

Procedural Generation of Unique Buildings

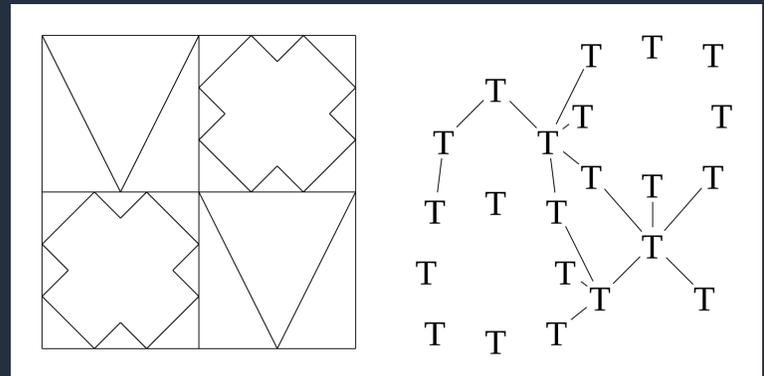
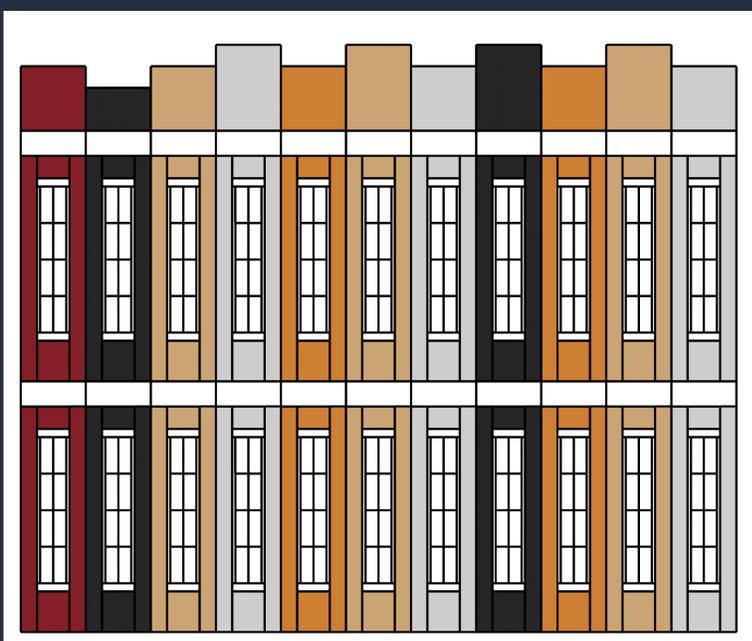
Mathias Plans

Introduction

For my BSc thesis I decided to tackle the problem of generating unique building procedurally. To that end, **Grape Grammar** was developed, a specific type of design grammar that takes aspects from graph grammar, split grammar, and wave function collapse algorithm.

Grammars

Most people are familiar with **formal grammars** that work over strings of alphabetical characters. But that is only useful in 1D space. Split grammars work over **shapes**, which can be in any dimension. Indeed, split grammars have been used in procedural generation of buildings since its creation. Graph grammar, as can be deduced from its name, works over **graphs**. The proposed **Grape Grammar** is a specific type of graph grammar that works in a similar way to split grammars.



Wave Function Collapse

Wave function collapse algorithm is an interesting method for solving **constraint-based** problems. Developed by Maxim Gumin, it was meant for procedural texture synthesis, but has been used to generate 3D structures as well. The original implementation is meant to work on a **grid**, which makes the results of the algorithm quite regular. But there exists a modification to this algorithm that **works on graphs** as well.

Results

The proposed Grape Grammar **represents 2D shapes as graphs** instead, meaning that both split grammar and wave function collapse algorithm can be used in tandem with each other, producing interesting results.

Check out my project page at <https://tinyurl.com/housecollapse>



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