# Plan

After hearing comments from some of my friends and seeing material online to suggest such, it has become apparent to me that creating a balanced FPS level, requires a skilled team and lots of testing.

I hoped to alleviate this problem, by creating a tool as a plugin for a game engine (UE4), that could procedurally generate balanced levels, based on a variety of factors (ultimately, 3 coefficients of Defensiveness, Flanking and Dispersion were chosen for this).

# Summarise aims/objectives

The overall aim of the project is that of creating a tool, that generates a level, for an FPS, that has an interior context (such as a cave or an office building), with one main degree of level gradient. In addition, the generator will produce a ‘balanced’ level, factoring in various aspects in relation to this.

# Demo software

* Time taken to development a framework for this tool (considering the nuances of using UE4)
* Only 2/3 coefficients were used (time)
* Although Wang Tiles were chosen as a method for balancing the generation of a level, it was decided that sticking to pure edge-colours for the placement of Zones, would not make sense later on into development of this tool, alternate heuristics were used instead, as well as considering the coefficients of course
* The levels that were generated, seemed to have a repeating number of a certain type of Zone, for the several of the rows from the first till the nth row (between 5th-8th row, at which point, different types of Zones would be chosen for placement).
* Intractable Problem: If one generated a level using this tool, with greater and greater dimensions, the tool would take longer and longer to generate a level (seemingly, on an exponential basis)

# Be prepared to answer questions on problems

In general, the project aims have all been achieved, as discussed in the previous section.

For the aim of creating a level that has one main degree of level gradient, although this was achieved, it could not be demonstrated, as the appropriate screenshots were not taken.

For the aim of having a generator that will produce a ‘balanced’ level, factoring in Defensiveness, Flanking and Dispersion coefficients, time constraints meant that the implementation of the Flanking coefficient into the Level Generator, could not be achieved.

The main learning points of this project are:

Time management should be considered more thoroughly at the start of the project

The scope of the project could be bounded by using appropriate planning tools and methodologies

I could have reviewed more literature prior to commencing the project.

If the project was to be repeated, I would probably choose to use a different game engine for the development of this tool, which would allow for a simpler implementation of the project; such as Unity 2017.

# Summarise Project and possible future development

The project’s overall aims are as follows:

* Creating a tool, that generates a level, for an FPS
* This level has an interior context (such as a cave or an office building)
* This level has one main degree of level gradient
* The generator will produce a ‘balanced’ level, factoring in Defensiveness, Flanking and Dispersion coefficients

These aims will now be considered in turn.

The first aim has been met, as detailed in the implementation section. This section details the creation of a toolbar plugin, in UE4, providing a base menu structure, that could be used to add an option for using the Balanced FPS Level Generator. Selecting this option shows a Property Editor for the Balanced FPS Level Generator tool. After the User has confirmed the options for the generation of the level, they are then able to click on the ‘GenerateLevel’ button, causing a level to be generated at the specified world position to the specified dimensions.

All the objectives for this aim have been met.

The second aim has also been met. This verifies that this aim has been achieved. All the objectives for this aim have been met.

The third aim has also been met, in that, the level has one main degree of level gradient. Unfortunately, as the screenshots of the level are top-down, this can only be implied. This issue has identified the need for ensuring that time is assigned to create screenshots that show the perspective point of view.

The fourth aim, to produce a ‘balanced’ level, factoring in Defensiveness, Flanking and Dispersion coefficients, has not been met in full. While Defensiveness and Dispersion coefficients are considered, the Flanking coefficient, although calculated, is not taken into consideration. The consequence of this is that a balanced level is produced, using the Defensiveness coefficient, regarding the amount of cover present in that Zone and, using the Dispersion coefficient, in relation to the distribution of objects in that Zone. But, because the Flanking coefficient has not been taken into consideration, the Level Generator would not factor in the quantity of Zones that will be adjacent to and surrounding the Zone placed at the current position.

The Flanking coefficient was not considered by the Level Generator, as my focus was on perfecting the implementation of the other two coefficients.

## Future Development

The project has highlighted that there are algorithms available for creating balanced levels, but, implementing these to create an appropriate balanced level for an FPS is not straightforward.

A project such as this, requires understanding of the available technologies and available time; as well as the needs of FPS Players, to enjoy playing an FPS on a level that is balanced for them, no matter which team they are put in.

In its current state, it is my belief that this project is a sufficient foundation that one could use for future development of a plugin for UE4, which could produce balanced levels for an FPS.