

Unity board game with cards



**Dublin Business School
Capstone Project Final Report
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¹ Unity logo taken from
<https://unity.com/legal/branding-trademarks>
Last accessed 07/04/2024

Abstract

For this project, I have made a digital board game using the Unity engine. I chose this project because I had already learned the basics of Unity in my own time and wanted to learn more about it while also developing my skills in C#. This was done entirely from the ground up and I enjoyed using C# in a way that I could visualize the code I had been writing.

The game itself plays like a standard board game with 4 players rolling a dice on their turn and moving around the board. The goal of the game is to reach the number of points set at the start of the game. Points are obtained by doing a lap around the board. The added twist to this game is the special spaces on the board which will grant the player one of 3 elemental cards. Once picked up the player can choose to use their cards on their turns to give them a modified effect to their next dice roll. Each element card grants a different modification and will be removed once they are used. 2 event spaces have random good and bad effects to add another bit of randomness to the game.

There are also UI elements to keep track of current turn order, player's scores, and player's card inventories and there is text in the centre of the board that updates with events within the game like player's getting cards or getting points. The game is designed to be straightforward for anyone to play and features a mix of randomness and strategy with when to use the cards.

Acknowledgments

I would like to thank my project supervisor Clive Gargan for the assistance on how to approach this project and the report.

Damien Kettle was also very helpful in giving advice several times when I demonstrated my project to him. I used the feedback he had given me to create a better project.

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Chapter 1: Introduction

The Aims of The Project

As stated in the abstract, this project aimed to create a unity game from scratch with only basic knowledge before making it. I knew before starting the project that I would need to learn the limitations and helpful features of Unity to make my game. With the Unity Engine being written in C/C++, I also had a lot of learning to do to write working and clean code.

The Scope of The Project

The scope I had set for myself when choosing this project was to make an interactable game that allowed up to 4 players to join in. I wanted the base of the game to be a board game with my idea of adding cards that players will collect by landing on certain spaces on the board. The cards would enhance the dice roll of the player that used it or can be saved to maybe remove a card from another player.

I wanted the game to not be overly complicated to make it more efficient to demonstrate so using a board game that many people would be familiar with was a good way to do that. Then adding the cards would make it more unique and add some strategy instead of the game being entirely based on dice rolls.

I also set out in my proposal to have the option for bots controlling players who are not there. This made it so the game could be played by 1 or 4 people.

When setting my scope, I already knew for visuals and audio I would be getting nearly all of those assets from Unity's Asset Store which can be used by any user of the engine and there are lots of ready-to-use resources there.

The game is played entirely locally but I may come back to this in the future and expand the game with more features and online multiplayer, Unity features many options to make online multiplayer a possibility.

The approach used in carrying out the project

After writing my project proposal around December I started the project in January and began by first getting the foundations of the game made. I had planned developments I had written before starting which I used as a list of priorities as I worked.

Before starting anything on the actual game itself I first needed to make sure my project was backed up in case of any files being lost or corrupted. I did this by using the version control features I downloaded from Unity's site. This will be discussed further in the technologies section of the report. After making sure the work I was doing would be backed up online I started going through the list I had created and when I ran into any difficulties with using Unity or writing the code itself, I would search online. YouTube was a great source of helpful tips when making the game and I learned lots of ways of making the whole process easier to work on from them.

Any milestones in making the game were immediately backed up and given notes to show what was added or changed.

As I worked on the game, I also met with my supervisor over video calls to give updates and for insight on any changes that should be made.

Chapter 2: Background

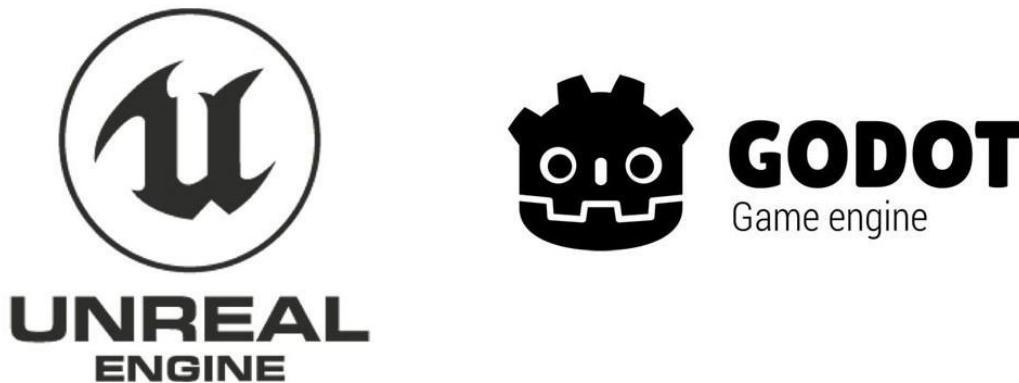
Context of the Project

By being interested in playing games myself, by making one in Unity as I would be developing my coding abilities while also making something I was enthusiastic about.

From researching while preparing my project proposal I learned just how popular Unity was in the game development field. An article by Arnia (a software development company) said it very well:

“The perks that it offers, such as the excellent graphics, compatibility with multiple platforms, strong community, and its unique and efficient features, like the play mode option, have made Unity stand out of the crowd.”²

When I heard just how popular Unity was, it made me want to pursue using that game engine over others in the market such as Unreal or Godot. Also with such a large community, I knew if I ran into any issues using the engine I could always look up solutions online to seek help.



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When I first chose to use Unity in my project I had only very basic knowledge of using the application so this was going to be a difficult task for me as I would need to learn to effectively use the tools provided by Unity while revising my C# skills. From following game tutorials over the Summer, I already knew that making the game would mostly be creating scripts for objects within the game and I had to be prepared to use what knowledge I had but also be ready to research methods to use which I had known about previously.

² Arnia Article on Unity's popularity

<https://www.arnia.com/what-makes-unity-so-popular-in-game-development/>
last accessed

³ <https://learn.unity.com/tutorial/exploring-the-editor-layout-2019-3#>

Unity layout picture taken from this Unity tutorial
Last accessed 07/04/2024

Typical Users

With the project finished, I stuck by the goal set by the interim report and kept the game very accessible for all ages. The controls are done entirely with the mouse and all fonts are big and legible. I purposefully chose an easy-to-read font and used big buttons for this exact reason.

Any Relevant Existing Software/Hardware

The most relevant software used during the creation process of this project was Unity itself and Visual Studio.



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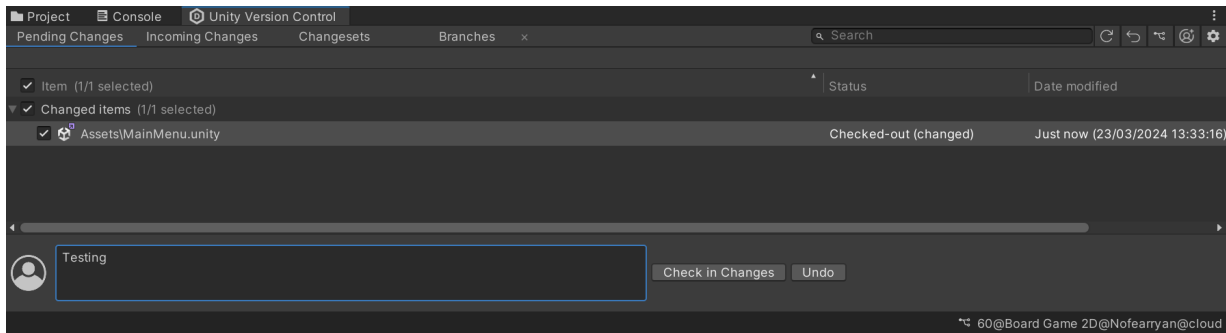
I knew the fundamentals of using Unity before starting the project, but after finishing this project I am a lot more confident with the features I had already been using and also learned a lot of new ways of using the app to the fullest. Some examples are learning how to import assets from the Unity Asset store and how to create multiple scenes for the game to make a start menu.

Visual Studio worked very well for writing the scripts I was using within the game. There were no issues using Visual Studio and worked very well paired with Unity. Any files that were updated within Visual Studio would immediately update within Unity which made testing a lot more manageable.

Source Control

Now with the game complete and ready for demonstration, I can confidently say that if used properly Unity Version Control is a great tool to use while developing in Unity. Once a project is backed up online to the Unity Cloud, it is very easy to make different branches of a single project and switch between them. I used it a lot when reaching any milestones in the project and made sure to note what additions had been made or changes. Also, on several occasions when some additions may have caused issues, I could simply undo those changes to the point at which I last saved my progress so there was no stress. I will be using Unity Version control in any future Unity projects I make.

⁴ Unity Logo
<https://unity.com/>



Version control tab within Unity project for checking in/Undoing changes.

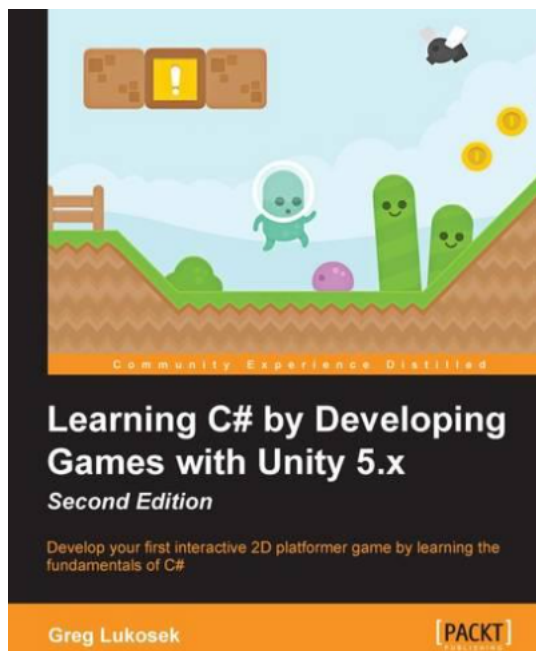
Chapter 3: Literature Review

While creating the game, I ran into a few roadblocks when it came to integrating some features that I could not do by myself. As mentioned before, there is a huge community of game developers who have shared guides on some aspects of Unity and C# to help people make their games. I found several articles on some issues, but two particular guides were the most helpful. Here is a book and video I found very helpful while developing my game:

Learning C# by Developing Games with Unity 5.x

“Learning C# by Developing Games with Unity 5.x” by Greg Lukosek was a great way of reading up on some Unity features I was unfamiliar with while also learning some new C# methods. The book does take several chapters before even beginning to write any code, but it does teach many lessons on how to properly organize files and game objects which makes the process much smoother. It also teaches good game design principles such as how to make UI appealing and scene management.

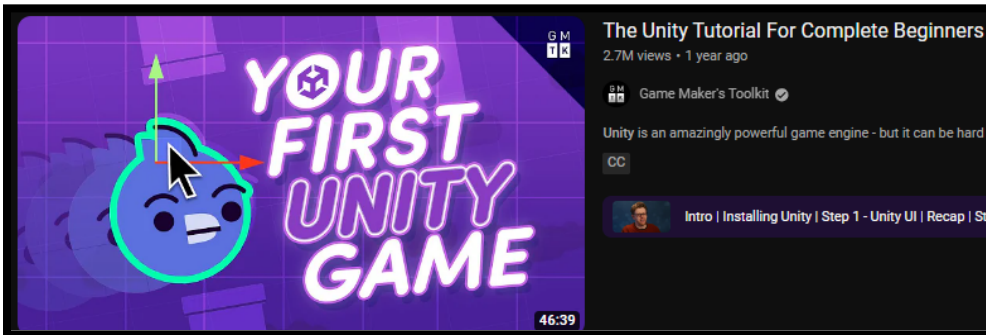
I would have preferred more visuals in the guide instead of blocks upon blocks of text, especially with Unity having a lot of menus to navigate through. I did not return to the guide after reading through it, but I did learn many good habits from it.



The Unity Tutorial for Complete Beginners

This video titled: “The Unity Tutorial for Complete Beginners” by the channel Game Maker’s Toolkit is a very well-put-together video describing step-by-step the process of making a game using Unity. The video explains the fundamentals of Unity’s UI, the game engine physics, and how to create game logic and UI elements.

Even with my game being very different in comparison to the one being worked on in this video, the content in this video was useful for me even during the middle stages of making my own game. It



helped me to understand a lot of aspects of Unity that I was not fully aware of beforehand, and I returned to this video several times for reminders on some key components of Unity and writing scripts.

Chapter 4+: Project Specific Chapters

The learner should discuss with his/her supervisor, the organization and content of these chapters?

Getting Assets and Audio

Some assets were made by me such as the player character and cards but the UI boxes, board background, and fonts came from two packs on the Unity Asset Store. The Unity Support page describes the store as:

“The Unity Asset Store is home to a growing library of free and commercial assets created both by Unity Technologies and also members of the community.”⁶

⁵ Unity Guide book : “Learning C# by Developing Games with Unity 5.x” by Greg Lukosek

https://www.awesomebooks.com/book/9781785287596/learning-c-by-developing-games-with-unity-5x/used?gad_source=1&gclid=Cj0KCQjw2PSvBhDjARIsAKc2cgO5_c3NCo6l5UJgJ8-bZAM6EfkbphUQEpBpfYHMqGKfH2cshXikUwaApYOEALw_wcB

Last Accessed 07/04/2024

⁶Article on Unity Support website about Unity Asset Store

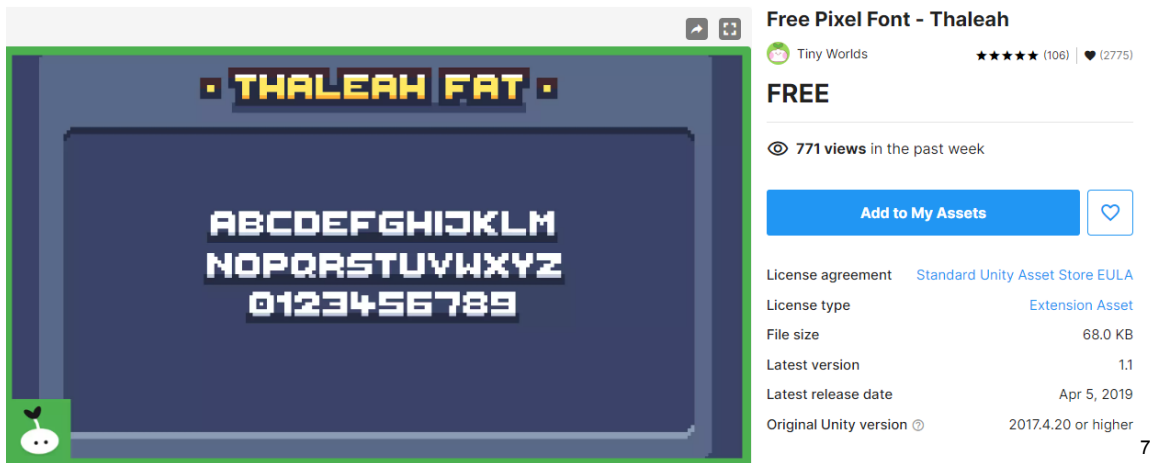
<https://support.unity.com/hc/en-us/articles/210142503-What-is-the-Unity-Asset-Store-and-how-do-I-purchase-Assets#:~:text=The%20Unity%20Asset%20Store%20is%20home%20to%20a%20growing%20library,examples%2C%20tutorials%20and%20Extension%20Assets.>

Last Accessed 07/04/2024

From my own experience, the store is a great feature of Unity and the community has shared a lot of amazing work for others to use, including free assets which I have made use of for this game.

The two asset packs that I used were:

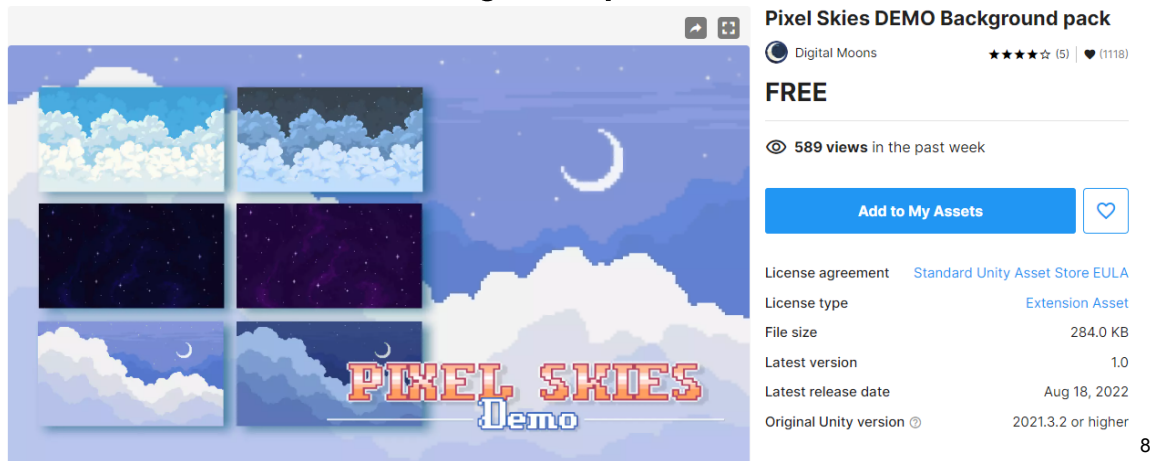
Free Pixel Font - Thaleah



The screenshot shows the Unity Asset Store interface for the 'Free Pixel Font - Thaleah' asset. On the left is a preview image of a pixelated font set with the title 'THALEAH FAT' and two rows of characters: 'ABCDEFGHIJKLM' and 'NOPQRSTUVWXYZ', followed by a row of numbers '0123456789'. On the right, the asset details are listed: 'Free Pixel Font - Thaleah' by 'Tiny Worlds', rated 5 stars (106 reviews) and 2775 likes. It is marked as 'FREE' and has 771 views in the past week. A blue 'Add to My Assets' button is present. Below this, a table of metadata is shown: License agreement (Standard Unity Asset Store EULA), License type (Extension Asset), File size (68.0 KB), Latest version (1.1), Latest release date (Apr 5, 2019), and Original Unity version (2017.4.20 or higher).

License agreement	Standard Unity Asset Store EULA
License type	Extension Asset
File size	68.0 KB
Latest version	1.1
Latest release date	Apr 5, 2019
Original Unity version	2017.4.20 or higher

And Pixel Skies DEMO Background pack



The screenshot shows the Unity Asset Store interface for the 'Pixel Skies DEMO Background pack' asset. On the left is a preview image showing a grid of six different pixelated sky backgrounds (daytime, night, and various cloud patterns) and a larger image of a night sky with a crescent moon and the text 'PIXEL SKIES Demo'. On the right, the asset details are listed: 'Pixel Skies DEMO Background pack' by 'Digital Moons', rated 5 stars (5 reviews) and 1118 likes. It is marked as 'FREE' and has 589 views in the past week. A blue 'Add to My Assets' button is present. Below this, a table of metadata is shown: License agreement (Standard Unity Asset Store EULA), License type (Extension Asset), File size (284.0 KB), Latest version (1.0), Latest release date (Aug 18, 2022), and Original Unity version (2021.3.2 or higher).

License agreement	Standard Unity Asset Store EULA
License type	Extension Asset
File size	284.0 KB
Latest version	1.0
Latest release date	Aug 18, 2022
Original Unity version	2021.3.2 or higher

I previously experimented with other backgrounds and fonts for a more fantasy like aesthetic, but it was hard to distinguish the background from the board spaces, so I went for a more simple and appealing background. These two asset packs work great together and give the game a nice retro/arcade game feel.

Near the end of the project development cycle, I was at the stage to add audio to make the game more appealing and also provide feedback for different events within the game. The main events I wished to feature audio were rolling the dice, getting a point, and winning the game. I also wanted the game to feature background music because the game would be too silent with only occasional sound effects.

⁷ Free Pixel Font – Thaleah

<https://assetstore.unity.com/packages/2d/fonts/free-pixel-font-thaleah-140059>

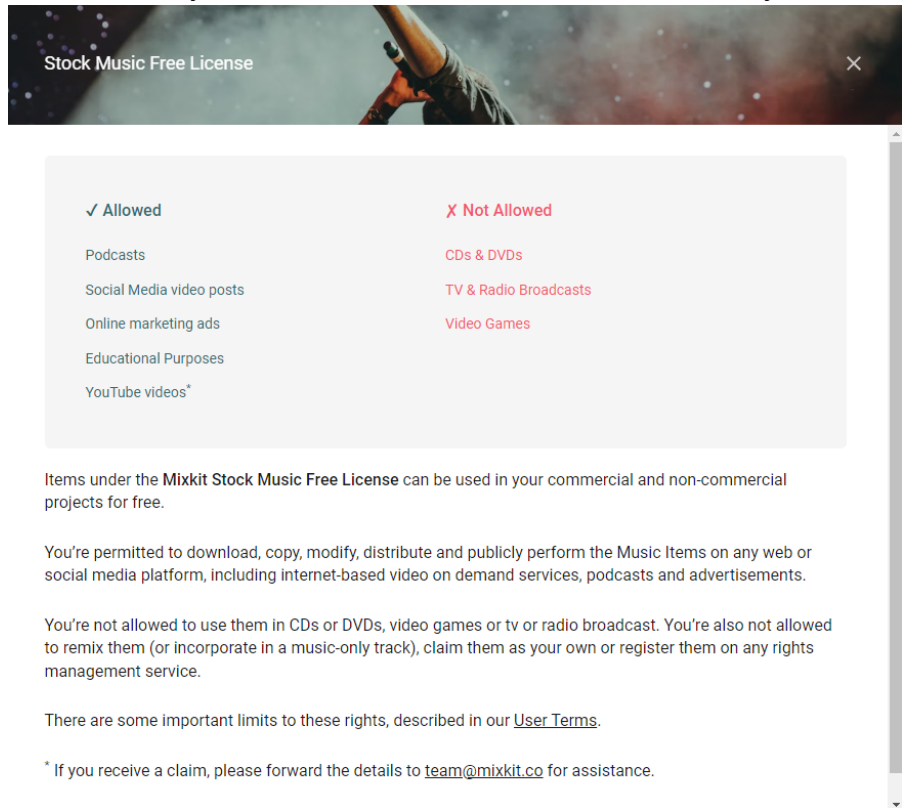
Last Accessed 07/04/2024

⁸ Pixel Skies – Digital Moons

<https://assetstore.unity.com/packages/2d/environments/pixel-skies-demo-background-pack-226622>

Last Accessed 07/04/2024

I downloaded all of the music and sound effects from the website Mixkit which hosts a huge library of stock videos, sound effects, and stock music for use in projects like my own. As seen below, a free license allows me to use their music as long as it is for educational purposes. As I am not publishing this game for public use with any of the sound effects or music, I am okay to use it.



⁹ Mixkit Free Music Licence picture
<https://mixkit.co/>
Last accessed 07/04/2024

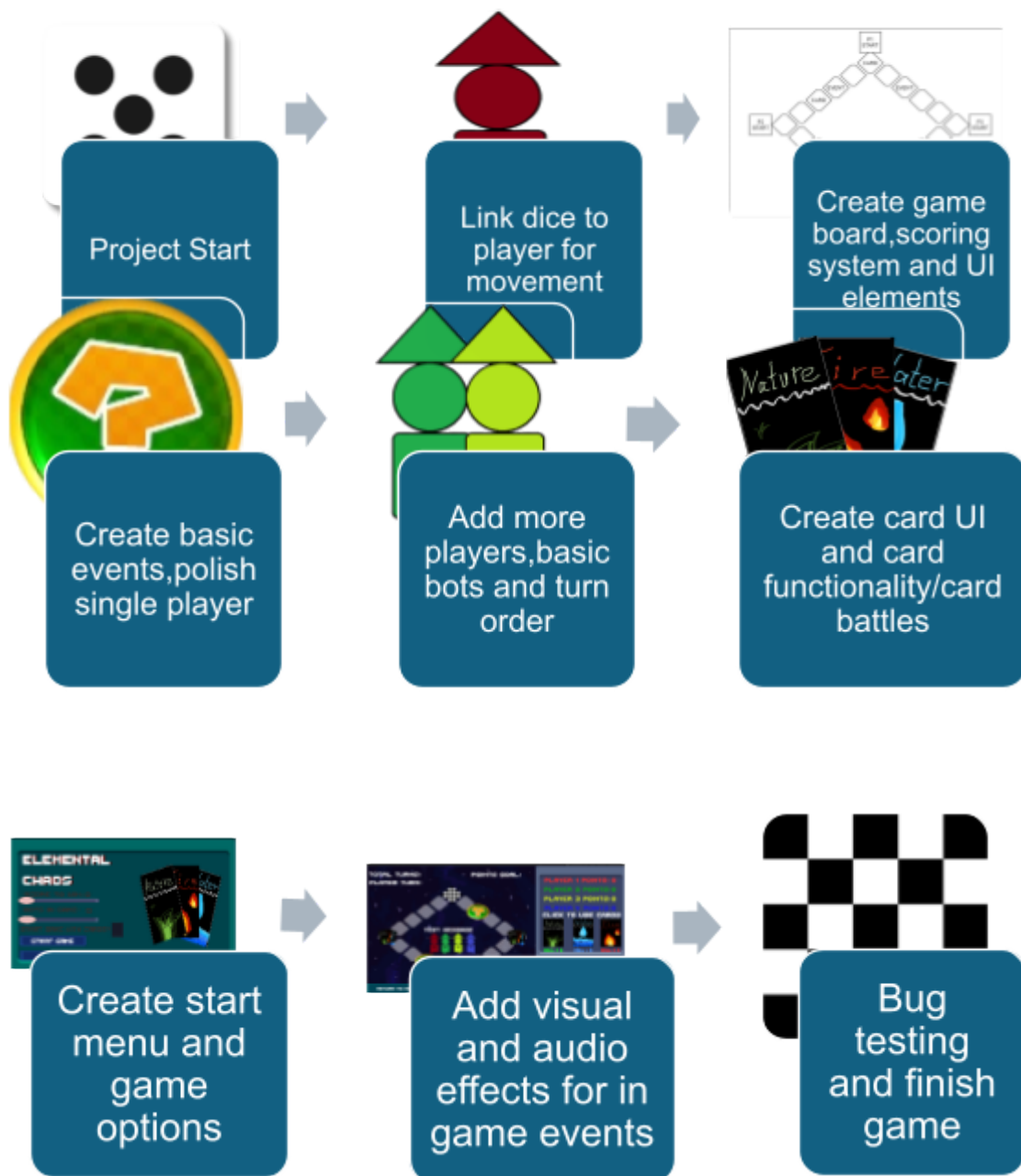
Chapter 5: Results and Evaluation

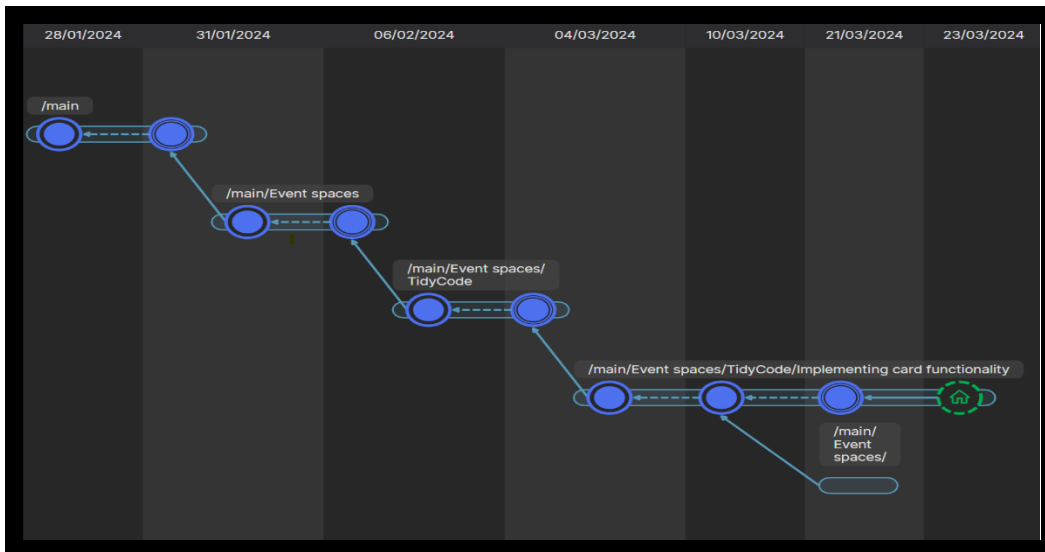
Final Development Timeline

Stage 1 - January

Stage 2 - February

Stage 3 - March





Unity Version control visual of branches being made during important milestones.

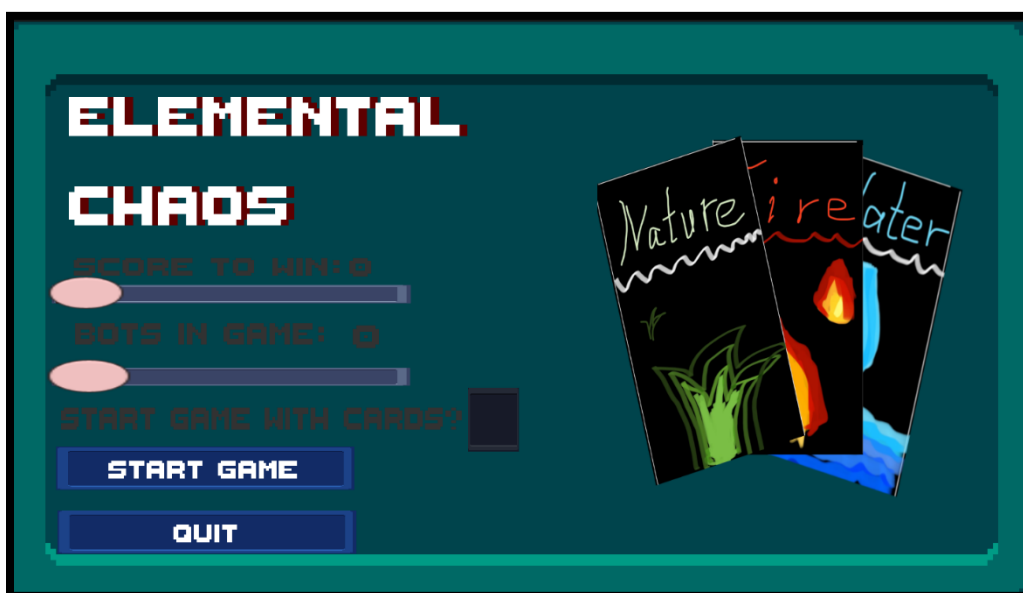
Game appearance

For the final version of my game I have two scenes, the main menu and the main game.

Main Menu

The main menu serves as a way to change different aspects of the main game, those being the score to win the game, the number of players controlled by bots and if the players start off with cards in their inventories or not.

After the options are selected the start game button will switch the scene to the main game with the chosen settings. When creating the main menu I also felt having a game title would be appropriate so I went with the name I chose in the project proposal: Elemental chaos.

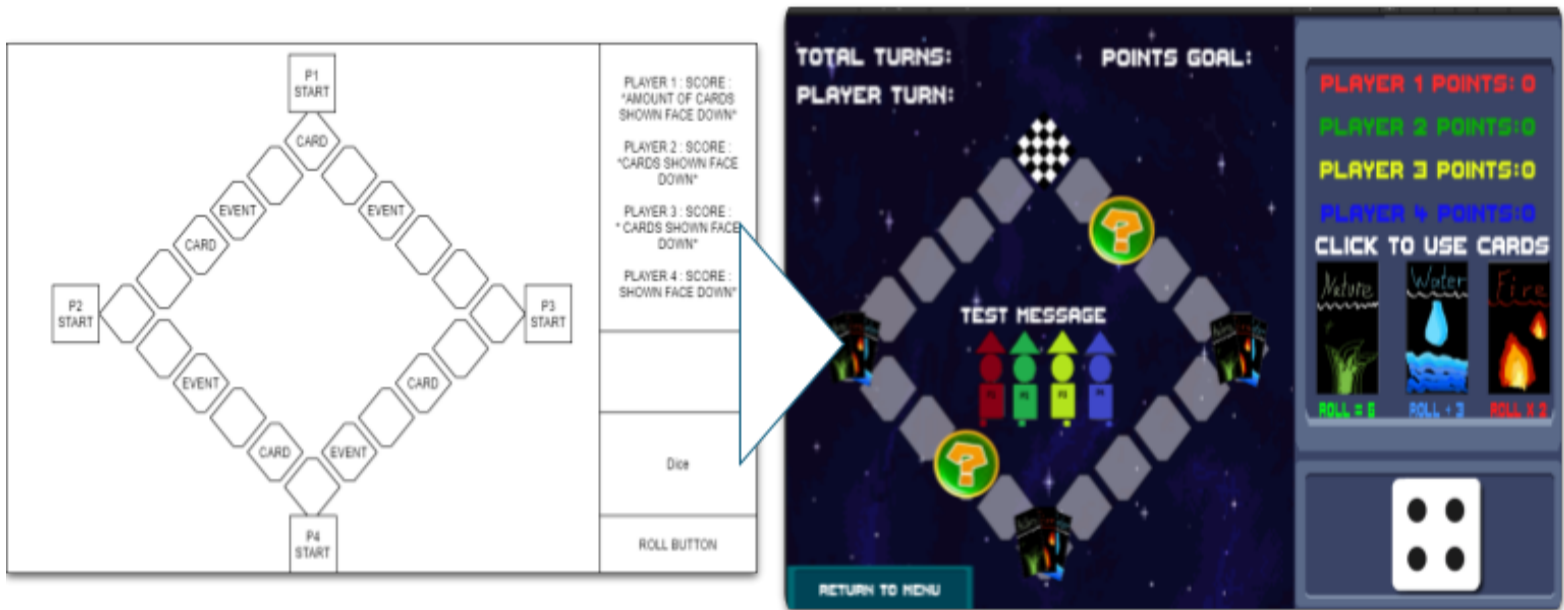


Main Game compared to old concept

For the appearance of the main game, I am happy that I stuck mostly with my original vision of how the game would look. Seen below is the original board game concept I had done for the project

proposal with the diamond shaped board, UI elements on the right-hand side and a space dedicated to the dice in the corner which were all kept in the final version. The original board design had each player starting in separate parts of the board, but I changed this during development to wanting to keep the code more manageable and have all players sharing the same script.

Another big change to the appearance of the main game is the card menu. If you look at the two images below you can see the plan at the start was for each player to have their cards face down under their score. This was originally planned to be the case if I ever implemented online multiplayer which was not the case when setting the expected scope in my interim report. I instead opted to use a card menu which stayed in one spot and would update depending on the current player's inventory. I am very happy with how it turned out and it allowed me to have enough space to display what each card did underneath them. The pixel font and background I downloaded from the Unity Asset store helped to make the game more appealing to play and the game is clear with what can and can't be interacted with only the dice and cards being clickable.

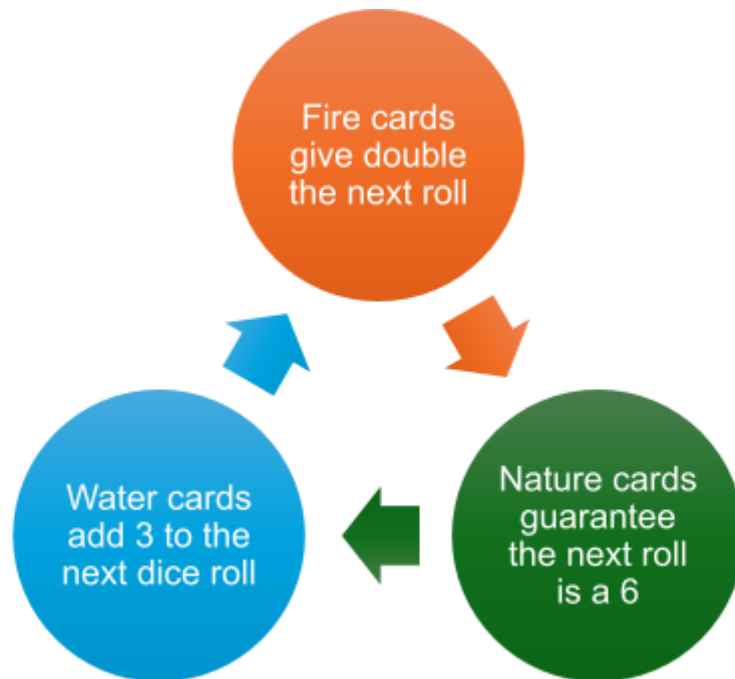


Final version of gameplay

The latest and last version of the game for this project plays nearly as I hoped based on my project proposal and interim report. I will discuss the changes made to the game in the next chapter, but there are no more renditions planned for this project. After bug testing each feature to ensure that the game will play out as intended in different scenarios in place here is how a typical game of Elemental Chaos would go:

- Upon running the game, the game start menu will display first with the game title, options to decide how game will play and the start/quit buttons. The points to win can be set from 1-10 points depending on how long the players involved want the game to go. The bots slider decides how many of the 4 players will be controlled by bots. Bots are designed to just roll a dice when it is their turn and will not use any cards they pick up. The last option is when the game starts should all players start with one of each card type or not. Having all card types will make the game go much faster but does not guarantee a victory for the first player because after using a card it is removed from your inventory.

- Once the game setting has been chosen the main game will begin, and the number of chosen bots is set starting from the last player. For example, if 2 bots are set then players 3 and 4 will be controlled by bots for the rest of the game and players 1 and 2 will still require player input for card selection as well as dice rolling.
- The turn order stays consistent for the whole game simply going from player 1 to 4, each player starts with 0 points. The score to win that was previously set will always appear on the top right of the board as a reminder.
- The dice are coded to be animated when clicked before landing on random number between 1 and 6. The player then moves that many spaces on the board. There is also a text box in the middle of the board which will display different events happening in the game for more clarity such as rolled dice roll result, when a player gets a point, the results of a card battle and more.
- After rolling the dice there's a chance a player lands on a special space, that could either be an event space or a card space. Event spaces have 4 different random events that could occur when landed on. They can move the player 6 spaces forward, give them a random card, give a point and if the player is very unlucky, they could lose a point. This was to balance out the event spaces and make the game more interesting.
- Card spaces provide one random card to the player who landed on it. Each player can hold one of each card type and in the final version of the game, all cards can boost the player's roll on their next turns if they use it. There are 3 card types:



- Card battles can occur if one player lands on another and then their card inventories are compared and if one has a card type that beats the other's then they win the battle. If the player who started the battle loses, they do not get a card removed but the other player would. These can end in a tie if both players have the same cards, or one player has no cards.
- This is what a typical turn involves and then the next player's turn starts. If a player does a lap around the board, they get a point and first one to the point goal wins the game which will be displayed in the middle of the board and the game will end with some visual effects to show it is over. From there the application can be closed or players can choose to return to the start menu to begin another game if they want.

Evaluation Of the Final Project

In evaluating my project, I would say it was a success in what I set out to do which was to create a game using Unity from scratch and learn how to use the application while improving my C# coding abilities. There were some slight issues I will be addressing but overall, I am content with submitting this project.

I completed all the goals set out in my project proposal and interim report and did not need to cut any major planned features set in the scope.

Due to my lack of experience with using Unity and my limited C# knowledge I did run into several issues while developing the game. I was able to use online forums for help on several occasions but especially midway into the project more issues were occurring, and it was more difficult to look for advice online when I already have multiple C# classes objects with their own attributes and methods I need to think about. Several times in the project I would be halted in my progress because I needed to sort out an unknown issue through bug testing.

It helped that as was creating different methods I was commenting on most lines of code which made testing for issues much easier as I went through them.

The game is based almost entirely on luck and random events just like most real-life board games. Some players may find this off-putting. Also, the change to card battles was overall for the better to keep it fast, but I feel it took some of the strategy out of the game.

Chapter 6: Conclusions and Future Work

Review Of the Project's Achievements

This project was one of the longest projects I have done by myself and it taught me a lot about how to manage a project of this scope in the IT world. I learned the importance of project proposals and interim reports. Setting manageable goals and when I eventually ran into issues, I had to research the best methods to progress which worked with the vision of the artifact.

This game was made for the sole purpose of setting a goal for myself which involved learning how to use Unity to make a game while also improving my C# coding abilities. With the game done and ready for submission I can say I have achieved that goal.

Changes to Game Design and Rules

Looking back over my project proposal and interim report, I am confident in saying that I have completed my goal of making a board game in Unity and have learned a lot during the process. There were some changes I made while making the game either out of limitations or because I felt the game would be better with them. Here are some of the changes I made to the game design and rules compared to the interim report:

- The biggest change was to the planned card battles. The original plan was very ambitious and featured players going against each other using the cards they got during the game to battle for points in a mini-game. These were heavily scaled down in the final version of the game for several reasons, the main one being how much time it took for the planned battles to take. I ended up changing the whole card battle idea to just be when a player lands on another, both of their cards are compared and if the player who landed on the other has a card that is strong against theirs, they will destroy the weaker card in the opponent's inventory.

This change is not as impactful as I wanted it to be when I started but I think it is a good compromise for the flow of the game and still using the different card types for a bit of strategy.

- I also made some other changes to some aspects of the gameplay since submitting the interim report for the better. Such as changing the goal of the game to reach a set amount of points to win instead of seeing who has the most points at the end of a selected amount of turns. I made this change because this seemed more gratifying and removed the possibility of ties occurring.
- The board design changed midway through development as well. The original plan was to have each player start in a different corner of the board and have to do a lap back to their original place to earn a point but I had to change this so that all players had the same start position because they all shared the same script and I would have had to create 3 extra sets of waypoints for each player to follow which did not work with what I had based my movement script on.

What I've learned during the development process

This project has been a great way to develop a game I am proud of while also learning a new application and honing my C# skills. During the process of adding the features I wanted the game to have I ran into multiple issues which I had to work around or research.

I had to learn the best way to move players around a board based on dice rolls and create a unique inventory for each player.

One issue I had was that I created a script for each player but that proved to be far too messy, and I had to rewrite a lot of my original code so each player shared one class instead. This change made it so I didn't have to change 4 separate classes whenever one needed to be changed and also taught me a very good lesson in tidy code.

I also learned about how to switch between different scenes while a game is running, this allowed me to create a start menu for my game and then I expanded upon that and discovered how to send information from one scene to the other. This can be seen in the game itself by the options on the main menu that change how the main game will play.

Another big issue that halted the development of the game was that players were visually moving to the places they rolled but the game only recognized them as moving 1 space every time. The code I had written seemed to be working as intended so I had to do my first proper debugging session on the project which I had previously not done before.

The results from the testing came out that players were being set only one space ahead because the game was immediately starting the next player's turn before the first player could update their current board space. To correct this, I introduced a pause in the code to wait 1 second before starting the next player's turn. This was an important lesson with using unity as I was previously not considering the time running in the game.

Plans for future work

With this game completed I feel far more confident in making another in the future with what I have learned. Unity also features many options to make a game online so I could maybe work on using this

project as a base for an online multiplayer board game. Some features could definitely be changed to better fit an online game such as hiding other player's cards to add more strategy for example.

I can also say that I feel more confident with my coding abilities as a whole and will carry over the good habits of writing clean code from this project into any future work I will be doing.

References and Bibliography