Rave Beat

Final Year Project - CTEC3451 Final Deliverable Report

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<https://github.com/im-e/rave-beat>

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# Introduction

Rave Beat is a rhythm game that was created with the aims to be accessible to all, while still challenging and training the rhythmical ability of the player, similarly to the ‘traditional style’ of rhythm-focused games that had popularised the genre. Its design from conception has had accessibility strategies in mind while ensuring that the rhythmical training aspect of the game is preserved. Rave Beat aims to show that using accessibility strategies from the beginning of a game’s creation can be inexpensive and successfully allows it to cater to an audience that regularly feels ostracized from the same style of games within the genre. This report aims to highlight the unique benefits that rhythmical skills can provide, how videogames have been used to train these skills, and lastly how I used that to create Rave Beat. I created Rave Beat in an attempt to convince more developers to use more accessibility strategies within games so that they solidify themselves into game development tradition.

# Why does Rave Beat need to exist?

## Rhythm and life

The definition of rhythm is described as “a regular movement or pattern of movements.” These movements can take many forms such as “sounds, words, or musical notes that are used in music, poetry, and dancing.” Rhythms are not just found in art forms; however, “Rhythmicity is a fundamental property of living matter.” Circadian rhythms are instinctual behaviours that have a distinct rhythm. Almost all living animals have some form of circadian rhythm that will affect their life, your own sleeping schedule and eating habits are perfect examples of this. There are also many other naturally occurring rhythms that impact our own day to day life, such as the sun rising and falling, seasons rotating between one another. Rhythmical skill is the ability to recognise regular sequences of movements as rhythms and being able to follow along or continue them by extrapolating from the sequence.

## Benefits from rhythmical skills

Rhythms control or influence many parts of our lives, this makes it no surprise that being able to recognise and follow rhythmical patterns is an essential skill that reaps many benefits to humans. These benefits are greater than one might think. After looking at the links between rhythmical skills and grammar skills, studies have shown that lacking “certain rhythmic skills can reflect underlying language and/or perceptual impairments.” This was follow up research based off earlier findings which showed that by training a child’s rhythmical skill, they will have an “improvement in a wider range of phonological awareness skills.” Adults are also able to see these benefits; “the neural foundations of rhythmic proficiency and its relation to language skills in young adults” was also investigated. The findings showed that “rhythm sequencing ability was linked to verbal memory, reading, and nonverbal auditory temporal processing” abilities.

Training rhythmical skill and the beginning of the problem

Rhythmical skills can be learned and improved through a plethora of activities, most of them involve participating in something musical, such as, playing an instrument, dancing, or singing. The problem here, is that it can be an intimidating challenge for those who do not have experience partaking in musical activities- learning a brand-new activity is difficult task for many people and requires lots of time and effort. How can we make learning and practicing rhythmical skills easier for those who do not have this experience?

A study that aimed to enhance rhythmical skill development within primary school students, found that the “use of rhythmic songs and games are fundamental to teaching rhythm.” These games and songs were activities that children participated in together, within a classroom. For example, a game included the children pairing up and taking it in “turns to clap a four beat rhythm which had not been clapped before to their partner.”

## The problem

Adults may find it hard to participate in rhythmic songs or games as many modern communities do not actively participate in them, with the most common occurrences of it today taking place at religious ceremonies and events. Our ancestors would frequently participate in communal celebrations of music, engaging the local community into dancing, singing and other rhythmical activities that are simply not reciprocated as frequently in modern life today. This means that lots of adults simply do not have access or have to go out of their way to learn or improve upon these essential rhythmical skills that have been proven to improve one’s life. This is a problem as every human being deserves the right to live a happy, fulfilling life and it is our responsibility to involve and teach others the skills and techniques that can help others achieve that happiness and fulfilment.

I believe that many lives of children and adults that lack essential rhythmical skills, will be able to see benefits and improvements within their lives if it was trained and exercised in some way regularly. These skills have the potential to help someone in their day to day life, help them to pursue a musical career or make them better at singing, or rapping. All of which have the potential to contribute to the happiness or fulfilment that one may need in their life.

## Real-life games to Video games

Studies show that “there are many creative, social and emotional benefits from playing videogames.” These benefits are similar to the ones found by participating in other art forms like painting or dancing. Videogames are like no other art form; however, they cover a large range of differing experiences, varying from fast paced, multiplayer competitive games, to laid back, light-hearted single player story games, all of which can be experienced from a comfortable setting of the players choice. Games can be enjoyed alone, with friends and family or under supervision of someone else. They engage people and can motivate them to do tasks that would otherwise be tiresome or repetitive, this makes games a great learning tool that can be used for both education and rehabilitation purposes.

Repeatedly interpreting rhythms and being challenged to follow them is a core part of developing one’s rhythmical skill. I believe that rhythmical videogames could streamline this repetitive process for many people and make the learning activity become more engaging and enjoyable, similarly how real-life rhythmical games work. Videogames have a greater potential to do this due as they are generally widely accessible for all ages and are experienced in a comfortable, personal environment in which people are more open and responsive to learning.

Firstly, I asked myself: if videogames can provide real-life benefits to players and real-life rhythmical games assist in the development of essential rhythmical skills, do we see improvements and benefits from playing currently released rhythmical videogames?

## Rhythmical videogames and their benefits

Research into this shows interesting results. An international survey on *Dance Dance Revolution (DDR) -* one of the world’s most popular rhythm videogames, was taken to study players experiences with the game, findings showed that playing the game provided a “positive effect on the social life and physical health of players, as it improves endurance, muscle strength, sense of rhythm, and creates a setting where new friends can be found.” Further research assessed their potential to be used within rehabilitation and a study was able to use rhythm videogames to successfully relieve symptoms of Parkinson’s disease- where elderly “patients who received … rhythm training” from playing a rhythm focused game had “improved their orofacial and manual performance.”

An interesting quality of these rhythm games, similarly to their real-life counterparts, all have a heavy focus on the rhythm following aspect of the game, also known as the ‘traditional style’ of rhythm game. Whereas games that are not focused this, only provide the same benefits that most videogame genres reciprocate. Patients of Parkinson’s disease who were able to improve their motor abilities played a ‘serious’ rhythmical game and *DDR* is well-known for being hard and exercising due to its heavy focus on ensuring the player sticks to the beat, with most players experiences with *DDR* being summed up by this Kotaku journalist’s personal experience who’s reactive strategy was to: “mash the mat with my feet.”

## The barriers of rhythmical videogames

A rhythm game that does not focus on rhythm following gameplay. That statement may sound like an oxymoron but is a frequent case in the rhythm game genre that I personally believe needs a separate genre classification from ‘rhythm games.’ These games end up being ineffective tools for improving rhythmical skills and providing benefits towards rehabilitation because they do not challenge the players rhythmical skills effectively enough. On the other hand, *DDR* has been shown to provide an improved “sense of rhythm” to players along with many other benefits, but it is still not a game which can be used to train rhythmical skills and resolve our problem.

“I hit the right button about 50 percent of the time, and it looked less like dancing and more like I had a scorpion in my pants.”

This is problem with *DDR* that many other rhythm games which train the player’s rhythmical skill share, the game and its design is largely inaccessible. Using or creating a game that is inaccessible as a tool to be used by many people is a bad idea that would only limit those who can benefit from it. For example, *DDR* requires players to use their feet on a mat rather than their hands on a controller. This instantly makes it impossible or incredibly difficult to play for people with mobility issues to play it, which would segregate many people from being able to do rhythmical training if it were used for that purpose. As someone who is physically able to receive the benefits of playing *DDR*, it upsets me to find out that “a large group of people find themselves excluded from playing videogames because of a disability” and *DDR* is most certainly one of them.

## Rave Beat and the solution

As mentioned, it is a human right for everyone to have the ability to live a happy and fulfilling life. The benefits that rhythm focused videogames can provide by improving and training one’s rhythmical skill can definitely contribute to this happiness and fulfilment. I do not believe that the rhythmical skills of children and adults today are currently trained or exercised regularly enough, which prevents them from receiving the essential benefits that rhythmical skills have been proven to give to us. A videogame that could be used as a tool to help people train their rhythmical skills and is accessible to all is a likely solution to this problem.

I believe that, a game that could do this is what many adults and children need to improve their essential rhythmical skills that will benefit them throughout life. Sadly, that rhythm game does not yet exist, as current games in the market either: do not correctly challenge the rhythmical skills of players and train them or are too inaccessible to be widely used as a rhythmical training tool.

This is why I decided to create Rave Beat as part of my final year development project, I want to be able to show that you can create a rhythm focused game that is able to effectively challenge and train a players rhythmical ability while using accessibility strategies throughout the project to ensure that the game can be played and used effectively as a tool by a varied, global audience.

The gameplay differences between these non-focused games, and focused ones must be understood to know why only focused rhythm games can have rhythmical training capabilities. Inaccessible rhythm game design must also be understood, to know how Rave Beat has been designed in an accessible way and most importantly, how we can reduce it across the genre as a whole. Learning from previous games which have either been successful or unsuccessful at doing so is a good way of understanding these concepts. This knowledge is vital to creating a game which also tries to succeed at doing just that.

# Understanding the design behind Rave Beat

## The beginning of rhythmical videogames

The “very first rhythm action game”- *Dance Aerobics*, was not focused on the players rhythm following ability. *Dance Aerobics* was a fitness themed game for the NES that was released in Japan during 1987 and released in the US a year later. It aims to keep the player fit with selection of “aerobic routines” to follow along to, using the Powerpad- a pressure sensitive mat that the game utilises. The goal of the game was to copy the actions of the aerobics instructor shown on screen using your hands and feet; pressing the same buttons on the Powerpad accessory that the instructor does. Every routine is a sequence of inputs that have been choreographed to a song, each button presses which the player has to perform is timed to the song, this ends up synchronising the actions of the player to the music creating digital rhythmical gameplay.

*Dance Aerobics* failed to challenge, assess, or provide feedback to the player’s rhythmical skill however, score penalties were applied when the player would incorrectly follow the routine by not pressing the correct button inside of its timing window. The timing window of the game’s inputs, however, was larger than the rhythmical timing of song which allowed players to not be penalised for performing actions that were quite out of time. Feedback was not provided based on rhythmical related errors either, which made it hard to see where mistakes were made. *Dance Aerobics* proved to us how games can include rhythm-following gameplay but be a bad tool for improving rhythmical skills and providing benefits related to rehabilitation due to the lack of focus on put on this gameplay. *Dance Aerobics* was never released to be a rhythm game, but an in-house fitness trainer so it is expected that it would not fit this purpose.

Nine years after the release of *Dance Aerobics, PaRappa the Rapper* was the next published game to include rhythm following gameplay and ended up being the first game ever to have solely rhythm-following gameplay. *Dance Aerobics* may have had similar gameplay being- ”press the corresponding buttons ... in time with the music”, but it had other gameplay modes that did not include rhythm following that were probably better suited to exercising and keeping fit. Whereas *PaRappa the Rapper* had only rhythm-following gameplay to sell itself and engage with its players. It was so successful in Japan that it was also “released in the U.S” a year later “in 1997” and is commonly acknowledged to be the first ‘true’ rhythm game because of this fact. The game played around the story’s protagonist PaRappa- a dog who wants to rap. Players progress through the story to help PaRappa “win the heart of Sunny Funny and learn from favourite rap masters” by “pressing buttons that correspond with various rap lyrics” in order as they appear on the screen. The story progresses through a series of levels, each featuring a new rap with its own sequence of buttons to correctly perform. The player’s performance is assessed and is given a grade at the end of the level; a certain grade must be met to clear the level and progress through the story.

*PaRappa the Rapper* had similar issues in challenging the rhythmical skills of players, which also made it unfitting as a rhythmical training tool. The timing system was an improvement, and the game penalised players for hitting outside of the song’s rhythm but it was still unable to provide useful feedback to the player based on their rhythmical errors, so players were unable to tell where they were making mistakes which meant that it was difficult unable to learn from them. Players were also unable to easily replay, or choose a specific levels they wanted to play due to the focus put on the games progression through its linear story, this makes the game unfun to play more than once and doesn’t encourage players to practice and improve through repetition, “the first principle of all learning.” *PaRappa* was a step closer towards being a good rhythmical training tool but it fell short by inhibiting its rhythm-following gameplay with its story. *Dance Aerobics* and *PaRappa the Rapper* are both good examples of how a game can involve rhythm following but not be effective at training one’s rhythmical ability, because of how the game has been focused which has been an important factor in Rave Beat’s creation.

## The beginning of rhythmically focused videogames

Konami innovated in gameplay and systematic designs of the rhythm games in several ways. They were able to accomplish this by taking the same “core mechanic” from previous games, which was to “press buttons in time with the music” and focused the design of the whole game around it. The rhythm-following aspect of the game was taken much more seriously and the ‘DJ Simulator Game’ called *Beatmania* was born.

In *Beatmania*, the player is a club DJ who performs songs for a crowd. Performing is familiar to other rhythm games- “The goal is to hit the keys (or slide the turntable) on the controller in time to the notes” shown on screen.The players performance is judged, and a performance-based grade is given, similarly to how you are graded in *PaRappa* *the Rapper*. In *Beatmania,* however, there is no story to progress through. Players progress in the game by clearing the first set of difficulties available, unlocking new songs and harder difficulties for the songs they already have. The game has a different grading system beyond clearing or failing a level and uses a record system that shows a player their best score on each difficulty. Players who enjoy the game are encouraged to improve their scores, not for new unlocks but for self-improvement. Players can see the progression of their technique and rhythmical skill by comparing current plays with previous records as they work towards improving their personal bests with the overreaching goal of perfecting every song in the game, a challenge that is almost impossible, given the accuracy of *Beatmania*’s timing system.

## The ‘traditional style’

Konami were able to create an addictive and rewarding gameplay cycle of improving your rhythmical skills using a controller, trained with a library of songs which each had a several difficulty levels. The player would repeatedly challenge their rhythmical skills, replaying songs to aim to beat their best scores while being overshadowed by the ultimate goal of perfecting every song in the game. This gameplay proved to be very successful in engaging players and became addictive for many and was genuinely successful in training one’s rhythmical skills.

*Beatmania* was such a hit that Konami’s Games and Music Division (GMD) that produced the game, re-named the division “Bemani, a shortened version of the game.” Bemani would go on to create several successful rhythm game titles that followed the same gameplay design cycle. One of which included the world’s most influential rhythm games: *Dance Dance Revolution*. *Beatmania, DDR* and many other Bemani games have become incredibly successful and are still ongoing franchises today, as they were able to and are still able to captivate their players into playing their games after experiencing all the content within. Even in a game that has gameplay which has almost stayed the same for over 20 years now! Finishing a game’s content is typically the point in which many go to find a new game to play. Bemani games however, were able to avoid players getting bored by using the addictive rhythm focused gameplay cycle that *Beatmania* first created- give levels high replay-ability and challenge the player to replay them and improve their records past what the game requires you to do, which engages players to do so and gradually improves their rhythm-following ability as they repeatedly train the skill. Making the player get better at the game and feel good about themselves through the sense of improving a skill. This inspired so many other rhythm games to use the exact same gameplay designs and systems that they basically became part of rhythm game development tradition and all of these rhythm-focused games such as *Rock Band, Guitar Hero* and *DDR,* all come under this ‘traditional’ style.

Bemani games and many other games which use this style of gameplay are not particularly accessible. *Beatmania, DDR, Pop’n Music* and *Guitarfreaks* which are some of Bemani’s most popular titles and other popular rhythm games like *Guitar Hero* and *Rock Band* all use proprietary controllers which either: require full body movements, require players to be stood up to play or have unintuitive layouts which make them all quite difficult to play for all types of people.

## Focused vs. Non-Focused

As shown in many non-focused rhythm games, players get too large of a timing window to hit the choreographed button, which does not challenge their rhythmical skill, just their accuracy to pressing buttons in order as the appear on screen. The games that do, rarely contain accuracy systems for providing feedback which are needed to improve one’s rhythmical skill or supporting systems which encourage the player into improving their scores, like a record system or a non-linear progression system.

When comparing *PaRappa the Rapper’s* gameplay focus against *DDR’s* gameplay focus, it is easy to see that *PaRappa* *the Rapper* is primarily focused around you progressing linearly through the story rather than being focused on its rhythm-following gameplay. This not just a bad thing however, as *PaRappa* and many of the other non-focused rhythm games have lots more to experience and enjoy than just rhythm-following gameplay, you are supposed to learn and experience the story, just as much as you play the game. When compared, *PaRappa The Rapper*’s ‘rhythm game’ genre grouping may seem out of place when put next to *DDR’s* exercising, strict, rhythmical-testing gameplay. Which is why the differences between the two gameplay focuses must be distinguished in some way as it largely affects the way the game has been designed, which in turn affects the way you experience the game. This has created two separate rhythm game sub-genres which each have their own communities and for good reason.

This separation exists because rhythm focused, traditional games have a few drawbacks that both the players and developers experience. I will go into more detail about these drawbacks later, but they became very apparent in the industry during the boom of *Guitar Hero*, where every game development studio was trying to release their own version of the game, making many gamers feel “overwhelmed by the variety of (similar) choices.” This was exacerbated due to the lack of innovation between each title, which was heavily based off gameplay which had already existed in some of the earliest rhythm focused games. Gameplay was almost indistinguishable between titles and the supporting systems that accompanied these games were not being innovated or improved upon, leaving lots of headroom for innovation to take over the market. It was during this time where many studios tried to innovate finding alternative methods to synchronising music to gameplay.

## Alternative synchronisation methods

These alternative methods, when used however, have all been quite poor in correctly challenging the players rhythmical timing which in turn has made them poor tools for improving rhythmical skills.

The most popular alternative method is audio spectrum analysis, where the game analyses the waveform of the song and creates data based on its shape to make events happen within the game in time to music. Many games that use this technique to synchronise gameplay elements with music are commonly mistaken as a rhythm games, using *Audiosurf* as an example, which is quoted to be “one of the first rhythm games to use adaptive technology to play any music that the player chooses.” However, players are not required to input actions in time to the music but are required to avoid obstacles that try to collide with the player in time to the music. Players are able to see the obstacle before it arrives and are forced to input outside the rhythm of the song or lose score for not avoiding the obstacle. This gameplay follows little to no rhythm, and games that use music spectrum analysis usually end up this way, even when an attempt on preserving the focus on rhythm-following has been made. This is because spectrum analysis is not consistently accurate at plotting beats and rhythms of a song. When used, it ends up creating beats that fall out of rhythm, which do not work well when playing a game that is focused around keeping time to the beat, so it is used to control gameplay elements in time to the music instead, like spawning enemies or bullets in time to the song which the player has to again, non-rhythmically avoid.

Many of these alternative methods suffer at training the players rhythmical ability in this way and in turn end up creating a lot of non-focused rhythm games, many of which are beloved and still played today but are unhelpful at improving rhythmical skills which do not provide adults with an engaging and enjoyable way to improve their rhythmical abilities from a comfortable place, which is what Rave Beat aims to become.

A traditionally based rhythm focused game is able to do this, however, but as we have spoken about, they have several drawbacks which need to be addressed and considered during the creation of my own game.

## Focused Games

Drawbacks to rhythm focused games affect both the players and developers. Firstly, levels must be synchronised to the music by hand, a task that takes lots of development time- tools may need to be developed to help the creation of these levels and require lots of playtesting to get perfect. Additionally, this puts a limit on how many songs can made in the development time of the game and how many difficulties that song can have, excluding the possibility of additional content. Another issue is that these levels are designed to be learned and mastered which means they cannot change or vary much between playthroughs. This can mean that if a level is not very fun to play, due to the way it was choreographed, it becomes cemented as a bad bit of content within the game.

A rhythm focused game can be great or terrible based on what songs are in the game and how the difficulties are choreographed. If the game does not have music the player enjoys, they are not going to enjoy the game. If the game has music the player enjoys, but all the difficulties for those songs are badly created then player is not going to be satisfied either, even if the gameplay behind it is perfectly enjoyable.

Rhythm focused games do not use powerups or items that make levels easier as they ruin the self-improvement-based nature of the game. When the player is given the power over the challenge that they are presented with, we get “an interesting dilemma: they could either abuse (it) to boost their own rankings and unlock new perks, or they could abstain and preserve the game’s fair play.” Players who may feel frustrated or too challenged may use this boost and get an improved score. This only artificially increases the players scores as they are playing a simplified or easier version of the same level and have not actually improved. The player is then forced into permanently playing this way, which is not as fun or how developers wanted you to experience it or they have to face getting the same scores that they were previously frustrated with, now knowing that all they can do is turn that easy mode on again and get better scores again. Practice modes or alternative modes may be available, but they do not affect the players records to prevent them artificially inflating their scores, which could hurt the enjoyment of the game.

# The design of Rave Beat

Rave Beat is a rhythm game that has been created in the traditional style, it uses rhythm-focused gameplay that using a timing system that can accurately challenge, assess, and provide feedback based on the player’s rhythmical ability while being designed from its conception with accessibility strategies in mind.

## Controller choice

Rave Beat does not use a proprietary controller to control the game, it is played using either of the standard console controllers: the Xbox, or Playstation controller. This is to ensure that the game does not force the player into playing in a specific stance or in a position that is uncomfortable for them which plastic handheld guitars regularly make you feel. Players are instead, made to feel as comfortable as possible using a controller that is familiar to them and this keeps the game largely accessible from any physical limitations that the player may have.

In the small chance that a player of my game is unable to effectively use the Xbox or Playstation to control my game, I have intentionally created an additional binding for each control within the game. Some of these additional bindings are single button presses that recreate the specific directional movement of the joystick that the game requires you to input, players who have custom controllers to assist with their disability or find it hard to accurately perform directional movements on a joystick are able to make use of these bindings and are able to simplify the input action, making the process easier for those players without affecting the rhythmical aspect of the game.

## Core gameplay

The aim of the game is to hit the notes shown on screen in time to the song that is playing. The game is split between actions that are controlled on the left side of the controller vs actions that are controlled on the right side of the controller. Each side, both left and right, have a colour that is used to differentiate the differences between each other. A note’s colour and screen position are used to determine what side of the controller is used to hit it. If a note’s colour is blue and on the left side of the screen, you use the left side of the controller to hit the note. If a note’s colour is red and on the right side of the screen, you use the right side of the controller to hit the note.

There are two semi-transparent lines which indicate where notes should be ‘hit.’ Notes which spawn on the track and go towards to the line on the ground are known as ground notes. Notes which spawn in the air and travel towards the line in the sky are called sky notes.

Ground notes are ‘hit’ by pushing the corresponding colour’s joystick to its edge, in the direction that is being asked for. The direction of a ground note can be understood through the way it looks. In chart difficulties 5 and below, all ground notes are set as non-directional, and can be hit by pushing the control stick of the corresponding side in any direction. In difficulties between 6 and 10, there is a mix of both non-directional and directional ground notes, a directional ground note has a scrolling arrow texture that scrolls in the direction that it needs to be hit. These directions are limited to Up, Down, Left and Right. The player will now have to push the control stick in the assigned direction, if the player uses the correct side but the wrong direction, the player will miss the note.

As mentioned, this has an input variation for players who find difficulty in using the joysticks to hit ground notes, players can use the four buttons that are on each side of the controller to emulate the pushing of the control stick in that direction. For an example, pressing square on the Playstation’s button pad- which is on the right side of the controller would emulate the right control stick being pushed directly to the left. This is because square is the ‘left’ button out of the four buttons on the right side of the controller, where button inputs emulate the directional pushing of the right joystick.

Sky notes have a transparent shell while revealing the colour of the note beneath. They are ‘hit’ by pressing either the shoulder or trigger buttons of the corresponding colours side. The input methods for the notes were originally flipped, with sky notes being hit using the joysticks and ground notes being hit using the shoulder buttons. This made learning the controls confusing as the top area of the screen was being controlled by the bottom half of the controller and the top of the controller being controlled by the bottom half of the screen. Which frequently confused the player’s mental separation from the two.

Players have a percentage based health bar which starts at 0% and increases gradually with every note that is hit, misses decrease the players health greater than hits which requires the player to have a generally positive performance to not lose their health score, if the player ends the chart with 80% of their health score then they will have ‘cleared’ the chart and be awarded with a clear grade. Any health value below this, is considered a fail. A hard mode can be toggled from the expandable records screen, the hard mode starts off players at 100% health with every note that is missed critically reducing the value of the health bar, very little health is gained back which requires the player to miss very few notes to be able to be awarded a ‘hard clear’ on a chart.

There is a maximum value score for every chart- 100,000. Players are awarded this score for hitting every note in the chart correctly, on time to the beat. ‘Nearing’ or getting a ‘Near’ on a note is when the player narrowly misses out on the timing of the note, when this happens, the interval of error is shown on the screen for a split second, this can either be ‘early’, or ‘late’. This can tell players when they are ahead or behind in rhythm and are able to make live adjustments to their timing as they are playing which allows fine tune their rhythmical timing and find out what their mistakes are. A near only counts for small portion of the score that is rewarded upon a perfect hit.

This is similar to notes which are missed, where no score is counted for the missed note. If players do not hit a button at all, ‘miss’ is displayed, if the player hits the wrong button, ‘wrong’ is displayed. A ‘wrong’ displays a different message than a miss but is counted as the same thing, this informs the player in detail about their errors which makes playing Rave Beat much less frustrating than other rhythm games which do not provide the same amount of feedback upon the type of same mistake.

## Charts, Menus, and the Chart Creation Tool

When a chart has been finished, the players performance for that play is graded, and the stats of their play are shown to them. The player is given a letter-based rank to describe how good their score was, this play is then added to the list of records for that song and players are returned to the chart selection screen. The chart selection screen shows all the charts that are within the game. A chart is a level that has a song with a single difficulty. Players use the directional pad or control stick to navigate the menu. When a chart is hovered over, it will appear in the chart inspector which displays additional information about the chart and the player’s best score on it. Players can press the select button to expand the records screen, where players can view all of their previous plays ranked by the score, on songs that they have played and also toggle the ‘hard clear’ mode which grants a special clear grade upon completion of a chart. When hovering a chart with the expand menu closed, the player can press A or Start to begin the chart.

The players records are saved each time a chart is completed, and the player’s save file can be loaded upon the start-up of the game to retrieve all of their saved scored. This was accomplished using serialisation surrogates to serialise the custom datatypes that stored chart information I had created in my game.

As discussed, charts are hand crafted levels that were made by me, the developer of the game. Charts were originally created through text data that stored the raw values of note types and note beat values. They were then implemented as a scriptable object which allowed for improved, easy editing of a chart. I had planned to create a chart editor system in the game that would allow players or at least developers create charts from within the game itself. This created several issues when it was tried to be implemented. The main problem was that accessing the players audio files own audio files was almost impossible to realistically implement, the only workarounds for this required me to use third party assets, many of which cost a large amount or through the use of the player moving the files they want to use into the directory of Rave Beat. This was not the solution that I was looking for, and so the scriptable object charting tool- only accessible to developers is the current way that charts are created in Rave Beat.

There is currently only one non-testing chart in the current game, I had planned to create several charts with songs that could attract and engage a global, varied audience, I spent too much time trying to build an improved version of the chart editor that worked in game. Creating charts, even with a good tool at hand can take a really long time, as any note that is mis-timed can greatly disturb the rhythmic flow of the game- charts require lots of developing time and playtesting to get right, something that a solo developer really doesn’t have the time for.

## Dynamic Play and Effects

I had planned to apply audio effects apply filters and other common DJ effects to the audio of the game along with visual effects that would all the synchronised to the music to create a sense of dynamic play that did not affect the static consistency of levels. There were two reasons for why this was not implemented, firstly, the actual implementation of the dynamic play system was a very difficult and time consuming task, the groundworks for the system started but quickly came to a halt when the main obstacles of the task showed themselves. I could quite easily toggle the audio effect on/off between one note to the next, but there was no movement or modulation within the effect that actually made it improve the sound of the song. This could be quite simply due to the fact that I am not a DJ, and when I tried to find ways to modulate these sounds dynamically to make the effect improve the song, I could only make it sound even worse. I could create an effect for a specific set of notes in a specific chart that sounded good, but the same effect would not fit anywhere else in the game. I should have implemented this into my scriptable object chart editor, where I could have individually effected parts of a chart that I wanted, through the chart editor. This would have taken lots more time however, and although it was a feature I wanted to include in my game, it would have not been implemented in the that way I would like.

## Records, Self-Improvement, Player Respect

The second reason that the dynamic play and effects system was not implemented was that the record system of Rave Beat was originally only going to be a minor system that only kept track of players personal best scores. I realised however, through my research that a working record system that provides an accurate list of your progression through the game is a much more important and core feature for a rhythm game that is designed for training one’s rhythmical skill. This system should have been a higher priority when mentioned as an objective with dynamic play being more of an aim or innovative goal that was optional.

## Accessibility

Rave Beat’s accessibility is largely based around its core gameplay design which has been heavily accounted for players who have low mobility or mobility issues. Rave Beat has a large UI that is designed to improve the readability of the text and UI elements, there was a plan to have a colour changing system, which allowed for players to choose the colour of the assigned left and right sides to their choosing to help players with colour-blindness but there simply was not enough time to implement it.

# Reflection

I believe that Rave Beat was able to successfully meet many of the aims that I had set for it, I know that many aims did not get met or had indirect solutions to meeting them that did not satisfy what the original aim had intended.

Many of these problems came from bad time management, many of the systems or features that I had planned to implement took a completely different amount of time than I had originally planned. Creating a game from a blank unity project can be quite overwhelming too, there are many features of a game that one takes for granted, for example saving and loading, a feature that actually caused me to heavily fall behind in progress due to an issue that caused me to get stuck for a long time.

This was also due to the fact that I had not properly planned all the elements that needed to be in the game and did not prioritise features that needed to be implemented. This caused a few of the major components to have a limited amount of development time being put into them.

COVID-19 also had a large effect on this piece of work, the ways in which I previously worked and spent time working on this project was flipped on its head when my quiet workspace was taken away after I had to quarantine with my family.

# Hypothesis

I believe that Rave Beat could genuinely serve as a helpful and useful tool in training the development of ones rhythmical skills, it is a very basic rhythm game that can charted in complex ways which allows for the game to be easily understood and hard to master. I was able to create a really good timing system which provided an excellent level of feedback based on rhythmical errors to the note, one that is on a level that I personally have not experienced before in rhythm games. It helped me solve lots of issues related to the timing system within the game and I noticed it helped me a large amount in improving my own scores and real time rhythmical accuracy within the game. The gameplay flow is perfect for hopping in and out of charts, with levels being easily restart-able allowing which creates an addictive, engaging traditional rhythm game that is able to support players into playing further due to the score, grading and record system that is within the game.

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“a regular movement or pattern of movements.” These movements can take many forms such as “sounds, words, or musical notes that are used in music, poetry, and dancing.” <https://dictionary.cambridge.org/dictionary/english/rhythm>

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“use of rhythmic songs and games are fundamental to teaching rhythm.” These games and songs were activities that children participated in together, within a classroom. For example, a game included the children pairing up and taking it in “turns to clap a four beat rhythm which had not been clapped before to their partner.”

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“the neural foundations of rhythmic proficiency and its relation to language skills in young adults” was also investigated. The findings showed that “rhythm sequencing ability was linked to verbal memory, reading, and nonverbal auditory temporal processing” abilities

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“core mechanic” as the other games, which was to “press buttons in time with the music” <https://www.ign.com/articles/2014/10/21/the-history-of-music-games>

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do not correctly challenge the rhythmical skills of players

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“mash the mat with my feet.” “I hit the right button about 50 percent of the time, and it looked less like dancing and more like I had a scorpion in my pants.”

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