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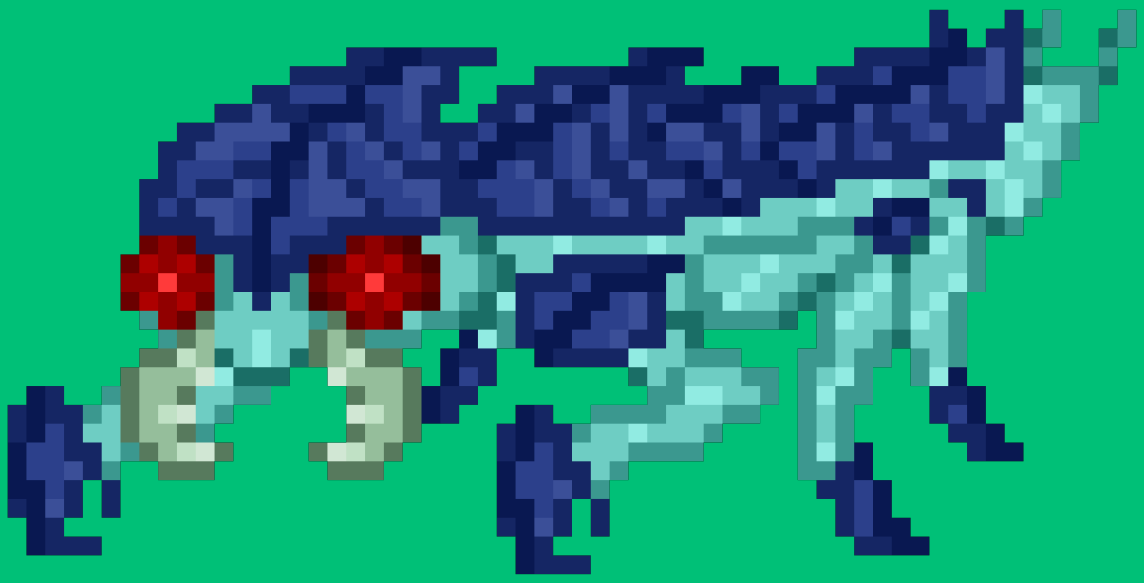

VOIDBORN

BA (HONS) COMPUTER GAMES DESIGN

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3794 WORDS

INTRODUCTION TO CONCLUSION ONLY

TABLE OF CONTENTS

ABSTRACT

The following document goes over the development process for Project Voidborn. The project was intended to demonstrate my personal capability to develop mechanics and gameplay from scratch with Unreal Engines Blueprinting system. Project Voidborn had been developed to be the main artefact of my Games Design Module, my final module as part of my Games Design course at Teesside University.

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Second Reader: Stephen Reeson
Metal Gear Solid Game Over Composer: Harry Gregson-Williams
Dungeon Crawler Baller (Sid Synthwave Remix) Composers: 8-Bit Weapon
The Essential Retro Video Game Sound Effects Collection Creator: SubspaceAudio
Enemy Pathfinding Input: Jamie Matthews
Industry Developer Input: Mark Jawdoszak (Gaslight Games Ltd) and Luke Wintflint (Coatsink Games)

Special Thanks to family, friends and fellow students who assisted me during the project's development.

LIST OF FIGURES

INTRODUCTION

With the recent increase of interest for roleplaying games such Dungeons and Dragons 5th Edition (Crawford et al., 2014)[1] and tabletop combat strategy games such as Warhammer 40k 8th Edition (Games Workshop., 2014)[2], the idea to develop video games that cater to these interests has become a more enticing idea. There have already been videogames that have taken influence from these non-digital games and found success in the online market. Games such as XCOM Enemy Unknown (2K Games 2012)[3] and Banner Saga (Versus Evil 2014)[4] play with turn based combat and have combat mechanics that function with similar basis to other non-digital games.

With proven success and an increase of interest from related media this means that there is a market for turn based combat strategy games. With this I planned to develop a core system that was influenced by tabletop rpg's and could be developed further into its own unique system. It is the intent of this project to develop an artefact that has mechanics and gameplay that fit within the turn-based combat genre using the Unreal Engine (Unreal Engine, 2020)[5]. This is intended to show that it is possible to do within Unreal and help demonstrate my own personal capabilities in doing so.

The following deliverables were created for the project proposal. These would be used to measure the success of my project come its conclusion:

- Mouse and keyboard control functionality
- A navigable combat grid system
- Minimum one player character type
- Minimum two enemy types with fitting AI elements
- A functioning turn-based initiative order
- Three controllable characters within the system
- One combat level

In addition to these regular deliverables I created a small list of potential elements that I would incorporate into project as stretch goals if work went well. These potential deliverables where as follows:

- A functional front-end UI system
- A packaged file executable
- A short proof of concept trailer to show others
- Custom art to make the game look pretty

RESEARCH REVIEW

The main areas of research came from the playing and dissecting various popular tabletop games and finding elements that repeated throughout all of them. These games included the following:

- Dungeons and Dragons 5th Edition
- Dungeons and Dragons Edition 3.5 (Cook, Tweet and Williams, 2003)[6]
- Mansions of Madness 2nd Edition (Fantasy Flight Games 2016)[7]
- Warhammer 40k 8th Edition
- Classical Chess (En.wikipedia.org, 2020)[8]
- Kingdom Death: Monster (Poots, 2012)[9]

Research also extended into looking into videogames that shared similar structure in the specifics of combat. These games included:

- XCOM: Enemy Unknown
- XCOM 2 (2K Games 2016)[10]
- Card Hunters (Blue Manchu 2013)[11]
- The Banner Saga Trilogy
- Warriors of Waterdeep (Ludia 2019)[12]

The purpose of this was to ensure that when it came to the development of my own system it would fit the genre properly and entice players who have played the games I have researched.

Visual elements where tested with public feedback as to ensure the aesthetic fitted the games genre (Tones, 2020)[13]. Custom art and word fonts where made to increase the overall quality of the project. This art was developed with inspiration from similar military sci-fi works of fiction such as:

- Aliens (1986)[14]
- Starship Trooper (1997)[15]
- Predator (1987)[16]
- Warhammer 40k.

Figure A. Surveyed Character Designs

Technical research was made very early on as to the feasibility of the project. There was not a great deal of pre existing information for the development of grid-based games within Unreal. There were examples of games such as XCOM: Enemy Unknown and XCOM 2 which were developed on heavily modified versions of the Unreal Engine, but most information of grid-based game development was for development on other engines. There were examples of premade blueprints available on the Unreal Engine Marketplace for purchase but given how the purpose of the project was to demonstrate my personal blueprinting skills, this proved counter intuitive. As such a large amount of time was spent experimenting before the projects official start as to find a way to achieve my objective.

Research on technical issues were made through out the course of the project's development. This being done as certain elements in scripting would not always function as intended and would require further understanding. A key example of this being the Enemy Blueprints Pathfinding, which required additional research during development.

CONCEPT DESIGN

The Voidborn project was conceived with three primary objectives, these being as follows:

- The development of a functional grid system.
- The development of a tabletop inspired combat system that demonstrates the grids usability.
- the demonstration of personal skill in the development of the grid and combat system.

In this way all three could be shown to potential employers as an example of value that I could add to their team if employed.

Voidborn was planned as a single player experience where the player would control a squad of agents sent on missions to exterminate alien threats. The Voidborn combat system works as follows. Player Agents and Enemy Agents take it in turns to defeat one another. An individual agent would take their turn to move and attack an opposing agent or using an ability unique to their character. Once their turn has completed the opposing force would have one of their agents take a turn and repeat the process of agents taking turns fighting each other till one side remained.

Figure B. Original Planned Initiative Order

Attacks would be made with an agent's weapon stats. They would make a number of attacks dependent on the weapon with a bonus to hit determined by the agent attack bonus. An attack would have a number generated between 1 and 20, emulating the d20 system of Dungeons and Dragons. If the total number generated was equal to or greater than the targets armour stat the attack would hit and proceed to deal damage. If the number generated was greater than the targets armour by eight or more then the attack would be a critical hit dealing a greater amount of damage. Damage would be reduced partially by the targets toughness rating if they had any, and then subtracted from their health. If the targets health was reduced to less than one the target would be knocked out of the fight.

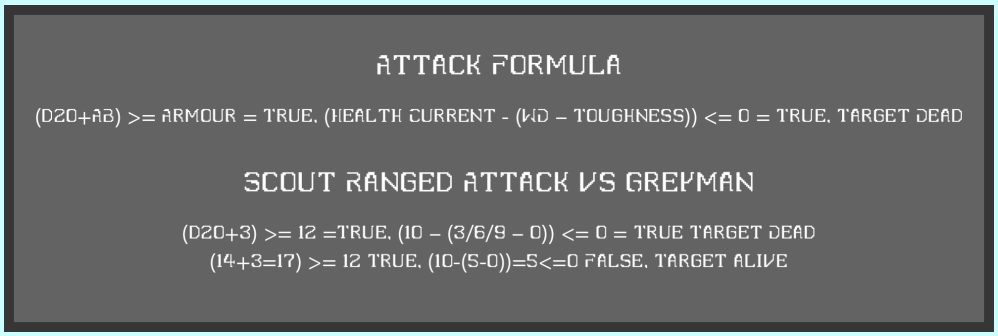

Figure C. Weapon Attack Formula

As well as having varying stats each agent was intended to have two abilities unique to them. These where designed to add further complexity and tactical thoroughness. However due to time constraints these and other mechanics had to be shelved in order to complete the project in time. These additional features could still be simulated in a tabletop scenario such as on such as roll20.net (Roll20, 2012)[17]

The original design also planned for the implementation of multiple playable agents, a squad so to say for the player to use. Certain mechanics where planned around the idea of having multiple agents such as the Aid-Bot's Targeting Lazer, a weapon that's special ability would give an ally agent a bonus on attacking a specific creature with a ranged attack. The squad of agents was intended to serve as a customizable group that could be loaded out with various agents' dependant on a mission briefing. For the Artefact what was developed was a basic combat level without the squad-

Figure D. Adapted Initiative Order

IMPLEMENTATION

The development of the project revolved around 4 blueprints. These being the Grid Tile BP (Blueprint), the Player Character BP, the Enemy BP, and the Initiative Order BP. As these elements where highly dependant on each other they could not be developed in a vacuum and as such are tightly linked with many castings between them

THE GRID TILE BP

The first BP that had to be developed was the Grid Tile BP. Without this the game would fail to function as intended. It was developed as a singular grid tile that could then be replicated and placed in the game level in a manner that allowed for various sized maps that did not need to conform to a one to one tile size. The map that was developed for the artefact had a 16 by 16 navigable grid space with a number of non-traversable tiles to help vary up the gameplay. Around this grid was a further set of tiles which where added to counter some of the pathfinding issues the Enemy BP found itself having.

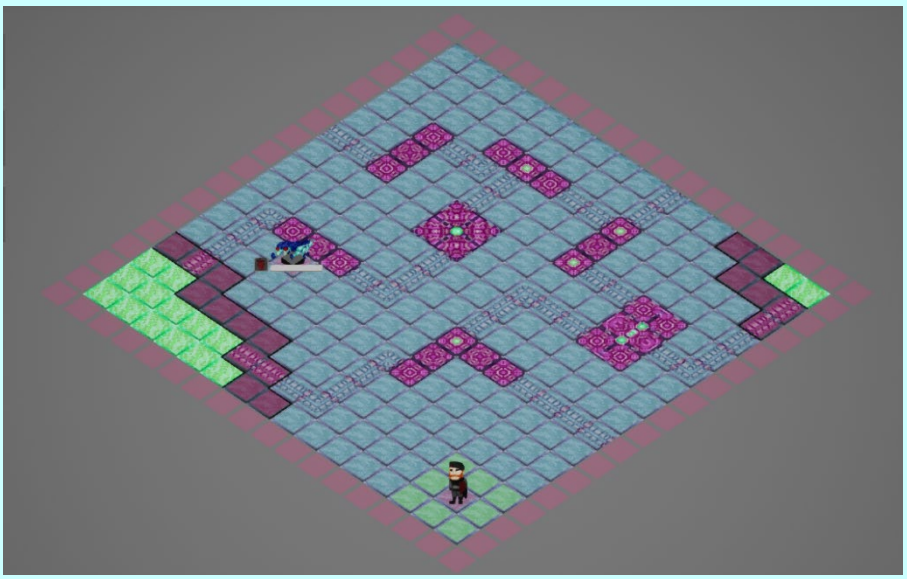

Figure E. Game Map Tiles Visible

Key information was stored on each tile such as its X and Y grid coordinates, its distance to the Player Character, the tiles that are directly adjacent to it, the traversable nature of the tile and whether the tile has a player or enemy tile upon it. These variables would be used for determining various aspects of the enemy AI and player capability. The ultimate purpose of this BP is to allow the communication and transfer of information between the Enemy and Player BP's. It is a vital aspect of this project and can easily be used again with some modifications to serve as a foundational mechanic.

THE PLAYER BP

The Playable Agents in the game are powered by the Player BP which stores all relevant information and variables for the player. The BP was developed so that it could be used as any given Agent in play. Before play begins the relevant attributes are set via the use of a game instance and a switch on int at the beginning of play. This sets all the relevant statistics for play and allows for easy development of new player agents. The original plan for the game was for three different agents but thanks to the set up of the blueprint the Sniper agent was added with ease.

When used in game the actions of the Player BP depended on what action had been selected in the HUD. Agents had the options of moving to adjacent tiles, making either a melee or ranged attack against an enemy or ending their turn if no valid actions could be taken. This worked off of an integer-based switch system that functioned similar to the Player Agent select process.

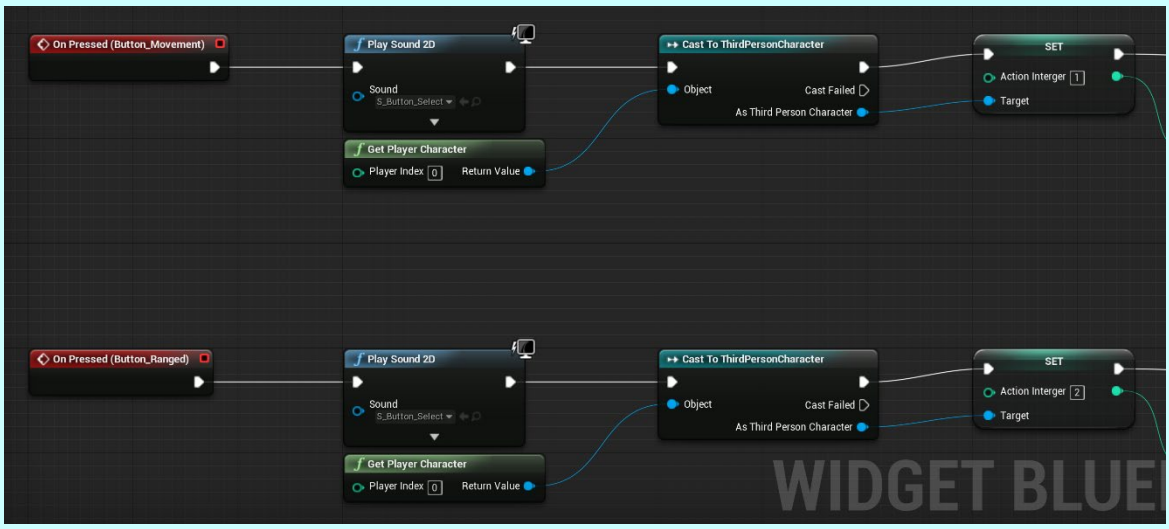

Figure F. Setting Action Integer Blueprint Script

Figure G. Ranged Attack Valid

THE ENEMY BP

The development of the Enemy BP was likely the most challenging aspect of this project. Before Voidborn I had never truly attempted to develop an enemy AI system. Because of this and the unique nature in which this game was intended to play numerous difficulties where encountered in its creation.

The Enemy BP was developed in the same integer-based system as the Player BP. However, the biggest difference between the two was the fact the Enemy BP required its own AI System. The AI system had to work with the two enemy types I had designed. These enemy types were as follows:

- Greyman, a range-based enemy that would flee melee combat
- Insectoid, a fast melee-based enemy that would pursue the player into close quarters combat

As can be seen, both enemy types would act and react to the player in differing ways. This meant that I had to develop to AI types, which was a challenge given my lack of experience in AI development.

Both enemies would make use of a path finding system in order to get closer to the Player Agent. This path finding system was to make use of the distance between the Enemy Agent and Player Agent, and then check the adjacent tiles of the enemy to see which one was closer to the player. Once this was done the enemy would move onto said tile and repeat the process till it reached a desirable range to the Player Agent or ran out of movement. This system of pathfinding had difficulties due to the potential risk of the closest tile being occupied by another Agent. As such measures where installed to avoid occupied or untraversable tiles when deciding where to move to. Once the Enemy Agent was in its desired range it would attack the player in order to defeat them.

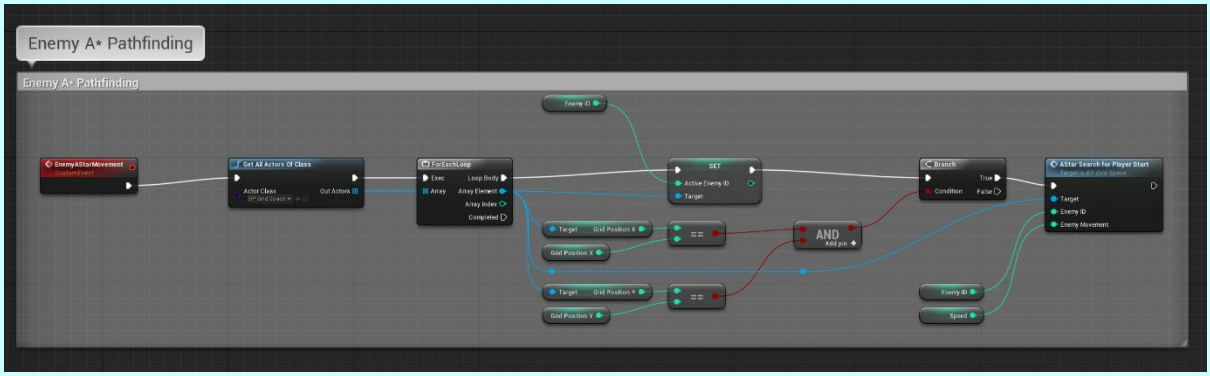

Figure H. A* Pathfinding Beginning Sequence

INITIATIVE ORDER BP

The purpose of the Initiative Order BP is to ensure that at the end of the players turn the enemy turn can be taken and adapt dynamically in the occurrence of an Enemy Agents removal. The way in which the Blueprint worked was as follows, at the start of the game the Blueprint would check to see how many Enemy Agents where in play, this would make an array which would take the Enemy Agents ID and only allow the appropriate Enemy Agent to act.

Figure I. Initiative Order Progression

In the case of an Enemy Agents death the Initiative array is reset with the now dead Enemy Agent removed. This does however cause the order to completely change meaning that the previous order of enemies may not be the same. For example, the insectoid that had previously acted in the initiative could be set to act next. This could be caused by the death of Greyman A by the Scout on turn 3. As such this could be reset in one of two ways as shown in Figures J, K and L.

Figure J. Initiative Order Reset Required

Figure K. Initiative Order Reset Version A

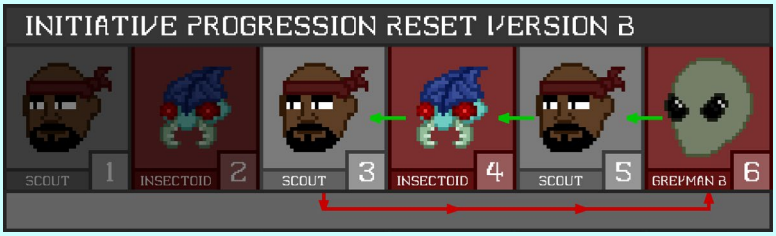

Figure L. Initiative Order Reset Version B

CUT ELEMENTS

In the original design for the artefact the player was intended to control three agents in a given match. This had to be cut due to a lack of time made available to develop. In the current artefact only one agent can be played at a given time. This had a knock-on effect to other elements of design which had relied on the idea of multiple player agents.

There was plans for the inclusion of a special ability that an agent could use on their turn as well as a consumable item, but these were sadly unable to be fully developed before the submission date and as such where not integrated into the game. The Special Ability can be seen referenced in the individual Agent Profiles which also include a Passive Ability that also was unable to be included.

In addition the initiative order is also not fully tested as it had to be edited extensively near the end of development as a major problem had begun to occur. This has been mostly solved but there are the occasional errors.

PROBLEMS AND SOLUTIONS

During the project's development there were no major tech troubles in regard to software. Most issues came from a lack of knowledge in a given field such as with how to do Enemy AI Pathfinding, which was solved with research and peer recommendation.

The basis of the enemy movement was developed with elements of A* Pathfinding as recommended by Jamie Matthews. The system was partially integrated but not completely as the system only needed to work at a minimum level. There are definite areas in which the system could function better and become more fleshed out, but the purpose of this project was to be focused on the grid and not the AI. In addition, the amount of time it would have taken to fully develop would have meant less work could be done in other areas.

There was one major issue that could not be solved in time, this being the integration of multiple Player Agents in play at once. The squad system was something that I had planned to have integrated and research into proper implementation was being made, again with some advice from Mr Matthews. The issue that ultimately lead to the removal of the squad was the factor of unforeseen circumstances outside of personal control.

A month's worth of working hours was unavailable due to the effects of the Covid-19 Lockdown in the United Kingdom. This delay in development resulted in several elements to be cut from the final artefact. Thankfully I had started working on parts of the project ahead of time. This cut down on the pressure of the project somewhat as it allowed time for the proper research and testing of complex mechanics.

TESTING

If there was one thing that I regretted about this project, it would have to have been the lack of large-scale testing of the artefact. This is not to say no testing had be done, on the contrary a fair amount of testing took place continuously through out development. This was to ensure mechanics worked as intended and to see if there were any obvious game breaking bugs in the game.

Testing would work via me making minor changes to a blueprint and seeing the effect it would have on the game. Often when a problem arose the solution was to use print strings to show where the script was going wrong. This allowed for numerous fixes to be made in a short span of time.

The problem with this style of testing was the fact I was fully aware of how my game worked, inside and out and lacked the input of first-time players. There were builds of the game released to the public early on, but very little feedback was given, and the plans for in person testing fell through due to the Pandemic.

I was able to offset this issue somewhat via the input of industry professionals Luke Wintflint and Mark Jawdoszak. They assisted with their thoughts and suggestions. Additionally during the final stretch of development I have been making great use of the guinea pig that is my father. His advice as an everyman consumer was very beneficial as it helped influence areas of the games UI which lacked clarity. Specific elements that where brought up was the lack of feedback for the player when they where in range of an enemy. This was solved with the introduction of targeting markers that would change colour dependant on whether the enemy was within range or not.

EVALUATION, OVERALL RESULT

When looking at the objectives set by myself in the proposal and the final output that was achieved, we see the following:

Key Deliverables	Status
Mouse and keyboard control functionality	Successful
A navigable combat grid system	Successful
Minimum one player character type	Successful
Minimum two enemy types with fitting AI elements	Successful
A functioning turn-based initiative order	Partial
Three controllable characters within the system	Partial
One combat level	Successful
Stretch Goal Deliverables	Status
A functional front-end UI system	Successful
A packaged file executable	Successful
A short proof of concept trailer to show others	Unsuccessful
Custom art to make the game look pretty	Successful

The majority of deliverables were met with success. Of the Key Deliverables the initiative order and three player characters were partially successful but not fully. Of the Stretch Goal only the trailer was unsuccessful, but it was the most ambitious and the lowest on priority.

The reason for my labelling of the initiative order and the three characters as partial successes are as follows. The initiative order does function properly the majority of time, but I cannot say with full certainty that it works every time. The initiative system would be deemed a full success if I had the time to fully test it to the extent I desired, but due to the time constraints that I am under I am unable to.

In regard to the three characters this is both a success and a failure, depending upon the view you take on its meaning. As stated earlier in the report the original intent of the project was to have a squad of characters to control simultaneously. This has been unsuccessful for the reasons previously stated. That said I have also already stated the fact that I have been able to make more playable classes then I originally planned. The artefact contains 4 playable classes which the player may choose from before playing. In this way I have succeeded in having 4 controllable characters, though they control as individuals and not as collective. As the original intent was for both factors to be integrated, I have decided on the labelling of partial. Had world events played differently I think I would say I would've called this a full success.

EVALUATION, REFLECTION

Looking back at the development of this project there are several areas that could've been done better. The out put of work took a drastic nosedive near the end of March which sadly could not be recovered from till early May. This isn't to say work had not been achieved during this time, but when compared to the out put of January and February the later months pale at the quality and quantity. In truth had it not been for the Pandemic and its unforeseen misfortunes I would confidently say that this project would have been a near complete success.

This isn't to say I am disappointed with what I have been able to produce, I am still proud of work. It is just a shame it couldn't be completed fully in time. That said I have achieved a great deal in this project. I have tackled issues outside of my own control and been able to overcome them. The fact I was able to develop an AI system with practically no prior experience is something that I am pleased with, even if it could do with some fine tuning.

My intent now is to continue developing the project after the submission. It is incomplete but given the encouraging words from those who I have shared it with, there is a great deal of potential yet to be achieved. The summer is to be a long one. My original plans to further my studies at the university may not be available, depending on the development of the pandemic. But should my studies resume or not I am eager to continue to develop Voidborn.

With this said the project was able to achieve the majority of its deliverables despite complications. When further development is done the main objectives would be as follows:

- Iron out the issues in the enemy's initiative order and pathfinding
- Implement the active and passive abilities that where cut for time
- Properly develop squad mechanics and multi agent play
- Add additional enemy types and variants
- Add more levels with varying terrain features

CONCLUSION

I will say, I believe this project has been a success. Much has been learnt during its development, be it creating AI or gaining a further understanding of game theory. Many a long workday was needed for success, and one to many all-nighters then one would want to have. There has been trying times to be certain, but this has been an experience that gives me hope. All I can do now is give my thanks to those who have assisted me, be it great or small. Voidborn has been a success and has proven my capabilities as a Games Designer. Thanks to you all.

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