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CPSC 589 Final Project Proposal

Procedurally Generating an Immersive Model of a Decorated Room for General Applications

ABSTRACT

Procedurally generated environments have become a popular interest of study due to their potential at creating possibly infinite content: many video games, such as *Minecraft* and *Diablo*, make use of randomly generated maps for this reason. However, procedural generation can have its limitations, and may create repetitive patterns. As such we would like to answer the question: "To what degree can a room be procedurally generated so that its layout and decorative components are realistic and aesthetically pleasant, while still allowing for a wide variety rooms and styles?" We seek to develop a framework to procedurally generate immersive 3D models of randomized rooms, while keeping the final product sensibly designed. This would allow us to understand and push the limitations of procedural generation in varied applications from architecture and interior design to video game and Virtual Reality research.

Introduction

PROBLEM STATEMENT

To what degree of realism can the modelling of interior room designs be automated by procedural generation, allowing both for experimentation in its design while still keeping aesthetically pleasing? We hope to answer this question by building a simple but useful framework that allows its user to procedurally generate an interior area, populating it with decorative and interactive objects. With such a framework, we hope that fields such as architecture and interior design find a simple way to experiment with designs, seek inspiration, or simply be playful with a space. In other fields such as video game design and Virtual Reality research, the fast creation of a randomly generated space allows for replay value, constantly exercising the element of surprise.

Our methods in accomplishing this task will mainly include researching and implementing methods to complete the procedurally generated part of building the room. It will also include modelling actual decorations, which the previous part will then integrate into its room building process.

LITERATURE REVIEW

Procedural generation has been popular in simulating, modelling and editing larger systems like cities (such as those by Greuter, Stefan, et al. and Kelly, George, and Hugh McCabe), and has also been used in a more small-scaled attempt at modelling a house based on its floor plan (Martin, Jess).

However, for intimate spaces like rooms, the most appropriate literature is Tutenel, Tim, et al.'s paper on procedurally generating the interiors of houses in video games, so as to increase the immersion of being able to enter houses that developers would otherwise not have the time to design by hand. This paper is a good contrast to our overarching goal. Its focus is on filling in the empty spaces in the interior of a house based on its 'role': a kitchen, for example, is procedurally generated with cabinets and counters. However, we want to design a framework that automates that process, while still keeping aesthetically pleasing and realistic overall. Thus we aim to expand the achievement of Tutenel et al. beyond the randomizing of certain assets in a room space.

Goals and Objectives

PERSONAL GOALS

On a personal level, the project will give us a deeper insight into the design of procedurally generated spaces and areas, and a greater understanding of the process as a whole. It will also give us a richer experience in 3D modelling, allowing us to apply this experience further in other related projects.

PROJECT GOALS

By the end of the project, we intend our framework to provide a realistically designed room that, while being aesthetically pleasing, can still have its design, decoration, and architecture altered over multiple iterations and trials by the user.

Methodology

As mentioned above, due to our lack of intimate knowledge on the process of procedural generation, our methodology involves first getting comfortable with the material. After this, we will spend time separately developing photorealistic models and implementing the procedural room generation for the purposes of answering our project question. When the two parts come together, we hope that our project will be successfully resolved, after accommodating possible errors, bugs, and faults with our procedural generation method.

PROGRAMMING LANGUAGE, API, PLATFORM

We expect to use C++ using OpenGL, as that is what we have become most comfortable working in. However, if we find a certain program or platform is more suited to answering our project question, then we intend to devote time to learning those skills early on in the project. Due to our lack of direct knowledge in the area, we cannot be sure of which specific platforms, APIs, or programs would be of use to us, or which we will be comfortable using - this is something we will decide at a point in the future.

Expected Results

We expect to see that using procedural generation is indeed a viable way of creating intimate and immersive room spaces, complete with sensible and aesthetically pleasing decoration choices. We believe that procedural generation will be a viable, unique, and engaging method of creating such spaces, and is applicable to a wide variety of fields as their interests see fit.

Group Responsibilities

MEMBERS' RESPONSIBILITIES

Generally, every group member is expected to deliver their work on time with a satisfactory level of quality, with exceptions being discussed among the group members. Code is to be commented to an understandable degree, and follow accepted coding conventions (number of tabs, etc.).

TIMELINE

Late-February

- Research on Procedural Generation of 3D Models complete.
- Necessary Platforms / APIs / Programs identified, and familiar to group members

Early-March

- Initial attempts at implementing Procedural Generation
- First handful of decorative models constructed

Mid-March

- Decorative models complete
- Procedural Generation of rooms is effective

Late-March / Early-April

- Procedural Generation of rooms is aesthetically pleasing, realistic, and parameters can be varied

Works Cited

Greuter, Stefan, et al. "Undiscovered worlds—towards a framework for real-time procedural world generation." Fifth International Digital Arts and Culture Conference, Melbourne, Australia. Vol. 5. 2003.

Kelly, George, and Hugh McCabe. "Citygen: An interactive system for procedural city generation." Fifth International Conference on Game Design and Technology. 2007.

Martin, Jess. "Procedural house generation: A method for dynamically generating floor plans." Proceedings of the Symposium on Interactive 3D Graphics and Games. 2006.

Tutenel, Tim, et al. "Rule-based layout solving and its application to procedural interior generation." CASA Workshop on 3D Advanced Media In Gaming And Simulation. 2009.