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CCG Easy Builder

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# 1. Abstract

This report covers the development of a card game creation tool within the Unity game engine. This will give avid card game players and designers a way to create card games quickly and easily without the use of lots of code. The product when fully developed will also give a reasonably priced alternative to other tools on the market.

The report begins by providing context for the project as a whole, exploring the background of the tool and how it can be useful to a wide range of different users. This involves the analysis of different existing card games and the tools that can currently be used to create new entries in the genre.

The report then goes on to describe the approach taken and the reason for decisions made involving different software and repository management for the project. It explains the reasons behind the choice to use the already existing Unity game engine as well as why github was used as repository management for the project. After outlining the different software used and why, it goes on to outline the methodologies used within each of the different software. Next it goes on to break down different social, ethical and legal issues that the project may face during development and after the final release. The project management processes and tools that were used throughout the development are then described and explained.

A breakdown of the development process is then provided which explains in detail each stage and subsequent testing during the creation of the final product. The sprint by sprint explanation is followed by a post mortem that reviews the different successes and failures of the project as a whole and this is followed by the developer’s final conclusions. These conclusions show that whilst the project as a whole was successful and worked as an excellent proof of concept, the scope originally outlined exceeded the time scale available.

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Github repository link: <https://github.com/HungryHorse/CCG-Easy-Builder>

# 2. Introduction

The project described in this paper is under the current working title CCG easy builder. CCG stands for collectible card game but hereafter will be referred to by it’s acronym. CCG easy builder is a tool made and intended to be used in the Unity game engine. The tool is designed in a way to enable non technically minded people to create their own card games. It works to allow users an easy way to create their own finished product without having to build each individual component. All cards and their effects can be made using a visual window rather than having to write code for each interaction the tool allows for a drag and drop style creation process. The product produced by the process described below is a prototype and works as a proof of concept for card builders within the Unity game engine.

A large amount of card game players enjoy dabbling in the creation of their own cards. However without an easy way to put these cards inside a real game they can’t be tested in any real sense. The tools that currently exist on the market either have a high price of entry or they lack in features and usability. The card game genre shows a high amount of strong designers but seems to lack an equal amount of developers, the tool described in this paper will help alleviate these issues.

There are a few core objectives that this project is aiming to fulfill. First is to ensure the validity of the idea. Second is the creation of a card creator that can be used with no previous knowledge of programming. This card creator will allow the developer to drag and drop card effects and also allow them to create new ones. The effects should be easy to build from existing keywords such as *damage*. Due to the nature of the project being a prototype there does not need to be many keywords just enough that the concept is laid out. Keywords should be simplistic and easy to add to with little effort but will need to be coded by the end user of the application. The tool should also allow for the creation of an entire card game with various different settings that can be edited to create a unique product, these settings include features such as different card costing methods as well as different combat styles. A simple card game will be created using both of these features to showcase created cards and the ability of the developer to quickly change the end product on the fly using a versatile settings menu.

This prototype will be built to make it as user friendly as possible but due to the short development period some user interactions might be lacking including a reduction in user choice as well as shortcomings in relation to artificial intelligence. Neither of these fundamentally reduce the success of the prototype but leave a clear area that could be used to improve the final product. The project also has scope for expansion in other areas, the main expansion being the addition of an easily implementable online network. The online network could provide netcode as well as server services for new card games being made with the tool.

This report will describe the method used to create CCG easy builder as well as the legal, social, ethical and professional issues surrounding the project. It will also break down how the development was managed throughout the process. This report will also breakdown each feature and explain how and why it was implemented into the final product.

# 3. Background

## 3.1 Field

This report is focused on the expansive and deep card game genre. The subsequent tool aims to improve the ability of the community surrounding the genre to create more content. The online card game genre [3] occupies a small portion of the gaming market as a whole but still manages to contribute about one percent of the total one hundred and fifty two billion dollars that the gaming market produced as of 2019. [2]

Before breaking down card games a general classification for games of different types must be described. There are two types of games, perfect information games and imperfect information games. An example of a perfect information game is chess, perfect information refers to the fact that both players know everything all the time and can make calculated decisions based on those facts. Imperfect games however restrict certain information from their players and as such the players must make calculations based on probability rather than exact knowledge of their opponents options. CCGs are generally imperfect information strategy games that revolve around two players trying to outwit each other whilst they reach a win condition for the game. Win conditions can vary from card game to card game but the most common is getting your opponent to zero life using the different mechanics, such as attacking using creatures, offered to the player by the game.

## 3.2 Key Players

There are two obvious goliaths within the card game genre. Hearthstone and Magic the Gathering possess a huge portion of the market share within the genre whilst also being distinct from each other. These games show clear mechanics that work within the genre and also the ways in which players enjoy interacting.

There appear to be very few card game creation tools on the market but the biggest found during research is called Dulst. This tool has been used to create various different card games but only really offers the ability to create a Hearthstone style game.

There are some obvious positives and negatives to both Hearthstone and Magic the Gathering. Hearthstone has an incredibly well optimised user interface (UI) and is a big draw to the game for new players in the card game genre. Hearthstone is also a very robust game with very few bugs and most bugs that are discovered reside in some of the more complex card interactions rather than players interacting with the game directly. The use of an incredible UI in combination with the robust system as well as fun core gameplay mechanics makes Hearthstone an incredibly well liked game with a player base of around one hundred million players as of 2020 [4]. It’s also important to note that Hearthstone was made using the Unity engine. Magic the Gathering on the other hand also has numerous different successes in the genre. Magic the Gathering boasts a collection of almost 20,000 unique cards, this huge array of cards allows for great variation between different matches. There is a significant amount of player interaction in Magic the Gathering due to instant spells which can be cast in response to the opponent’s actions. Coupling this with the thousands of different effects and cards allows for very deep gameplay and complex mind games between the two players. Magic the Gathering also uses a real text parser that translates card text into working game mechanics, this real text parsing allows them to much more quickly transfer their cards from the physical version of the game to the digital game client.

A program that allows users to create and play card games does exist already and it’s called Dulst. Dulst is a HTML5 program that allows for the creation of new card games without code and then also allows people to play them. This service uses numerous different text and tick boxes to allow the user to create their own game. This service makes it very easy for creators to host the games they make by providing servers alongside the development platform, it even allows the monetization of the games. Due to the fact the entirety of the Dulst application runs in browser makes it very accessible to a wide audience of players and creators. It’s not without flaws however, the application can only be used to make a very specific type of card game due to the fixed nature of the base level mechanics on offer, it can also be quite difficult to navigate the site as many of the options are not centralised. Dulst is also quite expensive to maintain due to the nature of its own monetisation method that utilises monthly subscriptions of up to four hundred and ninety nine dollars a month [5].

## 3.3 Market

A significant population of card game players enjoy creating their own cards for games that already exist. There are various different subreddits that make the fact people enjoy making their own custom cards obvious. There are eighty two thousand nine hundred card designers on the r/customhearthstone subreddit [6], twenty six thousand six hundred on the r/custommagic subreddit [7] and one thousand six hundred on the r/customyugioh subreddit [8]. These players obviously enjoy the design aspect of card games but without a suitable testing ground they lack the ability to truly learn about the balance of a card game. As the market stands currently there are very few cheap ways for players who do not possess programming ability to test their card designs and ideas. Numerous designers also enjoy the idea of creating their own card game from scratch but the time, money and effort required would be too much on top of their current life. There is a clear gap in this market for a tool that allows people to quickly and cheaply whitebox out and test a card game using minimal programming and game development skill.

# 4. Method of approach

## 4.1 Software and process

Collectible card game easy builder is a tool extension developed for the Unity 3D game engine. The program is built using C# and coded within the Visual Studio integrated development environment (IDE). The code in this project adheres to various standards such as private variable names always beginning with an underscore and camel case naming principles. These standards allow the developer to maintain consistency and readability during development. Having coding standards also allows for new developers to more quickly adapt to the programming if they plan on continuing development. These standards are adhered to throughout development and the code is amended if they have not been maintained during the end of sprint review (see project management). The Unity game engine has many general functions that were used and extended during the development of CCG easy builder. Unity also allows for the creation of custom windows and improvements to the default inspector, both of which were used to greatly improve user experience when interacting with the tool. The tool also uses scriptable objects due to their flexible nature and ability to preserve changes using serialization. Scriptable objects can save large amounts of data independent of classes, they also help to keep the memory footprint of the final project down by reducing the amount of copied data. The use of scriptable objects within Unity also streamlines the creation of new objects due to their ability to be saved within the base file structure while maintaining the information they have been created with. Normally information and changes are lost due to the Unity engines garbage collection system.

## 4.2 Repository management

The development of this project was performed whilst making use of a github repository. The repository was interacted with using the gitkraken graphical user interface (GUI) client. The repository stores the current and all previous builds of the project. The use of an online repository works to improve development by mitigating the risk of lost progress and also gives the ability to easily roll back to working builds. Repository use standards were implemented to ensure useability. Both the commit messages and titles are standardized, these improve the ability to rollback to the correct commit. The titles are numbered and have descriptive titles allowing for fast identification. The details provide a far more detailed description of what was added during that period of development. These descriptions allow not only the developer but any user to identify the development timeline. The descriptions also ensure the correct commit is being chosen during a project rollback. The commit messages must aptly describe the commit and content that was added to follow the repository standards. The use of a repository also allows the developer to work on different machines and have the most up to date build of the project via a cloud save. The ability to commit changes to a repository allows the developer to work on different machines easily. The respiratory is broken into two branches, the first branch is the master branch and the second is the staging branch. The master branch is used for stable builds and can be used at any point as a safe point to revert to. The staging branch is used for the development of the tool and is unstable, the staging branch is predominantly untested and is only merged into the master branch when it is deemed stable.

## 4.3 Testing

This project underwent three different methods of testing (functionality, sprint and usability). These three methods of testing ensure that the product performs at the highest possible level and also ensures that the development process is smooth.

The first of these methods is functionality testing. Functionality testing takes place once a feature is first implemented, this testing ensures the desired effect is achieved irrespective of its interaction with the rest of the system. This form of testing is not exhaustive and only checks that the implemented functionality works as intended. Each section of development is separated into sprints (see project management), testing takes place at the end of each of these sprints. Sprint testing is as exhaustive as possible and tests the integration of each feature within the system as a whole. This form of testing is done to make the end of sprint build as robust as possible and all discovered bugs are fixed before the staging branch of the repository is merged into the master branch. Whilst the sprint testing tries to remove any and all bugs some may remain, the main objective is to make the staging build stable so that the merge can be done safely. Stable builds are not necessarily bug free but they will not crash under any circumstance.

Once a build has been created it can move onto the final stage of testing, useability testing. Usability testing uses user feedback to improve the already developed project whilst also providing deep insight to the developer. A user testing the project may perform actions that didn’t even enter the developer’s mind and will greatly improve the usability of the final product. Usability testing also discovers a lot of hidden bugs due to the expanded use cases. Due to covid 19 during the development of this project usability testing was made far more difficult. In person useability testing could not be performed and instead all useability testing had to be performed over video call and because of that the scope of the testing was heavily restricted. The usability testing was used to great effect when creating the UI and user experience (UX) for this project but due to the limited scope the ability of the usability testing performed to reveal bugs was also reduced significantly.

# 5. Ethical, legal, social and professional issues

## 5.1 Ethical Issues

There are various different ethical issues with usability testing especially when factoring in the Covid 19 outbreak. First is the ethical implications when considering participants personal information. To avoid issues with personal information all participants in usability testing were not required to disclose their name and were instead referred to by either a number or not at all. An ethical approval document was filled out and filed with the university (Appendix 15.2). However if any participant in the useability testing would like their data removed they cannot be identified and therefore a participant must consent to their anonymised data being used during the development of the project. As the useability testing only allows non vulnerable adults to take part no specific considerations were necessary in regard to vulnerable people and their ability to consent. Testing also did not involve deception of any kind and thus the ethics of lying did not require consideration.

## 5.2 Legal Issues

There are legal considerations to make in regards to both using third party assets as well as posting a monetized project to the Unity asset store. Third party assets have been used during the development of this project and have been used during the production of promotional material. The assets used are part of a purchased bundle that allows for reuse and resale as long as the assets are not the primary selling point and therefore can be used legally in both pre and post production. A full review of the Unity asset store provider agreement has been performed during the development of this tool. Any assets sold on the Unity asset store remain fully owned by the developer. The developer agrees to uphold the standards of the Unity asset store when posting and therefore cannot submit inappropriate content, with this taken into account the assets used for all material are appropriate for the Unity store. [9]

## 5.3 Social Issues

There are very few social issues surrounding this project and the impact on the social climate will be minimal. Due to the fact that this project is a tool it is down to the end user to moderate their creations. However when the project is submitted in full to the Unity asset store there is an obligation for the developer to maintain moderation of the store page and ensure the users of the asset are not using the project in a harmful manner.

## 5.4 Professional Issues

There is a core issue with the professional release of a paid for program and that is maintaining the integrity of the project online. This includes protecting the source code from piracy as well as protecting the developers public image. To help protect the source code from piracy there are small code snippets that are marked by the developer and therefore can be leveraged to prove the true ownership of the source code if required. The code is maintained on a private repository and can only be obtained through a purchase on the Unity asset store and redistribution of the code is made difficult due to the fact the tool is locked to use within Unity.

# 6. Project management

This project uses an agile workflow implemented using the project management tool Trello. The scrumban methodology was used in this project mainly due to it’s highly flexible and versatile nature. The scrumban methodology is a hybrid of scrum and kanban. Scrum breaks down the work into small concrete deliverables and breaks down time into short fixed length iterations, these iterations are called sprints. Scrum also performs a retrospective at the end of each sprint which helps to optimize the final release plan. Kanban breaks a project into to-do, doing and done columns. By having a flexible backlog it allows a development team to continually improve their process throughout development. This project implements scrumban and breaks down development into sprints of two weeks. The two week period of time allows for a substantial amount of progress to be achieved whilst also keeping the time period short enough for end of sprint analysis and adjustment. The two week long sprint also aligns with the stable build that is required every two weeks by the project specifications. The development timeline is also broken down into two sprint long phases, these phases are used to provide useful milestones, as well as providing structure past a one sprint long period of time. Four phases were used to focus development on specific overarching goals.

Tasks are created at any time and placed into the backlog column of the Trello board, the backlog is used to store all current tasks and can be added to or removed from at any time during development. When tasks are created they are assigned a point value, a point is a unit of time and tells the developer how long a task should take. All new point values are based from information gathered from previous tasks and how much more or less time a task actually took. In the case of this project each point was worth an hour. At the start of each sprint tasks are assigned from the backlog column to the sprint tasks column. When the developer begins a task it moves from the sprint task column into the current tasks column and the start date on the trello card is assigned. After the task has been completed it moves to done tasks and is labeled as complete, the end date and time is also recorded. The difference in start and end date and time is used to calculate how many hours were taken to complete a task. Once a sprint is finished any remaining tasks are pushed back into the next week of development. After each sprint is completed an end of sprint report is performed. The end of sprint report records all of the completed tasks and the time discrepancy between actual time taken and estimated time taken. The discrepancy is used to calculate whether the overall estimation is above or below what is expected so that the next sprint’s tasks can be adjusted accordingly. During the sprint report, sprint testing is also performed. Sprint testing is used to guarantee that the build is stable before merging the staging branch into the master branch of the repository. Once the sprint report and testing have been completed the next sprint is allocated tasks from the backlog ready for the next stage of development.

# 7. Phase 1 - Prototype and research

The first stage of development that was undertaken was the development of the core card game mechanics. In this first stage there was a focus on the Hearthstone style of card game mechanics as they are the most simplistic and also offer a clear foundation from which to build upon. The aim of this stage of development was to create an initial card game prototype and use that as a testing medium for continued development in the later stages. The first sprint developed the core elements of a card game and it’s systems, these included features such as data objects for cards as well as fully implemented board and hand objects that could hold cards and be used for later implemented interactions. The second sprint in this stage then worked on fixing any issues left over from sprint one as well as adding features such as board formatting and card interactions.

## 7.1 Sprint 1

The first task for this project was to fully set up the Unity project that would be used as the engine for the duration of the development. This setup process involved the importing of packages that would be used for development as well as the universal Audio Manager that had already been created and used in previous projects. The packages included both scriptable objects as well as Text Mesh Pro. Scriptable objects are used to preserve data and provide an efficient medium for data transfer between different features. Text Mesh Pro is a Unity user interface text package that allows for more customisation and control when working with text elements for game UI.

After the Unity project was set up the project began with the creation of the cards. These scriptable objects were created with an initial suite of statistics that would be relevant for any regular card game such as health and damage. The cards were created as scriptable objects so that the data would be preserved inside and outside the Unity scene as well as being able to create instances of them when adding the card to the player hand.

Once the scriptable objects for cards were created an enumerator was created to differentiate different card types from one another. The enumerator acts as a foundation for new features that can utilize the card type such as a pause in the game when an opponent is holding a card of a specific type.

A physical representation for the card was then created. There were 3 core elements that needed to be created for this prefab (Prefabrication - Name used by unity to describe an object that can be used at any time via instantiation). The first element was the front of the card, which contains all of the information about the card such as name, attack and health. The back of the card can be used to show attractive art and potentially can be used as a method of monetisation with a game. However in the context of this tool is mainly used as a differentiator when drawing a card from the deck. The middle of the card is used to divide the two sides and prevent image clipping.

The next task completed was adding an object in the Unity scene that could hold both information about cards and also have a physical space for the prefabs. This acts as the hand for the card game. This task also required the creation of a physical limit to how far the card prefabs could spread out to avoid cards being pushed off screen when more were added to the hand. After the creation of the hand object in Unity, drawing from a deck was added. The deck is a list of card objects that can have cards added or removed from it. The deck can be shuffled in the Unity scene. The deck shuffle uses the Fisher-Yates algorithm, this algorithm is efficient and when using a truly random number provides true variance. This implementation of the algorithm uses a pseudo random number, so the variance is not perfect. However due to the small sample size of only one deck of cards being shuffled the imperfection from using a pseudo random number rather than a true random number is irrelevant. After multiple different shuffle algorithms were researched the Fisher-Yates shuffle was the most obvious choice in this instance. The Fisher-Yates shuffle algorithm is as follows:

The Fisher–Yates shuffle.

-- To shuffle an array *a* of *n* elements (indices 0..*n*-1):

**for** *i* **from** 0 **to** *n*−2 **do**

*j* ← random integer such that *i* ≤ *j* < *n*

exchange *a*[*i*] and *a*[*j*]

**for** *i* **from** *n*−1 **downto** 1 **do**

*j* ← random integer such that 0 ≤ *j* ≤ *i*

exchange *a*[*j*] and *a*[*i*]

The card draw feature is implemented using Unity animations that are edited using code so that cards can be drawn from any location. After a card has been drawn from the shuffled deck it is added to the hand but with no formatting so the card prefabs stack on top of each other and obscure the information. The task of formatting the cards involved two different parameters, first is the position of the cards within the hand and the next is the rotation. The position needs to allow for space between each card whilst also keeping them within set bounds thus keeping the cards in frame. The rotation of each card allows them to stay distinct from each other whilst also improving space management and allowing for more cards in less space.

A key component of card games is the ability to see what every card does. As space management is important the cards need to be small but information needs to be easily obtained during play in any situation. The best way to overcome this balance between readability and space management is to enable the player to hover over a card and increase its size. The increase in size in combination with bringing it to the forefront means that any card in the hand can be read no matter how many other cards obscure it normally. This task required the ability to detect when the mouse is hovering over a card at which point the card will have an enlarged version of itself instantiated above it. This enlarged card allows the player to easily read all of the content displayed upon it.

Moving the cards around by dragging them was added next. This was done by reusing the hover detection from the zoom in and then combining that with a conditional statement that checks for a mouse click. If the mouse is clicked whilst the card is being hovered it begins to follow the mouse position. There is also a condition for the card leaving the physical hand space that causes a physical change to the prefab that acts as a visual cue to the player that the card has left that hand. Using the ability to detect whether the card is outside the hand allows for the implementation of the casting of the cards. When the card is outside of the player’s hand and the player releases the card it enters something called the stack. The card’s data is added to the stack held inside the manager object as well as the image of the card travelling to a physical location and scaling up so that all the text is readable. After the card has been added to the stack it begins the process of being cast. A conditional function that returns whether a card is able to resolve is used and if it returns true the card is then cast. Once the ability to cast cards was added to the system the next component was the addition of the card type ‘creature’ entering the board once they were resolved. At this point in the development process only ‘creature’ type cards had the ability to resolve.

## 7.2 Sprint 2

The second sprint of this project focused on improving the base level card game mechanics created in sprint 1. The first improvement made in this sprint was the addition of creature formatting when entering the board as an optional feature. This works by taking the position of the floating card when it is cast and adding the card to the existing board in the corresponding location. This allows for the developer to add effects that correspond to the position of creatures and the ability to add another level of strategy to their respective games.

Phases were added at this point in development to provide more structure. Each turn is broken down into different phases beginning from the ‘start of turn’ phase and ending on the ‘end of turn’ phase. Having the turn broken down into different phases allows for certain restrictions to be placed on the casting of different cards. The phases can also be used to activate triggers such as card draw and resource gain at the start of the turn. Phases are implemented as parts of an enumerator and as such are versatile and malleable this means that the user of the tool has numerous options in the addition or subtraction of new phases. Using Hearthstone and Magic the Gathering as guides for different phase setups the user is provided a choice between the two with the main difference being a separate combat phase.

At this point in development cards other than creature cards had no effect when cast. The ability to cast spells was added, spells can target seperate valid objects and perform their effect. At this point in development the effects of a spell were hard coded. To complete this feature the ability to target different objects was required. This targeting feature was implemented using a generic function that could be reused for anything that required targeting in future. The targeting function is held by a singleton object and is accessible by any other script in the scene. Creature combat was added at this stage using the targeting function that had already been implemented. The player selects a creature from their side of the board and targets a creature on the opponent’s side. The selected creature and the targeted creature deal damage to each other and if either of the creatures are reduced to zero health points they die and are removed from the board. To allow the user to more easily balance the creatures and spells a costing system was added that would restrict the amount of spells that could be played in a turn. The amount of resources a card costs is editable when creating a card object.

# 8. Phase 2 - Card creation and Unity tools

## 8.1 Sprint 3

For card effects to work there needed to be a fully implemented event system. The basic event system was extended to allow for the transfer of scriptable objects. Using this extended event system, cards and card effects could now use the relevant information passed through the events to automatically perform their actions. By using the event system it allows for a generic function that can handle all effects and is thus far more expandable and usable. With the base event system being able to pass the card objects, the next task was implementing some specific events that activate at certain points in time. The first of these specific events was one that was activated when a card was played, all the cards are passed the information of the card being played. After the event ‘card played’ was added, both the ‘creature enters board’ event and the ‘card drawn’ event were added using the same core systems as were used for ‘card played’.

The ability for the creator to create their own cards as easily as possible was a major driving force for this project. The first element created was a specific scene within Unity where a card prefab can be edited to show a preview of how the final card will look in the game. When the card is selected in this creation scene the user can use the Unity inspector to edit the values on the card. The prefab in the scene is updated using the in built editor update system in Unity. The user can edit all of the basic card information such as name and cost using this system. Using the Unity custom editor capabilities a custom button was added that opens an editor window, this editor window acts as an effect builder for a new card. The window allows a player to make a new effect without any coding ability and acts as the main draw to this app. The user has the ability to name the effect and then using conditional formatting the relevant information is revealed in order to not overwhelm the user with all the information at the start. After the effect has been created the user can save the effect and select where it’s saved using a file explorer window. A user can add effects they have already created using the saved effects and add them to the card using the basic editing in the inspector. After the creation of the effect creation window a small suite of generic keywords was added to the system that allows the user to create effects that deal damage to targets. Keywords use a generic parent class that allows for the easy creation of new keywords for both the developer and the end user by utilising inheritance.

## 8.2 Sprint 4

After keywords were added with effects in the previous sprints the interaction between them and the events was added. Events will cycle through all effects and if the conditions set during the creation of said effect are met the event will trigger it. The event system needed to be updated during this time due to a lack of distinction between a card calling its own effect and the card calling the effect of another card. The solution was to add a conditional statement that distinguished between the card triggering the event call and all other cards. Thus allowing the system to function correctly. Additional functionality was also added to the event creation system by allowing users to use specific card data objects in the trigger section of the event allowing for increased usability. A function that translates an effect into plain text was created and allowed for the effect text to be added to the final and preview description box within the card. A small quality of life improvement was also introduced here where the flavour text the user writes in the description box of the card editor is separated from the effect using a line making it obvious what is important to the gameplay.

Also added during this sprint was the foundation for generic abilities. Generic abilities allow certain creatures to utilize rules specific to users of that ability, examples include being able to attack faster than other creatures as well as an ability that restricts the time that the creature stays on the board. At this time in development the parent class of ability was added to allow for much faster development of more specific abilities when progressing forward, this generic parent class also makes it far easier for the user to create their own abilities in future. The abilities are called by the manager at two different points. For abilities such as being able to attack straight away the manager calls the effect as soon as the card is played, otherwise the abilities are called at the start of each turn.

# 9. Phase 3 - Improvements to user interaction

## 9.1 Sprint 5

By utilizing the already created event system and the integrated effects the rest of the responses to triggers were implemented into the program. These are all the specific responses that relate to other cards triggering an event. These include all the different variations of card ownership so when creating new effects, the card can be triggered in response to specific player’s cards. Each specific response is implemented within each event in order to remove needless event calls wasting memory and time. The fully implemented effects also allow for targeting calls for any of the custom effects that have a target other than themselves.

During this sprint the settings menu was also introduced. At this point in the development process all of the settings for the tool were scattered between different relevant inspector panels. The settings menu centralizes all of the different options that the user has and also follows a uniform layout. Having the options centralized whilst also utilising a uniform layout allows for an improved user experience when using the tool. The settings window uses the Unity custom editor window system, the Unity editor window allows for a fully customisable window to be created using the LayoutGUI commands. These GUI commands allow you to create a GUI similar to the default inspector. Having a list of objects in the Unity UI system requires the use of a generalised object called serialized objects, which hold data in a serialized property. The serialized properties obscure the data held within them and the base class only has the ability to return the data if it is of a specified type. To be able to retrieve data of different types from the serialized properties an extension was required. The extension returns a generic class that can then be cast, this extension being able to return a generic class allows the settings window to set the correct objects from a list. All of the settings are saved using JavaScript Object Notation (JSON) serialization into a basic text file. This save file uses JSON as it has built in Unity support as well as being plain text readable. After saving all the information to a JSON settings file the data is transferred to all the relevant objects in the scene. The objects in the scene use the Unity system to draw GUI gizmos to display all of the relevant zones. It shows the hand, board, stack position and card preview zone. During the creation of the settings menu each option was removed from the relevant classes in order to avoid the potential confusion that duplication could cause the end user.

# 10. Phase 4 - Improvements to game play

## 10.1 Sprint 6

The main purpose of this sprint was to increase user choice when it came to how the players would interact with combat. This involved expanding the combat by adding the option to change from the original attacker's advantage to defender’s advantage. Attacker’s advantage is where the controller of the creature decides which target they attack whereas the defender's advantage is when the player attacking decides which creature will attack and the defender decides whether their creature blocks the attack or not. Hearthstone uses attackers advantage and Magic the Gathering uses defenders advantage so having both as options is important for the final product. More specific methods of creature interaction could be added in future but they do not fit within the scope of this project. Instead of the player targeting a creature on the opponent's board with one of theirs they instead click on their own and it is then marked to attack the opponent. The primed to attack creatures can then be blocked by the opponent, they choose one of their creatures and target one of the attacking creatures. The creature or creatures that were selected to block an attacking target then do damage to each other and death calculations are carried out. Any creatures that were not blocked by the defenders do their damage directly to the opponent. This method of combat allows for a slower card game due to the ability of the defender to constantly avoid taking life damage using their own creatures.

During this portion of development the stack had already been created but there was no way to interact with it. Cards in the stack would resolve without the opponent being able to interact with cards currently being held there. To add the functionality of stack interaction a check was added to see if any card in either hand had the ability to interact with the stack. In this build of the tool there is only the quick spell card type that can interact with the stack so that is what is checked for. An addition to this tool could be adding quick effects on cards that normally wouldn’t be able to interact with the stack, but the effect would be able to interact independently. This improvement to the stack would allow for far deeper gameplay interactions and would also allow players more opportunity to outplay each other. A more expanded stack interaction could also be added that allows effects to target cards already in the stack, this would allow for the addition of some type of counter ability that would stop a card from resolving and remove it from the stack.

Also added during this sprint to improve gameplay was the addition of some more generic abilities, as outlined earlier on in the document. The abilities that were added during this portion were rush, evasion and ethereal. Rush allows a creature to attack other creatures but not the opponent directly, this ability only has an impact during attacker's advantage. Creatures with evasion can only be attacked by other creatures with evasion when attacker’s advantage is enabled, only other creatures with evasion can block another creature with evasion when defender's advantage is enabled. Creatures with the ethereal ability only spend one turn on the board then they die. With continued development the ability to summon other creatures could also be added and in that situation the ethereal ability would be able to restrict the scaling of that effect.

# 11. End-project report

There are three core objectives that determine the success of this prototype. The first of these objectives is the creation of a user friendly card creator that can be used without coding ability or knowledge. The final outcome of the card and effect creator was a great success and clearly shows the ability to create a comprehensive card creator within the Unity engine. The effect creator currently has one keyword that can be added to card effects. However, the expandable nature of the source code means that even an inexperienced coder has the ability to implement their own functionality. Cards can also have abilities added to them via a drag and drop system that is easily expandable. All of the features implemented for the card creation inside of the tool work as intended and work to prove the presented concept of creating a tool that makes creating and testing different cards easy.

The second objective outlined at the beginning of this project is providing a tool that makes it easy for developers to create a fully fledged card game using a well designed user interface. Whilst the settings menu created during the duration of the process was adequate, given more time it could be refined further. The settings menu is sparse and lacks many of the desired options that would allow for end users to create unique experiences. There are also some Unity engine quirks that make the current settings menu nonoptimal and sometimes requires the user to reset object references. The ability for a user to create different cost systems also ended up falling outside of the scope of this project and thus only a Hearthstone esque mana system was created. However, giving the user the ability to create a card game has been implemented. The range of differences that can be expressed using the tool at the end of this project are far more limited than expected, however, this system works well as a proof of concept. On reflection this second objective was overly ambitious and it may not have been wise to include it in the initial scope

The third and final objective of this project was the creation of a card game that can be used to demonstrate that abilities of the tool. This objective was limited due to the lack of features implemented in the game creation aspect of this tool. The amount of work that would be required to create a substantial artificial intelligence (AI) was also misjudged and as such the final product only works as a way to showcase the card creation system. The features exist for two players to interact but without an AI or an implemented online service the ability to demonstrate that fact is limited. This final objective is successful as a way to showcase features but lacks the depth of a full game thus only partially fulfils the presented objective.

# 12. Project post-mortem

The project’s objectives were too large for the time period of development and should have been streamlined for the purpose of this process. The project objectives should have been used to fully support and show the usability of the card creator. More time could have been spent making more effects possible and making this prototype far more coherent as a proof of concept. The card game and the tool to create the card game could have been a full project on their own and thus this project spread development resources too thin. The spread of these resources lead to some features being less refined than they should have been. A more focused approach to specific elements would have made this prototype far more successful.

The project's development methodology and project management worked extremely well and helped keep the developer on track to hit certain milestones. However, a lack of specific tasks that needed to be completed in the later half of the project led to fragmented and delayed development as the project approached the finishing stages. The agile scrumban methodology provided a dynamic workflow that could adjust to the lack of clear direction however and by having sprints that provided stable builds at the end meant that the project whilst not finished still functioned and could be used for its intended purpose even if certain features were missed. The scrumban methodology also allowed the developer to adjust fairly easily to the disruptive change that Covid 19 had on the development of the project.

If this project was undertaken again more time would be spent at the beginning outlining specific and well scoped objectives. Each objective would be explored more deeply and the workload of each would have been assessed in greater detail. This early scoping would help to create a much more streamlined showcase of the core ideas for the finished product. The project would work better as a showcase of developer talent as well as a proof of concept if it was more focused on performing in specific areas rather than trying to provide a very broad tool that can be used for a variety of different use cases.

# 13. Conclusions

In the eyes of the author the card creation portion of this project was a huge success. It worked extremely well as a proof of concept for codeless card creators within card games. During the development a lot was learned about generic class systems and their usefulness when creating a dynamic system that allows for greater user freedom. However the other aspects of the tool could have been done better with a more comprehensive scope laid out at the start of the project. The features of the card game and card game creation tool portion of this project fall short of the developer’s overly ambitious expectations. However these features still work as a good showcasing tool for the card creation system and also work as an unfinished proof of concept when it comes to a tool that can be used within Unity to quickly make a variety of card games. In conclusion the scope of this project as a whole was too expansive but a lot was learned from that experience.

The project management used during the duration of the project was excellent and implemented in a strong way throughout development. It provided a great structure to development and was a key part of the project’s success.

In summary this project was a success but missed it’s full potential due to a lack of developer experience. It worked as an excellent learning experience and boosted the skills of the developer greatly in both coding ability and practices as well as the developer’s knowledge of the Unity engine as a whole. This can be used as a showcase project and also provides a fantastic foundation for a final product that can be monetized by the developer. When finished the author believes that the product could have an excellent impact on the card game community as a whole.

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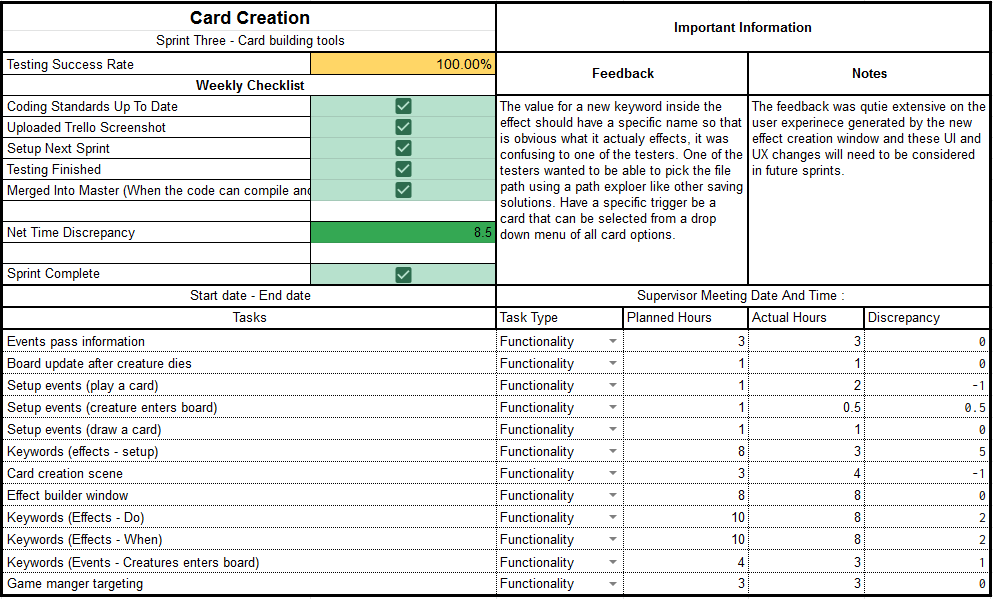
# 15. Appendix

## 15.1 Sprint reports and testing

<https://docs.google.com/spreadsheets/d/1kh2ilKmtjiVeIXHfPhnJsUVpkFFj8RJjTbJOA3aixlc/edit?usp=sharing>

### 15.1.1 Sprint report one

### 15.1.2 Sprint report two 15.1.3 Sprint report three

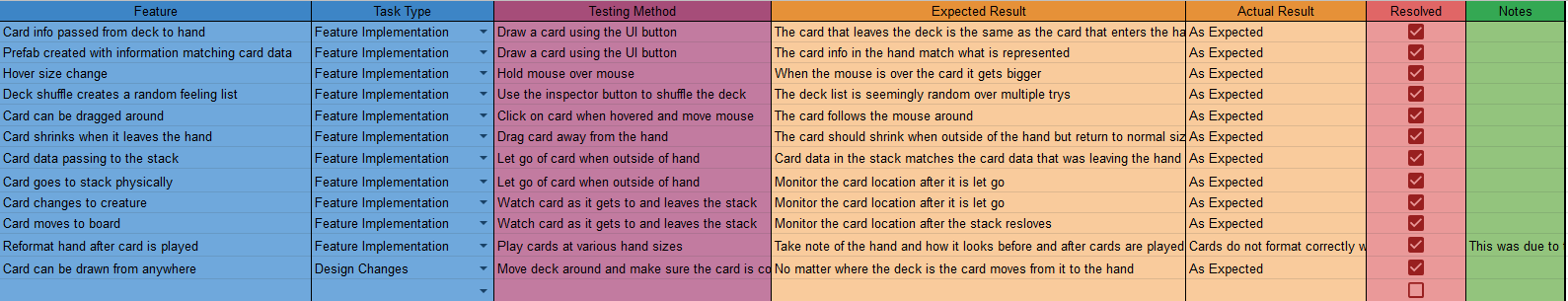


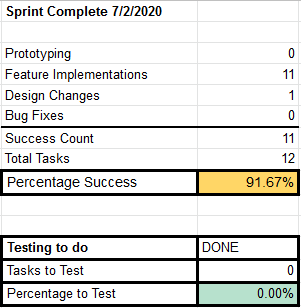
### 15.1.4 Sprint report four

### 15.1.5 Sprint report five

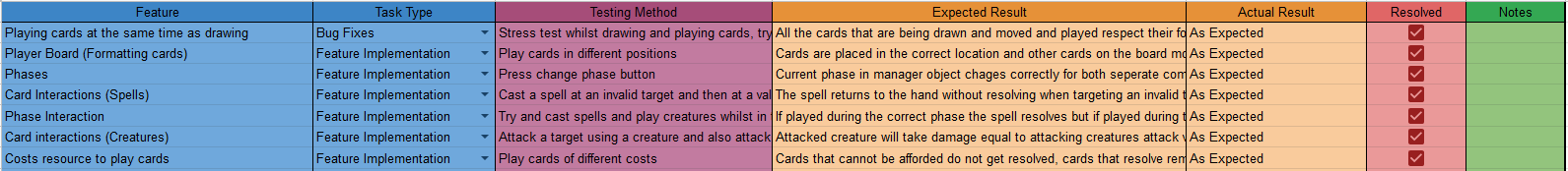
### 15.1.6 Sprint report six

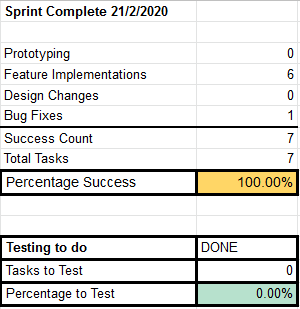
### 15.1.7 Sprint one testing



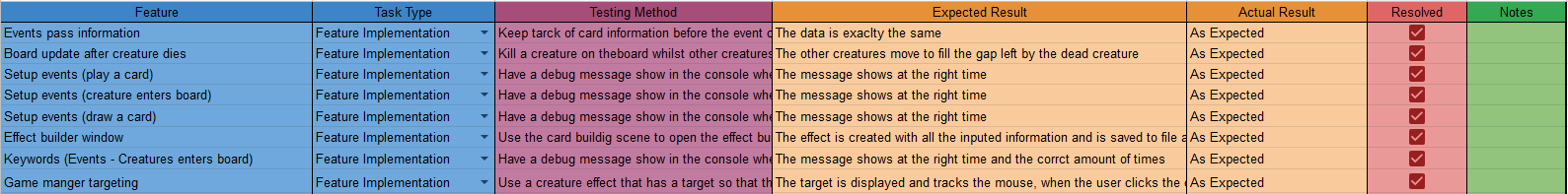


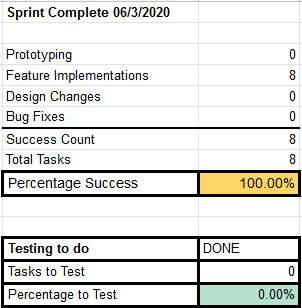
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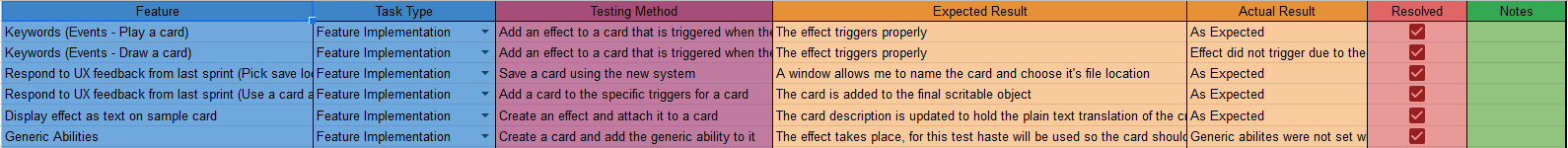


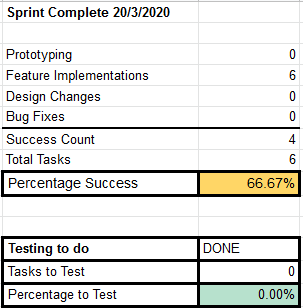
### 15.1.9 Sprint three testing



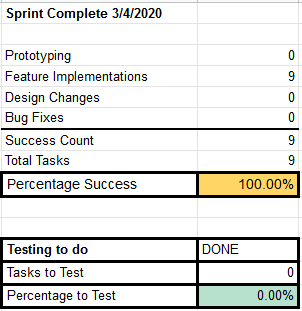
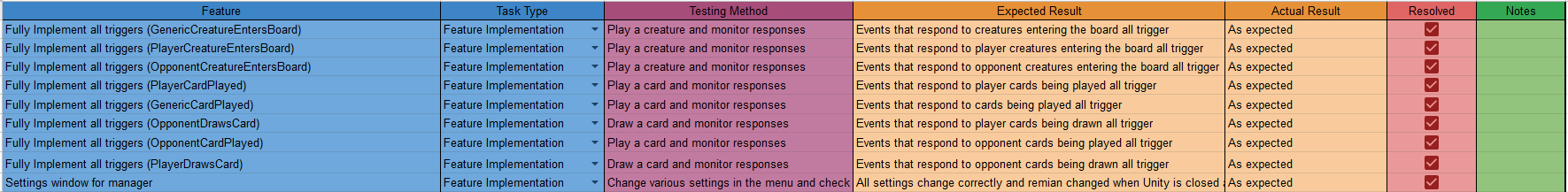


### 15.1.10 Sprint four testing

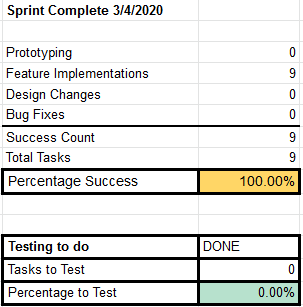
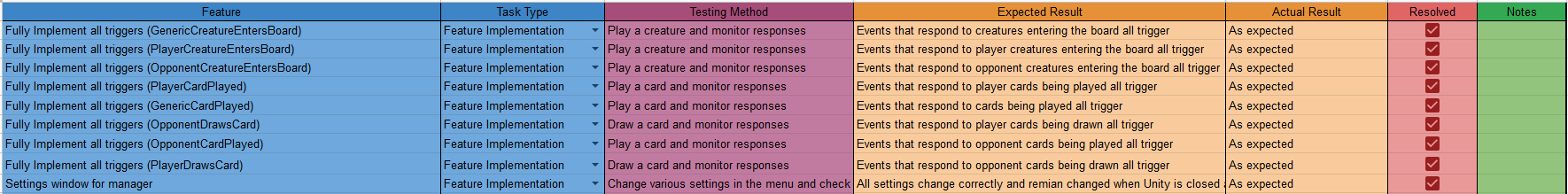




### 15.1.11 Sprint five testing



### 15.1.12 Sprint six testing



## 15.2 Ethical approval document

**PLYMOUTH UNIVERSITY FACULTY OF SCIENCE AND ENGINEERING**

**Research Ethics & Integrity Committee**

APPLICATION FOR ETHICAL APPROVAL OF RESEARCH INVOLVING

HUMAN PARTICIPANTS

**All applicants should read the guidelines which are available via the following link:**

<https://staff.plymouth.ac.uk//scienv/humanethics/intranet.htm>

This is a WORD document. Please complete in WORD and extend space where necessary. Clearly name any supporting documents and reference in the application.

*Postgraduate and Staff must submit a signed copy to* [*SciEngHumanEthics@plymouth.ac.uk*](mailto:SciEngHumanEthics@plymouth.ac.uk)

*Undergraduate students should contact their School Representative of the Science and Engineering Research Ethics & Integrity Committee or dissertation advisor prior to completing this form to confirm the process within their School.*

***School of Computing, Electronics and Mathematics******undergraduate students*** *– please submit to* [*SciEngHumanEthics@plymouth.ac.uk*](mailto:SciEngHumanEthics@plymouth.ac.uk) *with your project supervisor copied in.*

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1. ***TYPE OF PROJECT***

***1.1 What is the type of project?***

|  |  |  |
| --- | --- | --- |
| **Applicant** | **Type** | **Put X in 1 only** |
| STAFF | Specific project |  |
| Thematic programme of research |  |
| Practical / Laboratory Class |  |
| POSTGRADUATE STUDENTS | Taught Masters Project |  |
| M.Phil / PhD by research |  |
| UNDERGRADUATE STUDENTS | Student research project |  |
| Practical / Laboratory class where you are acting as the experimenter | **X** |

1. ***APPLICATION***

|  |
| --- |
| ***2.1 TITLE of Research project*** |
| CCG Easy Builder – (A card game creation tool) |
| ***2.2 Name, telephone number, e-mail address and position of applicant for this project (plus full details of Project Supervisor for postgraduate and undergraduate students)*** |
| Name: Jack Jay Brewer, Mobile Phone: 07391599694, Email: [jack.brewer@students.plymouth.ac.uk](mailto:jack.brewer@students.plymouth.ac.uk), Position: Undergraduate on the Computing and Games Development course Supervisor Details: Name: Swen Gaudl, Email: [swen.gaudl@plymouth.ac.uk](mailto:swen.gaudl@plymouth.ac.uk), Title: Lecturer in Computer Science |
| ***2.3 General summary of the proposed research for which ethical clearance is sought, briefly outlining the aims and objectives (no more than 200 words)*** |
| My project is targeted at a specific community of people that exist both inside and outside the university. A key component of this project will be information gathered from the community by using their opinions on how effective and viable this product is. This research will involve questionnaires as well as potential user testing on participants outside of the university.  *Within this work:*  *• All participation will be entirely voluntary, and participants can withdraw during the session.*  *• No financial incentive will be given.*  *• Once submitted, it will not be possible to identify (and therefore withdraw) the participants of the questionnaire.*  This ethical application is for testing and gathering information from the general public rather than a specific institution outside of the university. Information may be gathered over the internet via google form questionnaires but all user testing will be performed in person.  These tests and questionnaires will not involve any of the following:  - topics involving ethically sensitive issues,  - children (under 18) and vulnerable adults,  - deception,  - tasks that involve physical or psychological risk to participants |
| ***2.4***  ***Physical site(s) where research will be carried out*** |
| User Testing will be performed in the university but questionnaires will be completable over the internet so there is no specific site |
| ***2.5 Does your research involve external institutions (e.g. other university, hospital, prison etc. see guidelines)*** |
| Delete as applicable **No** |
| ***2.5a If yes, please give details:*** |
| ***2.5b If yes, you must provide letter(s) from institutional heads permitting you to carry out research on their clients, and where applicable, on their sites(s). Are they included?*** |
| Delete as applicable: **No Yes** |
| ***If not, why not?*** |
|  |
| ***2.6 Start and end date for research for which ethical clearance is sought (NB maximum period is 3 years)*** |
| **Start date: Date of approval End date: 13/5/2020** |
| ***2.7 Has this same project received ethical approval from another Ethics Committee?*** |
| Delete as applicable: **No** |
| ***2.7a If yes, do you want Chair’s action?*** |
| Delete as applicable: **No Yes** |
| ***If yes, please include other application and approval letter and STOP HERE. If no, please continue*** |

1. ***PROCEDURE***

|  |
| --- |
| ***3.1 Describe (a) the procedures that participants will engage in, and (b) the methods used for data collection and recording*** |
| *There are two main procedures that participants will be taking part in. The first of these are basic questionnaires, the participant will be required to give consent to the collection of their responses to the questions being asked. The second are usability tests which will require the participant to complete basic tasks with the application. A demonstration of the software may be given to the participants before they are asked to complete any tasks. An example task would be for the participant to without intervention create a new card in the tool. Data will be collected from participants in a variety of different ways, these methods of data collection include:*  *Conversations with me the investigator,*  *Written notes during any usability testing sessions,*  *Google forms filled out during user testing sessions,*  *Google form questionnaires filled out and submitted not during testing sessions* |
| ***3.1a If surveying or interviewing, you must include your questionnaire(s) and interview schedule(s).***  ***Are these attached:***  Delete as applicable:**No** |
| ***Questionnaires will be issued to outside participants from the approval of this document and can be filled out by participants at any time until the end of the module at which point the google form will be closed. The user testing will take place at the end of phases, the dates are as follows:***  ***23rd March 2020 – 25th May 2020***  ***27th April 2020 – 2nd May 20202*** |
| ***3.2 How long will the procedures take? Give details*** |
| ***Each questionnaire will take around 4-5 minutes and usability sessions will take between 10 and 30 minutes.*** |
| ***3.3 Does your research involve deception?*** |
| Delete as applicable: **No**  *If no go to section 4* |
| ***Please explain why the following conditions apply to your research:*** |
| ***3.3a Deception is completely unavoidable if the purpose of the research is to be met*** |
|  |
| ***3.3b The research objective has strong scientific merit*** |
|  |
| ***3.3c Any potential harm arising from the proposed deception can be effectively neutralised or reversed by the proposed debriefing procedures*** |
|  |
| ***3.3d Describe how you will debrief your participants*** |
|  |

***4. BREAKDOWN OF PARTICIPANTS***

***4.1 Summary of participants***

|  |  |
| --- | --- |
| ***Type of participant*** | ***Number of participants*** |
| *Non-vulnerable Adults* | *between 1 and 30* |
| *Minors (< 16 years)* |  |
| *Minors (16-18 years)* |  |
| *Vulnerable Participants*  *(other than by virtue of being a minor)* |  |
| ***TOTAL*** | *between 1 and 30* |

|  |
| --- |
| ***4.2 How were the sample sizes determined?*** |
| *Convenience, relating to what is expected for this module and achievable with the time available. As per industry practice, there is no requirement for statistical significance.* |
| ***4.3 How will subjects be recruited?*** |
| ***Face-to-Face - I may ask people to partake in person during events that I am attending.***  ***Discord Messages - I will send questionnaires to relevant discord groups containing appropriate subjects.***  ***Private messaging - I may message specific individuals to ask for their participation.*** |
| ***4.4 Will subjects be financially rewarded? If yes, please give details.*** |
| ***No*** |

***5. NON-VULNERABLE ADULTS***

|  |
| --- |
| ***5.1 Are some or all of the participants non-vulnerable adults?*** |
| Delete as applicable:  **Yes** |
| ***5.2 Inclusion / exclusion criteria*** |
| ***Participants will all have to be over 18 years of age*** |
| ***5.3 How will participants give informed consent?*** |
| ***Via consent form or in the case of questionnaire there will be a question that asks for their consent*** |
| ***5.4 Consent form(s) attached*** |
| Delete as applicable:  **Yes (Appendix B)** |
| ***If no, why not?*** |
|  |
| ***5.5 Information sheet(s) attached*** |
| Delete as applicable:  **Yes (Appendix A)** |
| ***If no, why not?*** |
|  |
| ***5.6 How will participants be made aware of their right to withdraw at any time?*** |
| *Information sheet, Consent form, and orally during briefing.* |
| ***5.7 How will confidentiality be maintained, including archiving / destruction of primary data where appropriate, and how will the security of the data be maintained?*** |
| *All audio/video recordings, field notes, and transcriptions will be stored on a password protected computer with access only to me. Transcriptions will use a coding system (such as I – investigator, P – participant, etc.), all personally identifiable data will be substituted. Published material (project report) will not identify individual participants.* |

***6. VULNERABLE PARTICIPANTS (Minors <18 years, and Vulnerable Adults)***

|  |
| --- |
| ***6.1 Are some or all of the participants:*** |
| (Delete as applicable)  ***Under the age of 16?*** **No**  ***Between the ages of 16 and 18?*** **No  *Vulnerable adults? (See guidelines)* No** |
| ***If no to all, please proceed to section 7.*** ***If yes, please continue and consult guidelines for working with minors and/or vulnerable groups.*** |

|  |
| --- |
| ***6.2 Describe the vulnerability (for minors give age ranges)*** |
|  |
| ***6.3 Inclusion / exclusion criteria*** |
|  |
| ***6.4 How will minors and vulnerable adults give informed consent?*** |
| ***Please delete as applicable and explain below (See guidelines)*** For minors < 16 only: **Opt-in Opt-out** |
| ***If opt-out, why?*** |
|  |
| ***6.5a Consent form(s) for minor/vulnerable adult attached*** |
| Delete as applicable: **No Yes** |
| ***If no, why not?*** |
|  |
| ***6.5b Information sheet(s) for minor/vulnerable adult attached*** |
| Delete as applicable: **No Yes** |
| ***If no, why not?*** |
|  |
| ***6.6a Consent form(s) for parent / legal guardian attached*** |
| Delete as applicable: **No Yes** |
| ***If no, why not?*** |
|  |
| ***6.6b Information sheet(s) for parent / legal guardian attached*** |
| Delete as applicable: **No Yes** |
| ***If no, why not?*** |
|  |
| ***6.7 How will parent/legal guardians, minors and/or vulnerable adults be made aware of their right to withdraw at any time?*** |
|  |
| ***6.8 How will confidentiality be maintained, including archiving / destruction of primary data where appropriate, and how will the security of the data be maintained?*** |
|  |
| ***Investigators working with children and vulnerable adults legally require clearance from the Disclosure and Barring Service (DBS)*** |
| ***6.9 Do ALL experimenters in contact with children and vulnerable adults have current DBS clearance? Please include photocopies.*** |
| Delete as applicable: **No Yes** |
| ***If no, explain*** |
|  |

***7. PHYSICAL RISK ASSESSMENT***

|  |
| --- |
| ***7.1 Will participants be at risk of physical harm (e.g. from electrodes, other equipment)? (See guidelines)*** |
| Delete as applicable: **No (Go to Q8)** |
| ***7.1a If yes, please describe*** |
|  |
| ***7.1b What measures have been taken to minimise risk?*** |
|  |
| ***7.1c How will you handle participants who appear to have been harmed?*** |
|  |

***8. PSYCHOLOGICAL RISK ASSESSMENT***

|  |
| --- |
| ***8.1 Will participants be at risk of psychological harm (e.g. viewing explicit or emotionally sensitive material, being stressed, recounting traumatic events)? (See guidelines)*** |
| Delete as applicable: **No (Go to Q9)** |
| ***8.1a If yes, please describe*** |
|  |
| ***8.1b What measures have been taken to minimise risk?*** |
|  |
| ***8.1c How will you handle participants who appear to have been harmed?*** |
|  |

***9. RESEARCH OVER THE INTERNET***

|  |
| --- |
| ***9.1 Will research be carried out over the internet?*** |
| Delete as applicable:  **Yes** |
| ***9.1a If yes, please explain protocol in detail, including how informed consent will be obtained, procedures concerning the right to withdraw and how confidentiality will be maintained. Give details of how you will guard against abuse by participants or others (see guidelines)*** |
| ***Only questionnaires will be taken over the internet and will be sent to closed groups of trusted people where abuse of the questionnaire will be mitigated by social contract. Consent will be obtained using a required question at the start of the form which will navigate to the end of the questionnaire if answered no. Data will be anonymised and there for once the questionnaire is completed a specific person can not be removed.*** |
| ***9.1b Have you included the online version of questionnaire and information/consent form? This should be as close to the format which will be viewed on line as possible.***  Delete as applicable:  **Yes (Appendix C)** |

***10. CONFLICTS OF INTEREST & THIRD PARTY INTERESTS***

|  |
| --- |
| ***10.1 Do any of the experimenters have a conflict of interest? (See guidelines)*** |
| Delete as applicable: **No** |
| ***If yes, please describe*** |
|  |
| ***10.1a Are there any third parties involved? (See guidelines)*** |
| Delete as applicable: **No (Go to Q11)** |
| ***If yes, please describe*** |
|  |
| ***10.1b Do any of the third parties have a conflict of interest?*** |
| Delete as applicable: **No Yes** |
| ***If yes, please describe*** |
|  |

***11. ADDITIONAL INFORMATION***

|  |
| --- |
| ***11.1 Give details of any professional bodies whose ethical policies apply to this research*** |
|  |
| ***11.2 Please give any additional information that you wish to be considered in this application*** |
|  |

***12. ETHICAL PROTOCOL & DECLARATION***

To the best of our knowledge and belief, this research conforms to the ethical principles laid down by the University of Plymouth and by any professional body specified in section 10 above.

This research conforms to the University’s Ethical Principles for Research Involving Human Participants with regard to openness and honesty, protection from harm, right to withdraw, debriefing, confidentiality, and informed consent.

**Sign below where appropriate:**

**STAFF / RESEARCH POSTGRADUATES**

**Print Name Signature Date**

Principal Investigator: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

Other researchers: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

**Staff and Research Postgraduates should email the completed and signed copy of this form to** [**scienghumanethics@plymouth.ac.uk**](mailto:scienghumanethics@plymouth.ac.uk)

**UNDERGRADUATE STUDENTS**

**Print Name Signature Date**

Student: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

Supervisor / Advisor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

**Undergraduate students should pass on the completed and signed copy of this form to their School Representative of the Science and Engineering Research Ethics Committee.**

**Signature Date**

School Representative on Science and

Engineering Faculty Research Ethics & Integrity

Committee \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

**Faculty of Science and Engineering Research Ethics & Integrity Committee List of School Representatives**

School of Geography, Earth and Environmental Sciences Dr Sanzidur Rahman

School of Biological and Marine Sciences Dr Gillian Glegg (Chair)

Dr Victor Kuri

School of Biomedical Sciences Dr David J Price

School of Engineering Dr Asiya Khan

Mr Chris Pollard

School of Computing, Electronics & Mathematics Dr Mark Dixon

Dr Yinghui Wei

Doctoral College, Deputy Director Prof Steven Furnell

External Representative Dr Satish B K

Lay Member Rev. David V. Evans

### **Committee Secretary: Mr Steven Neal**

### **Email: steven.neal@plymouth.ac.uk**

### **Tel: 01752 584877**

***APPENDIX A: SAMPLE INFORMATION SHEET***



**PLYMOUTH UNIVERSITY**

**FACULTY OF SCIENCE AND ENVIRONMENT**

RESEARCH INFORMATION SHEET

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Name of Principal Investigator**

*\*\*\*[student name]*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Title of Research**

*Usability Testing of Software for Computing Project module (Soft050)  
\*\*\*[project topic]*

For PRDC251, my group and I am required to develop (design, build and test) a piece of computer software to solve a real-world problem. I would like you to help me test my software, by telling me how effective it is.

This work is being done in accordance with the University of Plymouth’s ‘Ethical principles for research involving human participants’:

1. **Informed Consent**: The work may involve one or more of the following:

• **Observation** of you undertaking tasks using Software, such as finding a page on a web-site (30 minutes). You are encouraged to describe your thoughts during the activity. This seeks to evaluate the software (not you) – to see how easy it is to use.

• **Interviews**. you may be asked to describe your opinion of the usefulness of the software (30 minutes). This may be audio recorded to provide an accurate transcription.

• **Questionnaires** You may be asked to complete a short questionnaire, asking for your opinion of the usefulness of the software (20 minutes). Completion of the questionnaire will be taken as informed consent.

2. **Openness and Honesty**: There is no requirement for deception in this study.

3. **Right to Withdraw**: Signing this form does not commit you to take part in any part of the study. It is merely a record that you have participated willingly. You can withdraw at any time, during any activity, without giving a reason, by contacting the principal investigator and giving your **ID number** (at the top of this document). The data collected will not be in a format that could be used to measure the performance of individuals.

4. **Protection from Harm**: There is no obvious potential for this to occur, but the participant or the researcher can stop the study at any point.

5. **Debriefing**: The results of this study will be included in my project report, which will be available to all participants.

6. **Confidentiality**: Individual students or lecturers will not be identified in any field notes, transcripts, reports, presentations, or publications (internal or external).

If you are dissatisfied with the way the research is conducted, please contact the principal investigator in the first instance, or the module leader: mark.dixon@plymouth.ac.uk 01752 586225.  
 If you feel the problem has not been resolved please contact the secretary to the Faculty of Science and Environment Human Ethics Committee: Mrs Paula Simson 01752 584503

**The participant should keep this document**

***APPENDIX B: SAMPLE SELF-CONSENT FORM***

## **PLYMOUTH UNIVERSITY**

**FACULTY OF SCIENCE AND ENVIRONMENT**

**Human Ethics Committee Sample Consent Form**

CONSENT TO PARICIPATE IN RESEARCH PROJECT / PRACTICAL STUDY

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name of Principal Investigator

*\*\*\*[student name]*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Title of Research

*Usability Testing of Software for Computing Project module (Soft050)  
\*\*\*[project topic]*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Brief statement of purpose of work

To evaluate the effectiveness of *\*\*\*[project topic]* Software.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The objectives of this research have been explained to me.

I understand that I am free to withdraw from the research at any stage, and ask for my data to be destroyed if I wish.

I understand that my anonymity is guaranteed, unless I expressly state otherwise.

I understand that the Principal Investigator of this work will have attempted, as far

as possible, to avoid any risks, and that safety and health risks will have been

separately assessed by appropriate authorities (e.g. under COSHH regulations)

Under these circumstances, I agree to participate in the research.

Name: ……………………………………….

Signature: .....................................…………….. Date: ................…………..

**The participant should give this document to the researcher**

***APPENDIX C: SAMPLE Questionnaire and online consent***

***APPENDIX D: LINK TO SAMPLE Questionnaire and consent***

[***https://drive.google.com/file/d/1SBtOp4pFVCaakB5TyUn5DIj5TQfdPLJ1/view?usp=sharing***](https://drive.google.com/file/d/1SBtOp4pFVCaakB5TyUn5DIj5TQfdPLJ1/view?usp=sharing)

## 15.3 Card game questionnaire

## 15.4 Response to questionnaire

## 15.5 Project management

<https://trello.com/b/kTFeICQU/ccg-easy-builder-prco304>

### 15.5.1 Trello screenshot one

### 15.5.2 Trello screenshot two

### 15.5.3 Trello screenshot three

### 15.5.4 Trello screenshot four

### 15.5.5 Trello screenshot five

### 15.5.6 Trello screenshot six

### 15.5.7 Trello screenshot seven

### 15.5.8 Trello screenshot eight

### 15.5.9 Trello screenshot nine