

Procedural Art

Research Paper

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Figure 1- Town of Morthal [1]

Chosen theme: Morthal

- Morthal is the capital of Hjaalmarch, a place divided evenly between wind-swept tundra dotted with farms and a huge stinking salt marsh. [2]
- The hold offers minimal strategic value to the Empire but could be used by the Stormcloaks to stage a siege of Solitude during the time TES5: Skyrim takes place. [2]
- It's small population and remote location has kept it distant from most major conflicts in its history. [3]

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Visual Research:

Morthal is situated on the southern edge of Drajkmyr marsh [3], so dry ground can be hard to come by. The area is often surrounded by thick fog and twisted trees grow from the surrounding marsh, giving it a foreboding appearance to travellers.



Figure 2 - Morthal in Elder Scrolls Online [4]

In TES: Online, frozen undead wander in the wilderness around Morthal. Many frozen zombies are found in the marsh north of the city, whilst skeleton remains can be found to the east close to Kjenstag Ruins [5]



Figure 3 - Kjenstag Ruins in TES: Online [6]

The city itself is built on River Hjaal and the surrounding marshlands. There is a nearby lumber mill that makes use of the river as well as a few shops however not many due to the low populace. The Jarl's house stands out among them as it is built much larger than the rest. Many houses are connected with small dock walkways and there are plenty of ships around the area.



Figure 4 - A map of Morthal [7]

Materials:



Figure 5 - Screenshot taken from Skyrim of Morthal

Due to the small size of Morthal, there is not much to the city. All houses have thatch rooves, wooden walls and a stone foundation and are relatively square/blocky. The pathways are laid with stones and where not possible, wooden walkways are made. Houses are built in a Nordic style as with much of Skyrim, the city is surrounded by wooden walls and a large gate as an entrance. As a note, the references I am using of my game is rather heavily modded although lore consistency and style is kept, overall visual improvements (if you want my modlist, just ask, I love the game!).



Figure 6 - A commoner and jarl house respectively

In the images above it shows the three-part structure of a basic house on the left, this is the normal class citizen house. It sometimes has extensions and different widths. On the right is a much larger house where the Jarl of the city lives. The Jarl's house spans 3 stories and is made of different blocks which can be seen as very similar to pieces of the left image. With this information we can conceptualize the generation of these structures and their smallest parts.

Procedural Techniques:

First, I looked for any resources to give insight into creating buildings but could not find any. So, I decided it would be best to use the resources from the course and my own ideas for creating buildings. Due to the simple shape of buildings in Morthal, I kept the structure box shaped for a start with a roof based on the size of the building and random windows and doors.

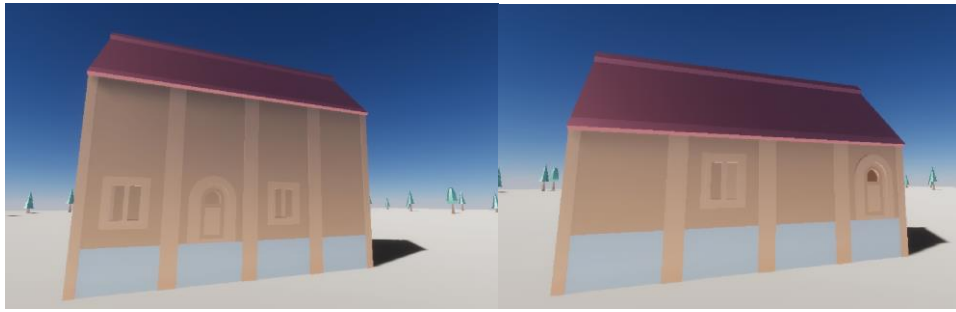


Figure 7- Initial creation of buildings

Due to the small size of Morthal (there is only about 6 houses) it is difficult to see a pattern in the town as well as the fact that nothing in Skyrim is procedurally generated other than their Radiant Quests to make quests based on factors of the player and are randomised [8]. It was difficult to find something suitable for the generation. Eventually I decided to go with the Lindenmayer-system (L-System for short) [9]. The L-system is a rewriting system where we can take an initial value called an axiom and rewrite it according to previously established rules of the L-system. This works well because it gives the city a more natural look.



Figure 8 - L-System modelling growth of algae [9]

The rules of the L-system are quite simple, if a value is A, it becomes AB if the value is B it becomes A. As with the image above, you can see in the visualisation that it splits for each value and at n=7 it is a large value.

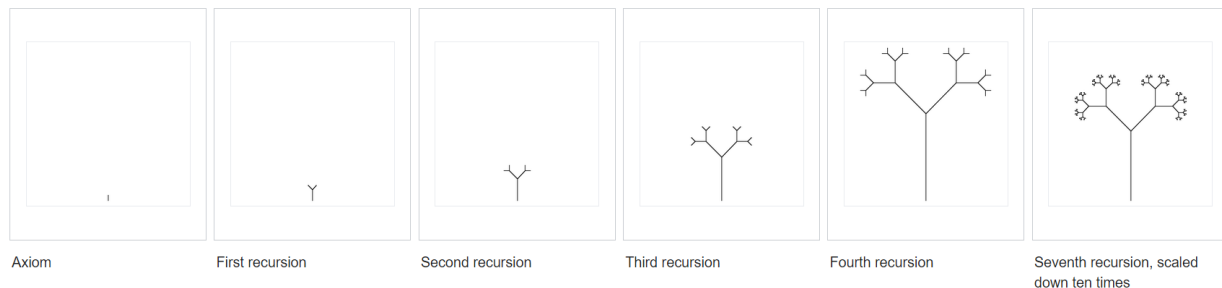


Figure 9 - Fractal (binary) tree with L-System

This system allows us to create multiple different forms of recursion, with a slight change of the rules, it can be modified into a binary tree where it continuously splits into smaller parts.

With some adaptation of this to match Gary William Flake's Turtle interpretation [10] of it, we can create a more procedural type of structure.




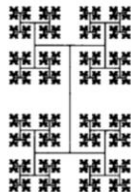
Cmd.	Turtle Action	Big-H	Angle: 90	Axiom: [F]--F	Rule(s): F = [[+F][-F]
F	(Draw Forward) Move the turtle forward by a fixed length, drawing a line from the old position to the new position.				
G	(Go Forward) Move the turtle forward by a fixed length, but do not draw a line.				
+	Turn the turtle to the right by a fixed angle. If an integer precedes the "+" symbol, then the turtle effectively makes that number of right-hand turns.				
-	Turn the turtle to the left by a fixed angle. If an integer precedes the "-" symbol, then the turtle effectively makes that number of left-hand turns.				
	Save the turtle's current position and angle for later use onto a stack of saved states.				
	Remove the last saved state from the stack and use it to restore the turtle's last saved position and angle.				
	Move the turtle forward by a length computed from the execution depth, drawing a line from the old position to the new.				

Figure 10 - Gary William's version of L-System [10]

The initial axiom for this version is [F]--F instead of A and the CMD tab reflects what the output would be for each of the values that it could read. There is only one rule as shown above which can be looped to create the repeating image. With some randomization it can be adapted into something more procedural.

This does however lead to a pattern that will always look the same, to change that I made it so that it has a different set of outputs for the rule. So F can be [+F][-F] or [+F]F[-F] or [-F]F[+F] and so on. By choosing between random outputs, it creates unique results that look distinct, and more man made.

External assets:

No external assets were used yet.

Contributions:

All the scripts are written by me basing it off the exercises given in the labs and a YouTube series by Sunny Valley [11] on procedural towns. There are some similarities to both sources however it has been mostly changed to suit to what I wanted to achieve as well as my own coding style.

I also made the post processing, sky and fog volumes for the scene as well as adjustments to lighting and the camera. The knowledge was obtained from Binary Impact's video [12] guide on how to work with HDRP settings. The tutorial serves as a base which I then further went into these visual effects.

References

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