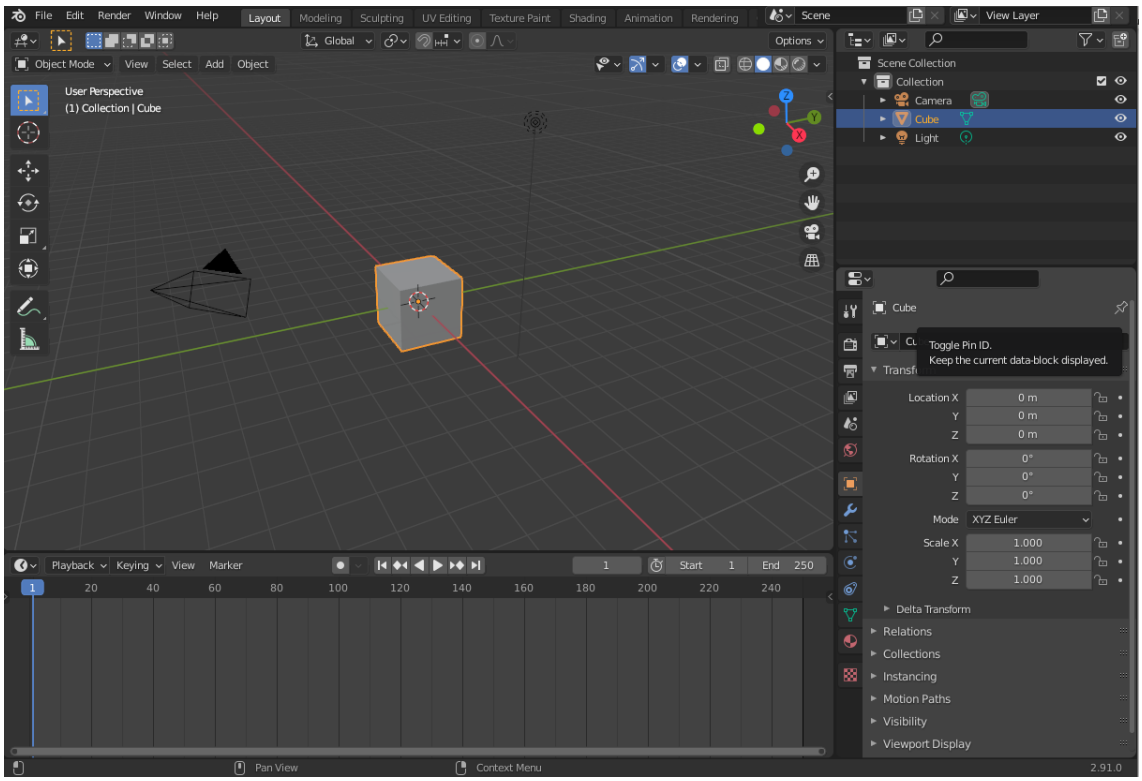


PICTURE 27. Colored sketch of the background

In this scene, the most important things are the alleyway walls and the trashcan in the entrance of the alleyway. They will get more attention in the animation, as they will be more in focus on the animation. The buildings in the back are secondary, so they do not need to be as detailed as the walls or objects in the alleyway. They can be represented by simple boxes or other simple shapes. The alleyway will be more textured and detailed and should be finished from all around, so it can be used for different camera angles. The street where the alleyway leads was not used in the final animation, but it was made if it later would have been necessary to use a view that would have shown the street outside of the alleyway.

5.2 Blender

Blender is a free 3D modelling and animation software, that offers tools that cover the whole 3D pipeline from modelling to simulation and compositing (Blender.org n.d.). Blender was chosen for this project because it offers a good variety of tools to create 3D environments, that can be made to fit into 2D animation. Blender also offers 2D animation tools, so the environments and animation can be made all in the same program.

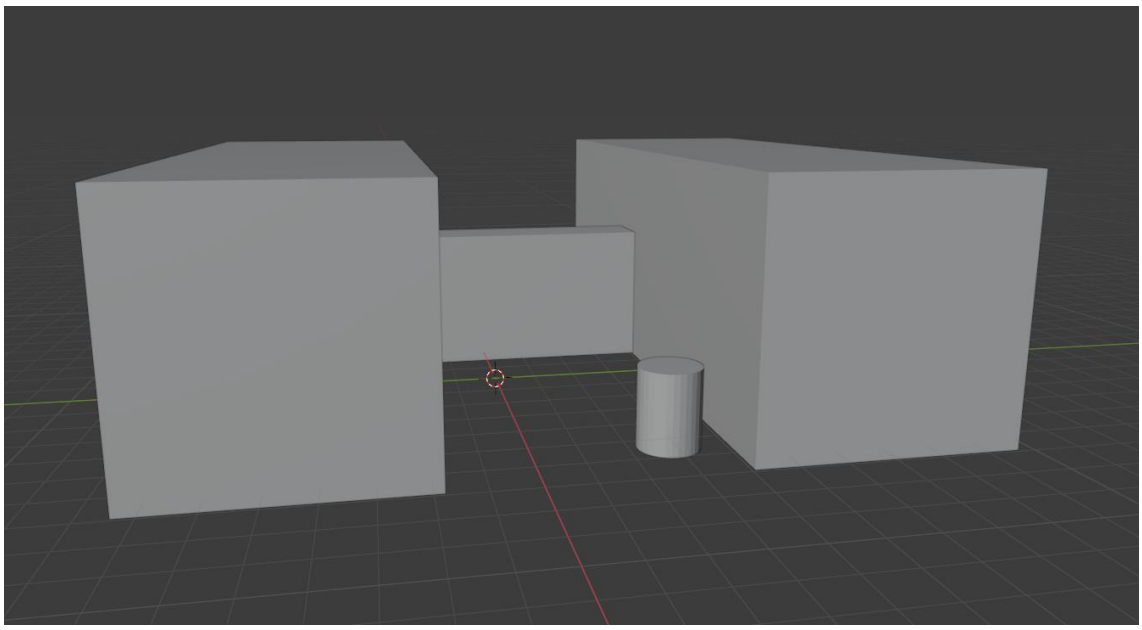


PICTURE 28. Screenshot of Blender's interface

5.3 Blocking

Blocking is a three-dimensional sketch made of simple 3D shapes, which is often made before the final model.

After the storyboard and rough sketches of the environment was done, I did the blocking based on the sketch I had previously drawn. I used simple shapes to build the environment quickly to test out how the sketch works and If I needed to change some things in the environment. This is a good way to test out ideas, as one can set lights and cameras in this early stage to see how the 3D environment works and if it there is any changes that are necessary. This way time as not wasted, as if I would have jumped straight into modeling complex 3D models, to only notice that it would not work in the final animation. Now I could see in the early stages what parts did not work and could change them in the blocking.



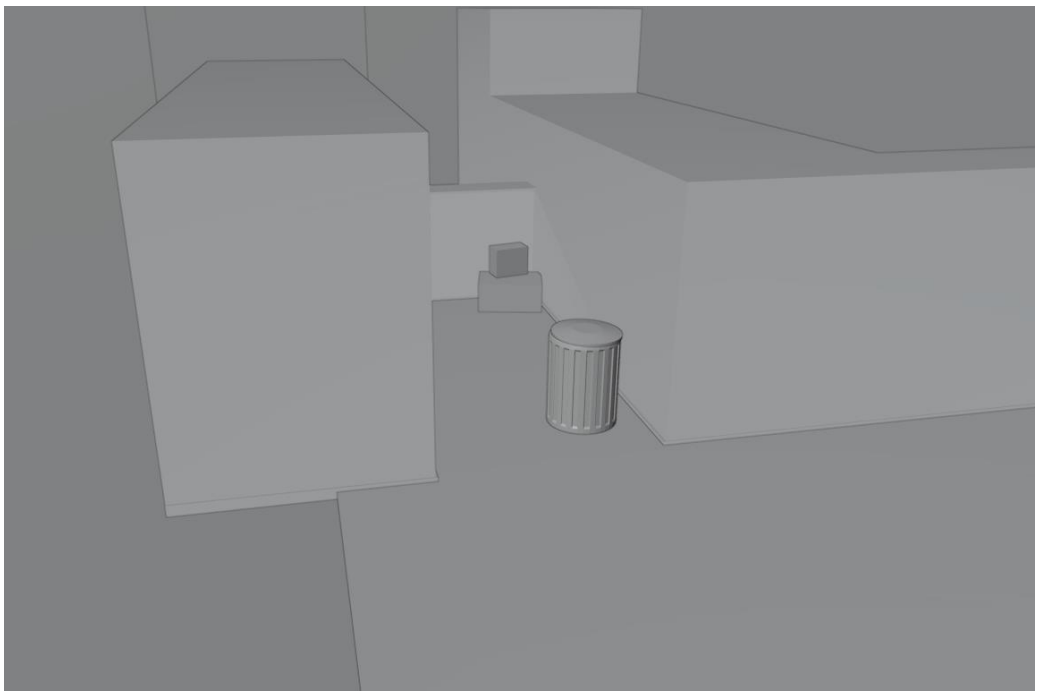
PICTURE 29. Blocking of the background

This blocking will serve as a 3D reference for the final and more complex modelling that will be made in the next part.

5.4 3D Modelling

When the blocking has been done, the modelling of the objects can be started. The complexity of models is determined by the project and what they are used for, but it is a good rule to use as simple models as possible, as more complicated ones can affect the speed at which the 3D scene is rendered. More complex models might be needed if the objects are viewed close or are in greater focus in the animation. If the 3D objects are going to be animated, the render time will be highly affected by the complexity of the model.

In 2D animation the designs are usually stylized and simplified, so simpler models can work better in this scenario.

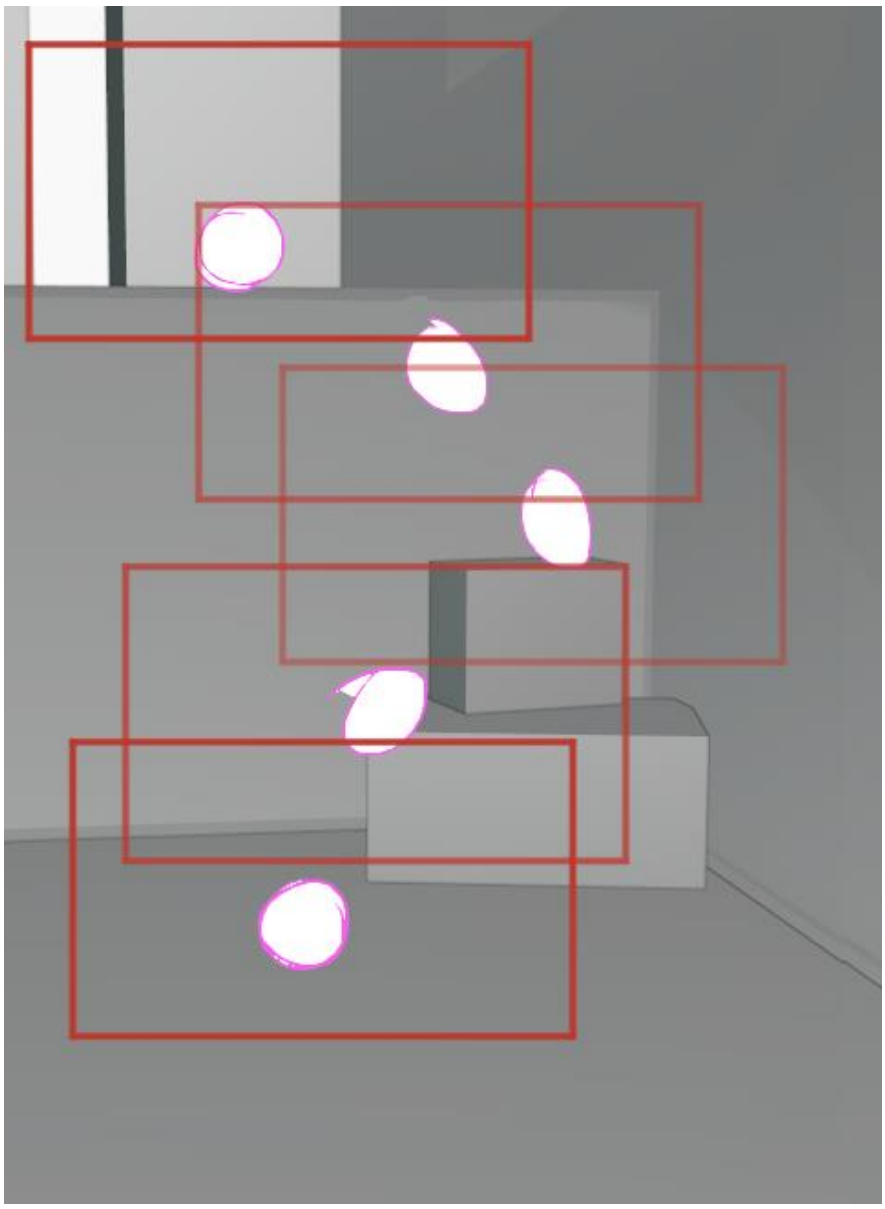


PICTURE 30. 3D models of the background

As stated in previous chapters, perspective is important in background art to show scale. In 3D programs like the blender, one can create objects by using real-life measurements. This way it takes less effort for the artist to make everything to be in scale and the perspective does not need to rely on the artist's skills alone.

5.5 Layout Design

When the 3D models were finished, the layouts for the animation could be done. In this project the layouts were made inside Blender, using the grease pencil tool, which allows one to draw over the 3D environment. Using this method, it was also possible to experiment with the camera setup, so one could see in real time how the camera movements could work in the final animation.



PICTURE 31. Layout design for the jump scene

5.6 Texturing

After finishing the 3D models and layouts, it was time to start the texturing. For this project, this was the most important part, as the scene relies on the textures to make it look like it was painted digitally. Texturing is what brings the models alive and affects how the scene will look and feel. For this, it helps to have a plan for colors and style, as in this part the color scheme will also be chosen.

This particular environment was designed to have colder shadows and warm-colored lighting. I chose yellow and oranges for the light areas and purple and

blue for the shadow areas. These colors are complementary colors, and as previously mentioned in the color harmony chapter, these colors can together make harmonic color designs. Generally, I wanted to make the shadow areas seem colder and light areas warmer, as it would be on a sunny day. Because the lighting can be changed later, the textures don’t need to completely match the final colors, but they were made with warm colors to match the warmer atmosphere of the environment. The lighting will add colder tones to shadows in the later part.

The style chosen for this project was more of a digitally painted look, so it was decided to paint the models digitally. Before this could be done, the geometry of the 3D models had to be turned into a flat image where one can paint into. This is called UV unwrapping and is commonly used in 3D to assign textures to 3D models. It can be imagined as if you took a cube made out of paper and made all the sides flat and connected.

In Blender, it is possible to paint into the 3D model directly in the 3D space. I used this function a little bit, but the final textures were painted outside of the blender, on the flat texture image that was created previously. For this step digital drawing program called Clip Studio Paint was used. To give the objects a more painted look, the textures were painted with a brush imitating traditional oil painting brush. The brushstrokes were left visible and not completely blended down, to make it seem more painterly.

PICTURE 32. Textured models

There are lots of different ways to do texturing. Other ways of texturing can include using real-world photographed textures. For example, there could have been used a real brick texture for the wall in the scene. Because the style of the animation does not need a highly realistic background, it was better to choose a more stylized way of texturing. Another way that could work in this particular project is using single base color for objects or gradient textures that rely more on the lighting.

5.7 Lighting

Lighting is a powerful tool to help create visually stunning artworks, and 3D environments are no different. Lighting is the key to making everything work together and it can easily break or make the whole scene. It can be used to completely change the mood and color scheme of the scene, so it is a powerful tool for a background artist.

For this scene, I wanted the wall on the right to have a light shining on it and the other wall to be in a shadow. I also wanted the light to mimic sunlight, so I made it bright white with a hint of yellow color. In real life, shadows are affected by the sky color and in Blender, you can change the world color by hand, which affects the shadows similarly to the sky color in real life. In this scene the sky is blue, but I wanted the shadows to appear more purple, so I had to change the world color towards purple. I had to create a separate plane for the sky so I could still have the sky appear blue.

PICTURE 33. Fully lighted scene

In Blender many different light sources can be created, which all behave differently. Lighting a three-dimensional scene works in many ways similarly to lighting a movie scene in a studio. There are often many different lights sources to light up different areas, as one often cannot light the scene properly. In this scene, there is one main light source, but I added additional light sources to light some areas better. There is also the skylight, which affects mostly the color of the shadows. Without these additional lights, the scene looks way darker.

PICTURE 34. Scene with just one light source

In this animation project lighting changes weren't necessary, but if the scene would have needed to have different kind of lighting in the end, it could have been relatively effortless change the lighting compared to if it had to be done by re-drawing all the background art by hand. As an example, in picture 35 there is an experimental night-time lighting, which was not used in the final animation.

PICTURE 35. Experimental lighting situation

5.8 Animation

Animations were the final part of the project. As the layout design was made inside Blender, the final animations were also sketched and finalized in the program.

Even though the rough animation was made using Blender's tools that allows one to draw over the 3D-environment, it was decided to render the backgrounds as images instead. The background images were then placed as the backdrop for the character animations. This allowed a more traditional way of animating, while still using the 3D-environment as the basis for all the backgrounds. If the scene would have needed the camera to rotate more, then it could have been useful to animate the character on top of the 3D-environment.

PICTURE 36. Screenshot from the final animation

PICTURE 34. Screenshot from the final animation

6 DISCUSSION

Making background art for animations is hard work and it requires a lot of studying and knowledge of the principles of art. It has an undeniably important role in animation and often needs as much of an effort as the animating itself. Deadlines are often hard in animation production, so any tools that help with making the project go faster are good to consider. Using 3D for background art can be a big timesaver if there are lots of environments that would require to have many different background illustrations. For complex environments, 3D can save time as the background artist doesn't need to draw everything by hand every time there needs to be a new camera angle. 3D can also help with the different principles that help to build a good background art for animation. 3D artists still need to have a good understanding of light, color, contrast, and perspective, but many of these things can be made more easily in a 3D environment or are easier to change later on. For example, lighting is way faster to design in a 3D environment than trying to figure it out in a painting or a drawing.

For all projects, 3D might not be a feasible option. It will depend on the style of the background art if it makes sense to create it in 3D. For example, highly exaggerated styles might not work as well in 3D as it would be easier to be made by hand. Sometimes the project might be so small that there is no real sense to use 3D, as the environments won't be seen from different angles. For very simple animations it might not be the best option either. It is highly dependable on the goal of the project if 3D is a good option for the particular project.

Even if the backgrounds are not made in a 3D program, a simple blocking can be very helpful for a background artist to plan their lighting and perspective for the background art. It can save time from the planning part, especially if the scene is complex, the perspective is extreme or the lighting for the scene is tricky to design just by hand.

Overall, 3D can be a very powerful tool that can quicken and make it easier to produce background art for 2D animations.

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APPENDICES

Appendix 1. Link to the project animation

https://youtu.be/gavkVX9Envs