UNIVERSITAT POLITÈCNICA DE CATALUNYA
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Centre de la Imatge i la Tecnologia Multimèdia

Aeternum:

A Trading Card Game with Augmented Reality

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Index

Abstract

This Bachelor's Thesis explores the fusion of traditional Trading Card Games with Augmented Reality technology, primarily focusing on the Aeternum TCG. The project's aim is to improve the learning experience of new players by using a companion AR app.

The project draws inspiration from renowned TCGs like Magic: The Gathering, Force of Will or Yu-Gi-Oh! To gain insights into game mechanics, card design and accessibility and design a deck that is simple to use but has depth.

The deck and the app that have been developed have been refined in playtesting sessions to create a fun and complex game that can be easily understood by all kinds of players.

This project is a glimpse into the potential of merging traditional tabletop games with new technologies to improve the experience of the users.

Key words

Augmented Reality, AR, Trading Card Game, TCG

Links

itch.io release: https://firealfa.itch.io/aeternum-ar

Aeternum in the Steam Workshop for Tabletop Simulator:
https://steamcommunity.com/sharedfiles/filedetails/?id=3028039809

Playtesting form: https://forms.gle/iazXT4ffthQaf3uL7

Table Index

Figure Index

Glossary

API: Acronym for "Application Programming Interface". A software intermediary that allows two applications to talk to each other.

App: Abbreviation for application. A computer program that is designed for a particular purpose.[1]

AR: Acronym for "Augmented Reality".

Asset: Anything that goes into a video game, such as characters, objects, sound effects, maps, etc.

Bug: A mistake or problem in a computer program.[2]

Build: A version of an application that is a standalone functional program that can be run on a computer.

Cel shading: A type of colouring that uses flat colours and straight lines to create the shadows and base colours.

Framework: It is a compilation of tools designed to help with the development of a certain task, an AR app in this case.

Hardware: The physical and electronic parts of a computer, rather than the instructions it follows.[3]

Library: A collection of prewritten code that programmers can use to optimise tasks.[4]

Mechanics: The ways in which players interact with the game's rules.

Method: A programmed procedure that is part of a defined structure.

Playtesting: The process by which a game designer tests a new game for bugs and design flaws before releasing it to market.[5]

[1] (Cambridge University Press & Assessment, n.d.)
[2] (Cambridge University Press & Assessment, n.d.)
[3] (Cambridge University Press & Assessment, n.d.)
[4] (Meltzer, 2023)
[5] (Wikipedia, n.d.)

Power creep: The gradual unbalancing of a game due to successive releases of new content, leaving the older ones underpowered.[6]

Prefab: Short for "prefabricated", used in Unity as a package of assets that can be instantiated at any given point as a unit.

Render: To create an image on a computer screen.

SDK: Acronym for "Software Development Kit". The SDK brings together a group of tools that enable the programming of mobile applications.[7]

Software: The instructions that control what a computer does; computer programs.[8]

Splash art: A full image, usually of a character and its surroundings.

TCG: Acronym for "Trading Card Game". Type of card game that is characterised by the creation and customization of the decks through a random assortment of cards acquired through packs that contain random cards or from trading with other players.[9]

UX: Abbreviation for user experience. The experience of someone using a product, system, or service, for example whether they find it enjoyable and easy to use.[10]

Vector image: It's a form of image that is defined by geometric shapes instead of pixels on a canvas.

VFX: Abbreviation for visual effects. Images in a film or entertainment that are created using computers, that can be mixed with live action.[11]

[6] (Power Creep, 2022)
[7] (*What Does the Acronym SDK Mean*, n.d.)
[8] (Cambridge University Press & Assessment, n.d.)
[9] (Lee & Brown, 1999, p.505)
[10] (Cambridge University Press & Assessment, n.d.)
[11] (Cambridge University Press & Assessment, n.d.)

1.- Introduction

1.1.- Motivation

For my Bachelor's Thesis in Video Game Design and Development, I have decided to take on the challenge of creating a card game that implements augmented reality. My motivation comes from several ideas that have aligned to allow me to pursue this project.

Firstly, during this degree I have participated in the development of a few small video game projects, but in each of them I have had to focus on just one aspect of it. I believe this project is the perfect opportunity to challenge myself by creating a game independently, allowing me to be involved in every aspect of its creation, including design, art, and code.

Secondly, I have been passionate about Trading Card Games (TCGs) for many years and I wanted to expand Aeternum by adding the augmented reality aspect to it. Aeternum has been a passion project of my dear friends Josep Riballo, Gerard Garcia and myself for some time and this is the perfect opportunity to upgrade it.

Thirdly, I am motivated to undertake this project because I believe that traditional TCGs offer a poor experience to observers and I think that this is an aspect that can be improved by using augmented reality to create a more visually appealing and engaging watching experience. The integration of augmented reality technology has the potential to revolutionise TCGs by adding a new layer of immersion and excitement for both players and spectators.

1.2.- Problem formulation

One of the main issues with traditional TCGs is that the viewer experience can be monotonous and unengaging, especially for those who are new to these games, due to the fact that what the spectator sees is just a table with a lot of text-heavy cards on it. Some games have adapted their physical game into a virtual version, making it easier for individuals to stream and for players to play the game wherever they are. This is a decent solution that can increase the popularity of the game, but these versions of the game are not the ones that are used in official tournaments, as these use the traditional physical version.

In addition, the main games in the scene have been around for decades, thus forcing them to power creep to keep the game interesting. This increase in the complexity of the cards' effects and the mechanics that have been introduced through the years makes it very difficult to introduce new players to the game. To try to avoid this problem, some games have tried to adopt a rotating format, which means that the players are only allowed to use cards released in a specific time frame; for example, only the cards from the past two years can be played. This is a good solution that makes it so that at least a small percentage of the game is still balanced and contained, and it also forces the players to buy the newer cards, thus keeping the game alive.

1.3.- General objectives

I have two main objectives with this project and each of them is related to the problems previously stated.

Firstly, I want to combine a card game with augmented reality technology so that the viewing and playing experience of the game is improved with the virtual representation of the card's effects and characters. This can be achieved by creating an augmented reality app that shows what each card does with animated 3D models.

Secondly, I want to use Aeternum as the base game as it is a brand new game that has not suffered from power creep, meaning that it has simple effects and that it can be easily picked up by new players.

1.4.- Specific objectives

To achieve the general objectives of the project, the following specific objectives have been identified:

AR App: To develop an application that uses augmented reality technology to enhance the viewing and playing experience of the Aeternum trading card game. This involves creating a user interface that allows the players to view the virtual representation of the cards they are playing in real-time and implementing the relationship between the physical cards and the virtual elements.

Aeternum: To expand the Aeternum trading card game by creating a new set of cards that have simple mechanics so that new players can learn the game easily and so that the game can be expanded on them in the future.

3D Models and Animations: To have a simple 3D representation of what each card does and that updates when a certain action is taken.

Spectator Experience: To create a fun spectating experience that is visually appealing through the use of special animations, particle effects, or other visual techniques, making the game more engaging for both viewers and players.

1.5.- Scope of the project

The scope of this Bachelor's Thesis project is limited to the following aspects related to the design, development, and implementation:

Platform: The development of the AR application will focus on a specific platform, such as smartphones or tablets, and will not be extended to other devices such as VR headsets or dedicated AR hardware.

Card Set Size: The project will focus on the creation of a limited number of new cards for the Aeternum TCG, with the understanding that further card expansions and updates may be developed in future projects.

Final quality: The project aims to create a working prototype of the augmented reality application and the Aeternum TCG expansion, rather than a fully polished, market-ready product.

Testing: The project will include user testing for the AR application to ensure that the game is engaging, accessible, and functional. However, comprehensive testing and balancing for long-term competitive play are outside the scope of this thesis.

Marketing and Distribution: The thesis will not cover the marketing, promotion, or distribution of the AR application or the Aeternum TCG expansion. These aspects fall outside the scope of this Bachelor's Thesis and may be addressed in future projects or collaborations.

Reach: The result of this project will be mainly used by the development team of Aeternum as a stepping point to continue developing the game, although it will serve as a good opportunity for players and spectators to see what could come off mixing traditional TCGs with augmented reality.

1.6.- Revised objectives and scope

During the early stages of development of this project, a few problems with the capabilities of the AR technology used were encountered (as explained in section 5.2.2.- AR Interaction). This meant that two of the specific objectives and one of the points of the scope were changed to redirect the focus of the project.

The objectives titled **3D Models and Animations** and **Spectator Experience** have been erased and replaced with these:

Quality Card Art: To have high quality 2D art for the cards and that each splash art follows the same art style.

Learning Support: To have comprehensible rules and card text so that the game is easier to learn and complement this learning with the extra information of the AR App.

The following point of the scope has been modified:

Final quality: The project aims to create a polished and market-ready product of the augmented reality application and the Aeternum TCG expansion.

2.- State of the art

2.1.- Augmented Reality

Augmented Reality (AR) is a technology that combines the real world with virtual elements, allowing users to experience an enhanced environment where digital objects are seamlessly integrated into their surroundings as seen in Figure 1.

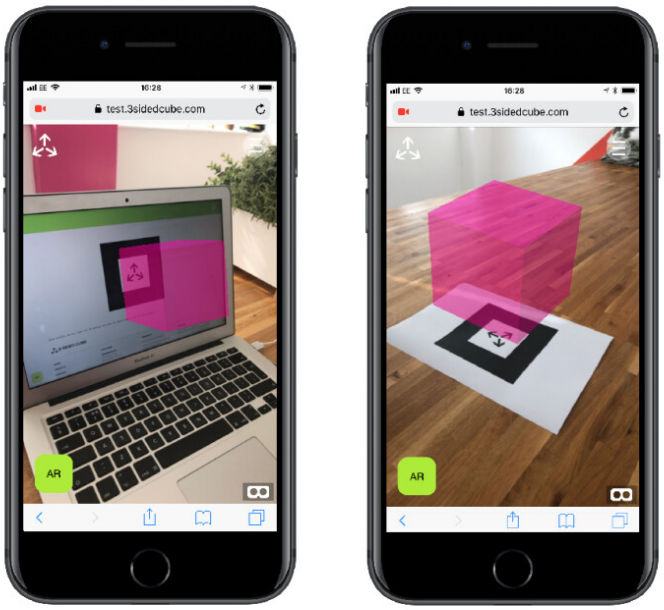


Figure 1: An augmented reality cube coming out of a drawing (3 SIDED CUBE, n.d.)

The concept of Mixed Reality (MR) has emerged as a broader term, encompassing both Augmented Reality and Virtual Reality (VR) experiences (Milgram & Kishino, 1994). The Reality-Virtuality Continuum introduced by Milgram and Kishino (see Figure 2), is a spectrum that describes the range of experiences that lie between the completely real and the entirely virtual environments. On one end of the spectrum is the real environment, while on the other end is the fully immersive virtual environment. AR lies around the middle, blending elements of both the real and virtual worlds.

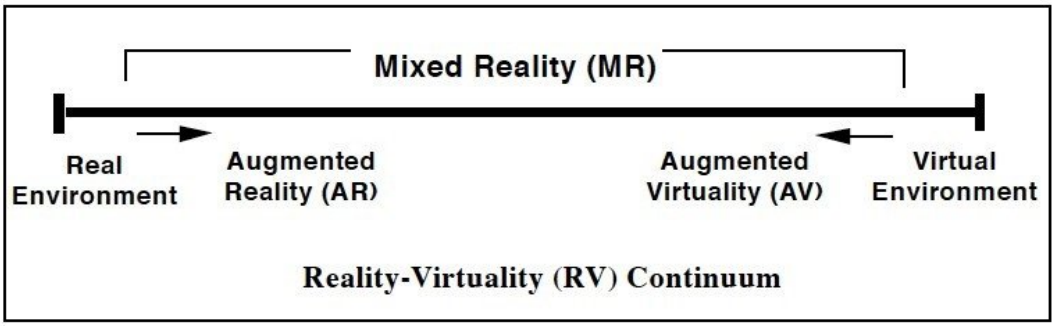


Figure 2: Reality-Virtuality (RV) Continuum (Milgram & Kishino, 1994)

Later, this Reality-Virtuality Continuum was revised by Skarbez et al. (2021) and it added a "Matrix-like" Virtual Environment as the extreme of virtuality (see 3).

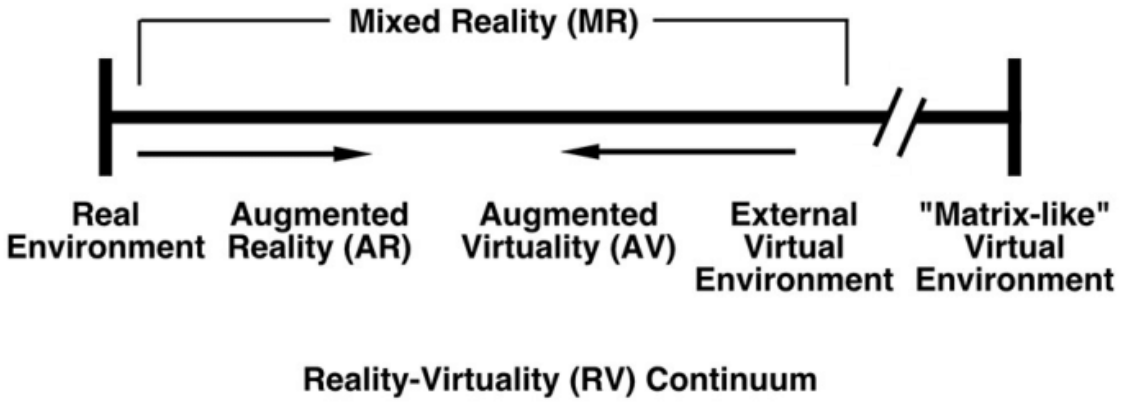


Figure 3: Revised Reality-Virtuality (RV) Continuum (Skarbez et al., 2021)

One of the most significant features of AR is that it does not completely replace the real world with a virtual environment, as is the case with VR. Instead, AR enhances the user's perception of the real world by overlaying digital objects, such as 3D models, images, or information, onto the user's view (Azuma, 1997). AR can be experienced using a variety of devices, including smartphones, tablets, and AR glasses, each offering different levels of immersion and interactivity. This project will focus on Android devices.

AR technology has been implemented across a wide range of applications, from entertainment and gaming to education and professional industries (Billinghurst & Duenser, 2012). In the context of this project, AR can be used to create an engaging and visually appealing experience for both players and spectators of the Aeternum trading card game by bringing the game's characters and effects to life in the form of interactive, animated 3D models.

In the following sections, AR Foundation and Vuforia will be explored. These are frameworks made specifically to work with augmented reality and that can be used in Unity Engine.

2.1.2.- Vuforia

Vuforia is a widely used AR development platform created by PTC Inc. (PTC, n.d.-a). It offers a comprehensive set of features that enable developers to create AR applications for various platforms, including iOS, Android, and Windows devices. Vuforia is well-known for its robust tracking capabilities, which include image, object, and model recognition, as well as support for markerless tracking using Vuforia's Smart Terrain technology (PTC, n.d.-b).

One of the key strengths of Vuforia is its powerful and reliable tracking capabilities, which can be vital for creating seamless and immersive AR experiences. Additionally, Vuforia provides a wide range of tools and resources for developers, including an extensive library of pre-built assets, sample projects, and documentation, making it a versatile and accessible choice for AR development (PTC, n.d.-b).

Pros of Vuforia include its robust tracking capabilities, extensive developer resources, and compatibility with multiple platforms. On the other hand, Vuforia requires a licence for commercial use, which may be a disadvantage for some developers or projects. Additionally, as Vuforia is not developed by Unity Technologies, it may not have the same level of integration with the Unity engine as AR Foundation, potentially requiring more effort to set up and maintain.

2.1.1.- AR Foundation

AR Foundation is a framework developed by Unity Technologies that allows developers to build cross-platform AR applications using a single API (Unity Technologies, n.d.). It provides a common set of features, components, and abstractions that can be used in combination with platform-specific AR SDKs, such as ARKit for iOS and ARCore for Android. By offering a unified development experience, AR Foundation simplifies the process of creating AR applications that can be deployed on multiple platforms, ultimately saving time and resources.

The AR Foundation framework is highly compatible with the Unity game engine and has an extensive range of features, including plane detection, image tracking, face tracking, and environmental probe support (Unity Technologies, n.d.). As a result, developers can take advantage of these advanced features to create immersive AR experiences with relative ease.

Pros of AR Foundation include its tight integration with Unity, cross-platform support, and comprehensive feature set. However, the framework may not offer the same level of specialised features or optimizations as platform-specific SDKs, which could potentially impact performance or functionality in certain cases. Furthermore, since AR Foundation relies on the underlying AR SDKs provided by device manufacturers, it may be limited by the capabilities of these SDKs.

2.2.- Game Engines

"A game engine is a software framework designed for the creation and development of video games. Developers use them to create games for consoles, mobile devices and personal computers. Typically, a game engine includes support programs and libraries among others to help develop and unit the different components of a project" (Valencia-García et al., 2016, p. 146).

From this definition, it can be seen how useful game engines can be for video game development as they provide developers with a plethora of useful tools that can be used to speed up the creation of a project. All of these tools that are available to the developer make it so that one can start creating the game without having to spend countless hours setting up the project with things such as rendering, sound, animation and much more.

Creating a game engine is a complex task that requires a big investment in time, money and knowledge. That is the main reason why only big companies with vast resources are the ones developing their own game engines for their line of games and why doing so falls out of the scope of this project. The next step is to choose which game engine will be used for this project.

There are several popular game engines available today, each with their own unique set of strengths and weaknesses. In the following subsections, the two most widely used engines (see Table 1) will be explored, Unreal and Unity (Toftedahl, 2019; itch.io, n.d.), and their respective advantages and disadvantages in the context of this project will be examined.

Game Engine	Number of projects	% of total games identified
Unreal	1726	25.6%
Unity	889	13.2%
Source	270	4.0%
Cryengine	238	3.5%
Gamebryo	215	3.2%
IW	192	2.9%
Anvil	166	2.5%
id Tech	113	1.7%
Essence	73	1.1%
Clausewitz	68	1.0%
Identified games with other engines	3266	48.4%
Total games identified (from Wikipedia, incl. DLCs and expansions)	6743	
Unknown/unidentified games	42538	
Total games in Steam database (incl. DLCs and expansions)		

Table 1: Game engines used in games released on Steam (data from 2018-12-20) (Toftedahl, 2019)

The data from this table might not be completely updated, but it is representative of what the market share is and it shows that Unreal and Unity are the top two competitors.

2.2.1.- Unreal

Unreal Engine, developed by Epic Games, is a prominent game engine that is widely used in the gaming industry for its high-quality graphics, performance capabilities, and advanced features. The engine is known for its powerful rendering capabilities and has been used in the creation of numerous visually stunning games across various genres (Cordone, 2019).

This engine is famous for its visual programming centred around blueprints. Visual programming lets the user create programs by manipulating program elements graphically rather than by specifying them textually (Jost et al., 2014). This can create an easier workflow once the user is used to this system, but it can make the learning curve to be a bit hard. Here is a list of the main features that Unreal offers (Epic Games, n.d.):

- High-quality graphics rendering capabilities (specially for 3D)
- Flexible and customizable material system
- Native C++ programming support
- Cross-platform build support
- Virtual Reality & Augmented Reality capabilities
- Niagara particle system and visual effects
- Rendering pipeline options
- World composition and level streaming

Unreal Engine is a powerful and versatile game engine with good support for AR development. However, its resource-intensive nature might not make it suitable for all devices, particularly older smartphones or tablets that may struggle to run AR applications with demanding graphics.

2.2.2.- Unity

Unity Engine, developed by Unity Technologies, is characterised by its versatility and community-created support content (Schardon, 2023), which has made it have a steady growth in users since its creation (see Johari, 2022, for more). By affixing reusable scripts and components, developers may quickly create and modify game objects thanks to the engine's component-based

architecture. This method encourages modularity and flexibility in the development process, making it possible to create complex games with less effort and development time (Schardon, 2023). Here is a list of the main features that Unity offers (Unity Technologies, n.d.):

- 3D and 2D Graphics Support
- Easy-to-understand architecture
- Unity scripting API in C#
- Cross-platform build support
- Virtual Reality & Augmented Reality capabilities
- Large asset store
- Unity developed packages
- Rendering pipeline options
- Animation tools
- Adaptability to other industries
- Analytics tools

In addition to all of these functionalities, Unity has a low learning curve and is the engine that has been taught more in my degree's curriculum. Moreover, its excellent support for multiplayer gameplay and various options for AR development have been significant factors in choosing this engine for this project.

2.3.- TCGs

Trading Card Games (TCGs), also known as Collectible Card Games (CCGs), are strategic games played with decks of cards that are specifically designed for the game. Players collect cards, build decks, and compete against one another using their custom decks, which are typically composed of a combination of resource, character, and action cards. Each card has unique abilities, and the goal of the game is to outmanoeuvre and defeat the opponent by reducing their life points or achieving a specific win condition.

2.3.1.- Magic: The Gathering

Magic: The Gathering (MTG), created by mathematician Richard Garfield and published by Wizards of the Coast in 1993, is widely considered the first TCG (Kotha, 1998). Magic's core gameplay revolves around players using land cards to generate resources, which are then used to cast spells, summon creatures, and activate abilities to defeat their opponent. The game has experienced sustained popularity and growth, with multiple expansions and formats introduced over the years.

The current state of Magic: The Gathering is characterised by its diverse player base, competitive tournament scene, and a wide variety of formats that cater to different playstyles and budgets (Wizards of the Coast, n.d.). It continues to be a popular and influential TCG, setting the standard for many subsequent card games in the industry.

2.3.2.- Force of Will

Force of Will (FoW), designed by Eiji Shishido and published by Force of Will Co. Ltd., was first released in 2012. The game has very similar mechanics to Magic, but introduces new features such as a unique resource system called "Magic Stones," which allows players to generate resources without relying solely on cards drawn from their decks. This helps to reduce the impact of resource variance and promote strategic gameplay (Force of Will Co., Ltd., n.d.).

The game has gained a following due to its engaging mechanics, stunning artwork, and unique themes drawn from various mythologies and folklore (see Figure 4). As of now, Force of Will continues to release new expansions and maintain a dedicated player base, although its total player base is smaller than that of Magic or Yu-Gi-Oh!; but it still has a lot of popularity in countries like Italy or France (Force of Will Co., Ltd., n.d.).

This game was a great inspiration mechanics-wise when creating Aeternum as the team thought it was a good evolution from its predecessor and it gave the players much more freedom of choice.

Figure 4: Amaterasu, the Oracle of Sacred Text (Force of Will Co., Ltd., 2014)

2.3.3.- Yu-Gi-Oh!

Yu-Gi-Oh! is a TCG created by Kazuki Takahashi, and first published by Konami in 1999, based on the popular manga and anime series of the same name. The game features a distinctive gameplay style that emphasises summoning powerful monsters, using spell and trap cards to support them, and strategically managing resources to defeat the opponent.

Today, Yu-Gi-Oh! remains a popular TCG with a dedicated fan base, regular expansions, and an active tournament scene. The game has evolved over time, introducing new mechanics and card types to keep the gameplay fresh and engaging (Konami, n.d.).

This game has one aspect that will be actively tried not to be recreated and that is the amount of text that the newer cards can have (see Figure 5). This is one of the factors that makes new players have a harder time when coming into the game.

Figure 5: Endymion, the Mighty Master of Magic from Yu-Gi-Oh! (Konami, 2019)

2.4.- Existing AR Card Games

While there are existing games that combine elements of Trading Card Games (TCGs) and Augmented Reality (AR), none of them precisely align with the vision for this project. These games have taken approaches to blend AR technology with card game mechanics but have not yet achieved the desired level of immersion or gameplay experience that this project aims to accomplish.

2.4.1.- Yu-Gi-Oh! AR

Yu-Gi-Oh! AR is an unofficial fan-made project, created by software engineer and Yu-Gi-Oh! enthusiast, MicrowaveSam (MicrowaveSam, 2019). The project uses AR technology to bring Yu-Gi-Oh! cards to life, displaying 3D models of the monsters on the physical cards. However, this project is not an official product, and its scope is limited to visualising the monsters, without providing a complete gameplay experience (see Figure 6).

Figure 6: Screenshot of MicrowaveSam (2019)'s video about Yu-Gi-Oh! AR

2.4.2.- Drakerz

Drakerz-Confrontation, developed by Peoleo Entertainment, is a TCG that uses AR technology to visualise the battles between players' creatures on the cards. Players place their cards under a webcam, and the software recognizes the cards, generating a 3D animated fight between the creatures (Peoleo Entertainment, 2014).

While Drakerz offers an innovative approach to card game battles, it has not gained widespread popularity and lacks the depth and complexity of more established TCGs .

2.4.3.- Lightseekers

Lightseekers, developed by PlayFusion, is both a TCG and an action-adventure role-playing game that features AR elements. The physical cards can be scanned using the companion app, granting in-game bonuses and unlocking digital content (PlayFusion, n.d.).

Although Lightseekers successfully integrates AR with a TCG, the game's primary focus is on its role-playing component, and the AR features serve as a supplementary aspect rather than the central gameplay mechanic.

2.4.4.- Genesis AR

Genesis AR, developed by Genesis Augmented Reality, is an AR trading card game that uses a mobile app to bring its cards to life. Players can scan their physical cards with the app, which then generates 3D models of the characters on the cards, allowing players to engage in battles using their smartphones (Genesis Augmented Ptd Ltd., n.d.).

While Genesis AR offers an intriguing combination of AR physical cards, it does not implement TCG mechanics in its gameplay.

2.5.- Conclusions about the state of the art

By doing the previous study of the state of the art, these following conclusions have been drawn.

Unity Engine has been chosen for its versatility, community support and the built-in support for Augmented Reality using AR Foundation. This framework has been chosen for its easy implementation and the cross-platform capabilities.

Magic: The Gathering serves as a notable source of inspiration for this project's game design as it creates a robust base that can be modified following some of the changes implemented by Force of Will, such as the Mana System. From Yu-Gi-OG! it can be learned that cards should be concise and/or explain what they do clearly.

3.- Project planning

3.1.- Planning and tracking

3.1.1.- Gantt

A Gantt diagram will be used to keep track of the tasks that are needed to be done and their duration as well as the main milestones and deliveries. The diagram can be seen below in Figure 7 and, beneath it, the same information is conveyed in the form of a table (see Table 2) so that each specific date and duration can be more easily checked.

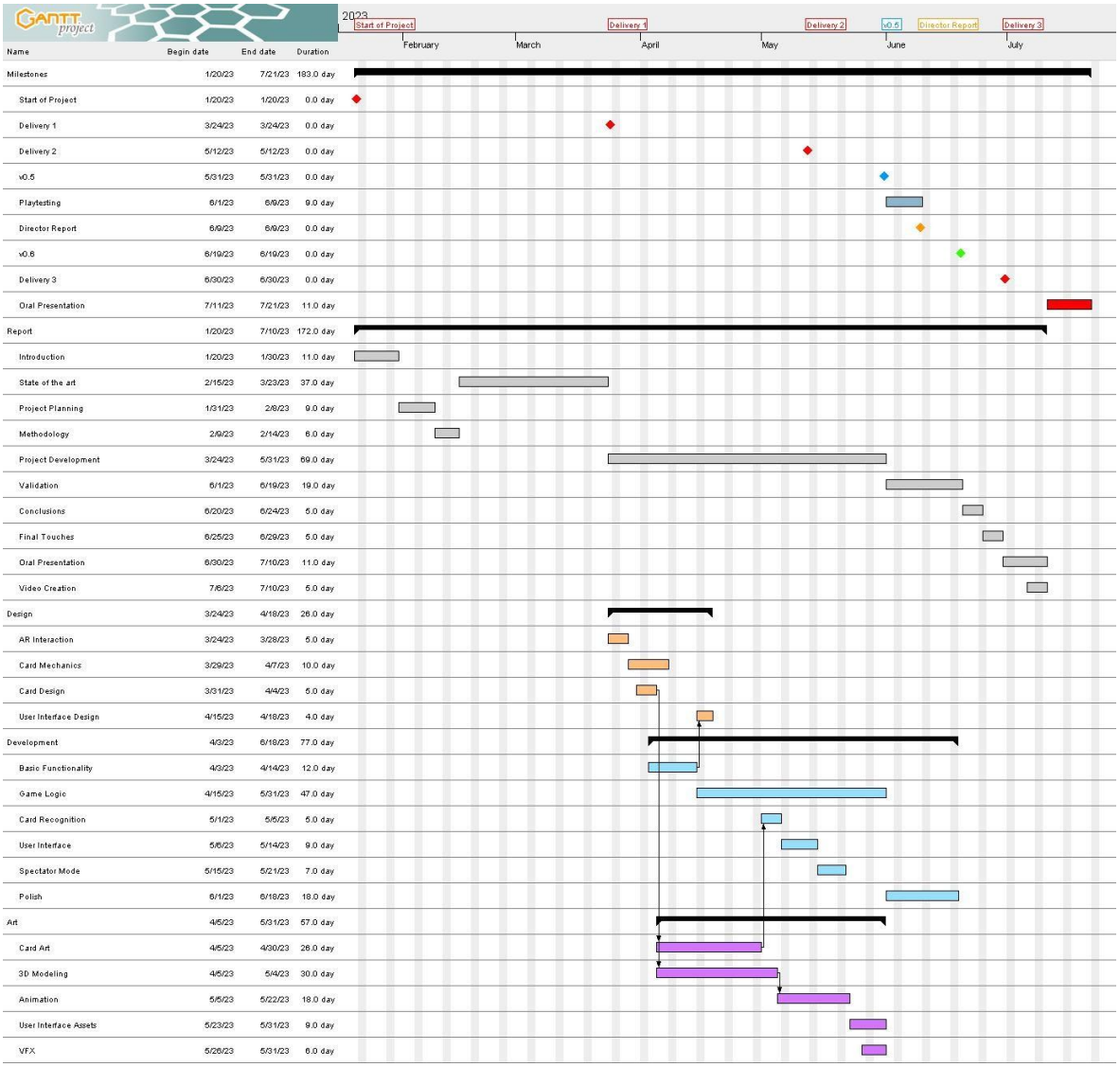


Figure 7: Gantt Diagram

Name	Begin date (m/d/y)	End date (m/d/y)	Duration (days)
Milestones	-	-	-
Start of Project	1/20/23	1/20/23	-
Delivery 1	3/24/23	3/24/23	-
Delivery 2	5/12/23	5/12/23	-
v0.5	5/31/23	5/31/23	-
Playtesting	6/1/23	6/9/23	9
Director Report	6/9/23	6/9/23	-
v0.6	6/19/23	6/19/23	-
Delivery 3	6/30/23	6/30/23	-
Oral Presentation	7/11/23	7/21/23	11
Report	1/20/23	7/10/23	172
Introduction	1/20/23	1/30/23	11
State of the art	2/15/23	3/23/23	37
Project Planning	1/31/23	2/8/23	9
Methodology	2/9/23	2/14/23	6
Project Development	3/24/23	5/31/23	69
Validation	6/1/23	6/19/23	19
Conclusions	6/20/23	6/24/23	5
Final Touches	6/25/23	6/29/23	5
Oral Presentation	6/30/23	7/10/23	11
Video Creation	7/6/23	7/10/23	5
Design	3/24/23	4/18/23	26
AR Interaction	3/24/23	3/28/23	5
Card Mechanics	3/29/23	4/7/23	10

Name	Begin date (m/d/y)	End date (m/d/y)	Duration (days)
Card Design	3/31/23	4/4/23	5
User Interface Design	4/15/23	4/18/23	4
Development	4/3/23	6/18/23	77
Basic Functionality	4/3/23	4/14/23	12
Game Logic	4/15/23	5/31/23	47
Card Recognition	5/1/23	5/5/23	5
User Interface	5/6/23	5/14/23	9
Spectator Mode	5/15/23	5/21/23	7
Polish	6/1/23	6/18/23	18
Art	4/5/23	5/31/23	57
Card Art	4/5/23	4/30/23	26
3D Modelling	4/5/23	5/4/23	30
Animation	5/5/23	5/22/23	18
User Interface Assets	5/23/23	5/31/23	9
VFX	5/26/23	5/31/23	6
TOTAL	**1/20/23**	**7/21/23**	**183**

Table 2: Gantt Tasks

3.1.2.- Kanban

To keep track of the detailed tasks that need to be done during the development of this project, a Kanban table will be used. The software used will be Notion, as it has incredible flexibility and it is the same software that I use on a daily basis for note taking and organisation, so having everything centralised will allow for a better workflow.

3.1.3.- GitHub

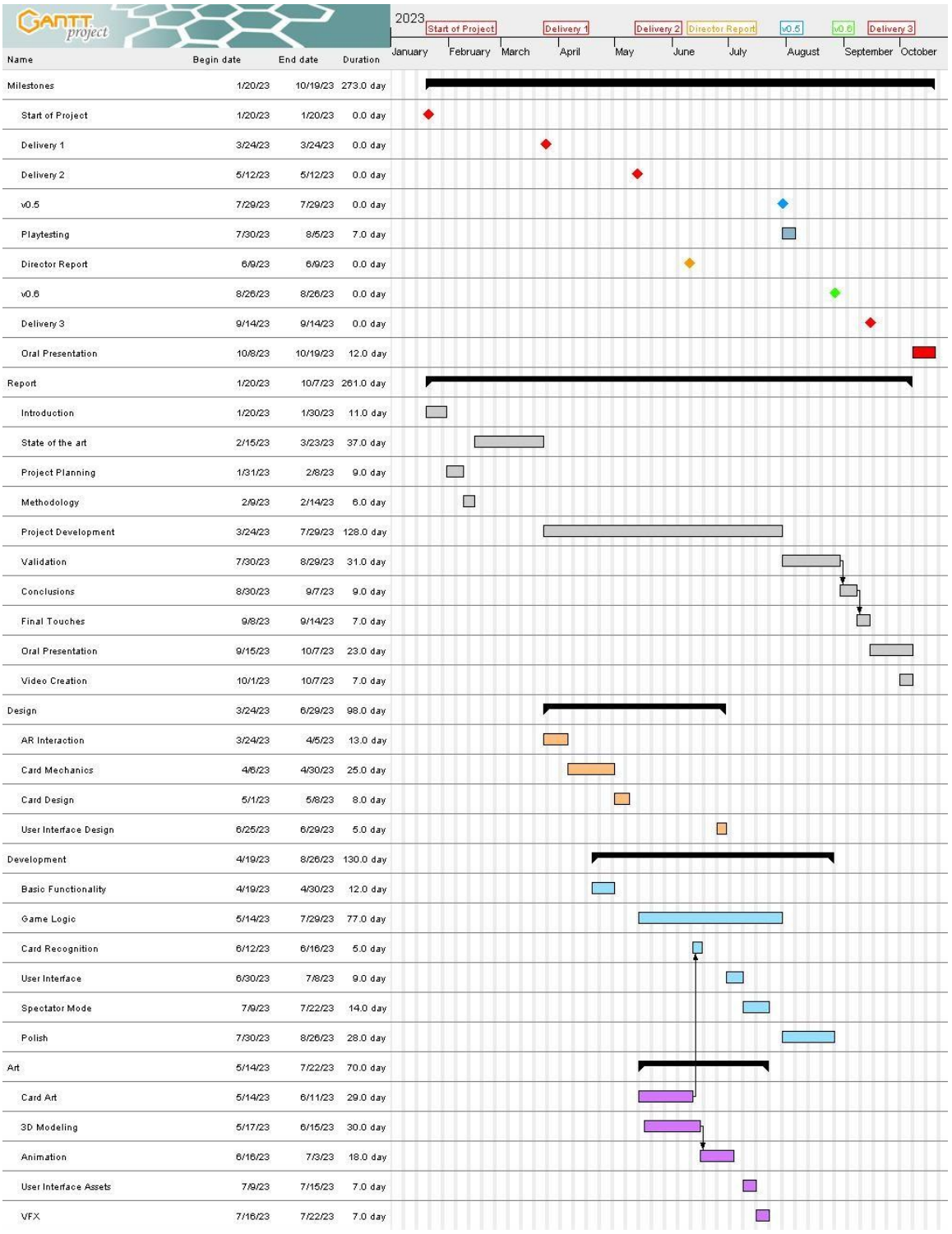
GitHub will be used to keep track of the development process and to keep an online backup of the project. The repository will be kept private to ensure that the code and assets are not used by third parties.

3.1.4.- Itch.io

The releases for Aeternum will be uploaded to Itch.io in the address found in the Links section.

3.2.- Revised planning

Due to unforeseen health-related issues, the development of this project experienced an unavoidable delay. These issues disrupted the planned schedule for the project's development and a new schedule has been made with a new deadline. The revised Gantt diagram can be seen below in Figure 8.



Name	Begin date	End date	Duration
Milestones	1/20/23	10/19/23	273.0 day
Start of Project	1/20/23	1/20/23	0.0 day
Delivery 1	3/24/23	3/24/23	0.0 day
Delivery 2	5/12/23	5/12/23	0.0 day
v0.5	7/29/23	7/29/23	0.0 day
Playtesting	7/30/23	8/5/23	7.0 day
Director Report	6/9/23	6/9/23	0.0 day
v0.6	8/26/23	8/26/23	0.0 day
Delivery 3	9/14/23	9/14/23	0.0 day
Oral Presentation	10/8/23	10/19/23	12.0 day
Report	1/20/23	10/7/23	261.0 day
Introduction	1/20/23	1/30/23	11.0 day
State of the art	2/15/23	3/23/23	37.0 day
Project Planning	1/31/23	2/8/23	9.0 day
Methodology	2/9/23	2/14/23	6.0 day
Project Development	3/24/23	7/29/23	128.0 day
Validation	7/30/23	8/29/23	31.0 day
Conclusions	8/30/23	9/7/23	9.0 day
Final Touches	9/8/23	9/14/23	7.0 day
Oral Presentation	9/15/23	10/7/23	23.0 day
Video Creation	10/1/23	10/7/23	7.0 day
Design	3/24/23	6/29/23	98.0 day
AR Interaction	3/24/23	4/5/23	13.0 day
Card Mechanics	4/6/23	4/30/23	25.0 day
Card Design	5/1/23	5/8/23	8.0 day
User Interface Design	6/25/23	6/29/23	5.0 day
Development	4/19/23	8/26/23	130.0 day
Basic Functionality	4/19/23	4/30/23	12.0 day
Game Logic	5/14/23	7/29/23	77.0 day
Card Recognition	6/12/23	6/16/23	5.0 day
User Interface	6/30/23	7/8/23	9.0 day
Spectator Mode	7/9/23	7/22/23	14.0 day
Polish	7/30/23	8/26/23	28.0 day
Art	5/14/23	7/22/23	70.0 day
Card Art	5/14/23	6/11/23	29.0 day
3D Modeling	5/17/23	6/15/23	30.0 day
Animation	6/16/23	7/3/23	18.0 day
User Interface Assets	7/9/23	7/15/23	7.0 day
VFX	7/16/23	7/22/23	7.0 day

Figure 8: Revised Gantt Diagram

3.3.- Validation tools

Internal playtesting will be conducted regularly to make sure that the game is balanced, that the builds are stable and that minimal bugs are presented in the final playtesting session. The playtesting of the TCG will be done using Tabletop Simulator. The game used can be found in Steam's Workshop or in the Links section.

To ascertain that the objectives of the project are being achieved, there will be an open playtesting session in which participants will have to fill out a form explaining their experience while playing the game and while spectating.

3.4.- SWOT

To help with decision making within the project and to gain a deeper understanding of this project's challenges and opportunities, a SWOT analysis can be used (see Table 3). This analysis examines the internal and external factors that may impact the project so that areas that require attention and improvement get revealed.

Strengths	**Weaknesses**
- The project uses AR technology to create a unique gaming experience. - Combining card mechanics with AR provides an immersive and interactive gaming experience. - The project can be scaled up to support a bigger set of cards.	- AR technology and card recognition may be challenging to implement. - The project has a tight deadline, which may affect the quality and scope of the final product.
Opportunities	**Threats**
- As AR technology becomes more popular and accessible, there is a growing market for AR-based games. - The game's expandable content and card system can provide opportunities for in-app purchases in the future, generating revenue.	- Sudden rapid advancements in AR technology may require the project to adapt or risk becoming outdated. - Ensuring that users find the game appealing and user-friendly may be challenging, affecting its success.

Table 3: SWOT analysis

3.5.- Risks and contingency plan

In any project, it is important to identify potential risks and develop contingency plans to mitigate their impact. In this section, the key risks associated with the project and the possible steps that will need to be taken to address them are outlined in the following Table 4.

Risk	Likelihood	Impact	Contingency Plan
Technical issues with AR technology	Moderate	High	Conduct regular testing throughout the development to identify and address technical issues early on. Further research on the subject will have to be done if the situation comes.
Lack of time	Moderate	High	Functionality will be prioritised over polishing.
Too many assets to be created	Low	High	Free assets from the Unity Asset Store can be obtained to substitute the missing characters or VFXs.
Dissatisfaction with UX	Low	Moderate	Create a comprehensible plan to upgrade the usability after playtesting.

Table 4: Contingency plan

3.5.- Cost analysis

In order to complete any project, it is essential to have a clear understanding of the cost of it. In Figure 9, there is a breakdown of the costs divided into the salary for one person, the hardware needed and the software that will be used.

The yearly income of 24.726€ has been calculated by taking the average between a 3D Artist's, Programmer's and a Videogame Designer's yearly salary (Glassdoor, 2023a, 2023b, 2023c).

		-	-	Yearly Income	Monthly Income
Salary	Gross Base Salary			24.726,00 €	2.060,50 €

		Expenses	Amortization (moths)	-	Monthly Cost
Hardware	Computer	2.000,00 €	48		41,67 €
	Peripherals	250,00 €	24		10,42 €
	Graphic Tablet	130,00 €	12		10,83 €
Software	Card Creator				33,99 €
	Blender				0,00 €
	Pack Adobe Cloud				62,99 €
	Pack Adobe Substance 3D				48,39 €

Monthly Total	2.268,79 €
Monthly Hours	100
Hourly Rate	22,69 €
Total Dedicated Hours	360
TOTAL COST	8.167,63 €

Figure 9: Cost analysis

3.6.- Revised cost analysis

The change in the schedule has added two more months to the production time, resulting in an increase in the total dedicated hours to the project. This change is directly reflected in the total costs and can be seen in Figure 10 below.

		-	-	Yearly Income	Monthly Income
Salary	Gross Base Salary			24.726,00 €	2.060,50 €

		Expenses	Amortization (moths)	-	Monthly Cost
Hardware	Computer	2.000,00 €	48		41,67 €
	Peripherals	250,00 €	24		10,42 €
	Graphic Tablet	130,00 €	12		10,83 €
Software	Card Creator				33,99 €
	Blender				0,00 €
	Pack Adobe Cloud				62,99 €
	Pack Adobe Substance 3D				48,39 €

Monthly Total	2.268,79 €
Monthly Hours	100
Hourly Rate	22,69 €
Total Dedicated Hours	560
TOTAL COST	12.705,21 €

Figure 10: Revised cost analysis

4.- Methodology

4.1.- Design Thinking Overview

The Design Thinking methodology is an ideology that is accompanied by a process and can be defined like such:

"The design thinking ideology asserts that a hands-on, user-centric approach to problem solving can lead to innovation, and innovation can lead to differentiation and a competitive advantage. This hands-on, user-centric approach is defined by the design thinking process and comprises 6 distinct phases." (Gibbons, 2016). These 6 phases will be detailed in the following sections: Empathise, Define, Ideate, Prototype, Test and Implement (Plattner et al., 2009) (see Figure 11).

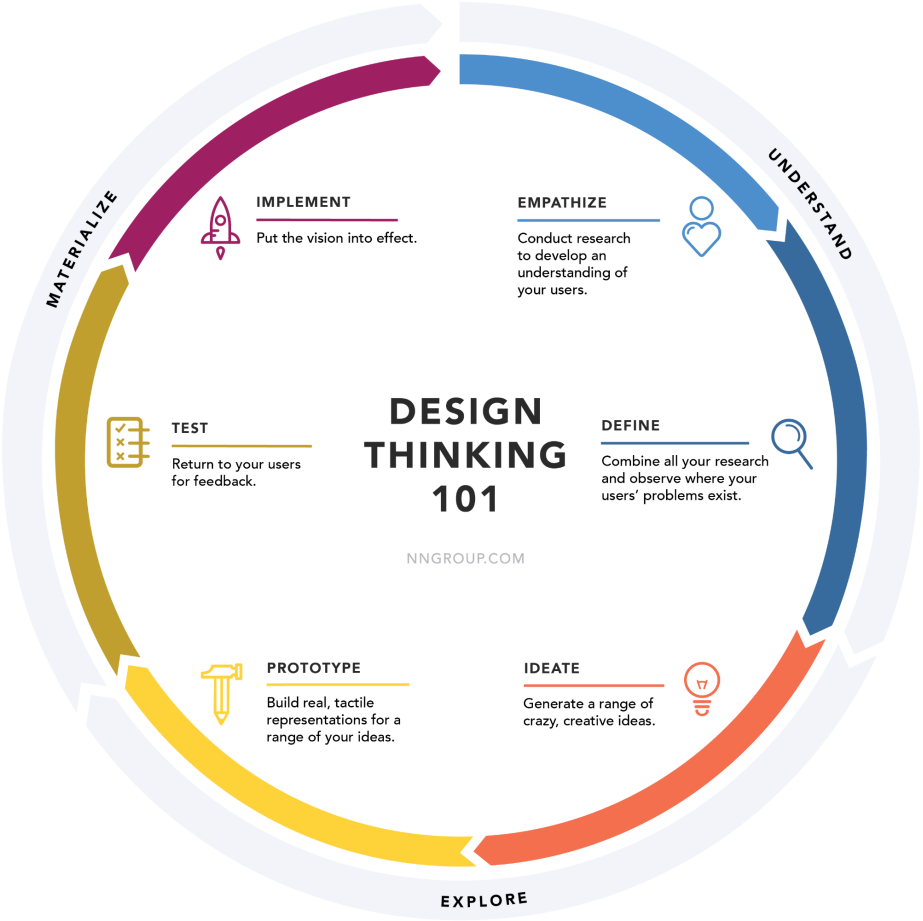


Figure 11: Design Thinking structure (Gibbons, 2016)

Due to the limitations in human resources, this project will follow an adaptation of the Design Thinking methodology in which only one Prototype will be created and Tested. But, doing so correctly and following the methodology will make it so that the project is easier to continue once this Bachelor's Thesis is completed.

4.2.- Empathise

This phase consists of conducting research in order to develop knowledge about what the target users do, say, think and feel (Gibbons, 2016).

To gather insight about the target users' needs and preferences, interviews with players of existing TCGs where they can be asked about their experience in the community will be conducted. Additionally, observation of players engaging with TCGs at local game stores or during tournaments could be very useful. Another thing that will give useful data is to look at the number of spectators during different live events such as tournaments and competitions.

Doing all of this will allow me to fully understand what the players want and if the project is well oriented.

4.3.- Define

In this phase the insights gathered during the Empathise stage will be used to clearly define the specific problems that this project aims to address. Doing so may cause that the original objectives stated in the Introduction have to be refined or new objectives to appear.

4.4.- Ideate

During the Ideate stage, what has been learnt from the Empathise and the Define phases will have to be taken into account to create a wide possible range of ideas from which to select great solutions (Plattner et al., 2009). This is the phase in which the actual brainstorming process takes place (Mueller-Roterberg, 2018) and where the possible ideas of what will be implemented are imagined.

4.5.- Prototype

In this stage, it is recommended that a lot of low-resolution prototypes are created to test if the Ideas are good enough and if they solve the problems they need to, although in later stages of development the prototype can be more refined (Plattner et al., 2009).

As it has been mentioned in section 4.1, this project will make a small variation of the original methodology; the first small prototypes will be skipped and a single more refined one will be done instead.

4.6.- Test

During the Test phase, feedback from the users about the prototype or prototypes that have been created is solicited so that it can be seen if the goals have been met (Plattner et al., 2009).

This stage intersects with the Validation of this project. It will be in this stage that the playtesting session will be held, in which experienced and inexperienced users will interact with the prototype. To check if the objectives have been met, the testers will be presented with a form.

4.7.- Implement and Iterate

After the testing has been completed, the prototype will be modified to include the upgrades that have appeared. Following this iterative methodology, the project will have higher chances of success long-term.

4.8.- Modifications to the Methodology

During the development of the project, working with this user-centred methodology has proven to be a good way of approaching the tasks. Because of this, the only modification done to the methodology will be the one initially stated and none more. This modification consists of creating only one refined prototype instead of several simple ones.

5.- Project development

5.1.- Insight about the users

The motivation to make this game a more enjoyable viewing experience and to make it more engaging comes primarily from my own experience and point of view but, to make sure that the proposed path is the right one to take, it will have to be validated by looking at other players' opinions. To do so, simple observation will be used during face-to-face tournaments, a comparison of online viewership between physical tournaments and their digital counterparts will be done and it will be followed by a small survey to TCG players.

5.1.1.- Tournament scouting

To gather information about the number of spectators during face-to-face tournaments, six different tournaments were spectated. Three were held in the store Gameria in Barcelona and the other three were held in the store inGenio in Barcelona. During these tournaments, the amount of people that attended the tournament to participate and how many attended as a spectator was tracked; the average time these spectators stayed in the tournament and how long the tournament lasted was also tracked. These are the results gathered:

- Gameria | Yu-Gi-Oh! | 30 March 2023
    - Number of participants: 13
    - Number of spectators: 1
    - Duration of the tournament: 247 min
    - Average time spent spectating: 82 min
- inGenio | Magic: The Gathering | 1 April 2023i
    - Number of participants: 24
    - Number of spectators: 2
    - Duration of the tournament: 263 min
    - Average time spent spectating: 54 min
- Gameria | Yu-Gi-Oh! | 6 April 2023
    - Number of participants: 11

        - Number of spectators: 0
        - Duration of the tournament: 259 min
        - Average time spent spectating: 0 min
- inGenio | Magic: The Gathering | 8 April 2023
    - Number of participants: 31
    - Number of spectators: 3
    - Duration of the tournament: 286 min
    - Average time spent spectating: 38 min
- Gameria | Yu-Gi-Oh! | 13 April 2023
    - Number of participants: 17
    - Number of spectators: 2
    - Duration of the tournament: 252 min
    - Average time spent spectating: 41 min
- inGenio | Magic: The Gathering | 15 April 2023
    - Number of participants: 24
    - Number of spectators: 1
    - Duration of the tournament: 271 min
    - Average time spent spectating: 34 min

Average number of participants: 20

Average number of spectators: 1’5

Spectator to participant ratio: 7’5%

Average duration of the tournament: 263’16 min

Average time spent spectating: 41’5 min

Spectating time to tournament time ratio: 15,78%

5.1.2.- Viewership

By looking at the viewership of different categories of the same game it can be seen which one interests people the most. The viewership between the physical version of Yu-Gi-Oh! and its digital counterpart, Master Duel, will be compared by looking at the official channel of the game (YuGiOhCardEU) and the overall Twitch viewership for those categories. The same comparison was planned for Magic: The Gathering, but both versions of the game are streamed under the same category, so there is no way of comparing the viewership. These are the results obtained:

- YuGiOhCardEU has an average of 875 viewers for their Master Duel tournament streams (TwitchTracker, n.d.-a).
- YuGiOhCardEU has an average of 967 viewers for their physical tournament streams (TwitchTracker, n.d.-b).
- The average number of viewers of all the Master Duel streams in Twitch is 1870 (TwitchTracker, n.d.-c).
- The average number of viewers of all the physical version of Yu-Gi-Oh! streams in Twitch is 247 (TwitchTracker, n.d.-d).

5.1.3.- Survey

This survey was conducted to 30 people who participate actively in the TCG community to see if they think that a game and app like the ones that will be developed during this project can better the viewing and learning experience of players. The survey results can be found in Appendix A.

The first question in the survey was asked to see if the demographics meet the viewership study done in the last section (see Figure A1). The next question aimed to see in what situations the respondents played and how many of them played online using the digital versions of the games (see Figure A2). This next question aimed to see if the players who answered the survey are interested in being a spectator and in what medium they spectate (see Figure A3). The last two questions are used to see if the type of application that is to be made can work in the ways that are intended (see Figure A4 and Figure A5).

5.1.4.- Conclusions

By looking at all of the information collected in the sections above, a few important statements can be concluded:

- The number of spectators in tournaments of local stores is incredibly low.
- Even though the viewership during big tournaments is similar, there are a lot more people interested in watching the digital version of the game than the physical one.
- Creating an application that helps visualise what cards do can improve the experience for spectators and new players alike.

5.2.- Design

Thanks to the insight obtained from the users, there is reassurance that the original objectives are well set and can create a useful product. With this out of the way, the designing of the game and application can start.

5.2.1.- Rulebook of Aeternum

Aeternum has been in development for quite some time and during this time the rules have been constantly evolving. For this thesis, the rulebook has been re-written with the most up-to-date version of the rules and adapted to better fit the scope of this project. This rulebook can be found in Appendix B.

This rulebook goes over the material needed to play the game, the organisation of the board, the cards and how they work and how the turns are set up.

A simplified version of these rules was redacted so that it could be shared with the participants of the playtesting sessions and it can be found in Appendix C.

5.2.2.- AR Interaction

5.2.2.1.- First approach

The original goal for the AR app was to enhance the spectator experience and to make it easier for new players to learn how to play. To do so, the plan that was devised for the app was the

following: spectators or players would be able to point their devices at the physical game field and the app would recognise the cards and superimpose a 3D virtual representation of the cards on the field; it would also show an overlay above the card with the effects of the card that could be used at that point in time.

Looking at the field and seeing all the cards come to life can be a great way to make the spectators feel more immersed in the game and the overlay of the effects on each card can also help in understanding the game state, thus making it easier to follow a game.

To test the viability of this idea, a small prototype was created in Unity. Doing so discovered a big problem; the AR Foundation framework could not track multiple instances of the same image, which meant that a complete view of the playing field could never be replicated in AR. To see if this problem was specific to this framework and perhaps it was a bad choice to begin with, the same thing was tested using Vuforia but it presented the same problem.

Creating a new image tracking system fell outside of this project's scope, so the solution to the problem was to adapt the main idea to the existing technology.

5.2.2.2.- Second approach

This new approach is much more oriented to the player and focuses on providing the players with easy access to the card's information.

The app will be used to scan just a few cards at the same time and display their abilities in an easy to understand manner. The card that is being scanned will have a border around it with the information that is needed next to it, such as the card's name, a short description of its effects and a mark to know whether the card can be played or not. If the user wants to know more about a specific ability the card has, it will be able to tap on said effect and a pop-up with the detailed information will appear.

5.2.3.- Card Mechanics Design

5.2.3.1.- Deck Theme

When designing a full deck in a TCG, it is important to establish a thematic foundation that not only defines the visual identity of said deck but also influences the mechanics and strategies that the cards have. To choose the theme for this deck, the first thing that had to be taken into consideration was in what Element of the game it would fall.

Aeternum has 5 different Elements (Light, Darkness, Nature, Water and Fire) each with a certain set of abilities that more or less fit on one point of the Metagame Clock. The Metagame Clock is a strategic game design concept that explains the ever-shifting landscape of strategies within a game's competitive environment (Workman, 2000; Mason, 2005). Each main strategy (or deck archetype in this case) is placed somewhere in the clock with the strategy that beats it placed on its right (as seen in Figure 12).

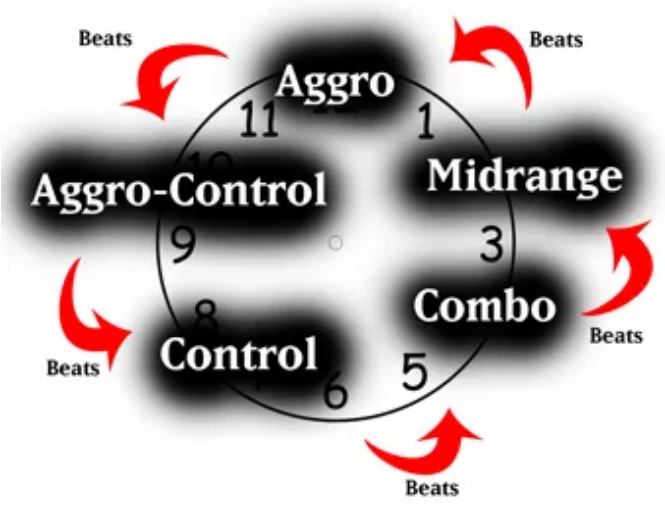


Figure 12: Metagame Clock (Buel, 2009)

The term "aggro" comes from the word "aggressive" and this type of decks focus on dealing as much damage to the opponent as fast as possible by creating as many threats as possible as fast as possible (Buel, 2009). Combo decks are focused on playing a combination of cards and using this combination to get to their win condition (Buel, 2009). Control decks focus on stopping certain actions and slowing down the pace of the game to win by having more resources than the

opponent. Aggro-Control is a mix between Aggro and Control, while Midrange is a mix between Aggro and Combo (Buel, 2009).

As it was stated previously, each Element in Aeternum more or less corresponds to a strategy: Fire equals Aggro, Light equals Aggro-Control, Water equals Control, Darkness equals Combo and Nature equals Midrange.

Aggro is probably one of the simplest archetypes to understand because its strategy and win condition are simple: play as many creatures as possible and attack the opponent. This means that the deck created will be of the Fire Element, as it will be easier to pick up by new players and the goal is to create a good learning experience.

The next thing to consider to complete the theme of the deck is the visual identity. In this case, simians were chosen because they represent the aggressive nature of the deck and because this theme can easily fit into the lore of the game.

This deck will be led by a strong simian called Bongar whose goal is to recruit a great army of simians and lead them to victory by rushing into battle and blowing things up. When the card mechanics are defined, this premise will have to be followed.

5.2.3.2.- Card Mechanics

When designing the mechanics of each card, the Sligh Deck of Magic: The Gathering was a great inspiration. The Sligh Deck was created by Jay Scheinder and later popularised by Paul Sligh and it introduced important basic concepts, not only for aggro decks, but also for card game design and deck building (Kusumoto, 1996).

The deck list can be seen below in Figure 13 and it consisted of creatures that had a low-cost and that are meant to attack as soon as possible combined with spells and abilities that deal direct damage to the opponent or their creatures.

CREATURE	20 CARDS
2 Dragon Whelp	2
2 Brothers of Fire	1
2 Orcish Artillery	1
2 Orcish Cannoneers	1
4 Ironclaw Orcs	1
2 Orcish Librarian	1
4 Brass Man	1
2 Goblins of the Flarg	

SUMMON	5 CARDS
3 Dwarven Lieutenant	
2 Dwarven Trader	

SORCERY	2 CARDS
1 Detonate	X
1 Fireball	X

INSTANT	9 CARDS
1 Shatter	1
4 Lightning Bolt	
4 Incinerate	1

ARTIFACT	1 CARDS
1 Black Vise	1

ENCHANTMENT	1 CARDS
1 Immolation	

LAND	23 CARDS
4 Strip Mine	
4 Mishra's Factory	
2 Dwarven Ruins	
13 Mountain	

SIDEBOARD	15 CARDS
1 Shatter	1
1 Detonate	X
1 Fireball	X
1 Meekstone	1
1 Zuran Orb	0
3 Active Volcano	
2 Serrated Arrows	4
1 An-Zerrin Ruins	2
4 Manabarbs	3

Figure 13: Deck list for the original Sligh Deck (Shvartsman, 2004)

The idea for this deck was to generate as many threats as possible in an efficient way by spending all the mana each turn. This introduced the concept of the Mana Curve, which is an application of maths to card games that attempts to maximise the chances of spending all the mana each turn by playing a certain number of cards that cost 1 mana, 2 mana, etc. (Shvartsman, 2004). The Sligh Deck's Mana Curve can be seen in Figure 14.

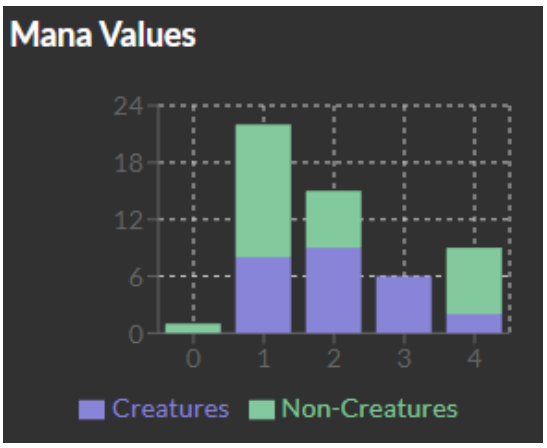


Figure 14: Sligh Deck's Mana Curve (Anonymous, 2021)

With these basic ideas of combining fast creatures that generate multiple threats and spells and abilities that deal direct damage and having a mana cost that follows a good mana curve, the deck list shown in Table D1 was created.

This first draft had a lot of flaws, specially in the cost of the cards and the power of the effects, but it created good opportunities for fun gameplay; such as the card that explodes when it receives damage (Mun Ki) and that can be searched (with Sa'ruu) or the card that costs less depending on the damage that the player has dealt to the opponent this turn (Zaaru).

After this first iteration, the cards were revised and small changes were made. This new version of the deck (seen in Table D2) was short-lived as, after some internal playtesting done using Tabletop Simulator, new versions of the cards were made. These cards had better defined costs that better fit the desired Mana Curve and names that were easier to remember. This version also included the first version of the Leader and a Special Astro that could be used to deal 1 damage, which was a simple way to smoothen out the Mana Curve and it makes it easier to use all the resources each turn. These versions of the cards also had more text on them, as each keyword was explained in detail. This is something that wasn't in the original version and seems to contradict our goal to make cards less cluttered with text, but the feedback showed that having the explanation for the ability was preferred when learning, at least in decks and carts meant for beginners. The third version can be seen in Table D3.

With this third version, the deck was looking closer to a finished product, but it still needed polish because some cards were too strong, especially Sprinting Oreol, which created too much value after turn 4. The Leader also had the problem of not fitting one of the core game pillars of Aeternum, as it wasn't one of the more important pieces of the deck and it wasn't used nearly enough as it was desired. To fix this, it was given a small rework and the abilities of the Leader and the Ascended Leader were swapped and tuned. This final version of the deck list can be seen below in Table 5.

Name	Type	Race	Speed	Cost	ATK	HP	Description
Bongar, the Recruiter	Leader	Simian	-	-	-	-	[Ascend] (F) (Once per game, you may pay (R) to flip this untapped card and put it onto the Field.) [Enduring] (F) (You can activate your [Ascend] ability multiple times during a game. Pay (R) each time you wish to [Ascend] after the first time.) Tap--> [Stargaze] (Put the top card from your Astro Deck into the Astro Zone. You can activate this ability only once per turn and only in your turn. This ability can not be responded to.) (F)--> Reveal the top 3 cards of your Deck. Choose one Simian from among them, put it into the Field and Exile it at the end of the turn. Send the rest to the Graveyard. You can only use this effect on your turn.
Bongar, the Leader	Ascended Leader	Simian	-	(F)	6	6	(F)--> Choose one: - Give a Simian +2/+0 until the end of the turn. - Give a Simian +0/+2 until the end of the turn. - Give a Simian [Swiftness] until the end of the turn. Tap--> Put a 6/6 Simian token in your Field.
Slow Burn Rock	Special Astro	-	-	-	-	-	Tap--> Produce (R) Tap--> Deal 1 damage to target Player, Creature or Ascended Leader.
Bomb Supervisor Kire	Creature	Beast/ Simian	Slow	(F)(F)(1)	6	4	[Swiftness] (This card can be tapped the turn it is played.) When this card is put into the Graveyard from your Field--> Search for a card named "Bomber Osvak" in your Deck and put it into your Field. If you control "Admirer Oiram", search your Deck for any number of cards named "Bomber Osvak" and put them into your Field instead. The Creatures

							put into the Field this way gain [Swiftness] until the end of the turn. Shuffle your Deck.
Bomber Osvak	Creature	Beast/ Simian	Slow	(F)(F)	2	2	Whenever this card receives damage--> Put this card from the Field into the Graveyard, then it deals 2 damage to each Player, Creature and Ascended Leader.
Admirer Oiram	Creature	Beast/ Simian	Slow	(F)(F) (2)	8	8	You may pay (F) less to play this card for each 4 damage you have done to an opponent this turn. Enter--> Simians you control gain +2/+2 until the end of the turn. At the end of your turn untap all Simians you control.
Sprinting Oreol	Creature	Beast/ Simian	Slow	(F)	3	3	This card gains +2/+1 and [Swiftness] if you control at least 4 Fire Astros.
Finder in Nasio	Creature	Beast	Slow	(F)	2	2	Enter--> Reveal the top 5 cards of your Deck. You may put a Fire Creature from among them into your hand. Shuffle the rest into your Deck. Exile this card--> Deal 4 damage to target Creature.
Bri'to the Assistant	Creature	Beast	Slow	(F)(F)	2	4	If a Fire source you control would deal damage, it deals that much +1 instead.
Accidental Explosion	Chant	-	Quick	(F)	-	-	Deal 5 damage to target Player, Creature or Ascended Leader.
Bongar's Mark	Chant	-	Quick	(F)(F)	-	-	Target Creature gains +4/+0 and "When this card is put into a Graveyard from the Field--> Put it into the Field tapped under its owner's control." until the end of the turn.
Monkey Slap	Chant	-	Slow	(F)(1)	-	-	Target a Creature or Ascended Leader you control: Deal damage equal to its ATK to target Creature or Ascended Leader. [Awakening](F)(F)(F)--> You deal damage to an additional target Player, Creature or Ascended Leader. (To

							Awaken a card, you must pay the extra cost when you play the card.)
Sacrifice to Amade	Chant	-	Quick	(F)	-	-	Send one Simian you control from the Field to the Graveyard--> Deal damage equal to that Creature's ATK to target Creature.

Table 5: Final iteration of the Bongar Deck

5.2.4.- Card Layout Design

The layout of the cards has to easily convey all of the information about the card while being visually appealing and letting the splash art shine. The different layouts used in this project were created using Card Creator.

A very important part of the card is its cost, as it means whether that card can be played at any given point, to make this information accessible to the player, it was placed in the top-left corner; this means that when the player has the cards fanned out in their hand they can see all of their costs simultaneously.

The description of the card also has to be easy to read and, to assure that is the case, it was given its own space of a box with white background and black text.

In Creatures, the ATK and HP values are also important, especially during battle. To make sure that those numbers were easy to read during combat and to give an indication that to attack the card needs to be rotated the ATK and HP values were placed rotated and on the left side of the card. This means that when the card was rotated to attack the values needed to complete the battle were facing the player.

The name of the card, its type and race were placed on coloured boxes that indicate the Element of that card; in this case, it was red to represent Fire. Other information like the card's ID, the copyright and the name or the artist were displayed at the bottom of the card in the border. See Figure 15 for an example of the described layout.

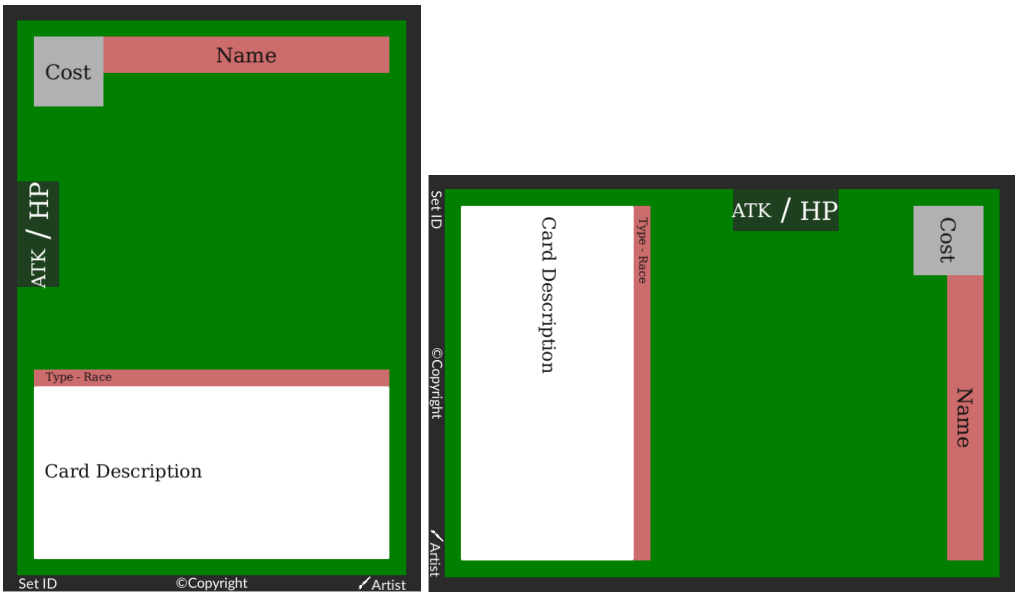


Figure 15: Creature and Ascended Leader card layout

The Leader, Chants and Astros also needed their own different layouts as they have different information to display. The Leader has no cost and no ATK or HP, Chants have no ATK or HP but do have a cost and Astros only have a small description. These three layouts can be seen below in Figure 16.

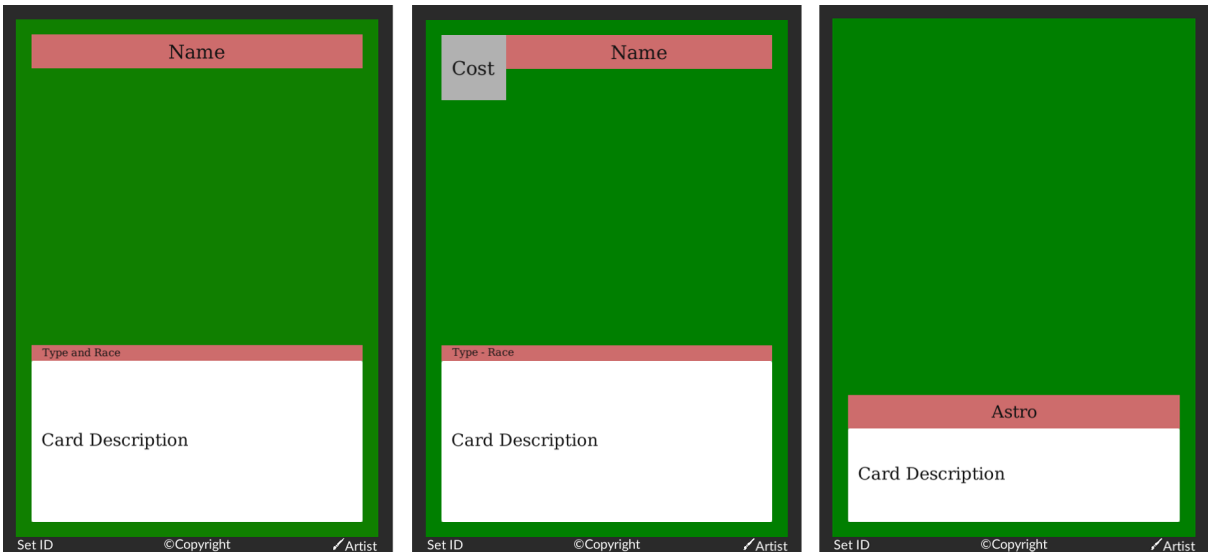


Figure 16: From left to right: Leader, Chant and Astro layouts

5.2.5.- User Interface

The UI (User Interface) of the AR app that will be developed needs to be easy to understand and easy to use. To achieve this, the app will consist of only three screens described below (also see Figure 17):

- The Main Menu with three options, each being: Play (to access the Scanning Scene), Help (to access the Help Menu) and Exit (to close the app).
- The Help Menu will have simple instructions on how to use the app and a Back button (to go back to the Main Menu).
- The Scanning Scene will be where cards are scanned, displaying a border around the card, the card's name, a short description of its effects and a square that displays whether the card can be played in that phase (see Figure 18 for an early version of this overlay and Figure 19 for the final one). It will have a Back button (to go back to the Main Menu) and a series of buttons on the bottom of the screen to select the current phase.

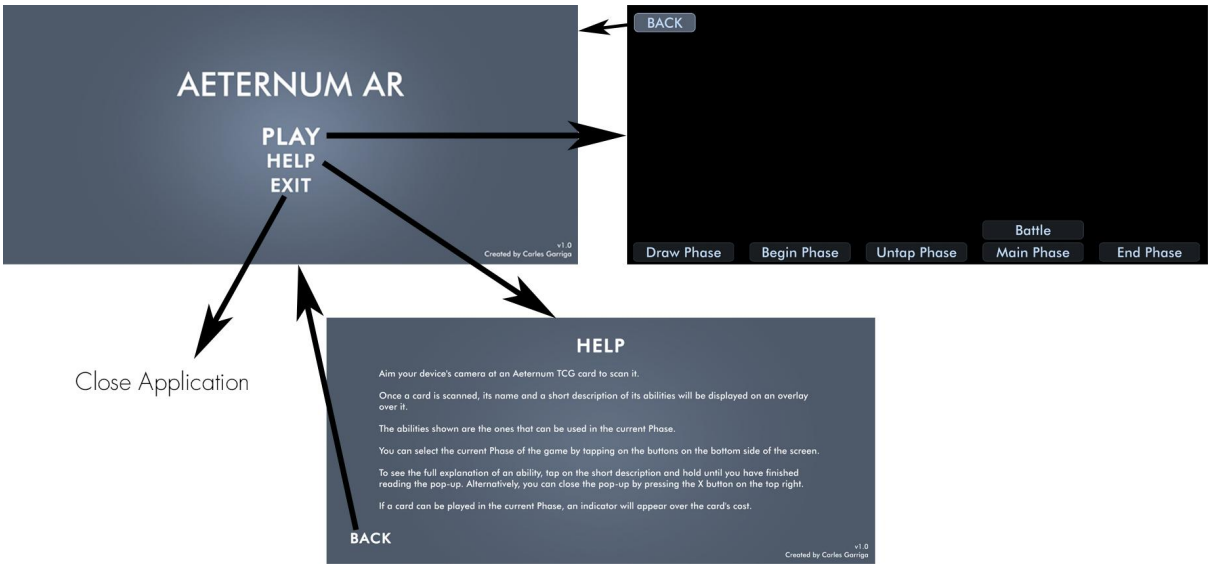


Figure 17: Menu flowchart

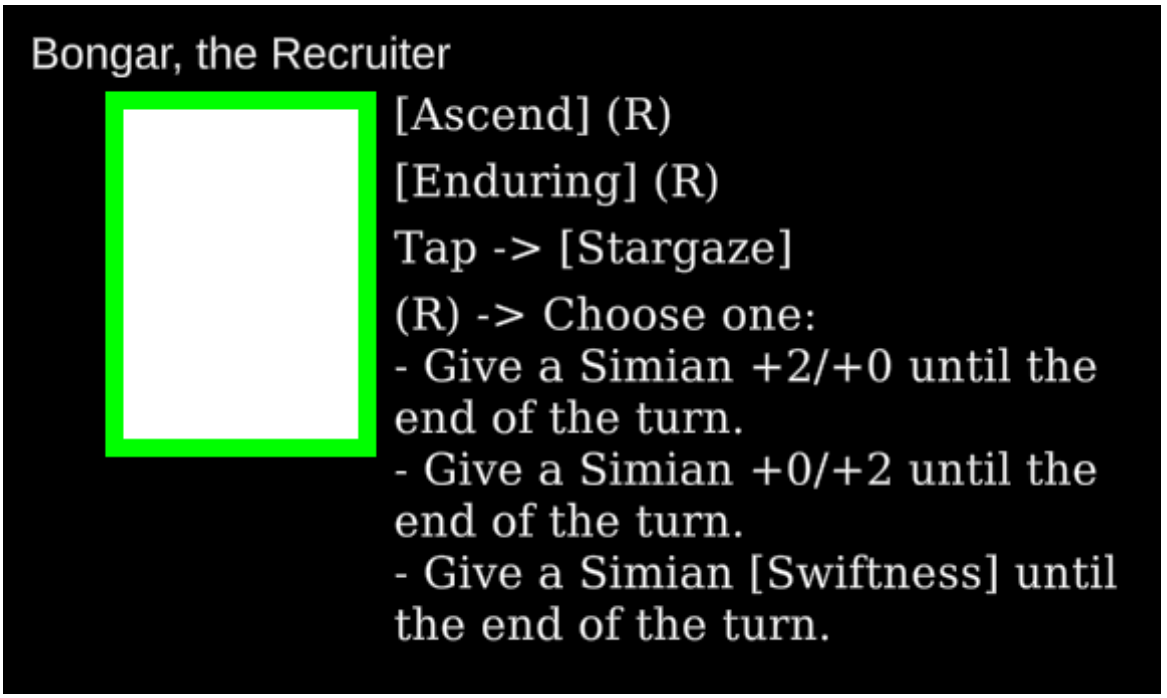


Figure 18: Bongar, the Recruiter with an early version of the overlay

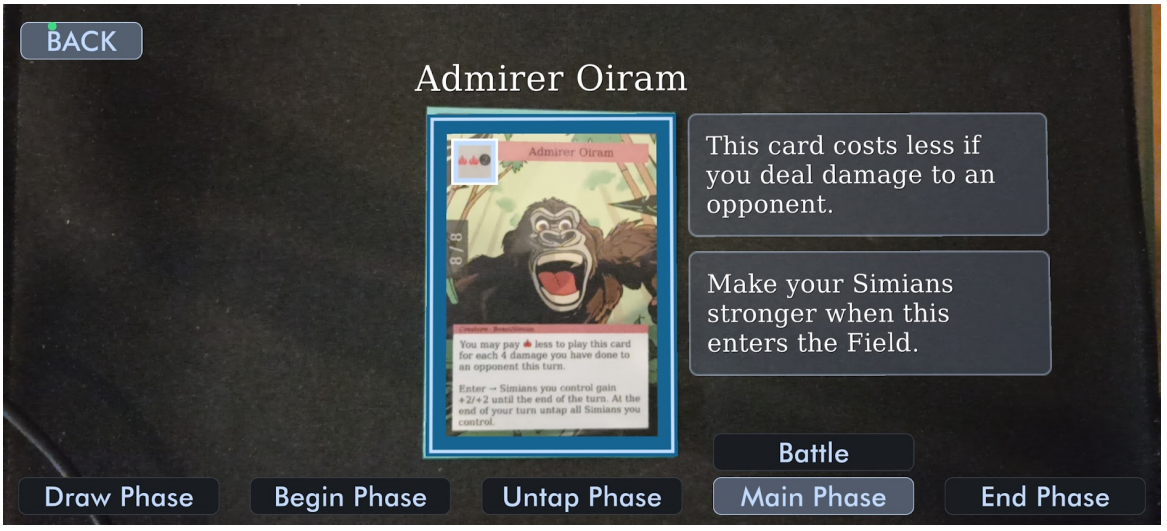


Figure 19: Scan of Admirer Oiram with its overlay effects

5.3.- Art

With the theme of the deck set and the layout of the User Interface thought out, their respective art can be done.

5.3.1.- Card Art

5.3.1.1.- The Actors

The cards of each set can tell a story by connecting their art and making it mean something instead of them just being random images. By joining the mechanics of each card and the theme of the deck, the actors of this story and their sub-plots get more and more defined. The final images and the card back can be found in Appendix E and will be mentioned during the explanation below.

The main character of this story is the Leader, Bongar. Bongar has two sides: the first one is him as a Recruiter, as someone who is building their army, and it's shown that he isn't too strong but that he has potential (see Figure E1); the second one is him as a true Leader, and shows him in a pose that gives off confidence and power (see Figure E2).

The other characters of the story are Bongar's henchmen, and they all fill certain parts of the story. One group of characters are in charge of explosives and are led by the supervisor, who looks like someone intelligent and organised (see Figure E3). The next ones are: the main bomber, who shows their crazy nature with a big explosion behind them (see Figure E4), and the assistant, who helps light the fuses and makes everything deal more damage (see Figure E8). But, obviously, with so much explosive, not everything works as intended and there must be some kind of unwanted explosion (see Figure E9).

There is also a more ritualistic side of the army that works with sacrifices and with empowering the troops (see Figure E12 and Figure E10). And there are also the brutes that go into the fight and attack the opposition with their bare hands (see Figure E5, Figure E6 and Figure E11). Another important actor is the talent finder (see Figure E7).

5.3.1.2.- Splash Art Creation

Once the actor or situation that goes into each card is set, the creation of the splash arts can begin. The first thing to do is to choose an artistic style to follow for the cards. In Aeternum, each deck has a different art style instead of having all the cards of the game follow the same style, this means that any particular style could be chosen for this deck. The style chosen for this deck has been a comic book style with bold black shadows and thick lining combined with flat colours shaded using cel-shading like in Figure 20.

Figure 20: Fragment of the front page of Love Everlasting #1 (Charretier, 2022)

The process to get the final images seen in Appendix E will be explained in this section. Bomb Supervisor Kire will be used as an example during the explanation.

The first step to create a splash art is to think of the composition of the image and to search for references, which can range from stock images, to posing references, to self taken images, to 3D renders or to AI art. With this character, the goal is to make him look like he is intelligent and organised. To do so, the character will hold a couple of files while looking sideways into the camera. The references used for the character's face are seen below in Figure 21.

Figure 21: Stock images used as reference for Bomb Supervisor Kire

These references can be processed in Adobe Photoshop to get the important lines that define the shape of the face, making it easier to translate the shape to the desired style. The steps are the following (also see Figure 22):

1. Convert the image to grey-scale by de-saturating it (Ctrl+Shift+U).
2. Filter the colours so the black and white pop up more by using the Camera Raw Filter (Ctrl+Shift+A).
3. Apply a Stamp Filter (Filter → Filter Gallery).

Figure 22: Splash art creation process, part 1

With this black and white image it is now easier to create the lineart for the character. This lineart is done following the inking style and then passed through Adobe Illustrator to convert it to a vector image (see Figure 23).

Figure 23: Splash art creation process, part 2

This process is then repeated for all the lineart of the card, ignoring the spots where the information of the card goes to not do unnecessary work. The full lineart of this example can be seen in Figure 24.

Figure 24. Splash art creation process, part 3

The final steps are to give colour to the image and then send the coloured splash art to Card Creator to generate the final card (see Figure 25).

Figure 25: Splash art creation process, part 4

This whole process is then repeated for each card of the deck.

5.3.2.- User Interface Art

The art for the UI of the AR app has to be simple enough so that it doesn't clutter the screen but captivating enough so that the user knows where to tap or what is happening on the screen.

The colour chosen for these elements has been a grey-blue contrasted with white and very light blue. These images for the buttons were created in Adobe Photoshop in a small square. This square image was then processed in Unity's Sprite Editor to make it adapt to the size of each button or coloured area (see Figure 26).

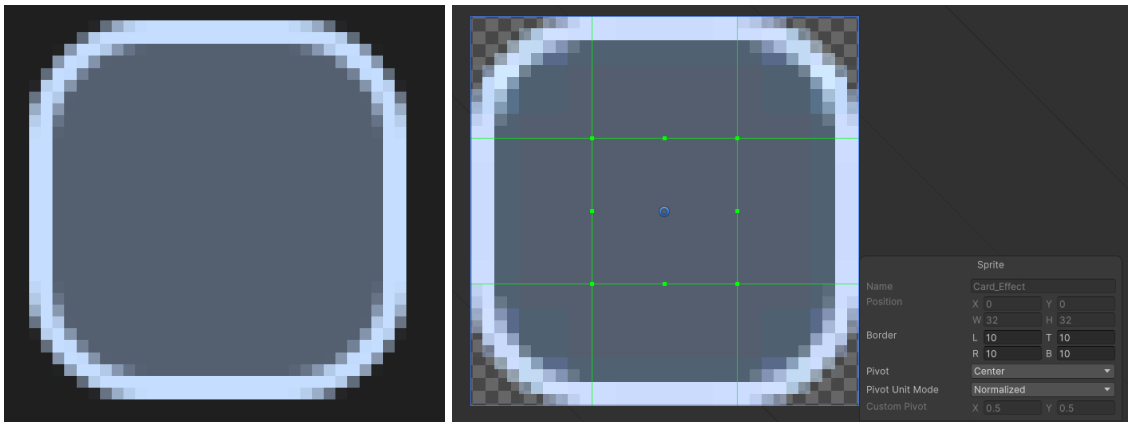


Figure 26: Sprite for the background of the cards effects and its process in Unity

The UI elements that were created were: the border that appears around the card when it is scanned, the background for the effects that appear next to the card, the square that appears over the cost of the card if it is playable on the current phase and the buttons to choose phase as seen in in action in Figure 27 below.

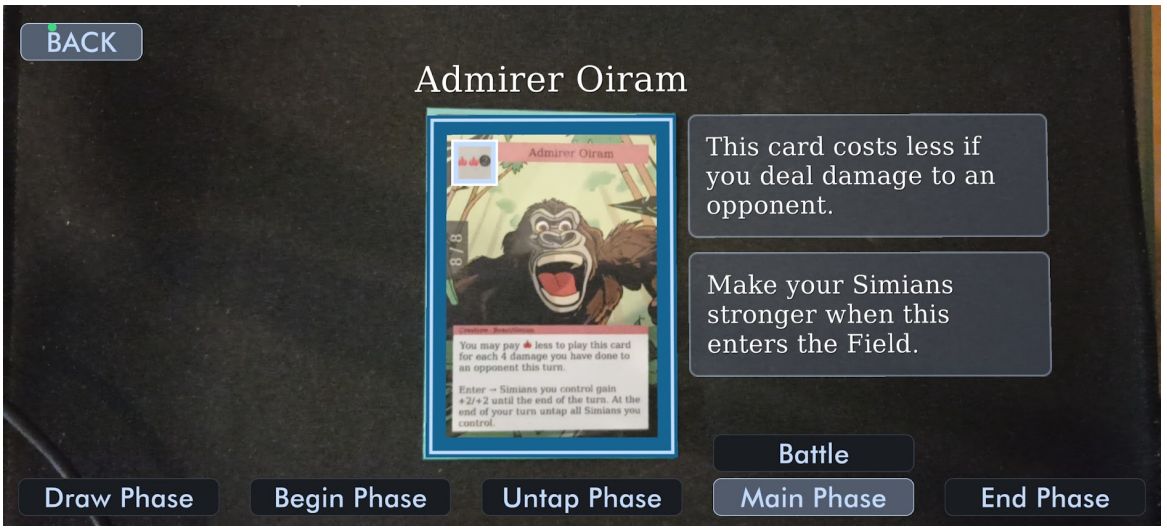


Figure 27: UI Elements over Admirer Oiram

5.4.- Code

The app was developed using Unity Engine's version 2021.3.23f1 with the AR Core project template that comes with AR Foundation's version 4.2.7 installed. This way most things needed to create an Augmented Reality scene come prepared, such as an object called "AR Session" that controls the user input while AR is being used and an object called "AR Session Origin" that holds the script needed for tracking images and a Camera with the correct settings.

By creating a "Card Library" and attaching it to the "AR Tracked Image Manager" of the "AR Session Origin" object, the camera is able to track the desired images. As it has been stated previously, this framework can only track one instance of the same image. A snippet of this library can be seen in Figure 28.

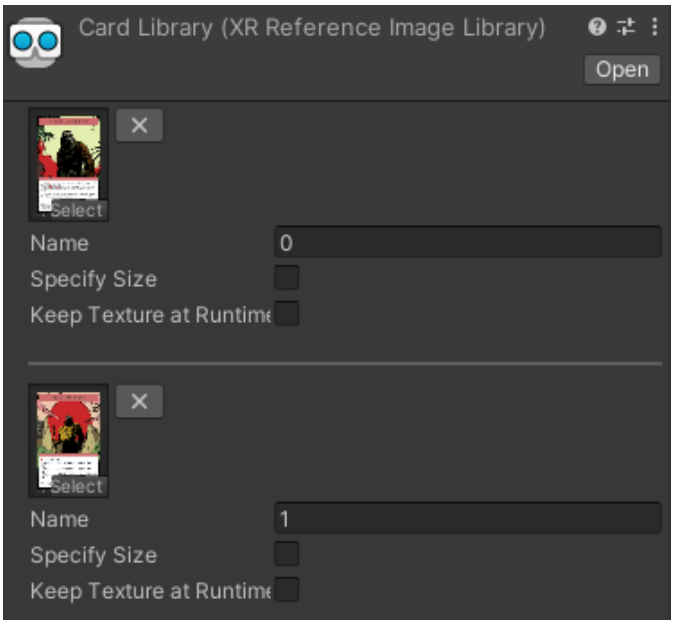


Figure 28: Snippet of the Card Library

This will allow the app to track cards, but the important part is to display the information related to that card. To do this, a couple of scripts were created. The first one is called "Card" and it is a class that stores all the information that could ever be needed for a card: its id, name, cost, speed of play, card type, card race, ATK value, HP value, its image and a List with all its Effects. Not all of this information is needed at this current time, but having the class prepared with the needed information makes it easier to expand on the app in the future.

```
public class Card
{
    public int id;
    public string cardName;
    public string cost;
    public int speed;
    public string cardType;
    public string cardRace;
    public int atk;
    public int hp;
    public Sprite cardImage;
    public List<Effect> effects = new();
```

The Effect class stores the short text that will be seen when the card is scanned, the full text that will be displayed when said effect is tapped and an integer with the speed of the effect, to know in which phase it should appear.

```
public class Effect
{
    public string title;
    public string fullText;
    public int speed;
```

All the Cards and their Effects are then set in the script of an object called “Card Database” as seen in Figure 29. In some cases, the value for the atk, hp or speed can be -1, meaning that they don’t have those values and should not be processed.

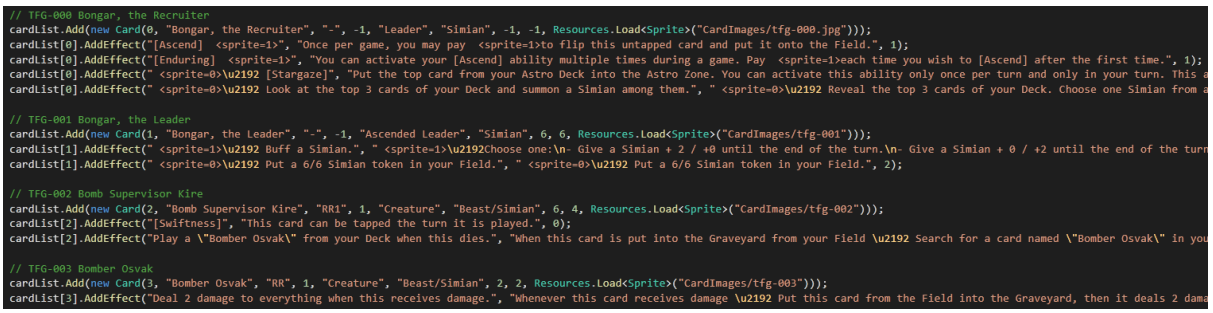


Figure 29: Snipped of the Card Database script

Once the card information is stored, the next step is to display it. To do so, a few prefabs were created. Going from bigger to smaller, the first one is the one called “Card Canvas”. This prefab contains a Canvas set to World Space, meaning that it can be created in a 3D environment,

the border that will appear around the card, the card's name, a square that should appear when the card is playable and a container where the effects will appear. This structure can be seen below in Figure 30.

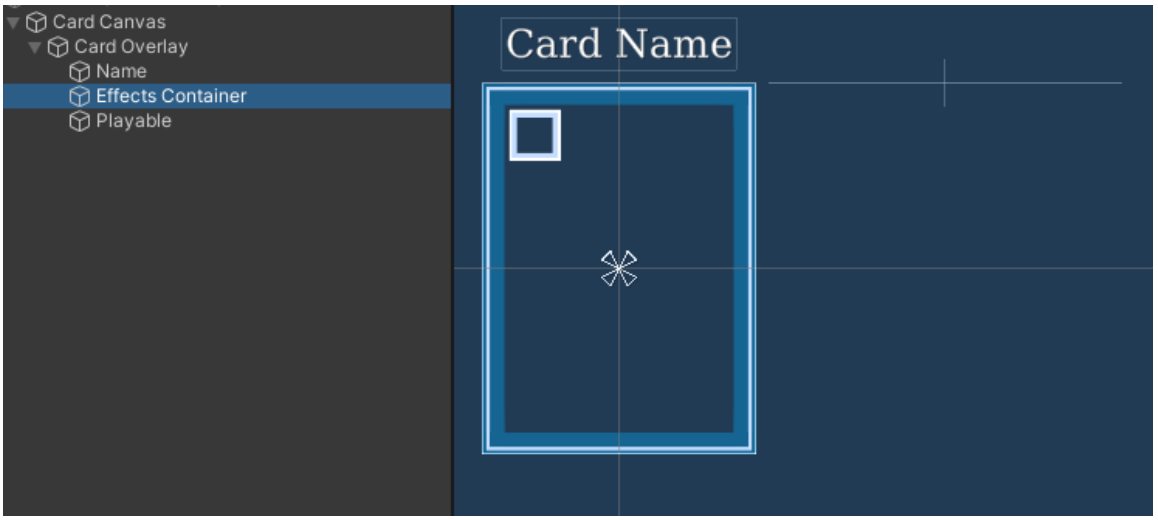


Figure 30: Card Canvas prefab

There then are the simpler prefabs, like the "Effect Text" and the "Effect Pop-Up". The first one holds the short text of the effect and appears inside the "Effects Container" of the "Card Canvas" prefab. And the second one holds the full description of the text and appears when the "Effect Text" is tapped, it also has an X button to close the pop-up.

To make the prefabs appear when they are supposed to, a series of scripts will have to be created. The first one is an "Image Tracking Manager" that fits the needs of our app and spawns the "Card Canvas" on the scanned image and stores it in a Dictionary. To do so, our image manager subscribes to a method of the other image manager to know when an image is tracked.

```
private void Awake()
{
    trackedImageManager = FindObjectOfType<ARTrackedImageManager>();
}
private void OnEnable()
{
    trackedImageManager.trackedImagesChanged += OnImageChanged;
}
private void OnDisable()
{
    trackedImageManager.trackedImagesChanged -= OnImageChanged;
}
```

```
    private void OnImageChanged(ARTrackedImagesChangedEventArgs args)
    {
        foreach (ARTrackedImage trackedImage in args.added)
        {
            AddNewImage(trackedImage);
        }
        foreach (ARTrackedImage trackedImage in args.updated)
        {
            UpdateImage(trackedImage);
        }
        foreach (ARTrackedImage trackedImage in args.removed)
        {
            RemoveImage(trackedImage);
        }
    }
```

When a new image is added, it spawns the prefab of the card on it and as a child of the tracked image so that it follows its movement and it also sets the size of the prefab so that it fits the image.

```
    private void AddNewImage(ARTrackedImage _trackedImage)
    {
        string cardId = _trackedImage.referenceImage.name;
        GameObject newCard = Instantiate(cardPrefab, _trackedImage.transform);

        spawnedPrefabs.Add(cardId, newCard);


spawnedPrefabs[cardId].GetComponentInChildren<DisplayCard>().SetCard(int.Parse(c
ardId));
        spawnedPrefabs[cardId].transform.Rotate(90f, 0f, 0f, Space.Self);

        // Calculate scale
        Vector3 imageSize = _trackedImage.size;
        Vector3 cardSize =
spawnedPrefabs[cardId].GetComponent<RectTransform>().rect.size;
        Vector3 scale = new Vector3(imageSize.x / cardSize.x * 10, imageSize.y /
cardSize.y * 10, 1f);
        spawnedPrefabs[(cardId)].transform.localScale = scale;
    }
```

This last method is accessing a class called “Display Card” to set what card’s information needs to be shown. This script creates an instance of the “Effect” prefab that was mentioned earlier

for each effect the card has at any given point and puts it into the "Effects Container", it also toggles the square that says whether the card is playable or not in the current phase.

```
    public void UpdateEffects()
    {
        ClearEffects();
        foreach (Effect effect in displayCard[0].effects)
        {
            if (gameManager.playableSpeeds[effect.speed])
            {
                DisplayEffect(effect);
            }
        }
        DisplayPlayable();
    }

    private void DisplayEffect(Effect effect)
    {
        GameObject effectBox = Instantiate(effectPrefab, effectsContainer);
        effectBox.transform.SetAsLastSibling();
        TMP_Text effectBoxText = effectBox.GetComponentInChildren<TMP_Text>();

        if (effectBoxText != null)
        {
            effectBoxText.text = effect.title;

effectBox.GetComponent<EffectPopUpController>().SetText(effect.fullText);

popUps.Add(effectBox.GetComponent<EffectPopUpController>().popUp.gameObject);
        }
```

```
    private void DisplayPlayable()
    {
        GameObject playable = gameObject.transform.Find("Playable").gameObject;
        if (displayCard[0].speed >= 0)
        {
            if (gameManager.playableSpeeds[displayCard[0].speed])
            {
                playable.SetActive(true);
            }
            else
            {
                playable.SetActive(false);
            }
        }
    }
```

To know the current game phase, the buttons on the screen update the "Game Manager" by calling the SetCurrentPhase method when they are clicked and sending a specific value. This updates an array of boolean variables , each storing whether that speed can be played or not.

```
    public bool[] playableSpeeds = new bool[4];// 0 = passive; 1 = slow; 2 =
quick; 3 = lightning
    public enum EffectSpeed
    {
        PASSIVE,
        SLOW,
        QUICK,
        LIGHTNING
    }
```

```
    public void SetCurrentPhase(GamePhase newPhase)
    {
        currentGamePhase = (int)newPhase;
        SetPlayableSpeeds(newPhase);

        DisplayCard[] displayCards = FindObjectsOfType<DisplayCard>();
        foreach (DisplayCard displayCard in displayCards)
        {
            displayCard.UpdateEffects();
        }
    }
```

```
    private void SetPlayableSpeeds(GamePhase newPhase)
    {
        switch (newPhase)
        {
            case GamePhase.NONE:
                ResetSpeeds();
                break;
            case GamePhase.DRAW_PHASE:
                playableSpeeds[(int)EffectSpeed.PASSIVE] = true;
                playableSpeeds[(int)EffectSpeed.SLOW] = false;
                playableSpeeds[(int)EffectSpeed.QUICK] = false;
                playableSpeeds[(int)EffectSpeed.LIGHTNING] = false;
                break;
```

This defines the main parts of how the app works: the Image Tracker Manager scans a card and creates a Card Overlay prefab over it with that card's information. Depending on the current game phase that is selected with the UI buttons, its effects are displayed on a list next to the card.

This also works for the card itself, and not only the effects, and a square appears over the cost of the card to show it can be played. This serves the functionality of having information about the card that is quick to get and easy to understand, but each effect has a full description that is also important that it is available. To make this information appear, the Effect prefab has a script that controls whether it is pressed or not and, if it is pressed, the Pop-Up will appear. As this Pop-Up is created when the Effect is created at the same time the Effect is, but only shown when pressed, its text is set at its creation (as seen in the DisplayEffect method above).

```
public void OnPointerDown(PointerEventData eventData)
{
    isExpanded = true;
    popUp.SetActive(true);
}
public void OnPointerUp(PointerEventData eventData)
{
    isExpanded = false;
    popUp.SetActive(false);
}

public void SetText(string text)
{
    popUp.GetComponentInChildren<TMP_Text>().text = text;
}
```

The final thing that needs to be looked at is the navigation between screens. The main way to do so is by having a button with a script attached to it. When the button is pressed, it calls a method in that script which brings the user to the desired scene. An example can be seen in Figure 31 and the code below it.

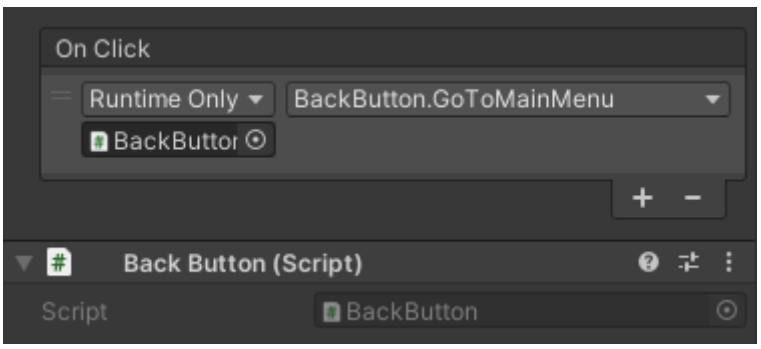


Figure 31: Back Button information On Click

```
public class BackButton : MonoBehaviour
{
    public void GoToMainMenu()
    {
        SceneManager.LoadScene(0);
    }
}
```

The other used for navigation is the use of the back arrow of the Android device. An Exit Manager is created which is always active by using the function DontDestroyOnLoad. This script takes the user back to the Main Menu and, if they are already there, it closes the app.

```
    void Update()
    {
        if (Application.platform == RuntimePlatform.Android)
        {
            if (Input.GetKey(KeyCode.Escape))
            {
                if (SceneManager.GetActiveScene().buildIndex == 0)
                {
                    Application.Quit();
                }
                else
                {
                    SceneManager.LoadScene(0);
                }
            }
        }
    }
```

6.- Validation

The validation of the project is divided in two parts that were done one immediately after the other. The first part is an in-person playtesting session that is used to observe how the users interact with the game and the app and the second part is feedback collection through a form to have more in-depth information about the user's opinions.

6.1.- In-Person Playtesting

To assess the effectiveness of the AR app and the quality of the physical TCG, an in-person playtesting session was conducted. This session involved people who were both experienced and inexperienced in playing TCGs to see if the learning experience was good enough to work for both player profiles.

Participants were given a short description of the rules (which can be found in Appendix C), a device with the Aeternum AR app installed and a physical copy of the Bongar Deck developed during this project. Their instructions were to familiarise themselves with the Aeternum AR app, to read the simplified rules and then play a game. If they had a doubt about the game, they should try to solve it by using the app or the rules given and, only if they still couldn't solve it after that, they could ask the interviewer.

The main goal for the playtesting was to see if the players could learn the game fast, if they enjoyed the card's mechanics and art and whether the Aeternum AR app was polished and as useful as it could be.

During the session, But observation alone isn't enough to determine these things, that is why participants of the playtesting session were asked to fill out a form.

6.2.- Feedback Collection

The form that was given to the participants of the playtesting can be found in the Links section and the complete results can be found in Appendix F. This section will give an overview of these results.

The form is divided in three sections: general questions, questions about the application and questions about the physical game.

The first two questions were to see the level of experience of the participants with Trading Card Games and with Aeternum in particular, as some participants had taken part in the other internal playtests. In this playtest, participants were of all levels of experience and half had already played and half had not (see Figure F1 and Figure F2).

The participants were also asked whether they thought learning TCGs was difficult or not, and an overwhelming majority said they did (see Figure F3). Their reasoning behind it was that these kinds of games have a lot of variables and it is difficult to remember all the things you can do (the original answers can be seen below in Figure 32).

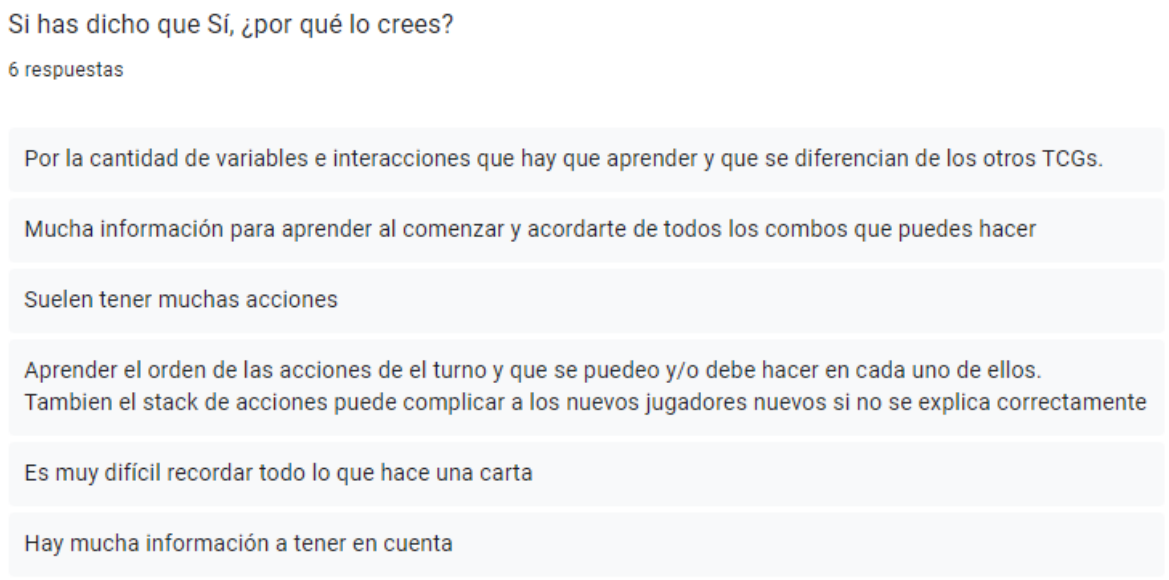


Figure 32: Answers to why the participants think TCGs are difficult to learn

The next set of questions the participants were asked were about the AR application. The questions about the understanding and usability of the app were answered positively (see Figure F5, Figure F6 and Figure F8) and, to improve the application for future versions, the participants were asked for possible improvements and whether they had found any bugs. The proposed changes are the following (see also Figure F7, Figure F9 and Figure F10):

- Fix the background of the Main Menu so that it fits all screen sizes and resolutions.
- Create a slideshow in the Help Menu with easier to read instructions.
- Put the simplified rules in the Help Menu.
- Add a life counter to the app.
- Add arrow buttons to the main scene to move between phases in order.

The final set of questions of the form were about the actual card game and how difficult it was to learn to play it. As seen in Figure 33, it was relatively easy to learn the game just by using the simplified rules and the cards themselves, but using the app made it easier to learn how each card could be used (see Figure 34).

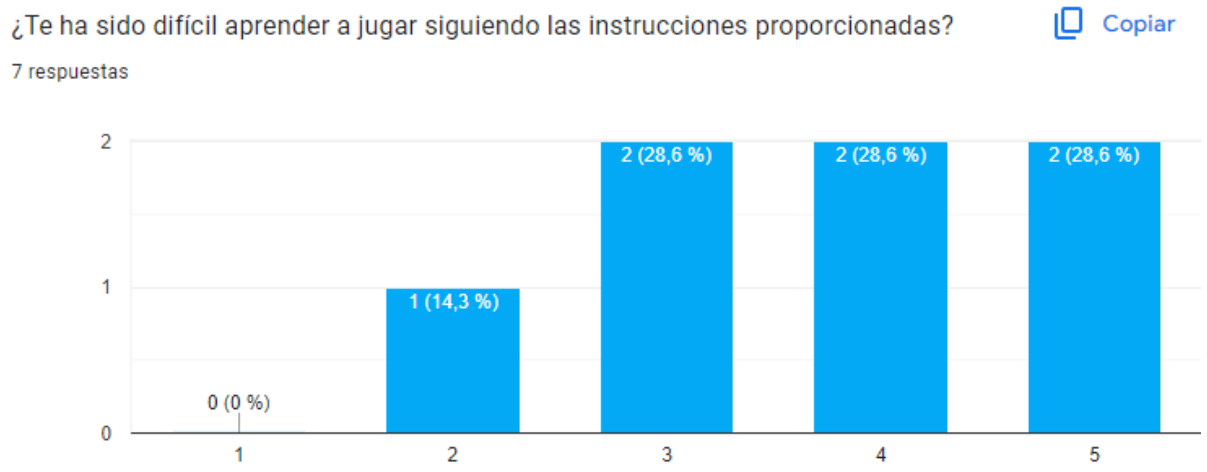


Figure 33: Answers to how difficult the game was to learn using the simplified rules (1 for hardest - 5 for easiest)

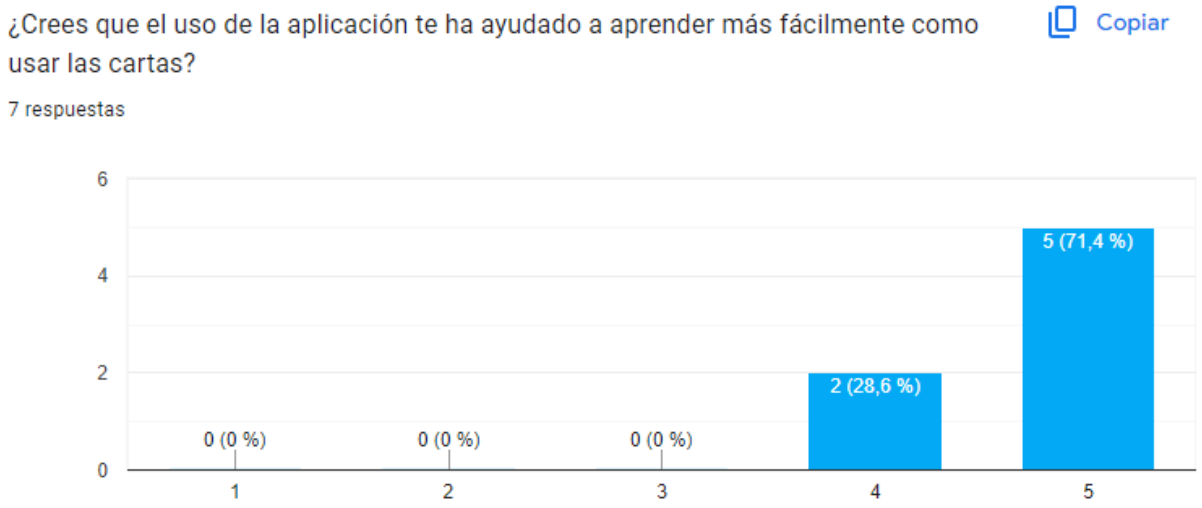


Figure 34: Answers to whether the app made it easier to learn the cards (1 for harder - 5 for easier)

The next question is an important one, as the ultimate goal of a TCG is for its players to have fun, as it is a game after all. The results were positive in this aspect as seen in Figure 35.

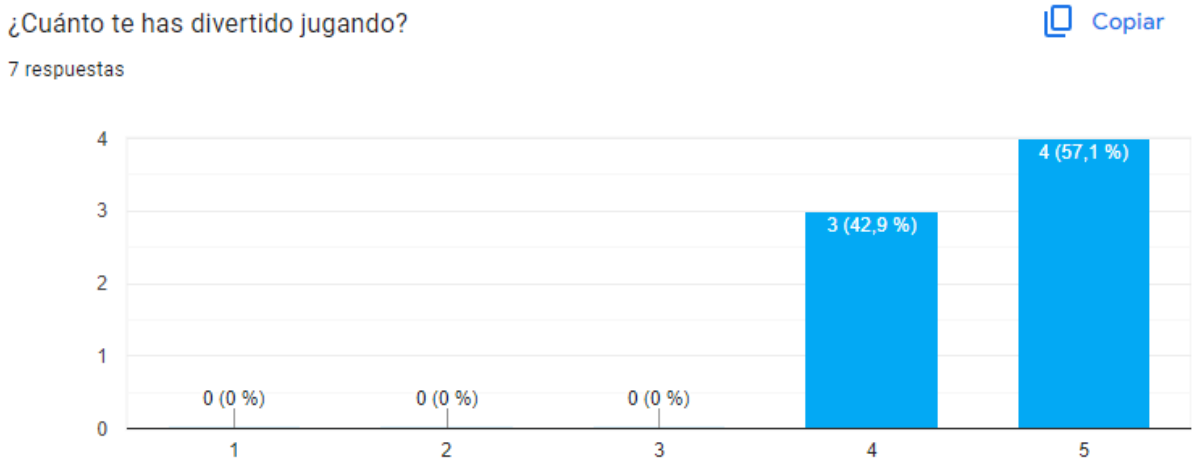


Figure 35: Answers to how much fun participants had while playing (1 for no fun - 5 for most fun)

The last questions asked for what the participants like most and least of the game and for possible improvements on the game. This is what can be extrapolated from the answers (the full answers can be seen in Figure F14, Figure F15 and Figure F16):

- The resource system is fair and fluid.
- The card mechanics are engaging.
- It was easier to remember what to do (probably because of the app).
- There are a lot of options in the deck.
- The readability of the cards can be improved.
- The players want more cards.

Even though the playtest wasn't done with a big amount of people, all of these answers offer decent enough feedback to know where to proceed from this point and to give substantial improvements to the app and game before a new playtesting session is held or the product is released to the market.

7.- Conclusions

To summarise what has been achieved, this Bachelor's Thesis has designed a full deck for the Aeternum TCG, created the art for the cards in the deck and has created an AR app for Android that helps visualise what said cards can do.

The following list has been done to check if what has been achieved is in line with the original objectives:

- The general objective "to combine a card game with augmented reality technology so that the viewing and playing experience of the game is improved with the virtual representation of the card's effects and characters" has been **partially achieved** due to the shift of the app into being more player focused.
- The general objective "to use Aeternum as the base game as it is a brand new game that has not suffered from power creep, meaning that it has simple effects and that it can be easily picked up by new players" has been **achieved** as Aeternum was the game used for this Bachelor's Thesis and feedback about the ease of use of the game was positive.
- The specific objective "to develop an application that uses augmented reality technology to enhance the viewing and playing experience of the Aeternum trading card game" has been **achieved,** albeit it is not focused on the viewing experience.
- The specific objective "to expand the Aeternum trading card game by creating a new set of cards that have simple mechanics so that new players can learn the game easily and so that the game can be expanded on them in the future" has been **achieved** as the Bongar Deck has been developed and it has been simple enough to learn for the testers.
- The specific objective "to have high quality 2D art for the cards and that each splash art follows the same art style" has been **achieved** as the art created for each card follows the same art style and it resembles that of a market-ready product.
- The specific objective "to have comprehensible rules and card text so that the game is easier to learn and complement this learning with the extra information of the AR App" has been **achieved** as the majority of the testers had no trouble understanding the game and found the AR app to be useful.

The fact that the deck created and the combination of physical game and AR app was well received by the testers is a promising sign for Aeternum and possibly for the TCG community. Because, if classical board and card games can be successfully combined with new technologies, a whole new generation of products could come out to the market; these being companion apps like the one developed or games that require both mediums to work. The intersection of tabletop gaming and AR holds untold potential, and this project is one of the early steps that goes towards this direction.

Although what has been created could be considered market-ready, some improvements and expansions can be done.

7.1.- Future Plans

In the near future, the main goal is to implement the upgrades to the AR app that were proposed during the playtesting session and have an app that has a more extensive "Help" section, a life counter and improved navigation between game phases.

Once these changes have been made, the app could be upgraded to fit a spectator mode that can be used in streaming platforms and that could potentially scan the whole table and understand its state. But, ultimately, the plan will be to expand on the Aeternum TCG with more fun, complete and basic decks like the one created in this Bachelor's Thesis.

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Appendix A: Initial scouting survey

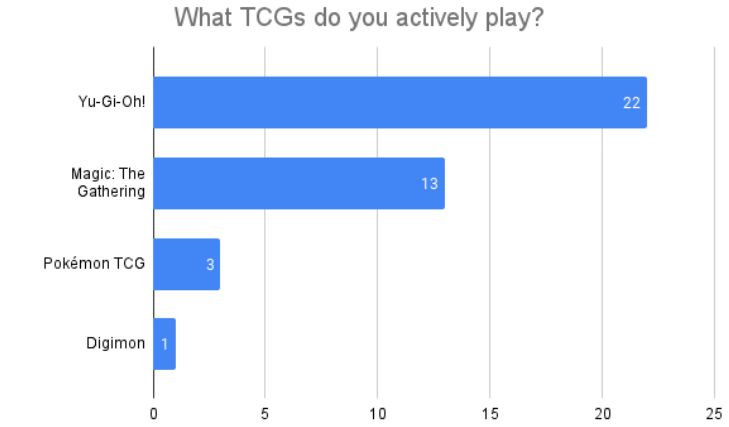

Figure A1: Played TCGs survey results

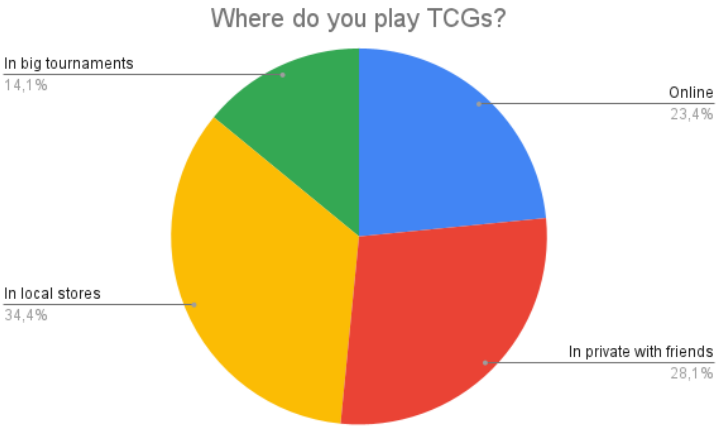

Figure A2: Location of play survey results

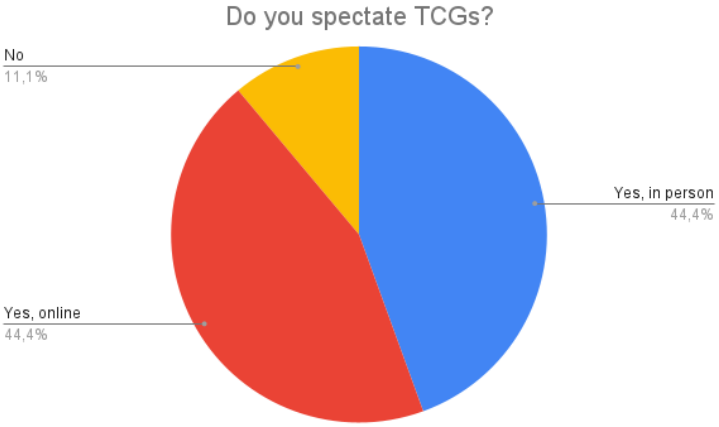

Figure A3: Spectating survey results

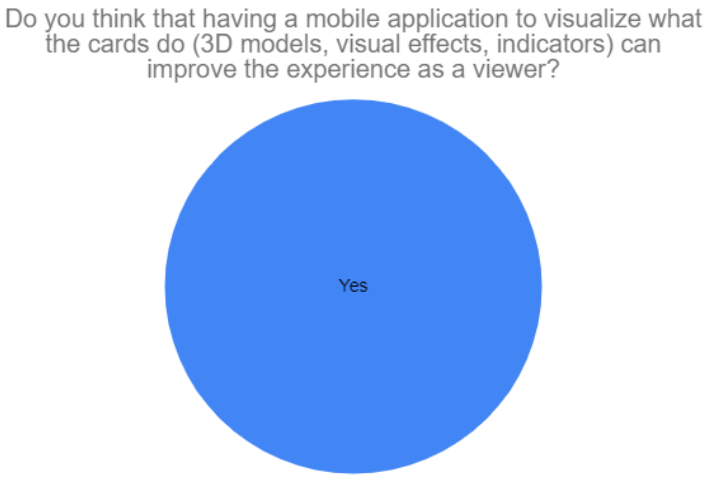

Figure A4: Viewer experience improvement with app survey results

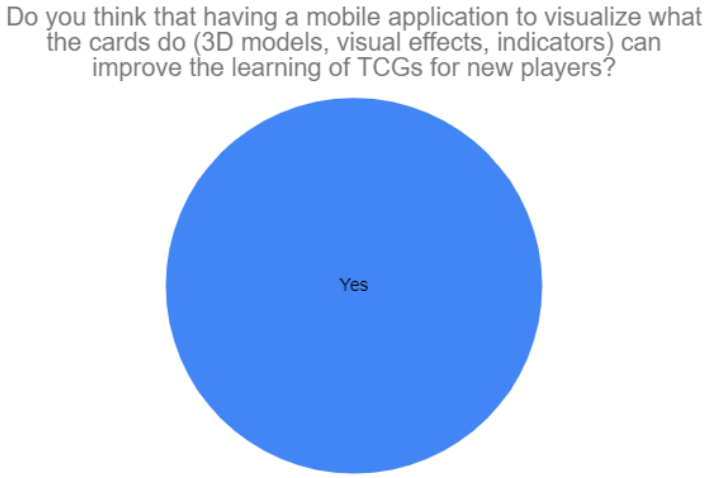

Figure A5: Learning experience improvement with app survey results

Appendix B: Aeternum Rulebook

About the game

Number of players

This game is played by two players.

How to win

The main goal is to reduce the opponent's Health to 0, this is the main losing condition.

If both players lose the game at the same time, the game ends in a draw.

If an effect states a player wins the game, that player wins the game.

During a game, players may concede the game and leave it. In this case, their opponent wins. Conceding the game is not replaced by any effects and no effects force players to concede.

Deck Building

You can create and customise your own Deck with your favourite cards. These cards can come from pre-built Decks or from Booster Packs.

Golden Rules

Whenever a card's text directly contradicts these rules, the card takes precedence. The card overrides only the rule that applies to that specific situation.

Things that you need

Leader

The Leader is a special type of card that gives identity to your deck, it is your most important card and you can only have one.

Main Deck (40 to 60 cards)

The Main Deck is where most of the cards you will play go; these cards are "Creatures" and "Chants". It can have a minimum of 40 cards and a maximum of 60.

There can be a maximum of 4 copies of any card with the same name.

Astro Deck (10 to 20 cards)

The Astro Deck is created from 10 to 20 cards of the "Astro" type, the main resource of Aeternum.

The player can have as many Basic Astro cards, but only a maximum of 4 non-basic Astro cards with the same name. The Basic Astro cards can have the following elements: Light, Darkness, Nature, Water or Fire.

Side Deck (0 to 15 cards)

This is a separate Deck of cards you can use to change your Main Deck during a Match. After each Game in a Match, you can swap any card from your Side Deck with a card from your Deck and/or Astro Deck to customise your strategy against your opponent. The number of cards in your Side Decks must not exceed 15. The number of cards in your Side Deck before and after you swap any cards must be exactly the same.

Additional items

- **AR App**: Using the Aeternum AR App can help improve the experience for new players and for spectators of the game.
- **Dice**: They are very versatile and can be used for a variety of reasons such as coin tosses, dice rolls and counters.

- **Calculator**: The Health of the players changes constantly during a Game and using a calculator makes it easier to keep track of each player's Health.
- **Card Sleeves**: Protecting your cards from getting bent or scratched is really important. If you use card sleeves, they all have to be the same so your cards are not marked.

The Board

The space in which the game is played has different zones that are listed below. Each zone has a specific function inside the game and a set of cards that go there.

Cards in Private zones can only be possibly looked at by you and cards in Public can be looked at by both players.

Deck Zone (Private)

When the Game begins, each player's Main Deck is shuffled. Your Main Deck is placed face-down in this zone. You draw cards from here to add to your Hand. If a card effect requires you to reveal cards from your Main Deck, or look through it, shuffle it and put it back in this zone afterwards.

Astro Deck Zone (Private)

When the Game begins, each player's Astro Deck is shuffled. Your Astro Deck is placed face-down in this zone. You play cards from here to add to your Astro Zone.

Hand (Private)

The hand is where a player holds cards that have been drawn from the Main Deck. Cards can be put into a player's hand by other effects as well. At the beginning of the game, each player draws a total of five cards.

Each player has a maximum hand size, which is normally seven cards. A player may have any number of cards in their hand, but as part of their End Phase, the player must discard excess cards down to the maximum hand size.

A player may arrange their hand in any convenient fashion and look at it at any time. A player can not look at the cards in another player's hand but may count those cards at any time.

Astro Zone (Public)

This is where you place Astro cards when they are played. Cards in this zone can have a specific orientation: tapped or untapped.

Leader Zone (Public)

This is where you place your Leader. Cards in this zone can have a specific orientation: tapped or untapped. The face down side of a card in a Leader Zone can be seen only by its controller.

Field (Face up cards are Public)

This is the zone where most of the cards will be put into. These cards are of the following types: “Creature” or “Chant”; additionally an Ascended Leader can also be put into the Field.

Cards in this zone can have a specific orientation: tapped or untapped.

Graveyard (Public)

This is the zone where destroyed or used cards are placed in. Each player has their own Graveyard. Any new cards put into a Graveyard are put on top of the cards already in the Graveyard.

Exile Zone (Public)

The zone a player puts their exiled cards in. Each player has their own Exile Zone. If an effect exiles a card face down, treat the card as though it were in a hidden zone. Except for players that are allowed to see the information of the card. Cards in the Exile Zone are referred to as “exiled cards”.

Board Distribution

The Board and its zones can be organised in any way the players desire, as long as both players have clear knowledge of which zone is which.

Components of a Card

Name

This is the name of the card. A name is referred to when you build your deck as part of its restrictions. When a card name is mentioned in card text it appears in quotations.

Cost

This part of the card tells how much Astro you have to pay to play this card.

The elemental cost is specified by the number of Astro symbols in the card and you need to pay one Astro of the specified element for each Astro symbol of that element.

A free cost is shown by the number next to the Astro symbols. This cost can be payed with any type of Astro.

Speed

This number indicates the Speed at which this card can be played. Depending on their symbol, the speed can be Lightning, Quick or Slow.

Type

This indicates what type of card this card is.

Types of cards: “Leader”, “Ascended Leader”, “Astro”, “Creature” or “Chant”.

Race

It is the subtype of a card. It is used to give more information about the card and to set archetypes within the game.

ATK

This is information that Ascended Leaders and Creatures have. “ATK” is the value that represents how much damage the card deals while in combat.

HP

This is information that Ascended Leaders and Creatures have. “HP” is the value that represents how much damage the card can take while in combat. If a card suffers damage equal to or more than its HP, it is destroyed.

Description

This is the text that describes the effects or abilities of the card. If a card has more than one paragraph in its text, each paragraph is a different effect or ability.

Some cards have sentences with a different font in their description area. These sentences are called flavour text and have no rule purpose.

Additional Information

This section includes information that is not relevant to the game, but to the card itself such as its artist, the copyright, its serial number and its rarity. This additional information has no rule purpose.

Orientation

During the Game, a card can be untapped (meaning that it is in vertical position) or tapped (meaning that is in horizontal position).

How to play

How to win

A Match is a set of 3 Games, in which the winner is the player that wins 2 out of the 3 Games.

Each player starts a Game with 40 Health. You win a Game if: you reduce your opponent's Health to 0; if your opponent is unable to draw a card; or if a card's effect says you win. If you and your opponent both reach 0 Health at the same time, the Duel is declared a draw.

Victory Conditions:

- Reduce your opponent's Health to 0.
- Your opponent is unable to draw a card when they are supposed to draw.
- Win with a card's effect.

Preparations

Before you start a game, you need to construct your Main Deck, your Astro Deck and have your Leader prepared.

Once you have this prepared, you will need to shuffle your Main Deck and your Astro Deck and place them in their respective zones in the Board. Place your Leader in the Leader Zone as well.

Then, each player sets their Health to 40.

The next step is to choose which player starts. To do so, both players must use a mutually agreeable method (flipping a coin, rolling dice, etc.) to do so. The player who wins said method will choose who starts the Game. For the next Games inside a Match, the loser of the previous Game decides who goes first.

Each player draws 5 cards from the Main deck and adds them to their Hand. Each player can choose to take a mulligan. Mulligan is a process whereby players choose to change any cards in their Hand, then each player shuffles the chosen cards into the deck and draws the same amount of cards that were shuffled into the deck. This process can only be done once per Game.

After all the preparations are completed, the first player becomes the turn player and begins their turn.

Turn structure

This game is played in turns that each player performs alternatingly. During each turn, the turn player performs the following phases in this order.

Draw Phase

In this phase, the turn player draws a card (drawing a card means taking the top card of your Main Deck and adding it to your Hand). If this is the first turn of the game, the turn player does not draw a card.

Drawing a card makes the phase skip to the Begin Phase.

No cards or abilities can be played in this phase.

Begin Phase

If an ability states “at the beginning of your turn”, it is played when this phase starts.

If more than 1 “beginning of turn” effects have to be triggered, the turn player chooses the order in which they are triggered.

The turn player’s effects trigger before the opponent’s.

Both players can use Quick and Lightning cards and effects in this phase.

Untap Phase

The turn player untaps all their cards. Doing so makes the phase skip to the Main Phase.

No cards or abilities can be played in this phase.

Main Phase

The turn player can use Slow cards and abilities in this phase.

Both players can use Quick and Lightning cards and effects in this phase.

The turn player can do the following actions as many times as they can in the order they want:

- Start a battle
- Play a card
- Use an ability

Once during this phase, as a Slow effect, the turn player can tap the Leader or the Ascended Leader and put the top card of the Astro Deck into the Astro Zone.

The turn player chooses when this phase ends, making the phase skip to the End Phase.

End Phase

If an ability states “at the end of your turn”, it is played when this phase starts.

If more than 1 “end of turn” effects have to be triggered, the turn player chooses the order in which they are triggered.

The turn player’s effects trigger before the opponent’s.

Both players can use Quick and Lightning cards and effects in this phase.

At the end of the End Phase, both player’s cards are healed up and their HP goes back to full.

Battles

The Battle Phase happens when a player attacks and it is resolved in the order stated below.

Both players can use Quick and Lightning cards and effects during the Battle.

Declare Attack Step

The Battle starts when the turn player selects an attacking card.

"At the beginning of battle phase" trigger conditions happen.

The attacking card is tapped.

The turn player selects the target for that attack. This target can be a player, a tapped Creature or a tapped Ascended Leader.

Declare Block Step

The non-turn player can choose to block the attack with an untapped card they choose.

The blocking card is tapped.

Damage Step

The blocking card loses HP equal to the attacking card's ATK.

The attacking card loses HP equal to the defending card's ATK.

All of this damage is calculated simultaneously.

End of Battle Step

"At the end of battle phase" trigger conditions happen.

Types of Card

Leader

The Leader is a special type of card that gives identity to your deck, it is your most important card and you can only have one.

They are initially placed in the Leader Zone.

Once during the Main Phase, as a Slow effect, the turn player can tap the Leader and put the top card of the Astro Deck into the Astro Zone.

Additionally, the Leader usually has certain effects that may be used to give you an advantage.

Leaders have a unique ability called [Ascension].

Ascended Leader

An Ascended Leader is placed in the Field when it is played unless the card states otherwise.

An Ascended Leader has separate effects from its other side.

When an Ascended Leader that has 0 HP or less is destroyed, it doesn't go to the Graveyard, it is flipped to its Leader side and sent back to the Leader Zone.

The turn an Ascended Leader is played, it cannot be tapped; meaning that it cannot attack or use some effects.

Once during the Main Phase, as a Slow effect, the turn player can tap the Ascended Leader and put the top card of the Astro Deck into the Astro Zone.

Astro

The Astro cards are the main resource in this game and they can be Basic or Non-Basic.

Astro cards can be tapped to generate an element of its type.

Basic Astro cards can be of one of these five types: Light, Darkness, Nature, Water or Fire.

Non-Basic Astro cards usually work in tandem with a specific Leader and might have extra effects apart from the generation of elements.

Creature

Creatures are cards you play to help you in battle and can be played by paying the appropriate elemental cost.

They can be used to attack the opponent Player, Creature or Ascended Leader.

They can be used to block an opponent's attack.

The turn a Creature is played, it cannot be tapped; meaning that it cannot attack or use some effects.

Creatures that are destroyed go into the Graveyard.

Chant

A Chant is a type of card that can be played from the hand and that has a specific effect.

Chants don't have ATK or HP and go to the Graveyard once their effect resolves.

Action Speed

Actions have a given Speed and, depending on that Speed, they can be performed at certain points in time. The 3 Speeds, from higher to lower, are the following: Lightning, Quick, Slow. Every card or effect will have the symbol of its corresponding speed next to it.

Action Speeds follow the following ruling:

- Lightning actions can respond to any action.
- Quick actions can only respond to other Quick actions or to Slow actions.
- Slow actions can not respond to other actions.

Chain of actions

Doing an action creates a Chain. Responding to an action with an action of your own puts the response in the Chain. When both players choose to not respond anymore, the Chain is resolved in the opposite way it was created; meaning that the last response added is the first one to be resolved.

Passive effects are not considered to have a Speed, as they are always active; this means they do not create a Chain and can not be responded to.

Keywords

Keywords are words written on the card and enclosed in []. These Keywords represent an ability given to that card.

[Ascension]

This is a continuous effect that Leaders usually have.

'[Ascension] (Cost)' means 'If this card is an untapped Leader in a Leader Zone, its controller may play its Ascension process'. The (cost) is referred to when that Ascension process is played.

The Ascension process usually consists of flipping the Leader over and putting it in the Field.

[Swiftness]

This is a passive effect. It changes when the card can attack or use its effects.

A card with [Swiftness] can attack and its effects the turn it's put into the field.

[Pierce]

This is a passive effect. It changes how the damage in a battle is dealt.

If an attacking card has [Pierce] and its attack is blocked, the damage calculation is done in the following way:

- The attacking card deals its ATK to the blocker's HP.
- If the ATK of the attacking card is greater than the blocker's HP, the excess ATK is dealt to the original objective of the attack.

[Awakening]

This is a passive effect. It changes how the card is played and resolved.

"[Awakening] (Cost): (Text)" means "As you play this card, you may awaken and play this card. If you do, that card has the extra cost of (Cost), and is played to the Field with the ability denoted by (Text)."

"To awaken" a card means to play the card paying its [Awakening] cost.

Glossary

Tap: To rotate a card from its vertical position into its horizontal position.

Tapped: In horizontal position.

Untap: To rotate the card from its horizontal position into its vertical position.

Untapped: In vertical position.

Appendix C: Simplified Aeternum Rules

General Rules

Your main goal is to reduce your opponent's Health to 0.

The winner of a coin toss chooses whether to go first or second.

The player that goes second starts with a mana token that can be exchanged for 1 mana.

Players draw 5 cards before the game starts.

Each player can choose to take a mulligan. Mulligan is a process whereby players choose to change any cards in their Hand, then each player shuffles the chosen cards into the deck and draws the same amount of cards that were shuffled into the deck. This process can only be done once per Game.

Types of Card

Leader: Special type of card that gives identity to the deck. You only have one and it is located on your bottom left.

Creature: Found in your Main Deck, they are the soldiers of your army and they are the main way to attack your opponent. They are put into the Field when they are played and into the Graveyard when they die. You will need to tap these cards to attack.

Chant: Found in your Main Deck, they have an effect that is used once, then the card is sent to the Graveyard.

Astro: Found in the Astro Deck, they are the resource of this game. You will need to tap these cards to produce mana to play other cards.

Turn Structure

Draw Phase: The turn player draws a card. The player that goes first doesn't draw a card in the first turn.

Begin Phase: Effects that say "at the beginning of the turn" are resolved.

Untap Phase: Untap all your tapped cards.

Main Phase: You can play creatures and chants and use their effects. You can also start a battle.

Battle: You select the creature with which you want to attack and target a player or an opponent's tapped creature to attack it. The opponent can then decide to block the attack by tapping one of its creatures. Then, simultaneously, the blocking card loses HP equal to the attacking card's ATK and the attacking card loses HP equal to the defending card's ATK.

End Phase: Effects that say "at the end of the turn" are resolved. If you have more than 7 cards in your hand, send cards from your hand to the graveyard until you are left with only 7. At the end of the End Phase, both player's cards are healed up and their HP goes back to full.

Action Speeds

Slow: Things that you can only do in your Main Phase, like playing a creature or using a chant.

Quick: Some cards have a lightning symbol beneath its cost, that means that it can be played at any time, even in your opponent's turn. Additionally, all of the abilities of tour cards can be used at any time.

Glossary

Tap: To rotate a card from its vertical position into its horizontal position.

Tapped: In horizontal position.

Untap: To rotate the card from its horizontal position into its vertical position.

Untapped: In vertical position.

Appendix D: Deck Iterations

Name	Type	Race	Speed	Cost	ATK	HP	Description
Bongar the Recruiter	Leader	Simian	-	-	-	-	[Ascend] (F) [Energise] (F) (F)--> Choose one: - Give a Simian +2/+0 until the end of the turn. - Give a Simian +0/+2 until the end of the turn. - Give a Simian [Swiftness] until the end of the turn.
Bongar the Leader	Ascended Leader	Simian	-	(F)	6	6	(F)(F)--> Reveal the top 5 cards of your Deck. Choose one Simian from among them and send it to the Graveyard, this card gains its effects until the end of the turn. Shuffle the rest into your Deck. Tap--> Put a 6/6 Simian token under your control.
Hou	Creature	Simian/ Beast	Slow	2	4	2	Enter --> This card gains +2/+1 for each Simian Creature you control until the end of your turn. At the beginning of your --> This card gains +2/+1 for each Simian Creature you control until the end of your turn.
Mun Ki	Creature	Simian/ Beast	Slow	1	4	4	Whenever this card is dealt damage --> Put this card from the field into the Graveyard, then it deals 2 damage to each Player, Creature and Ascended Leader.
Sa'ruu	Creature	Simian/ Beast	Slow	3	8	6	[Swiftness] On deletion --> Search a card named "Mun Ki" in your Deck and put it into your Field. If you control "Hou", search your Deck for any number of cards named "Mun Ki" and put them into the Field instead. The Creatures put into the Field this way gain [Swiftness] until the end of the turn. Then shuffle your Deck.
Goo	Creature	Beast	Slow	1	3	4	If a source you control would deal damage to any opponent or any Creature or

							Ascended Leader your opponent controls, it deals that much +1 instead.
Zaaru	Creature	Simian/ Beast	Slow	5	8	8	You may pay (R) less to play this card for each 4 damage you have done this turn to any opponent. Enter --> Simians you control gain +4/+4 until the end of the turn. At the end of your turn --> Recover all Simians.
Wuu	Creature	Beast	Slow	2	4	4	Enter --> Reveal the top 5 five cards of your Deck. You may put a Fire Creature from among them into your hand. Put the rest on the bottom of your deck in any order. Exile this card: This card deals 4 damage to target Creature.
Koun'gu	Creature	Beast	Slow	3	8	4	[Pierce]
Burn	Chant	-	Quick	1	-	-	This card deals 5 damage to target Player, Creature or Ascended Leader.
Buff	Chant		Quick	2	-	-	Target Creature gains +4/0 and "When this card is put into a Graveyard from the Field --> Put it into the Field rested under its owner's control." until the end of the turn.
Warrior's Warth	Chant		Slow	2	-	-	[Awakening](R) Target Creature or Ascended Leader you control deals damage equal to its ATK to another target Creature or Ascended Leader. If this card was Awakened, target Creature or Ascended Leader you control deals damage equal to its ATK to another target Creature or Ascended Leader and another target Player.

Table D1: First iteration of the Bongar Deck

Name	Type	Race	Speed	Cost	ATK	HP	Description
Bongar the Recruiter	Leader	Simian	-	-	-	-	[Ascend] (F) [Energize] (F) (F)--> Choose one: - Give a Simian +2/+0 until the end of the turn. - Give a Simian +0/+2 until the end of the turn. - Give a Simian [Swiftness] until the end of the turn.
Bongar the Leader	Ascended Leader	Simian	-	(F)	6	6	(F)(F)--> Reveal the top 5 cards of your Deck. Choose one Simian from among them and send it to the Graveyard, this card gains its effects until the end of the turn. Shuffle the rest into your Deck. Tap--> Put a 6/6 Simian token under your control.
Slow Burn Rock	Special Astro	-	-	-	-	-	Tap--> Deal 1 damage to target Creature or Ascended Leader.
Bomb Supervisor Kire	Creature	Beast/ Simian	Slow	(F)(F)(1)	8	6	[Swiftness] When this card is put into the Graveyard from your Field--> Search for a card named "Bomber Osvak" in your Deck and put it into your Field. If you control "Admirer Oiarm", search your Deck for any number of cards named "Bomber Osvak" and put them into your Field instead. The Creatures put into the Field this way gain [Swifntess] until the end of the turn. Shuffle your Deck.
Bomber Osvak	Creature	Beast/ Simian	Slow	(F)(F)	4	4	Whenever this card receives damage--> Put this card from the Field into the Graveyard, then it deals 2 damage to each Player, Creature and Ascended Leader.
Admirer Oiram	Creature	Beast/ Simian	Slow	(F)(F)(F)(2)	8	8	You may pay (F) less to play this card for each 4 damage you have done to an opponent this turn. Enter--> Simians you control gain +4/+4 until the end of the turn. At the

							end of your turn untap all Simians you control.
Sprinting Oreol	Creature	Beast/ Simian	Slow	(F)	3	3	This card gains +3/+3 and [Swiftness] if you control 4 Fire Astros.
Finder in Nasio	Creature	Beast	Slow	(F)	2	2	Enter--> Reveal the top 5 cards of your Deck. You may put a Fire Creature from among them into your hand. Shuffle the rest into your Deck. Exile this card--> Deal 4 damage to target Creature.
Bri'to the Assistant	Creature	Beast	Slow	(F)(F)	2	4	If a source you control would deal damage to an opponent or any Creature or Ascended Leader an opponent controls, it deals that much +1 instead.
Accidental Explosion	Chant	-	Quick	(F)	-	-	Deal 5 damage to target Player, Creature or Ascended Leader.
Bongar's Mark	Chant	-	Quick	(F)(F)	-	-	Target Creature gains +4/+0 and "When this card is put into a Graveyard from the Field--> Put it into the Field tapped under its owner's control." until the end of the turn.
Monkey Slap	Chant	-	Slow	(F)(1)	-	-	Deal damage equal to the ATK of a Creature or Ascended Leader you control to target Creature or Ascended Leader. [Awakening](F)--> You can target an additional Creature, Ascended Leader or Player.
Sacrifice to Amade	Chant	-	Quick	(F)	-	-	Send one Simian from the Field to the Graveyard--> Deal damage equal to that Creature's ATK to target Creature.

Table D2: Second iteration of the Bongar Deck

Name	Type	Race	Speed	Cost	ATK	HP	Description
Bongar, the Recruiter	Leader	Simian	-	-	-	-	[Ascend] (F) (Once per game, you may pay (R) to flip this untapped card and put it onto the Field.) [Enduring] (F) (You can activate your [Ascend] ability multiple times during a game. Pay (R) each time you wish to [Ascend] after the first time.) Tap--> [Stargaze] (Put the top card from your Astro Deck into the Astro Zone. You can activate this ability only once per turn and only in your turn. This ability can not be responded to.) (F)--> Choose one: - Give a Simian +2/+0 until the end of the turn. - Give a Simian +0/+2 until the end of the turn. - Give a Simian [Swiftness] until the end of the turn.
Bongar, the Leader	Ascended Leader	Simian	-	(F)	6	6	(F)(F)--> Reveal the top 5 cards of your Deck. Choose one Simian from among them and send it to the Graveyard, this card gains its effects until the end of the turn. Shuffle the rest into your Deck. Tap--> Put a 6/6 Simian token tapped under your control.
Slow Burn Rock	Special Astro	-	-	-	-	-	Tap --> Produce (R) Tap--> Deal 1 damage to target Player, Creature or Ascended Leader.
Bomb Supervisor Kire	Creature	Beast/ Simian	Slow	(F)(F) (1)	6	4	[Swiftness] (This card can be tapped the turn it is played) When this card is put into the Graveyard from your Field--> Search for a card named "Bomber Osvak" in your Deck and put it into your Field. If you control "Admirer Oiarm", search your Deck for any number of cards named "Bomber Osvak" and put them into your Field instead. The

							Creatures put into the Field this way gain [Swiftness] until the end of the turn. Shuffle your Deck.
Bomber Osvak	Creature	Beast/ Simian	Slow	(F)(F)	2	2	Whenever this card receives damage--> Put this card from the Field into the Graveyard, then it deals 2 damage to each Player, Creature and Ascended Leader.
Admirer Oiram	Creature	Beast/ Simian	Slow	(F)(F) (2)	8	8	You may pay (F) less to play this card for each 4 damage you have done to an opponent this turn. Enter--> Simians you control gain +2/+2 until the end of the turn. At the end of your turn untap all Simians you control.
Sprinting Oreol	Creature	Beast/ Simian	Slow	(F)	3	3	This card gains +3/+3 and [Swiftness] if you control at least 4 Fire Astros.
Finder in Nasio	Creature	Beast	Slow	(F)	2	2	Enter--> Reveal the top 5 cards of your Deck. You may put a Fire Creature from among them into your hand. Shuffle the rest into your Deck. Exile this card--> Deal 4 damage to target Creature.
Bri'to the Assistant	Creature	Beast	Slow	(F)(F)	2	4	If a source you control would deal damage to an opponent or any Creature or Ascended Leader an opponent controls, it deals that much +1 instead.
Accidental Explosion	Chant	-	Quick	(F)	-	-	Deal 5 damage to target Player, Creature or Ascended Leader.
Bongar's Mark	Chant	-	Quick	(F)(F)	-	-	Target Creature gains +4/+0 and "When this card is put into a Graveyard from the Field--> Put it into the Field tapped under its owner's control." until the end of the turn.

Monkey Slap	Chant	-	Slow	(F)(1)	-	-	Target a Creature or Ascended Leader you control: Deal damage equal to its ATK to target Creature or Ascended Leader. [Awakening](F)(F)(F)--> You deal damage to an additional target Player, Creature or Ascended Leader. (To Awaken a card, you must pay the extra cost when you play the card)
Sacrifice to Amade	Chant	-	Quick	(F)	-	-	Send one Simian you control from the Field to the Graveyard--> Deal damage equal to that Creature's ATK to target Creature.

Table D3: Third iteration of the Bongar Deck

Appendix E: Aeternum TFG Set Cards

Figure E1: TFG-001 Bongar, the Recruiter

Figure E2: TFG-001 Bongar, the Leader

Figure E3: TFG-002 Bomb Supervisor Kire

Figure E4: TFG-003 Bomber Osvak

Figure E5: TFG-004 Admirer Oiram

Figure E6: TFG-005 Sprinting Oreol

Figure E7: TFG-006 Finder in Nasio

Figure E8: TFG-007 Bri'to the Assistant

Figure E9: TFG-008 Accidental Explosion

Figure E10: TFG-009 Bongar's Mark

Figure E11: TFG-010 Monkey Slap

Figure E12: TFG-011 Sacrifice to Amade

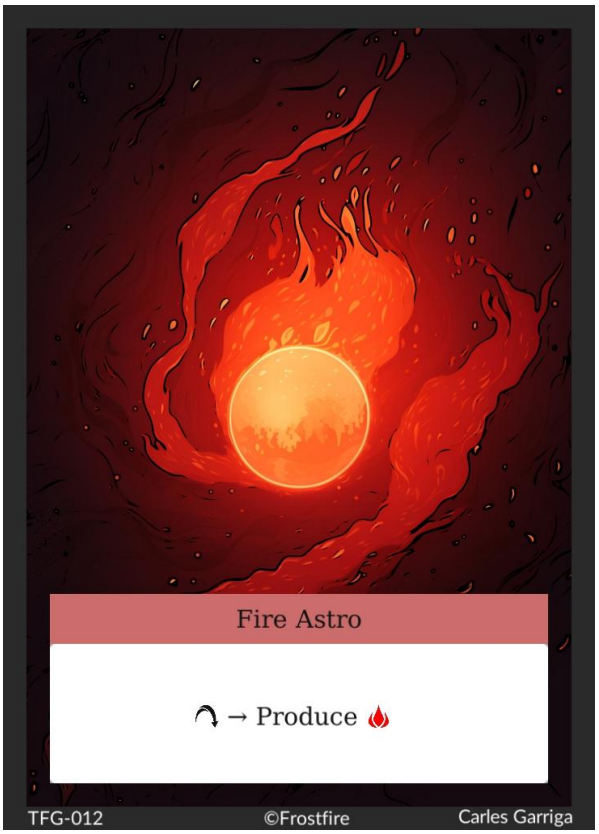

Figure E13: TFG-012 Fire Astro

Figure E14: TFG-013 Slow Burn Rock

Figure E15: Aeternum TCG Card Back

Appendix F: Playtesting Forms Results

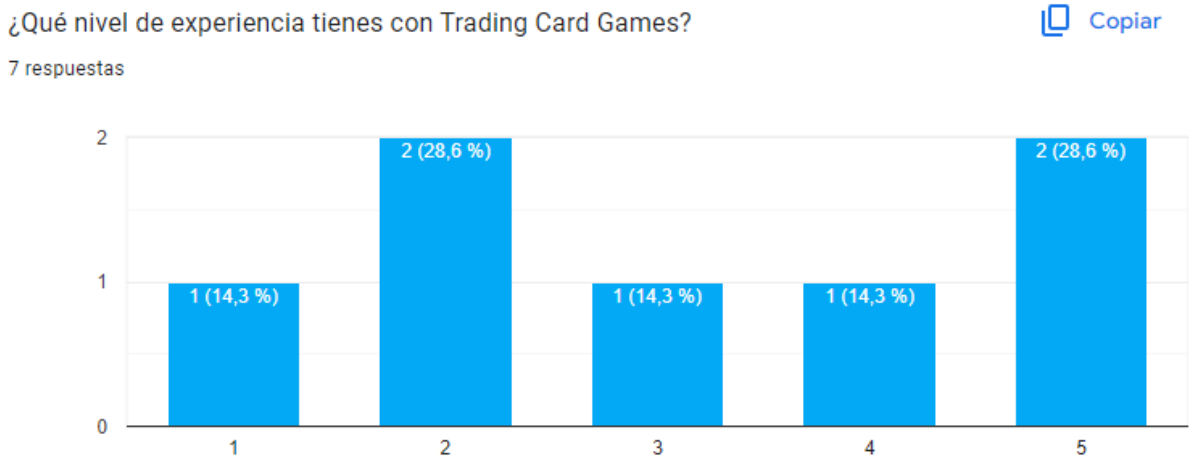

Figure F1: ”What level of experience do you have with Trading Card Games?” results

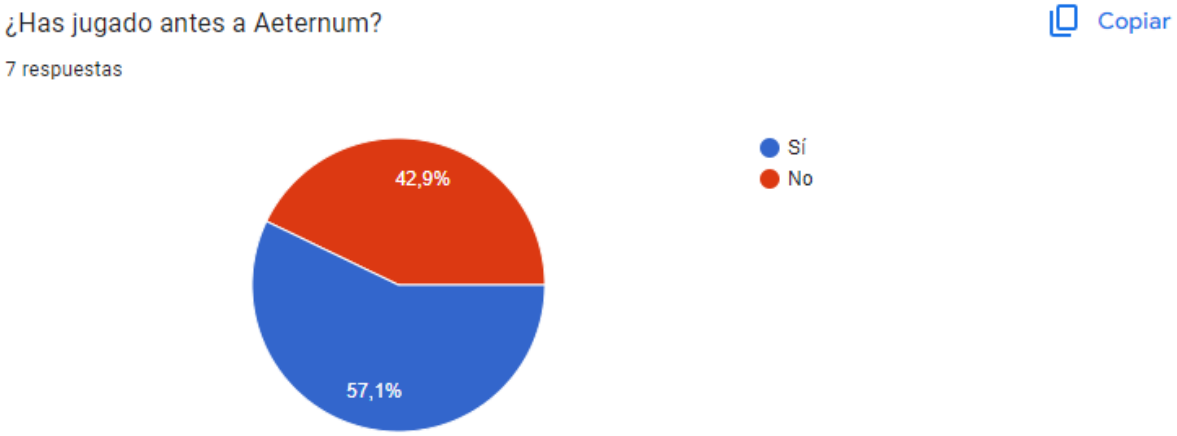

Figure F2: ”Have you played Aeternum before?” results

Figure F3: ”Do you think Trading Card games are difficult to learn?” results

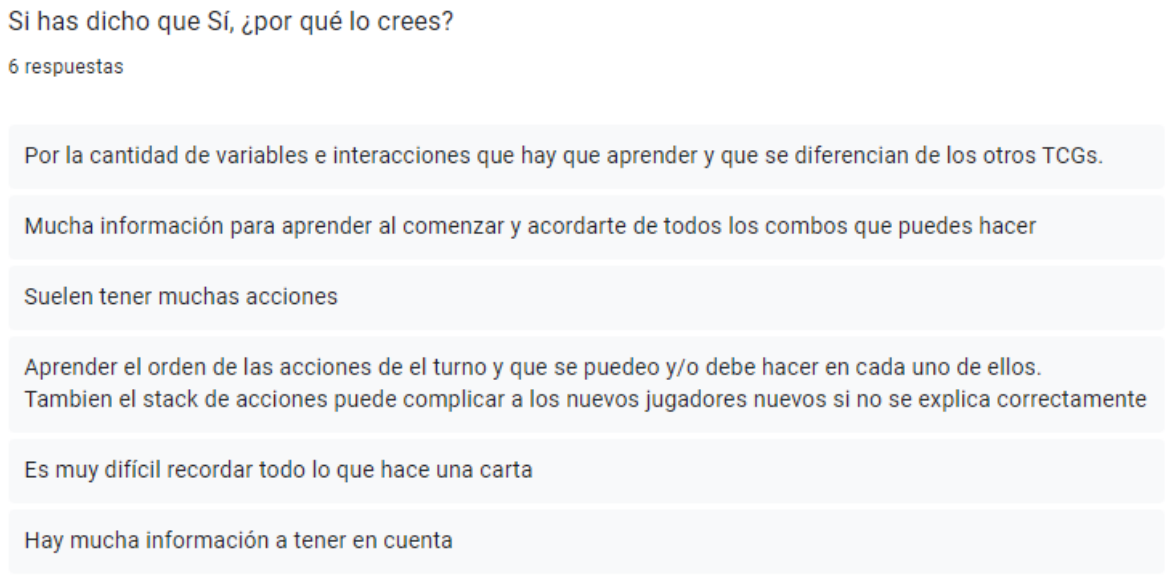

Figure F4: ”If you answered Yes, why do you think so?” results

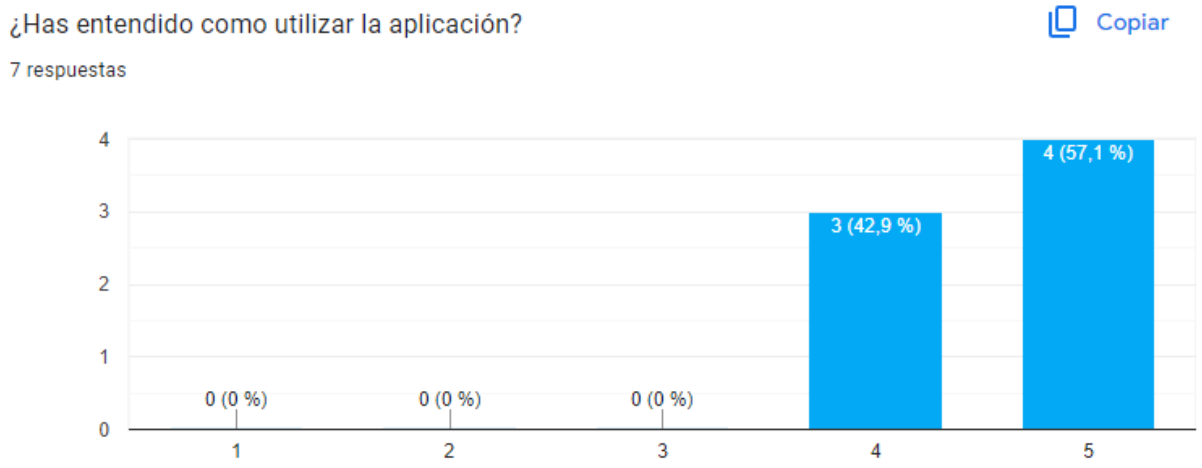

Figure F5: ”Did you understand how to use the application?” results

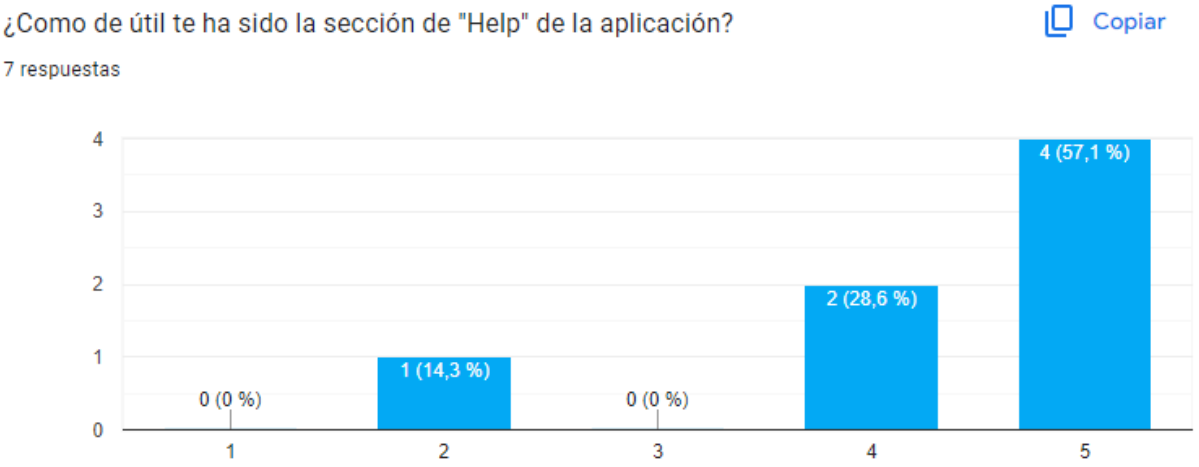

Figure F6: ”How useful did you find the “Help” section of the application?” results

¿Cómo mejorarías la sección de "Help" de la aplicación?

3 respuestas

Enfatizando algunas palabras clave como "Phase" o "abilities" para que los usuarios entiendan algo más o resulte sencillamente más visual. De otra manera se puede hacer estilo slideshow con imágenes que complementen los textos.

Poner conceptos basicos o palabra clave

Se podrían resaltar las palabras importantes

Figure F7: ”How would you improve the “Help” section of the application?” results

¿Has entendido para qué sirven los botones de cambio de fase?

Copiar

7 respuestas

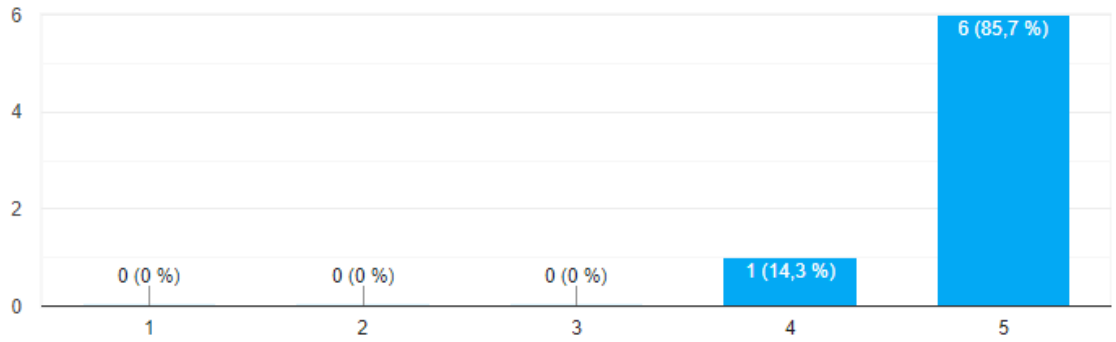

Figure F8: ”Did you understand what the phase change buttons are for?” results

¿Te has encontrado con algún bug?

7 respuestas

No

Más allá de perdida de tracking dependiendo de la iluminación, nada.

Mi pantalla 2k no estaba adaptada y se veia el fondo de Unity

Deseos de un enlace utilizado para compartir las descripciones de las habilidades de la tarjeta.

Figure F9: ”Have you encountered any bugs?” results

¿Qué crees que se podría mejorar sobre la aplicación?

7 respuestas

- Contador de vidas y optimización de resoluciones de pantalla.
- Añadir un contador de vida, botón para cambiar de fase, una explicación de las normas básicas en la aplicación
- Estaria increible que fuese de algun amanera mas automatica
- Un par de botones que permitan pasar a la siguiente o a la anterior fase me resultaria mas comodo
- Se podrían poner las normas del juego en la sección de Help
- Un contador de vidas
- Poder trackear toda la mesa a la vez

Figure F10: ”What do you think could be improved about the application?” results

¿Te ha sido difícil aprender a jugar siguiendo las instrucciones proporcionadas? Copiar

7 respuestas

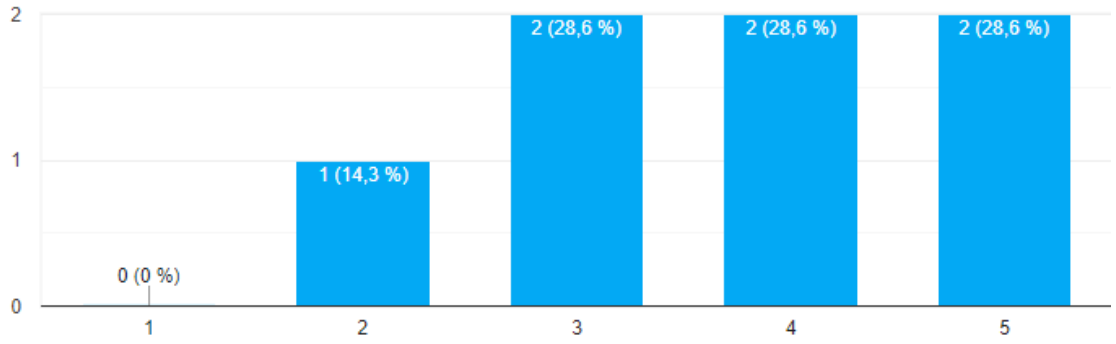

Figure F11: ”Did you find it difficult to learn how to play following the instructions provided?” results

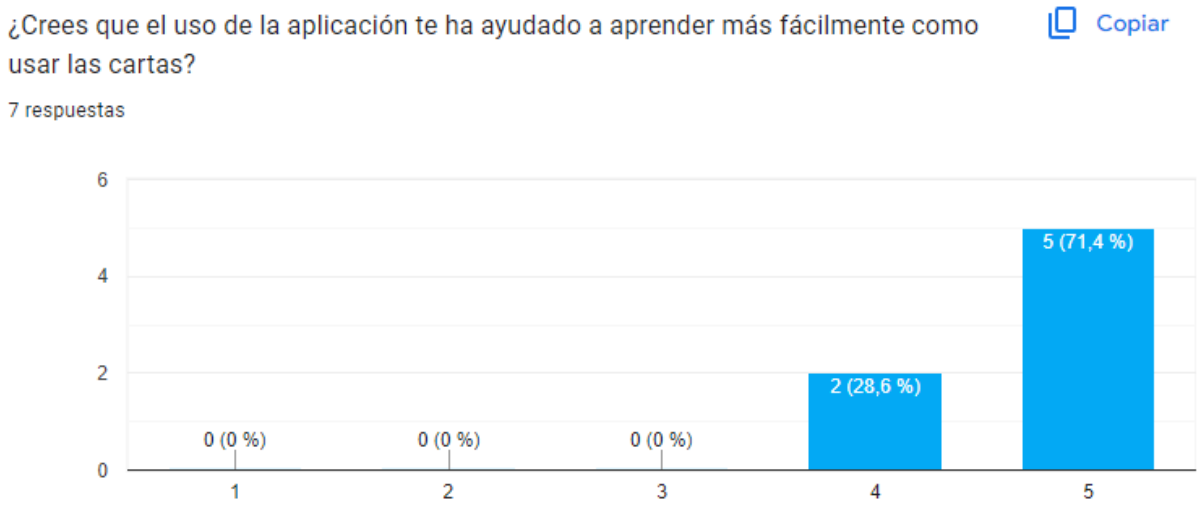

Figure F12: ”Do you think that using the application has helped you learn more easily how to use the cards?” results

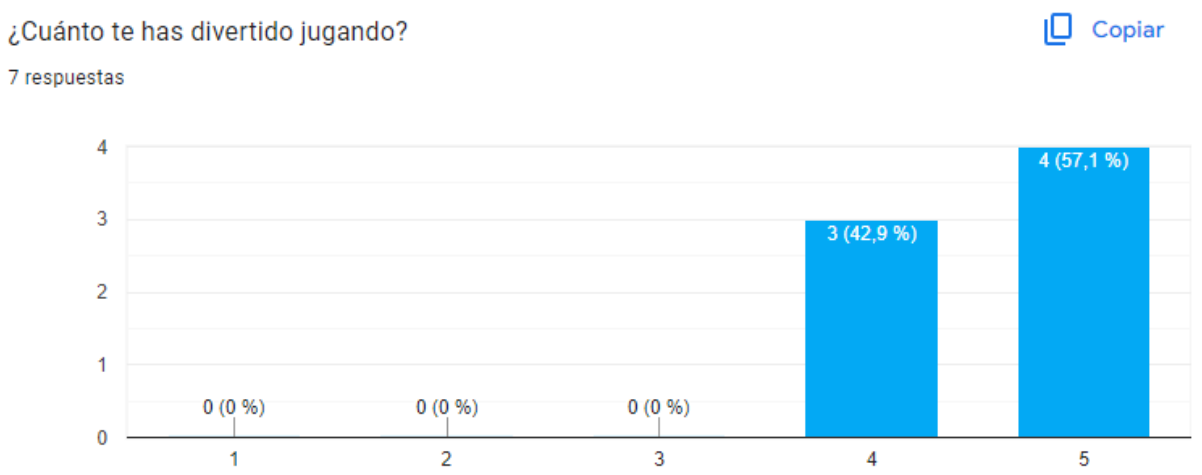

Figure F13: ”How much fun did you have playing?” results

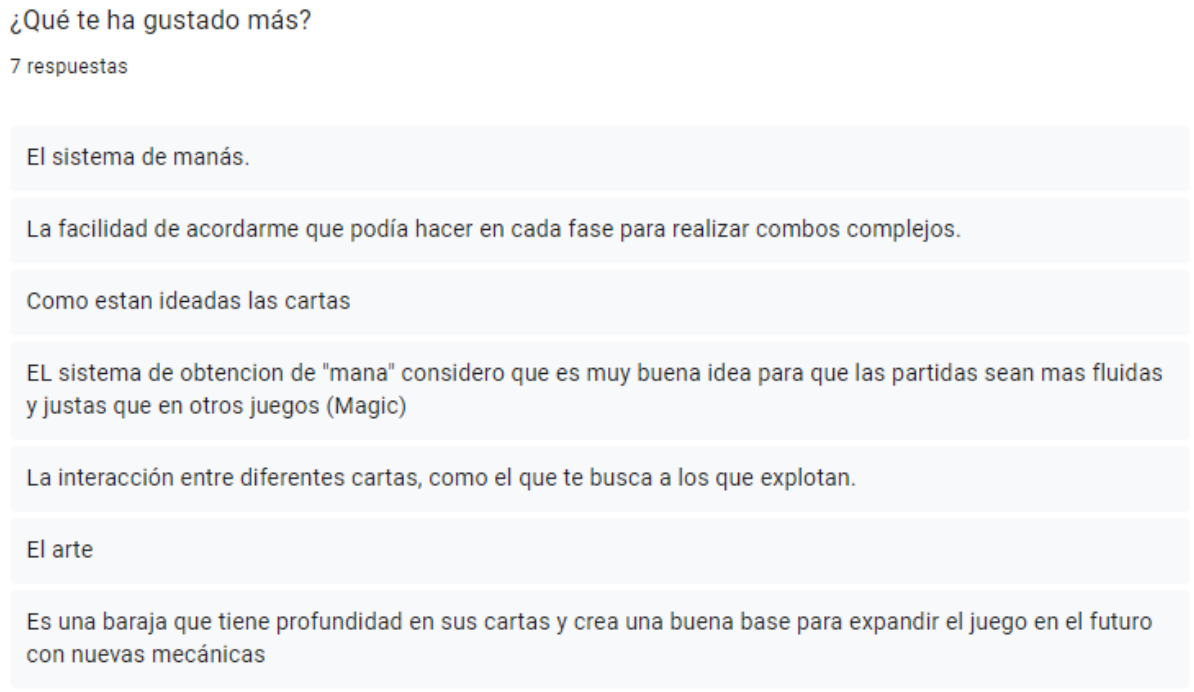

Figure F14: ”What did you like more?” results

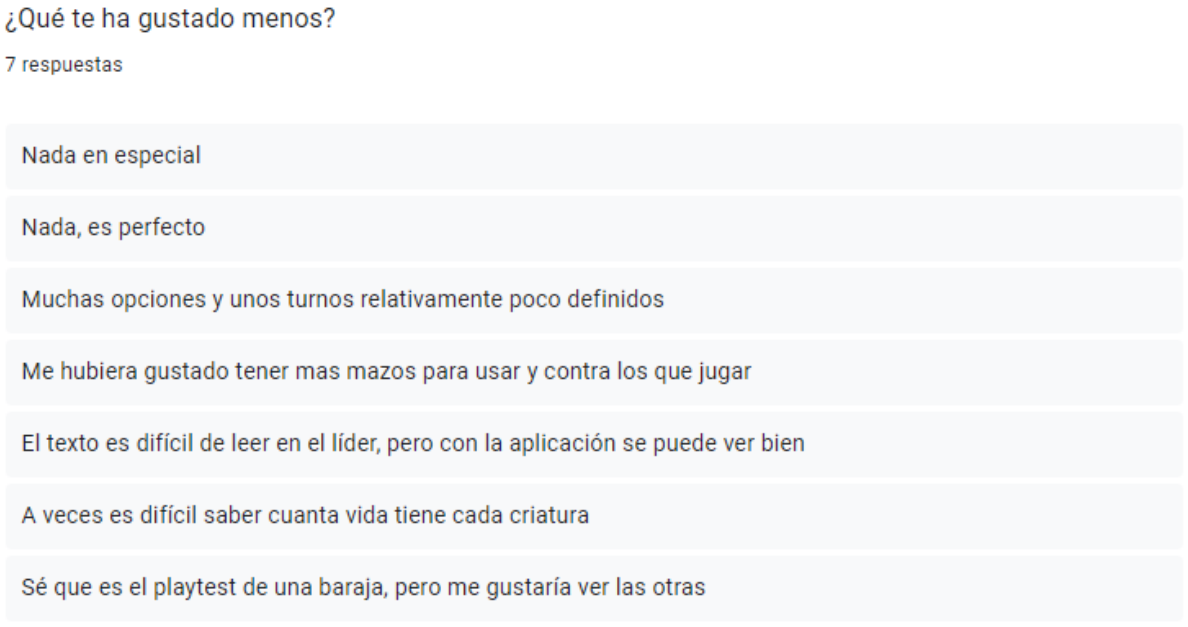

Figure F15: ”What did you like least?” results

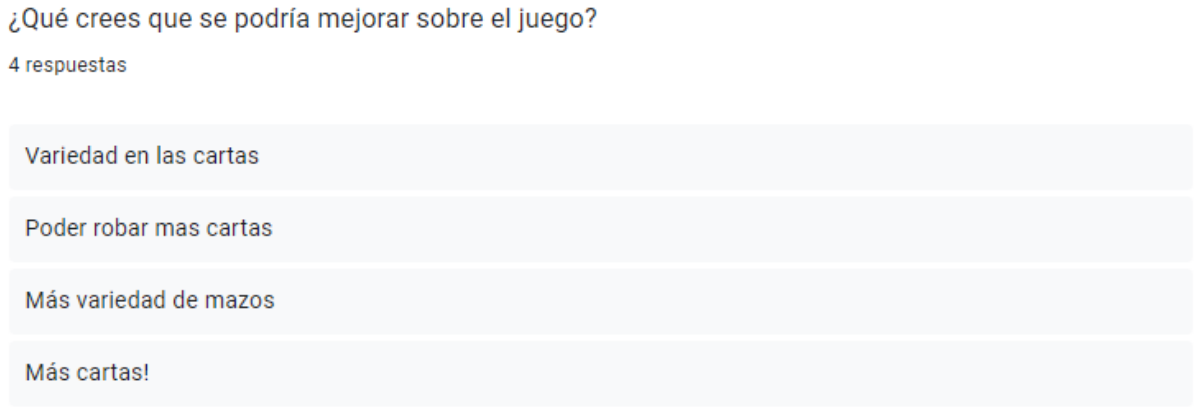

Figure F16: ”What do you think could be improved about the game?” results