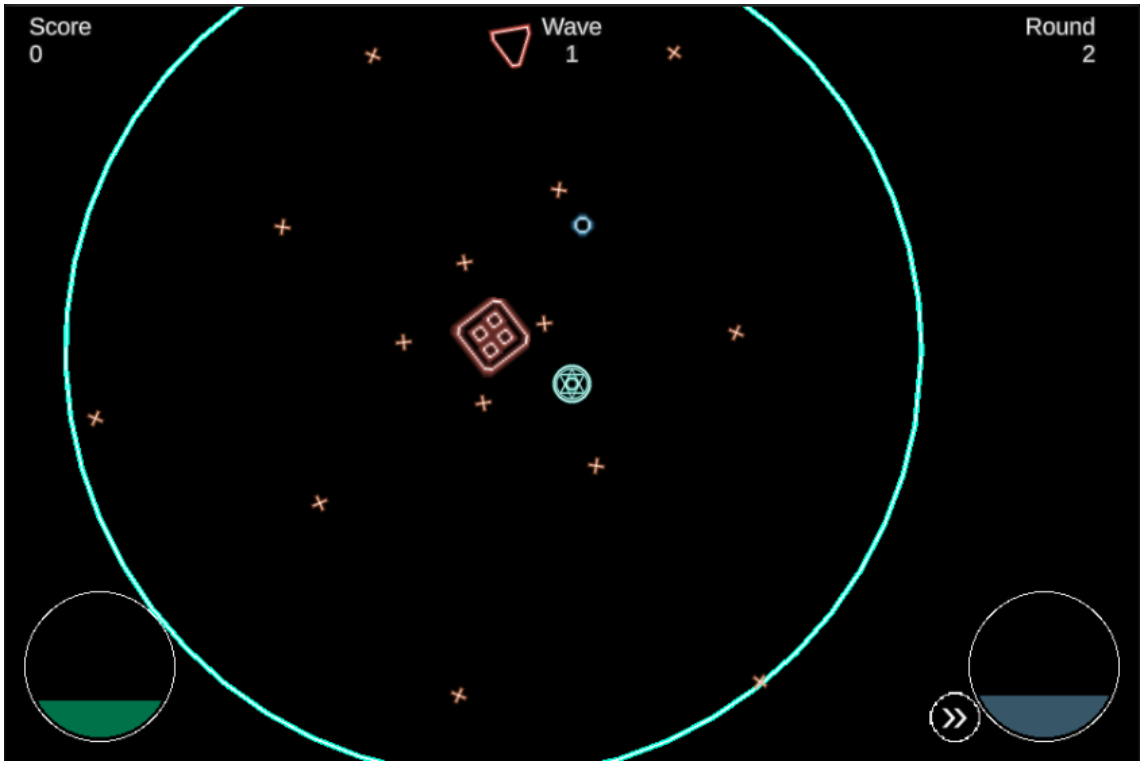
Winds Of Magic



Advanced Game Mechanics Report
GAV4003-N-BF1-2020

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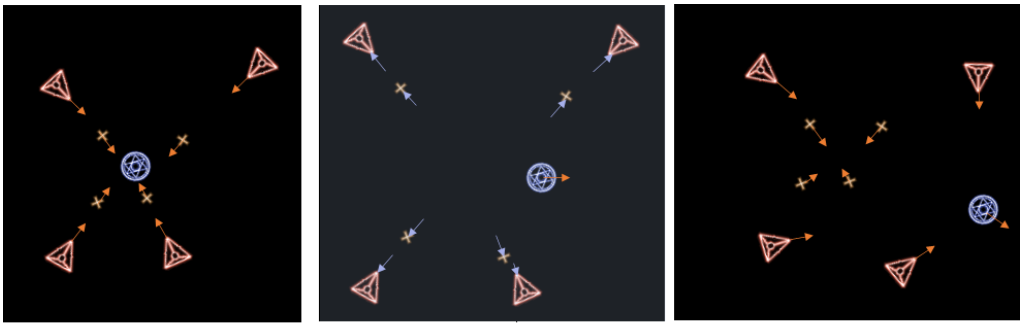
Game Pitch

The **Shoot 'Em up** genre or **Shmup** can be considered an old one, with early titles like ***Spacewar!*** (Russell *et al*, 1962), or **Asteroids** (Atari, 1979) having been made more than 40 years ago. Since then, the genre has branched out originating thousands of games (McMillan, 2013) making the creation of innovations challenging for designers.

Something that I have yet to see is the use of the **time rewind**, a mechanic more common in **decision-making puzzles**, that could **organically replace the dodge or shield** that often appears in the genre. I call the prototype **Winds of Magic** (**WoM**)

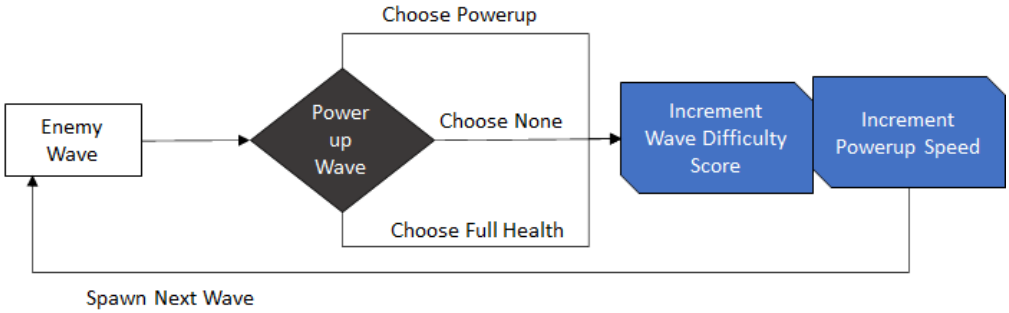
Upon activation, the mechanic would cause enemies to move backwards, damage to be reversed or even choices altered, allowing for both a kind of dodging, as well as a soft restart, **giving the player a unique dimension of 'movement'** to play in.



1. Player won't Escape?! **2. Reverse Time and Flee...** **3. Crisis Avoided!**

It then follows a **progression model** taken from **roguelikes** where each session of play presents different encounters and power ups, sometimes helping the player and sometimes bringing impossible challenges that cause them to restart over and over to try and beat their high scores.

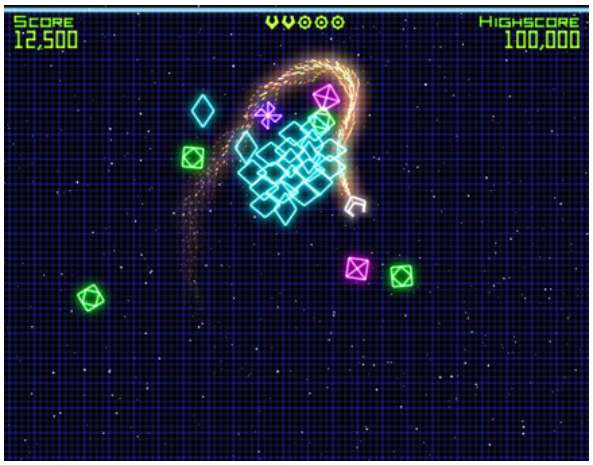
Game Loop

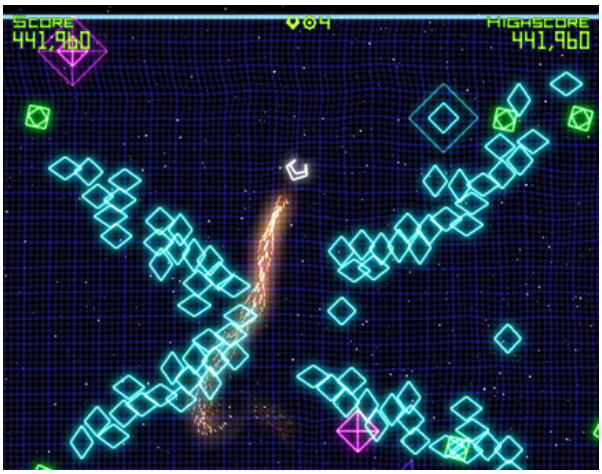


A **commercial version** could take the implemented prototype and add **bosses** after a set number of waves, more types of powerups that change and **synergize bullets** and **online** features such as **co-op** and **leaderboards**.

Inspirations

Geometry Wars: Retro Evolved (Bizarre Creations, 2003)





Its simplicity of **graphical design**, neon aesthetic, and **constrained space** inspired the core gameplay elements for **WoM**.

Braid (Blow, 2008)

This game gave the idea of **time rewind** thinking that it would allow players to redo mistakes or have puzzle-like boss encounters.

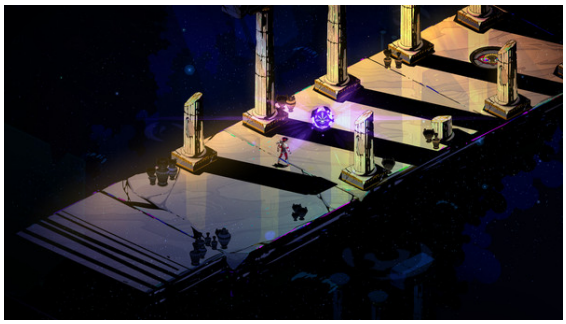
Life is Strange (Dontnod Entertainment, 2015)

This game informed me how the **time resource** should be limited by having a **dwindling window of opportunity**. It also made me give players the option to **change decisions** on which power up they wanted to take forward.

Binding of Isaac (BoI) (McMillen, Himsl, Baranowsky, 2011)

My initial idea was taken from its **encounters**, replacing the dungeon crawl elements with alternating waves of enemies and bosses. **Power progression** was also influence by its stat system, power ups increase or decrease stats by fixed tiers instead of floating values, and their **representation** can be seen in the pause menu.

Hades (Supergiant Games, 2020)



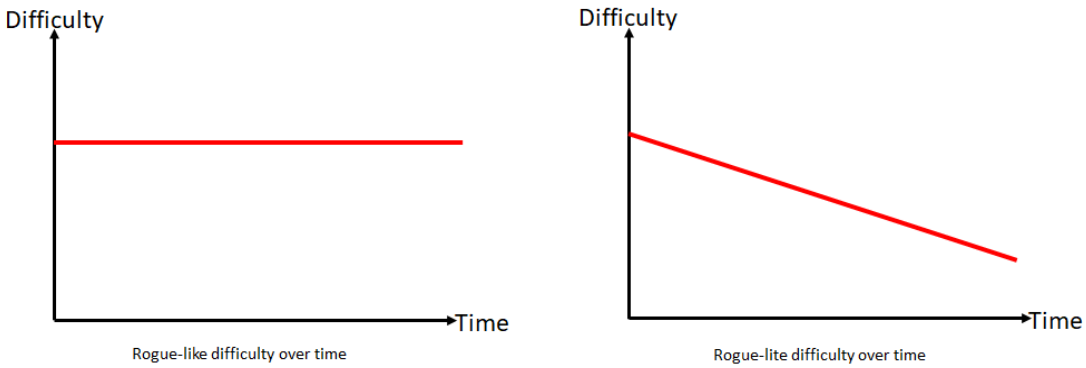
I took its idea of giving players a **binary choice** on which **upgrades** they want **after a battle**, for a constant drip feed of stat progression.

On Progression, Flow and Roguelikes

Flow theory (Csikszentmihalyi, 1988; Chen, 2007, pp. 31-34) indicates that the positive state is reached when a level of **skill matches the level of challenge** provided, this is an ideal state for game designers to induce, however **players naturally improve**, and boredom ensues. Other readings (Duckworth, 2017) indicate that there is **enjoyment in the harsh training** to belong in higher levels of mastery, bypassing flow through **deliberate practice**, by pushing oneself into the axis of anxiety.

There has been success (Chen, 2006) in creating an **adaptive difficulty system** that automatically brackets players to their correct challenge level, but this can be an **expensive** algorithm to develop, whose design may not fit all types of games.

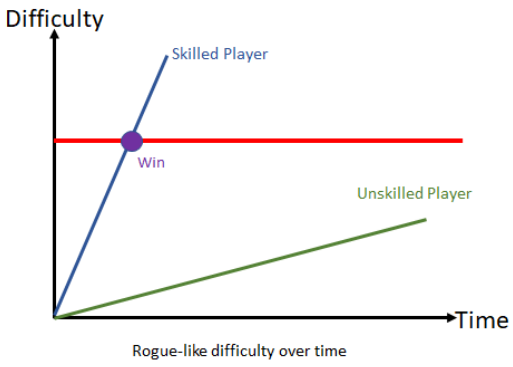
The way I applied these theories to **WoM** was to start by looking at how difficulty worked in the **genre**, not of **Shmups**, but of **Rogue-likes and Rogue-lites**. *Game Maker's Toolkit* (*Game Maker's Toolkit, 2019*) presents the following **comparison** on how their **difficulty** can be interpreted:



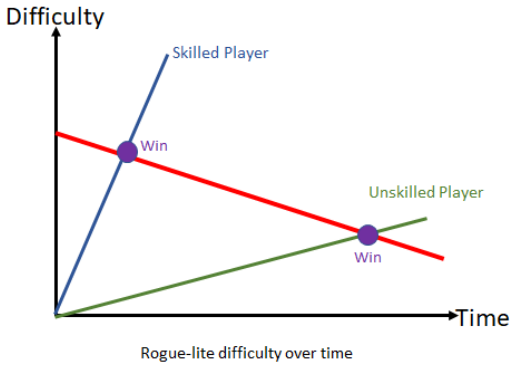
In a **Rogue-like** a challenge's **difficulty is constant** since starting conditions are always the same, so victory depends mostly on player skill; In a **Rogue-lite**, challenge **difficulty decreases** overtime as the player improves their starting conditions. This has an impact on how the game can be faced by skilled and unskilled players:

- **Rogue-lites** seem to accommodate difficulty to lower skill, allowing for **faster Flow states in unskilled players**, however they can quickly become uninteresting for skilled players.

- **Rogue-likes** seem to ask **unskilled players** to perform **deliberate practice** in order to improve themselves and eventually reach a **Flow** state.



Rogue-like difficulty over time



Rogue-lite difficulty over time

For **WoM** i decided that each wave should have a somewhat **constant difficulty ceiling** akin to **Rogue-likes**, however, I tailored encounters so that different spaces of **Flow** could exist for both player types:

- **Early waves** are **easier** and allow unskilled players to practice before the game's difficulty ramps up, causing them to die and return to their sweet spot of play.

- For skilled players, the game at **high levels** is high paced and **challenging**. Unfortunately, the backlash in speeds that death causes can be frustrating, but I saw skilled testers have a longing for the high paced levels, and a desire to repeat the game over and over to get there, something reminiscent of **Hard Fun** and ***Fiero*** (Lazzaro, 2004).

For the implementation, each **enemy** was given a **difficulty score**, and a **wave's difficulty** was calculated by multiplying the sum of those scores by a **modifier factor**, based on the number of enemies spawned.

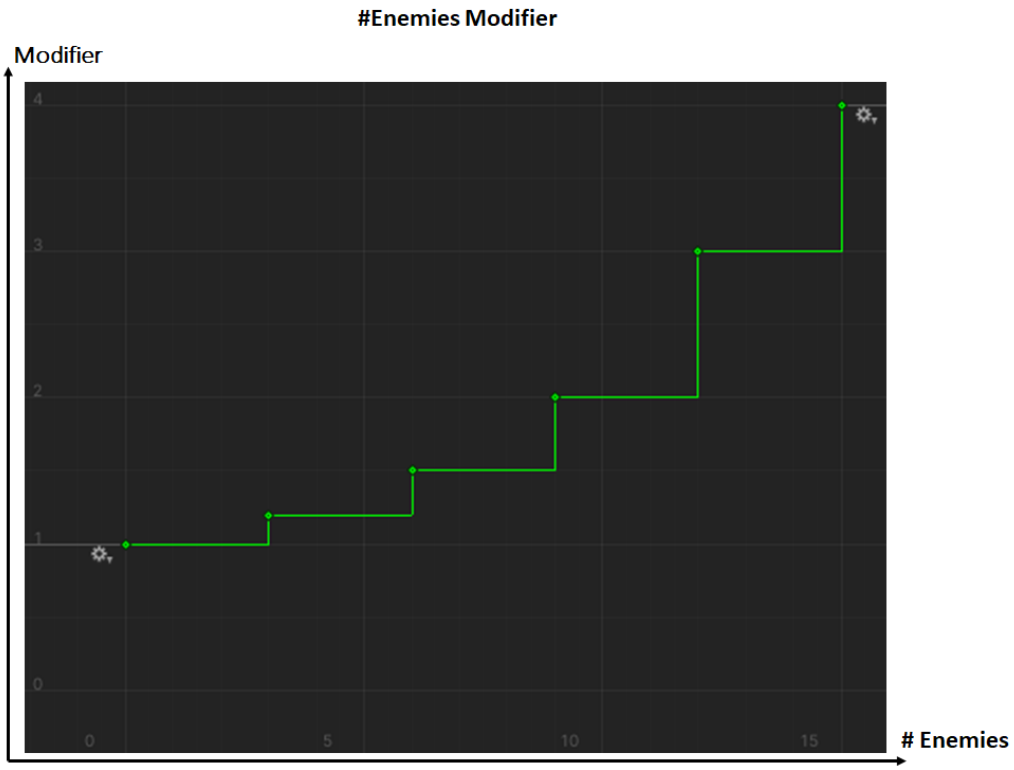
$$\text{Wave Difficulty} = \Sigma\,(\text{Enemy Score}) * \#\text{EnemiesModifier}$$

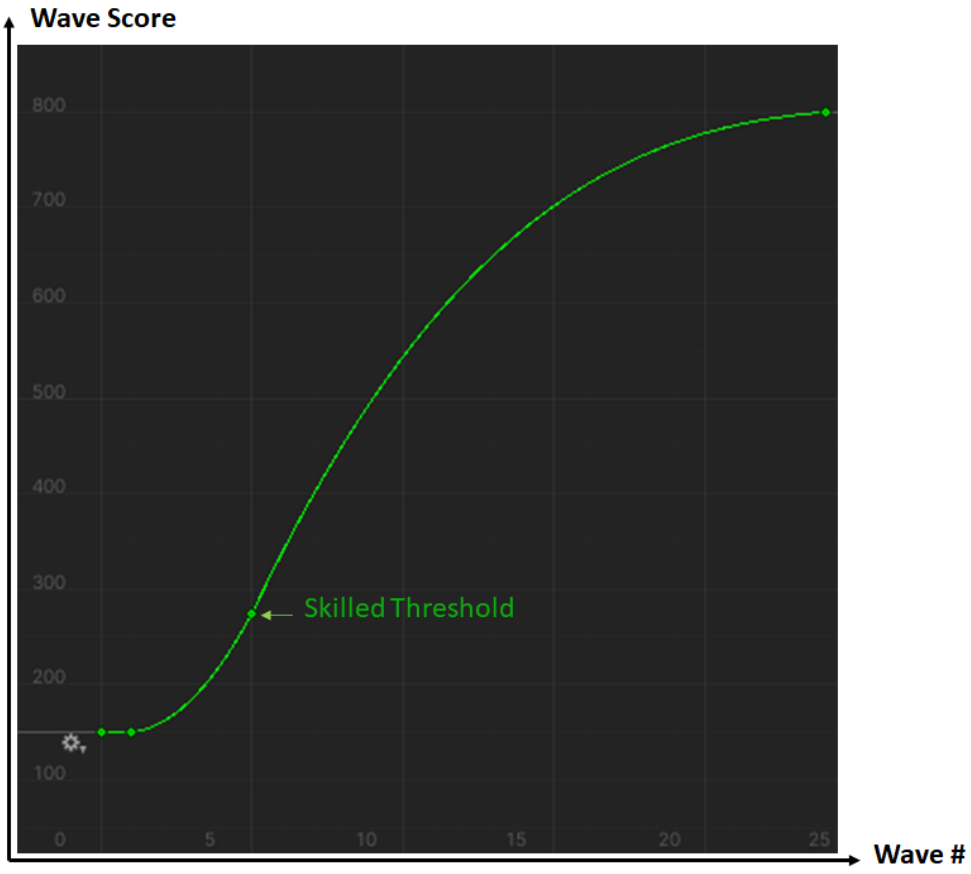
This is similar to how *Dungeons and Dragons* (Mearls *et al*, 2014, p.82) balances its encounters:

ENCOUNTER MULTIPLIERS

Number of Monsters	Multiplier	Number of Monsters	Multiplier
1	× 1	7–10	× 2.5
2	× 1.5	11–14	× 3
3–6	× 2	15 or more	× 4

Playtesting was done until the following curves were reached:





Note that due to the prototype's expected play duration of a few minutes, **balance was only adjusted up to wave 25**.

Another way challenge was balanced with wave progression is in the design of the **powerup wave**. Here the player has a choice between a full health pickup or one of two power-ups. As **waves increase**, so too does the **speed** of these collectibles forcing the player to spend their rewind or have less opportunities to choose. It also attempts to **organically balance firepower to player skill**:

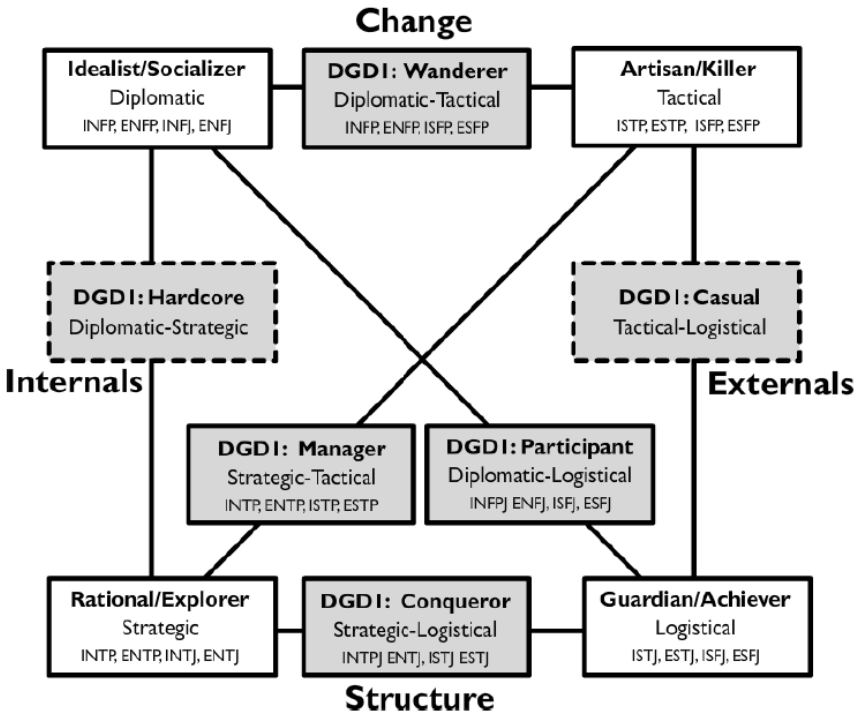
- Skilled players are likely to avoid damage and can ignore the full health, becoming stronger for stronger waves.

- Less skilled are likely to require the full health to survive a bit longer, at the cost of lacking firepower for stronger waves.

On Fun types and Player Typology

From previous studies (Capelo, 2013) I have found a **unified model** (Stewart, 2011) between some commonly used **player typologies**:

Keirsey	Bartle	Lazzaro	Motivation	Problem-solving	Overall Goal
Artisan (tactical)	Killer	Serious fun	Power	Performance	Do
Guardian (logistical)	Achiever	Hard fun	Security	Persistence	Have
Rational (strategic)	Explorer	Easy fun	Knowledge	Perception	Know
Idealist (diplomatic)	Socializer	People fun	Identity	Persuasion	Become



For **WoM**, I took this into account and while I considered the name attributed to **Bartle's MUD types**, I took to mind the properties **of Keirsey's Temperaments** and **Lazzaro's Fun Types**:

Regarding Achievers

These were the **target group** to satisfy. Creating a game that afforded the **intrinsic rewards** of **continuous self-improvement** and mastery was the start, but I then considered the creation of a **high-score** system to give players a visible

proof of their efforts for them to chase after. The **high score** system may seem obvious, but it was not part of the initial concept and arose when thinking about how to improve **Achiever's** experience.

Regarding Explorers

I hypothesized that this group would find some enjoyment in an **innovative mechanic** for the genre, the **rewind**, as well as innovative **boss encounters** together with a projectile **synergy system** akin to *The Binding of Isaac's*. Unfortunately for this prototype version, these were **too ambitious** and was always kept as an optional **stretch goal** that was never reached but would guide it to become a **commercial product**.

Regarding Killers

Killers would be pressed to find anything that would satisfy them, unless I was able to adapt high scores into **leaderboards** wherein the game would offer that level of **interpersonal competition** that they thrive for. The **logistics** of online leaderboards would be beyond my intentions for the prototype so were never added as **scope**.

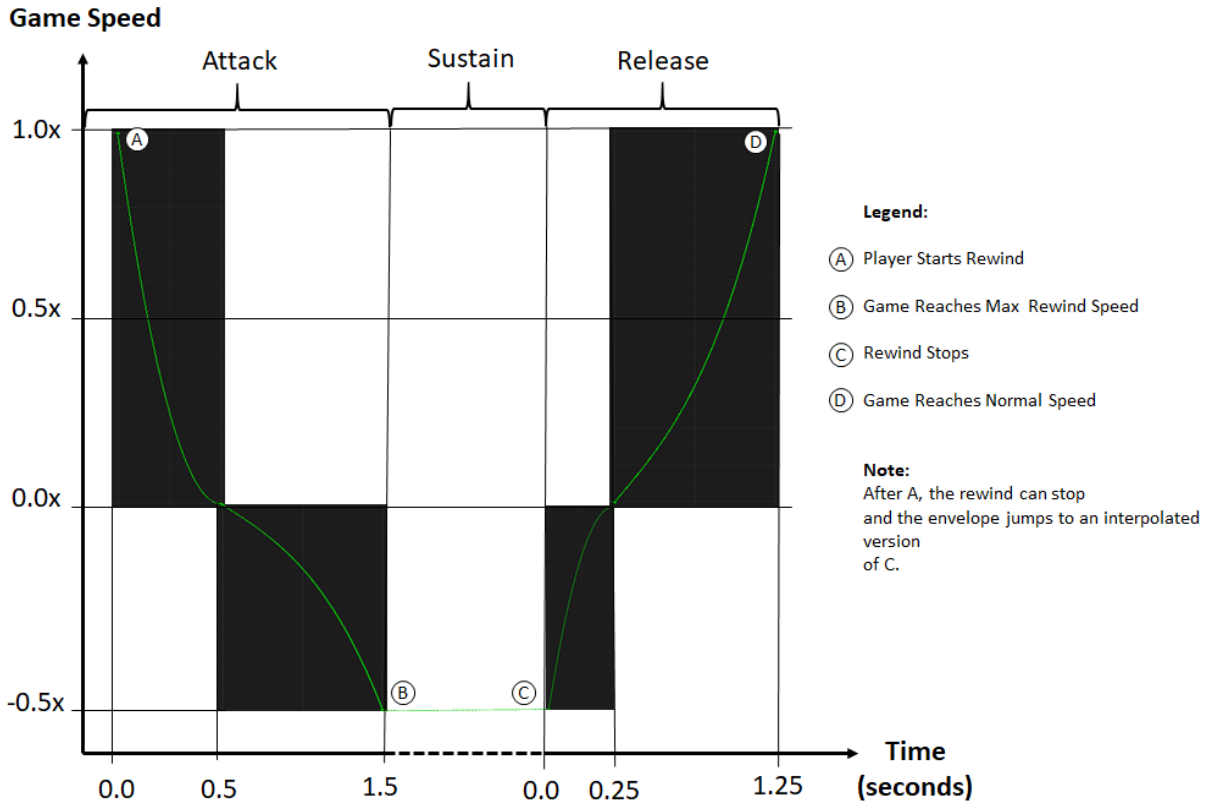
Regarding Socializers

Catering to them would be difficult as the game is an **explicit single player** game with little option for online, or local types of gameplay. One could stretch the idea to include **multiple players cooperating**, but I chose to focus on the single player experience.

On Game Feel

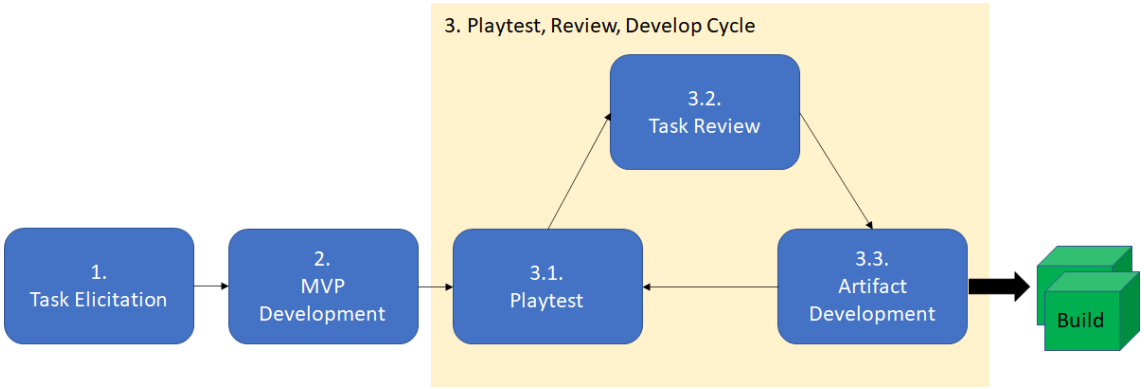
The **goal of Game Feel** is to ultimately provide a **great feeling game** to the player by succeeding on different types of experiences (Swink, 2009, pp.33-34). **WoM's Game Feel** is seen in hundreds of small implementations, too many to go into detail, however, the experience of **'Learning, practicing and mastering'** is explored in '***On Difficulty, Flow and Roguelikes***'.

Another important aspect to succeed was in making sure that **entering and leaving time rewinds felt good** and allowed the player to **react fairly**. So, I made sure to create and modulate the transition similar to an inverted **Attack, Decay, Sustain and Release envelope**:



On Game Iterations and Playtesting

The development process of **WoM** was greatly influenced my personal experience with **Agile software development**, with the following pattern:



1. Intended features are divided into tasks and prioritized with **MoSCoW** (Must Have, Should Have, Could Have, Won't Have), creating a plan for what constitutes the **Minimum Viable Product** (**MVP**).

2. The **MVP** is implemented.

3. A **continuous iteration cycle** is entered:

    1. **Playtest** - Current build of the game is **playtested**

    2. **Task Review** - **Feedback** from playtest is **compiled** into prioritized tasks using **MoSCoW**.

    3. Artifact Development – **Development** of features and fixes until enough work, that can be playtested, has been made. At the end of this stage a new **complete deliverable** has been made and the cycle either **restarts** or the project is ready **to ship**.

Playtesting was therefore a crucial informant on the **iteration** process, so it is worth looking at my specific approaches:

- **Variations** of a build were **tested against one another**, having different people test them in **different orders**. This would highlight which direction the game should head.

- By **observing gameplay**, I could identify **difficulty spikes and valleys**, as well as whether features were quickly understood or required further **tutorialization**.

- At the **end of a playtesting session**, an **informal discussion** gave me insight into the mindset of players and their qualitative opinions allowing for discovery and brainstorming, while previously **prepared questions** focused them on the issues I believed the game could be having.

- **Recording** both **gameplay** and **discussion** allowed me to go back and calmly review for missed details.

Given the state of the **corona epidemic**, and as a student, it was **hard to find volunteers** to playtest the game so **optimizing** their usage was essential. For this game I considered **two types of playtester**:

- **First timers**

Individuals who **never played** any build. These were crucial to understand whether mechanics were properly **tutorialized** and could only be considered part of this bracket for a single playtest session, making them a **valuable resource** that needed to be spread across builds.

- **Repeaters**

Individuals who **played different builds** of the game. They were used to test **incremental improvements**, as well as to balance the game's difficulty and overall feeling.

On Tutorialization

From my **professional experience**, developing first-time user experiences for mobile games, as well as **industry knowledge** (Extra Credits, 2012) (Vollmer, 2016), **teaching** the game's components and rules is an **essential** part in creating mastery and enjoyment for players.

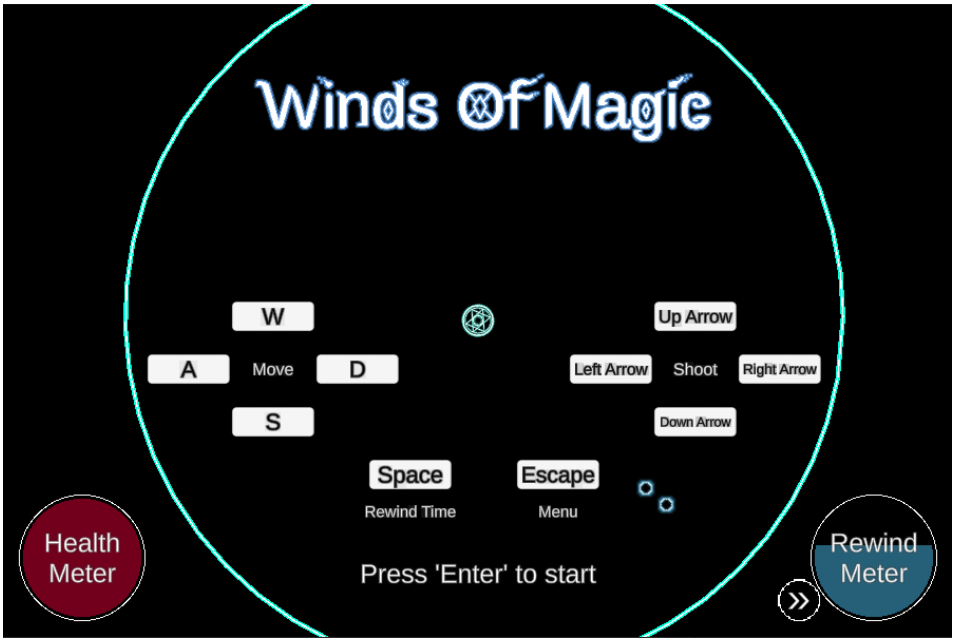
Given the **playtesting feedback** the following was **tutorialized**:

Controls

First time players felt a bit lost with the **controls**, so some **instructions** were required. Given the prototype nature of the project and its scope, I decided to make a very simple **tutorial** that appears when the player first loads the game.

Following industry recommendations (Berbece, 2019), I made it **non-invasive**, similar to games that allow practice in safe spaces, such as the loading screen in *Bayonetta* (PlatinumGames, 2009) or the starting room in *Binding of Isaac* (McMillen, Himsl, Baranowsky, 2011).

Here the player can move, shoot and use time reversal **until they are ready to start**.



Death Rewind Tutorial

Players were having a lot of difficulty understanding what happened **when they died** but were still **able to rewind**, so I added a small tip to remind them.

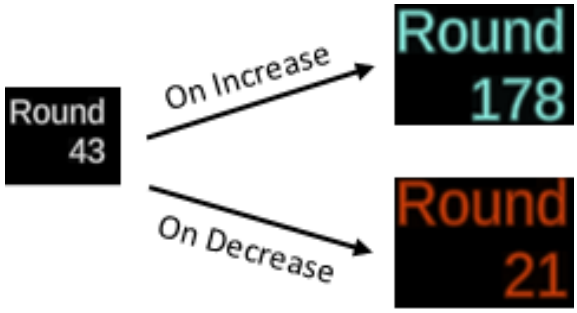
Pickup effects

These were initially **confusing** and **hard to memorize**. The newer **iconography** attempts to indicate their **function** and a message explicitly indicates their **effect** when captured.

Additionally, some **first timers** reported being **afraid** of powerups since they were **moving**. To try and create a **positive priming** to these round objects I made the first enemy of every game **always spawn** a static health pickup. This pickup uses a typical health symbol and should be associated with something positive. This guarantees that they have at least had a **chance to interact** with a still, seemingly friendly pickup before the moving variant appears.

Score pop animation

One of the hardest things to teach without blatantly telling the players was that **score is negatively affected by pickups**. I decided to teach this **indirectly** by **animating scores** whenever there is positive or a negative change, this way players can make the connection that pickups affect it. The colors chosen are different depending on whether the score goes up or down, and are readable for **colorblind** disabilities:

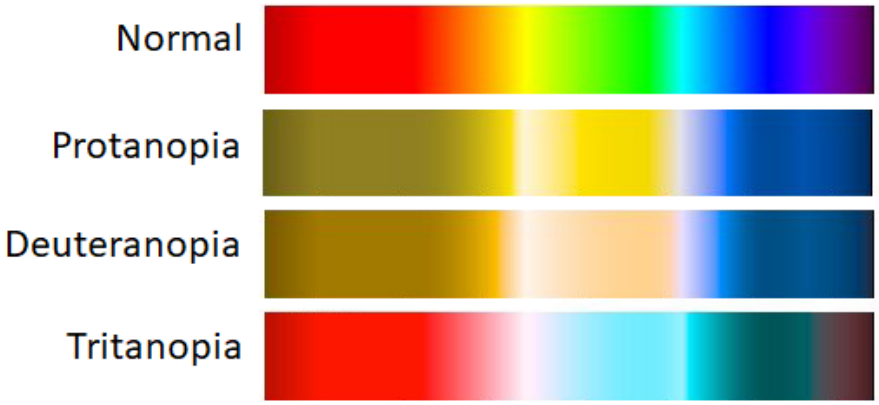


On Accessibility:

Game accessibility focuses on bridging the gap caused by **player limitations** (physical, mental, linguistic, cultural, ...), thus increasing the potential player base. For **WoM** I decided to focus on two types of limitations: **Color Blindness** and **Mobility Impairment**.

Color Blindness

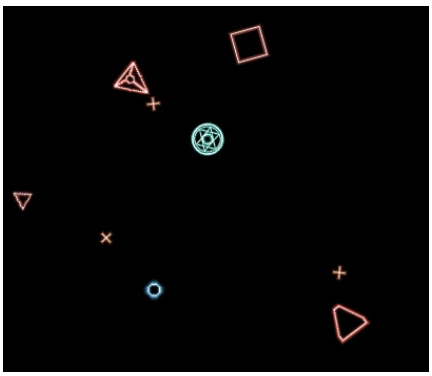
Color Blindness is a vision deficiency where the eye becomes **limited** in processing the **color spectrum** either due to an anomaly in, or lack of, its cone receptors - red (protan), green (deutan), and blue (tritan). This leads to **a narrower spectrum** of perceived colors that should in its extremes appear as compared below (Flück, 2006):



Due to the **high prevalence** of the disability, approximately 1 in 12 men and 1 in 200 women (Game Maker's Toolkit, 2018), this is an issue that the **medium cannot afford to ignore** and what follows are the solutions for WoM.

- High Contrast

Since inception, I created a **neon artstyle** that presented clearly defined shapes that **contrast** with the background, making each entity easy to spot (Game Maker's Toolkit, 2018).



- Shape Design

According to Rogers (2014, pp. 94-95) the **shape** of a character informs its **personality**, following his recommendations I ensured consistency between object types and shapes.

Players and **friendly objects** are **circular** while **enemies** and **hazards** have **sharp outer edges**, often triangular or square in shape.

Additionally, each **enemy** has a **distinct shape**, and **shooter** enemies have **inner circles**, as many as the number of bullets they fire.

Positive Entities are Circular

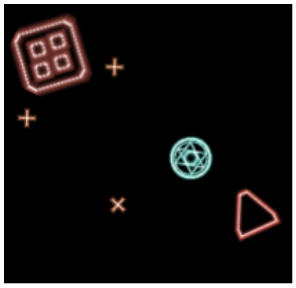
Negative Entities have Edges

- Color Channel Presets

Inspired by research (Power, Barlet, 2019; Game Maker's Toolkit, 2018; Barlet *et al*, 2012), **WoM** has **presets** to account for each type of **Color Blindness**.

The game offers the ability to create a **custom preset**, by changing each **color channel** individually.

These presets are based on the spectrums shown above and were only tested with **Unity's limited colorblind mode**, needing to be properly tested with colorblind people.



Default Preset

Protanopia Preset

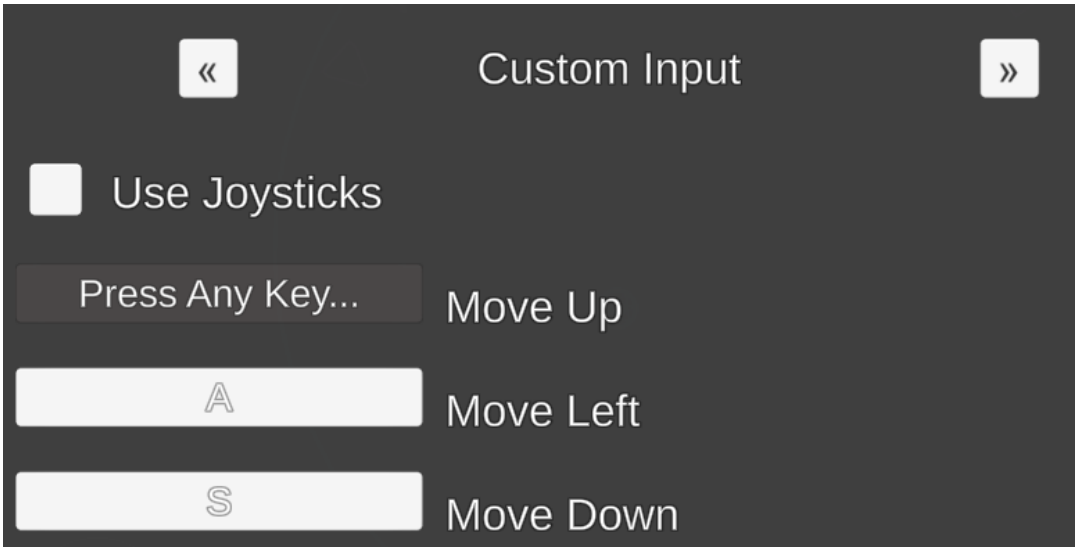
Mobility Impairment

This refers to how a player has **limited movement** capability, and the causes of the impairment can be very broad, from neurological disorders to loss of function (Barlet *et al*, 2012, p.10). Accessibility **solutions** for these types of disability seem to focus on **customizing the game** to allow for personal ways of playing, from changing input, to balancing challenges.

- Input Presets and Rebinding

WoM has **presets** for different types of player (Querty, Azerty, Right-Hand, XBox Controller, Playstation Controller) and more importantly allows each gamer to easily **remap** the **key bindings to** their preference.

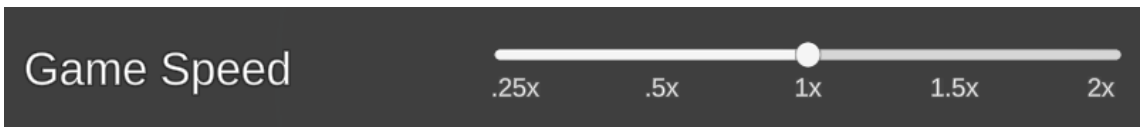
This is one of the **most requested features** for mobility impaired players (Barlet *et al*, 2012, p.10), and they often require **specialized hardware** to play that requires it (Voelker 2016).



- Adjusting Game Speed

This type of **game assist** should allow "...those with dexterity, precision and strength issues to interface with the game at an easier rate of speed" (Barlet *et al*, 2012, p.22).

An interesting and **unexpected** consequence was that during playtesting some **skilled players** enjoyed **increasing the speed** in order to play at higher levels of difficulty.



- One-Handed Mode

This is almost a **game mode** unto itself, enabling **auto-shooting** that targets the closest enemy to give players who can only use a paired axis of movement a fulfilling experience, since **dodging and positioning is still fun** on its own.

This can also be **paired** with the **right-handed preset** for players who can only use their right hand (the default mode already supports left-hand players).

Conclusion

Winds of Magic was a challenging game to implement, not only **technically**, given its main mechanic, but also as a **game design product**. It forced me to iterate tirelessly until it felt good, and a lot of features were born from playtesting rather than initial conception.

Regarding the **time rewind** mechanic in **Shmups**, I barely scratched the surface of what was possible. While I believe to have proved it is a **functional** and **fun** addition that generates **interesting choices**, such as experimenting with pickups, it also needed **more enemies** that force usage of the mechanic, or **puzzle-like boss encounters**.

In terms of **Accessibility**, the prototype is a success that shows many of the variants that can be implemented in **Shmups** to support **Color Blindness** and **Movement Impairment**.

Overall, the **final product** is a **playtester verified fun game** that hides more **replayability** than expected and that I consider, from an *advanced game mechanics* perspective, well **thought-of** and **solid**.

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Annex A – Player Balance

						Tiers						
	Units	Start	Min	Max		1	2	3	4	5		
Player												Legend:
MoveSpeed	Unit/Second	10	0,75	2		0,75	1,0625	1,375	1,6875	2		Start Tier
Health	HP	3	2	5		2	2,75	3,5	4,25	5		
RollbackRecoverySpeed	Rollback/Second	0,33	0,01	0,1		0,01	0,0325	0,055	0,0775	0,1		
RollbackTime	Seconds	5	2	10		2	4	6	8	10		
iFrameTime	Seconds	0,5	0,5	1		0,5	0,625	0,75	0,875	1		
FireRate	Seconds	1,15	1,75	0,4		1,75	1,4125	1,075	0,7375	0,4		
Projectile												
AddedSpeed	Unit/Second	1	1	5		1	2	3	4	5		
Size	Units	0,15	0,05	0,2		0,05	0,0875	0,125	0,1625	0,2		
Damage	HP	1	0,5	3		0,5	1,125	1,75	2,375	3		
Game												
StartRollbackSpeed	0											
MaxRollbackSpeed	3											
Dropped												
RollbackCount	Rollbacks	1	1	1								
FireAmount	Bullets	1	1	10								
Acceleration	Unit/Second^2	200	200	200								

Annex B – Enemy Balance

Image Name	 Chaser	 Speedy Chaser	 Rusher	 ChaserShooter	 Double Shooter	 QuadShooter	 OmniShooter	 WeirdShooter
Mechanics	Chase	Chase	Chase, Rush	Chase, Shoot	Chase, Shoot	Chase, Shoot	Chase, Shoot	Chase, Shoot, Defend
Health	3,5	1	2	2	7	7	15	2
MoveSpeed	0,65	1,5	0,5	0,5	0,3	0,3	0,1	0,5
Bullet Pattern	-	-	-	1	2, 2	4	20	3
Bullet Spawn Time	-	-	-	1.1	0.75, 1	1	2.5	1,5
Action Distance	-	-	1,5	2	-	-	-	1
Collision Damage (~ 1/3 health)	1,2	0,5	2	1	3	3	4	2
RequiresTimeTravel	0	0	0	0	0	0	0	1
BulletsPerSecond	0	0	0	0,909090909	4	4	8	2
Score	43	18	30	34	119	119	234	150
ScoreOffset	2,15	0,9	1,5	1,7	5,95	5,95	11.7	7,5
ScoreBulletHit	1,075	0,45	0,75	0,85	2,975	2,975	5.85	3,75
ActualScoreBuleltHit	1	1	1	1	3	3	6	4

Annex C – Pickup Effects

Image									
Name	Opila	Ehwaz	Berkano	Dagaz	Algiz	Eihwaz	Sowuli	Urus	Hagalaz
Symbolism	Heritage	Horse	Birth	Dawn	Defence	Death	Sun	Power	Havoc
Health	+								-
Move Speed		+						-	
RollbackTime		-	+						
Rollback Recovery Speed				+		-			
Iframe Time					+		-		
Fire Rate	-					+			
Projectile Speed				-			+		
Projectile Size			-					+	
Projectile Damage					-				+