Hamlin

"Guitar Hero and Zelda have a kid, but it's a rat"

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Hamlin is a music learning game inspired by the legend of the Pied Piper of Hamlin. We continue the legend many years later - but from a rat's perspective! Since the Piper's arrest, music has been banned for its dangerous magical powers and now silence reigns throughout the land of Espero - or so it is believed. But a few brave believers in the power of music have been guarding its secrets, waiting for a hero with enough musical talent to bring melody and joy back to the people of Espero...

Contents

1 Overview

1.1 Main Concept

The game's core concept is to teach music in a fun and engaging manner through exploration of an open world. As they progress through the storyline the player learns musical scales, rhythm, chords and simple melodies, using their computer keyboard as a piano keyboard to play different instruments. The player wins the game by mastering the correct scales and melodies to lure all the monsters away from the cities.

1.2 Unique Selling Point

Hamlin's unique selling point is that it combines the simple and fun musical interaction of games such as *Guitar Hero* with a genuine educational aspect: the player learns real music theory through the gameplay, not just how to push buttons in time to cues on a screen! Hamlin enables anyone to learn music theory, whether for personal interest or in preparation for a music exam.

2 References

As part of our initial design process, we carried out market research on existing music games; listed below are a selection of the main available games.

2.1 Piano Wizard Academy

This is a PC game primarily marketed at children, which teaches them how to play the piano using a MIDI keyboard. There is no open-world exploration in the game; a simple animated background is shown for each piece of music, with this background serving as a simpler alternative to standard musical notation. For example, one background is an underwater scene with piano keys at the top and floating bubbles to show the user which key to press when. The game does not support any additional instruments.

2.2 Earmaster

This is an ear training program which trains the player to recognize intervals, notes, scales and chords by ear. It is a purely educational tool with no storyline or game world, but does teach music theory.

2.3 Singstar

In Singstar the user needs to follow a pitch line on the screen and sing correctly. It is similar to karaoke with an achievement system where the player earns points if they sing with the correct pitch. This aspect of the game is similar to Hamlin, but Singstar features no open-world exploration and no keyboard interface; the only instrument is the player's voice. We are however considering implementing microphone pitch detection as used in Singstar as an optional feature in Hamlin (for players with access to a microphone).

2.4 Guitar Hero

In the Guitar Hero series of games players can select from a variety of instruments which are played using external controllers (for example, plastic guitars with touch pads instead of strings). These games teach the basics of rhythm as players must play notes at the correct time (as shown by visual cues on screen). The series is fun to play and immensely popular but doesn't aim to teach music theory; it is primarily about enjoying the music, and the player can succeed in the game by simply learning the right rhythmic patterns whilst never learning about the relations between the chords or melodies.

We have also drawn inspiration from several games unrelated to music:

2.5 Zelda Ocarina of Time

In this game, the player is a hero who fights monsters and can travel in time by playing an ocarina. It features a massive open world with an engaging storyline and soundtrack. It has no educational music aspect to it but was a strong inspiration for Hamlin's open world exploration and narrative.

2.6 Pokémon

In this series the player fights and collects free roaming monsters in an open world. Once collected, monsters can be used in competition with other monsters (the goal famously being to "catch them all"). Like Zelda it has no music teaching element but was an inspiration for Hamlin's open world.

3 Specification

3.1 Target Group

From children to the elderly, interest in music is universal and so we hope that Hamlin will appeal to a wide range of players. The game's increasing level of difficulty means it is appropriate for players with a range of skill levels in music, from beginners to advanced.

3.2 Genre

Hamlin is of course a music game! It has a strong educational aspect, challenging the player to develop their knowledge of melody and rhythm, and also an artistic aspect in its emphasis on discovering music and appreciation of the power of music. Thanks to its narrative and large open-world it is also an exploratory adventure game.

3.3 Art Style

Hamlin will use low poly art as its primary artistic style. As its name suggests, low poly art uses 3D models with a relatively low number of polygons to achieve a distinctive visual style which we feel is well suited to the game's mood and narrative.

Figure 3.1: Example low poly art from the Unity Asset store

3.4 Forms of Engagement

In terms of the 8 forms of player engagement defined by Hunicke, the game's primary form of engagement is expression ('game as self-discovery'), because the game's main focus is enabling the player to discover different styles of music and express themselves musically. The

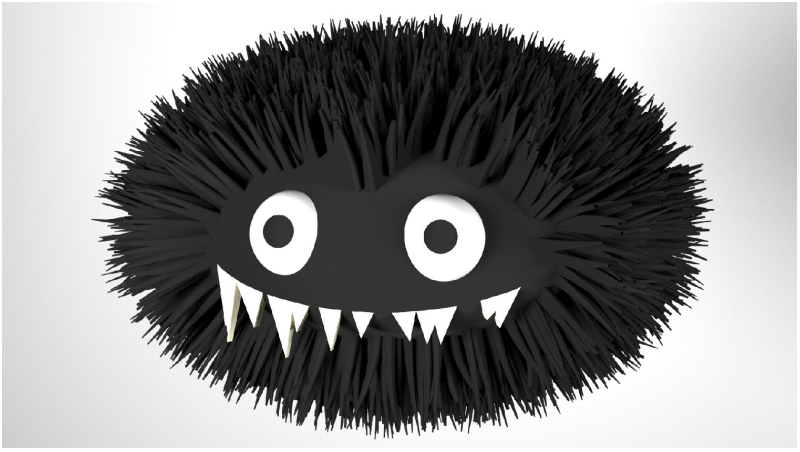

Figure 3.2: Monster concept art - 3D model is lower poly

player also engages with the game's narrative as they find out more about Hamlin's world and free the cities from the monsters. The game is therefore ideally suited to 'achiever' and 'explorer' player types.

4 Gameplay and Game Setting

The player interacts with the game using the computer keyboard as a piano. When a monster appears the player must play scales, chord transitions or melodies to lure the monster away; the musical complexity depends on the player's current progress through the game, and each monster requires different music.

In terms of the technical implementation, the scales (for example the chromatic, major, minor, harmonic minor, and melodic minor scales) and chords (for example major, minor, diminished, diminished seventh, and half diminished seventh chords) are stored as arrays of integers, which describe sequences of notes in terms of their interval from the key note. In our current prototype the player must press the correct keyboard keys for the required sequence of notes, with each note played being checked against the relevant array; a mistake is indicated by a failure sound and the player must restart the sequence.

The key note is chosen randomly and the difficulty level can be set using the circle of fifths. The more flats or sharps are involved then the more difficult the sequence will be to play.

For example, take the C Major scale. In MIDI Reference Notation (see Appendix for details) a C in the 5th Octave has the number 60. So a major scale with offsets 0, 2, 4, 5, 7, 9, 11 from key note C in 5th Octave will result in the required input sequence 60, 62, 64, 65, 67, 69, 71 (which are all mapped to keyboard keys to match a piano keyboard as closely as possible; the player does not need to type in these numbers!).

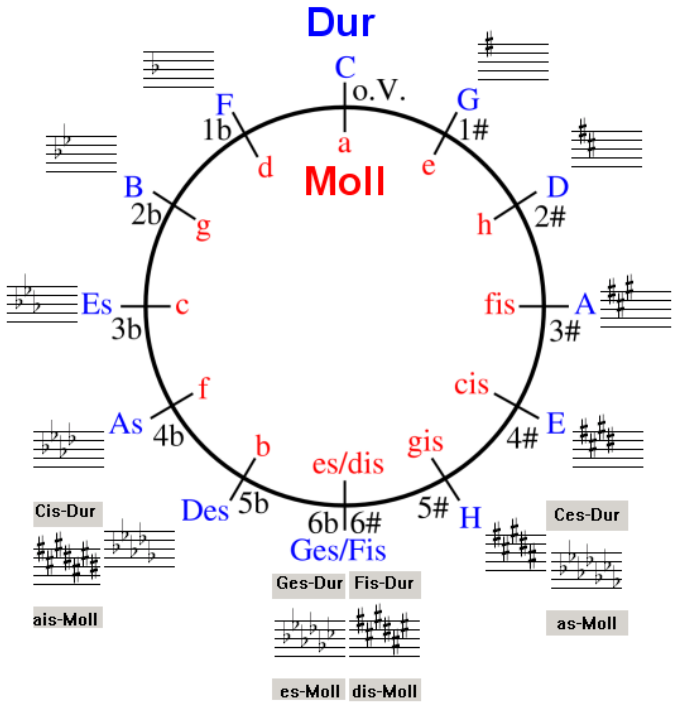

Figure 4.1: The circle of fifths

4.1 Mood and Emotions

The game is designed to be a fun exploration of music and to also be suitable for children, so although the initial back story is sad we do not intend to create a particularly dark mood in the game. We want to provide a friendly learning environment for the player: it should be fun to play the scales and defeat the grumpy music hating monsters!

4.2 Story

In the legend of the Pied Piper, a rat catcher who lures rats away from a town with his magic flute turns on the townsfolk after they refuse to pay him for his work, and begins to lure their children away instead of the rats. The game's story continues the legend many years later. As the rat Hamlin, the player discovers the Piper's long-lost flute and journeys through Espero to discover the flute's true purpose. Since the Piper's arrest, music has been banned for its dangerous magical powers and now silence reigns throughout the land of Espero - or so it is believed. But a few brave believers in the power of music have been guarding its secrets, waiting for a hero with enough musical talent to bring melody and joy back to the people of Espero. And heroes can come in the most unusual of forms - sometimes even in rat form! Hamlin's journey takes the player through the whole history of music as he meets the people who still believe in music, from the monks guarding the secrets of choral music to the outlaws and their subversive jazz.

4.3 World/Environment

The setting of the game is a 3D open world. The individual levels will be self-contained city areas designed by hand in Unity, and between levels the player will explore a procedurally-generated environment.

4.3.1 Procedural Generation

We are currently investigating procedural terrain generation techniques to determine the best approach. By far the most popular approach appears to be using layered octaves of Perlin noise to generate a height map, and then adding textures according to a biome definition which may also make use of additional noise maps. For example, a very simple biome definition might say that any point with a height less than 0.3 (on a scale between 0 and 1) is water, whereas a point with a height of 0.3 or above is either sand, swamp, or forest depending on its moisture level (defined by a separate noise map).

Alternative more complex approaches model the terrain with Voronoi diagrams rather than as a grid of points. Such grid models are more flexible and allow for modelling of real-world geological aspects such as tectonic plates.

4.4 Objects in the Game

The main collectibles in the game are the musical instruments which Hamlin discovers as he progresses through the themed musical history levels. The game will also feature a wide variety of static buildings and environmental objects such as rocks and trees.

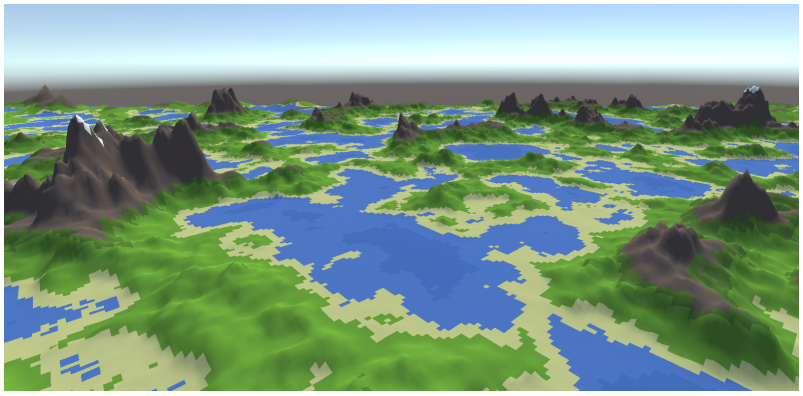

Figure 4.2: Prototype procedurally generated terrain

4.5 Characters in the Game

The game's main character is the rat Hamlin. The game's world features a variety of different monsters, named for their musical weaknesses (for example Pythagorian or F# Dorian monsters). The player also meets a variety of human NPCs, some of whom have been guarding the secrets of music (such as monks, rockers and the jazz outlaws), and others who have only ever known silence and are introduced to the power of music by Hamlin.

4.6 Main Objective

The player's main objective is to lure all the monsters away by playing music so that the joy of music can safely be reintroduced to the people of Espero. In terms of educational objectives, the game teaches the player the basics of musical theory up to a high school level.

4.7 Core Mechanics

4.7.1 Achievement System

As the player learns more chords and rhythms and progresses through the game levels they receive new instruments as rewards for their achievements. These instruments reflect the theme of the current level (for example an electric guitar in the rock-themed level). The player begins the game with their voice as their sole instrument, and then is rewarded the Piper's magic flute as a reward for completing the tutorial level.

4.7.2 Levels

The procedurally generated open world is populated by music-hating monsters who roam around. They can be defeated by playing music styles, scales and chords specific to each monster. The player practices the scales they have learned through defeating the monsters. In the themed cities (levels), the player learns new aspects of music from the NPCs guarding music's secrets. Once these have been mastered, they must free the city by using what they have learnt to defeat the monsters in the city.

Each city covers different aspects of musical theory and has a different 'theme' or period of musical history. In each city, there is an in-game book which provides more detail on the musical history and theory covered in that level for players who are interested. We keep this extra detail contained within the books to ensure that players with less interest in the theory are not overwhelmed with detail and prevented from enjoying the game.

Our initial plan for the musical themes of each level is as follows:

Level	Instrument	Learning Aspect
Monk	Voice	Scales
Classic I	Flute	Chords
Classic II	Piano/Harp	Chord Arpeggios
Blues	Acoustic Guitar	Chords Progressions
Rock	Electric Guitar/Drums	Rhythms
Pop	Electronics/Synthesizer	Polyrhythms
Jazz	Saxophone	Jazz Scales/Chords

Table 4.1: Level Themes

Realistically, given the limited time frame of the project we may not have sufficient time to create all our planned levels. We will focus on creating the first 3 levels to teach the core concepts of scales, melodies and chords; if time allows we will add the later levels to the base game, but they could also be released as separate DLC packs after the game's release.

4.8 Controls

The player controls Hamlin using the arrow keys to run around in the world and the mouse to rotate the camera to look around. To play instruments in the game the player uses their computer keyboard using a standard computer keyboard to piano keyboard mapping shown in the figure below (as used in audio production software). This is designed to be as close to the experience of using a real piano keyboard as possible. Obviously this approach is less realistic for instruments other than piano; the keys still map to the same notes, but they will not correspond to the button combinations / strings used to play that note on the given instrument. The game will also support MIDI keyboards for players with access to them.

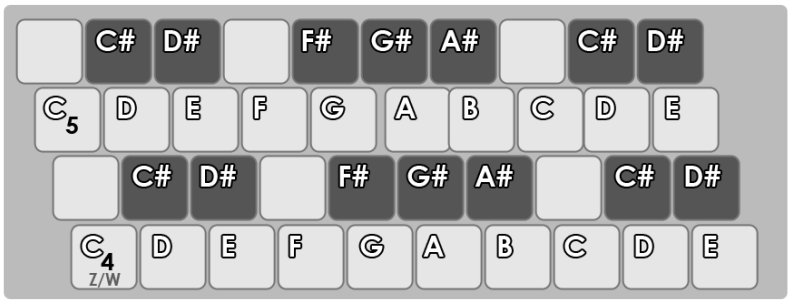

Figure 4.3: Computer keyboard to piano keyboard mapping

5 Front End

The UI is under development and is subject to change. We plan to have a very simple and unobtrusive UI so that the player can be completely immersed in the game, and the game will by default play in fullscreen mode.

5.1 Start Screen and Menus

The start screen will present the standard PC game menu buttons of "New Game", "Load Game", "Options" (featuring audio, input and graphical settings), and "Exit". When the player chooses one of these buttons the UI will fade to the relevant screen (or close the game window in the case of "Exit").

We are currently considering a medieval UI theme, for example using a medieval font, looping choral music whilst showing the start screen, and a wooden-look table for the menu options.

5.2 End Screen

This is currently a work in progress but will congratulate the player on completing the game and present the game credits.

6 Technology

6.1 Target Systems

The target platform is desktop PCs (Windows and Mac). We currently have no plans to develop the game on mobile platforms as they are not well suited to realistically simulating a piano keyboard.

6.2 Hardware

The game will support MIDI controllers for playing the instruments but it will also be possible to play the game using a standard computer keyboard.

As chord progressions can also be played in arpeggio, monophonic controllers such as MIDI Saxophones or MIDI Guitars can be used as game input. However, for the prototype we will focus on playability with standard MIDI Keyboards.

The keyboard to piano mapping will be user configurable but by default will use the standard layout common in audio production software (see Section 4.8).

6.3 Development Systems/Tools

Our primary development tools are Unity and Visual Studio, which we are using to design and script the game's levels. Other software tools include Reaper for creating the game's music and 3DS Max for 3D modeling. We also hope to use the Vicon motion capture cameras at the IEM (Institute of Electronic Music and Acoustics) in order to animate the NPCs with a variety of realistic dance styles as Hamlin reintroduces music to the game world.

7 Topic and Inclusion

7.1 Main Theme

Our game is themed around the GDD course's Topic A: "a different perspective". Hamlin provides the player not only with a different perspective on the Pied Piper story (by continuing the story from the perspective of a rat rather than a human) but most crucially with a different perspective on the world of music. By enabling the player to discover musical concepts interactively, we hope to provide a far more engaging learning experience than the traditional context of school music lessons.

7.2 Inclusion

7.2.1 Diversity

Hamlin is designed to be an inclusive video game enjoyable for anyone interested in music, regardless of their age or background. In addition, playing as a rat places all players on a level footing - we deliberately chose a non-human main character, as any human character would inevitably be from a specific background and so would be relatable for some players but not others.

Currently we are focusing on Western music styles; these are the styles we feel most confident teaching to others due to our own musical backgrounds. We believe that even so the current musical selection is sufficiently broad to appeal to a wide range of players. However, we are aware of the Western cultural bias in the game's music curriculum and are keen to extend the content to cover music from other world regions in the future.

7.2.2 Accessibility

We will be developing the game with accessibility issues in mind to cater to as broad an audience as possible. The game is non-violent with no gore or extremely dark plot elements, so is appropriate for all ages. As the game's focus is auditory rather than visual, we hope to provide a good game experience for partially sighted players. We hope its creative and playful approach to learning will support players who find traditional classroom settings difficult, for example players with learning disabilities.

7.2.3 Humanity

Humanity is a core value in the game: the objective of the game is bringing happiness to the world by playing music! The hero also avoids violence by simply luring the monsters away from the cities rather than killing them.

8 Marketing and Publishing Strategy

We plan to begin marketing the game on Twitter after producing our first prototype; we will then keep fans up-to-date on current progress on the game. We will encourage newsletter sign-ups through promotions (for example early access to the game before release) so we can carry out email marketing campaigns immediately prior to the game's release and afterwards (for example for DLC). We will also create promotional stickers for the game to hand out to students and attach to noticeboards around the TU; these are inexpensive, long-lasting and have the potential to reach a large target audience.

At the end of the course we will release the game on *itch.io* and will promote the game on other social media platforms such as Facebook, Instagram and Pinterest. We will also look for events where we could present our game for further publicity, such as the GameDevDays in Graz. At these events we will gather user feedback in order to further improve the game. We are very keen to see the game used in educational settings to complement existing music teaching, so if there is sufficient interest we will also seek to form collaborations with schools. If our initial release proves popular we would seek investors in order to continue development (for example, developing further levels as DLCs).

9 Timeline

Our project timeline is as follows:

Milestone	Description	Date
	Initial concept and design	22.11.17
	Prototypes of procedural terrain and music input system	05.12.17
0	First release of Game Design Document	08.12.17
	VICON motion capture for dance animations	09. - 10.01.18
1	First game prototype (without motion capture)	12.01.18
2	QA Feedback	26.01.18
3	End of project - game release	09.03.18

Table 9.1: Project Timeline

10 Team and Credits

10.1 Team Members

- **Graphics and Modelling** - Jan Lanz, Andrea Saba
- **Game Programming** - Catherine Easdon **(Project Coordinator)**, Pablo Borreguero
- **Audio and Level Design** - Michael Romanov, Christian Walter

10.2 Additional Credits

This section will be updated as we progress with the project implementation. We will credit assets we use from the Unity Asset Store along with any code libraries used.

10.3 Appendix

10.3.1 MIDI Note Numbers for Different Octaves

Octave	C	C#	D	D#	E	F	F#	G	G#	A	A#	B
0	0	1	2	3	4	5	6	7	8	9	10	11
1	12	13	14	15	16	17	18	19	20	21	22	23
2	24	25	26	27	28	29	30	31	32	33	34	35
3	36	37	38	39	40	41	42	43	44	45	46	47
4	48	49	50	51	52	53	54	55	56	57	58	59
5	60	61	62	63	64	65	66	67	68	69	70	71
6	72	73	74	75	76	77	78	79	80	81	82	83
7	84	85	86	87	88	89	90	91	92	93	94	95
8	96	97	98	99	100	101	102	103	104	105	106	107
9	108	109	110	111	112	113	114	115	116	117	118	119
10	120	121	122	123	124	125	126	127				

Table 10.1: MIDI Note Numbers