



CATÓLICA
ESCOLA DAS ARTES

PORTO

Internship at Warhorse Studios

Internship report submitted to the Portuguese Catholic University in partial fulfillment of requirements of the Master's Degree in Sound and Image with Specialization in Sound Design

by

João Fernandes Carmona Freire

Porto, July 2019



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Report done under orientation of

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Acknowledgements

I would like to thank everyone at Warhorse Studios for giving me this opportunity and helping me understand how a game is created. I want to specifically thank Vojta Nedved and Matous Verner for having me in their team and for teaching me more than I could ever expect during the 6 months of my stay. I want to also leave a word of thank you to Kateřina Matějčíková for offering me the internship position and for helping with whatever was needed during my stay.

I would also like to thank my family and girlfriend for supporting me before and during this internship.

Finally, I would like to thank André Perrotta for helping me with this report.

Abstract

This report presents the work developed at a 6 months internship at Warhorse Studios, an independent company dedicated to the creation of videogames based in Prague – Czech Republic. The work presented here comprehends distinct tasks related to the production and sound design for the Kingdom Come: Deliverance.

The work was developed at the Warhorse Studios in collaboration with Audio Lead designer Vojta Nedved, dialogue director and sound designer Matous Verner and Adam Sporka, sound and music programmer. The several tasks that were completed during the internship included: management of audio assets, field recording, dialogue editing and sound design.

The internship proved to be very rewarding by allowing a deeper understanding of how sound teams operate in a real company where responsibilities exist, and deadlines need to be met. The experience gained at Warhorse Studios incited the desire to learn even more about sound its characteristics and possibilities.

< **Keywords:** Sound, Videogames, Warhorse Studios >

Resumo

Este relatório apresenta o trabalho desenvolvido ao longo de 6 meses de estágio no estúdio independente Warhorse Studios, com sede em Praga na República Checa. O trabalho descrito neste documento descreve tarefas relacionadas com a produção e design de som do jogo “Kingdom Come: Deliverance”.

O estágio foi feito sob a instrução do *Audio Lead Designer* Vojta Nedved, do diretor de diálogos e *designer* de som Matous Verner e do programador de som e música, Adam Sporka. O trabalho desenvolvido durante o estágio envolveu a organização, gravação e edição de sons e diálogos.

O estágio foi especialmente valioso por ter permitido o contacto com uma equipa de som que opera na indústria dos videojogos e dentro de uma grande empresa onde os prazos para terminar trabalho têm que ser cumpridos. A experiência nesta empresa alimentou uma ainda maior vontade de aprender e investigar as características e possibilidades do som.

< **Palavras-chave:** Som, Videojogos, Warhorse Studios >

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1 Introduction

1.1 Warhorse Studios

This internship took place at Warhorse Studios, a video-game development studio based in Prague, Czech Republic, that has been steadily growing over the past 4 years. The company released their first game in 2018 called “Kingdom Come: Deliverance” for PC, Xbox One and Playstation 4. Since it was founded in 2011 by renowned game designer Daniel Vávra and producer Martin Klíma, the studio has received numerous awards such as the “Best PC game award” at Gamescom and “Best Narrative” at the CEEGO awards (“Central and Eastern European Awards”) and is now seen as one of the most promising independent game studios in Europe. In 2019, the company was purchased by Koch Media/THQ Nordic for 33.2 million euros.

1.2 My role inside the company

At the beginning of the internship, a briefing took place where the future plans of the company were presented. The plan involved the release of two new expansions called “Band of Bastards” and “A Woman’s Lot” as well as many small updates with bug fixes and small corrections to the studio’s main product: Kingdom Come: Deliverance. Hence, the main objective of the internship was to help the lead team as much as possible in completing all tasks that were necessary to achieve the objectives that were set during the meeting.

As described in this report, the work done in this internship involved using Pro Tools and other common *software* but also learning how to use new tools and creating new *workflows*. All the tasks assigned had a real impact in the development of the game and they varied in length according to their complexity. For example, applying sounds to animations is fairly simple but since there are hundreds of animations, the task can take a long time to complete.

1.3 Chronogram

The internship took place from November 2018 to May 2019 and the work schedule was distributed as follows:

November	<p>Planning the internship and learning how to use several tools in the studio.</p> <p>Understanding the <i>workflow</i> of the sound team.</p> <p>Playing the game and finding small details that needed to be fixed.</p>
December and January	<p>Recording, creating and editing sounds for the third expansion of the game “Band of Bastards” and its promotional trailer.</p> <p>Understanding how convolution reverb is used to create realistic acoustic responses.</p>
February and March	<p>Planning all the work for the fourth and last expansion “A Woman’s Lot”.</p> <p>Recording dog sounds for the dog companion present in this expansion.</p> <p>Learning how to use the Character Tool and understanding how animations work inside CryEngine.</p> <p>Watching and working on rendered and in-game cutscenes.</p> <p>Observe how the Japanese cutscenes are mixed in 5.1 surround.</p>
April	<p>Editing dialogue and implementing it in the game.</p> <p>Understanding the method created by the studio to make the dialogue editing process faster.</p> <p>Sound design in Reaper for the trailer of “A Woman’s Lot”</p>
May and June	<p>Designing, editing and mixing all the sounds and music present in the trailer for the Royal Edition of Kingdom Come: Deliverance.</p>

2 Detailed description of the internship

2.1 Kingdom Come: Deliverance and the videogame industry

Warhorse Studios is an independent company that since 2011 has worked on Kingdom Come: Deliverance: a story-driven realistic medieval game set in the Holy Roman Empire. The game follows the story of Henry, the son of a blacksmith, born in the town of Skalitz in Bohemia. The game is played in a first-person perspective and the player assumes the role of Henry. In the first hours of the game, the player is introduced to the town of Skalitz and its citizens. The first quests involve performing normal day to day tasks and helping Henry's father, Martin, forge a new sword for Sir Radzig Kobyla, their liege lord.

The peaceful and quiet lifestyle of Skalitz is soon put to an end with the arrival of an enemy army of Cumans that destroys and kills everything. Only Henry and a few others escape, and this is where the real game begins. The world of the game is then opened for the player to explore and complete the story however he sees fit.



Image 1 – Kingdom Come: Deliverance

A game such as Kingdom Come: Deliverance can only be developed and commercialized by a well configured company with several employees spread over distinct departments.

Warhorse Studios is structured in the following manner:

- **Project Management** – This department includes the Executive Producers of the studio as well as the Producers. It is responsible for managing the studio and also for the finances of the company. This department includes the creators of the company and they are responsible for every management decision. This includes for example selling the studio, hiring new employees or moving to new offices. At Warhorse

Studios, Martin Klima is the executive producer and Martin Fryvaldsky is the CEO.

- **Design** – The design department is responsible for creating the concept and original idea of game as well as writing all the story and designing the content and rules of the gameplay. It is comparable to the role of a director in a movie. The main designer is the person that has the original vision and has to see through all the process and keep the final result as close as possible to the original idea. At Warhorse Studios, the Lead Designer or Director is Daniel Vávra, who is also known as the creator of the old Mafia 1 and Mafia 2 videogames.
- **Programming** – The programming department is mostly constituted by software engineers and programmers that are responsible for developing codebases or other development tools. There are many types of programmers in a videogame company and these can range from Gameplay programmers to UI programmers to even Sound Programmers that are responsible for implementing every sound created in the game.
- **Art** – The art department is mostly comprised of visual artists that are responsible for the creation of visual concepts of everything that is going to be present in the game, from characters to landscapes or even objects. Depending on how big the company is the number of people in this department will be bigger or smaller. In large companies, each artist is specialized in a particular type of visual art while artists in smaller companies have to be able to work with many different types of art.
- **Animation** – Animators are responsible for the way movement and behavior are portrayed within a game. They create thousands of different animations for each entity in the game that has movement. This applies to all human characters, all the animals as well as all objects present in the game that have any type of movement or visual behavior.
- **Audio and music** –The sound department is responsible for everything that the players hear while playing the game. The sound engineers record and edit all the sounds and implement them in the game. At Warhorse Studios the Audio Lead is Vojta Nedved, responsible for managing every sound asset in the game and leader of the team. The other member of the sound team is the dialogue director and sound designer Matous Verner.

The music department includes the sound and music programmer Adam Sporka and Jan Valta, the conductor and main composer of the music present in the game.

- **Cinematic** – This department is responsible for the creation of every cutscene in the game as well as most of the trailers that are released to promote the game. Most of the people in this team have a background in cinema.
- **Public Relations** – The PR team is responsible for the marketing of the game. They manage social networks, the youtube account of the studio and are responsible for uploading all the trailers and information into the internet as well as answering reasonable questions from the online community.
- **Quality Assurance** – This department is responsible for thoroughly playing the game, testing every possible situation and then reporting back to the other departments all the mistakes they have found. Each platform requires a specialized tester, and at Warhorse there are testers working with Playstation 4, Xbox One and PC versions of the game.

2.2 **Playing the game and understanding sound implementation**

After arriving at Warhorse Studios and meeting the team, the assignment was to simply play the game. While this may seem to be a strange assignment at first, it quickly made sense.

Having a background in sound for film and music, there a number of things that a sound designer is not aware when working with videogames, even though there are obvious similarities and similar principles. For example, if a sound designer from a videogame company needs to record and edit a sound, he will probably do it in the same way as someone from the film industry would.

The big difference is in the way sound designers implement each sound in a medium that is interactive. While films are timeline based and there is no interaction between user and object, videogames are interactive most of the times. There is no way to predict the behavior of the player and so there's no fixed timeline. Sound is thought as something that is constantly present and changing at every moment. A player might trigger a certain event that results in a certain sound being played or he might go to a different area in the game that has a very different ambiance playing and suddenly everything must change sonically.

find small mistakes that team had not noticed before. Those problems could range from *shapes*¹ not drawn correctly to wrong files attached to *entities*² in the game world.

After some time searching, there were houses in the map that did not have the correct interior ambience attached to them and even some buildings that did not have a region drawn at all. A small list of mistakes was created, and the team discussed all the things that were found. At this point, Vojta, explained that some of the things found were also limitations of the engine and there was no way to change them but some of the other problems could easily be fixed. At this point, the work involved performing basic tasks such as the creation of *shapes* and *entities*, which contain sounds that are triggered in a specific place and are attached to a visual object.

2.4 Character Tool and animations

The next task assigned involved adding sound to specific animations of human characters and horses. When working inside Cryengine, there is a tool that is designed specifically for this called Character Tool where a preview of hundreds of different animations is showed. A sound designer uses this to have complete synchronicity between the sounds and the visual animation. The majority of the work done in this tool is related to the assignment of footsteps and foley to the movement of humans and various animals. While this is a simple task, it is also very time consuming since a single character can have hundreds of different animations and each of them has to have sound.

It is also important to state that the sounds used in this tool are all edited beforehand and are all ready to be used and implemented. The sound team at Warhorse had a number of different footsteps sounds and foley recordings with different intensities to use for all the animations. This applied to humans as well as horses but instead of using normal footstep recordings, the sound designer uses hoof step sounds recorded in contact with many different materials such as gravel, mud or wood.

When the team started working on the last expansion “A Woman’s Lot”, one of the tasks that was assigned was to record sounds for a new dog companion that was going to be featured in the game. This dog had many different animations and each of them required new sounds. To be able to record this amount of new sounds, the producers of Warhorse Studios decided to hire trained dogs that would be able to perform certain actions on command. The team recorded the dogs barking, running, drinking and even howling. All the sounds recorded in this afternoon

¹ Shape – area in which a looping sound will reproduce (Papolulis & Pillai, 2012).

² Entity – Object in the game world that can be interacted with in many ways (Papolulis & Pillai, 2012).

were later edited and implemented into the character tool in Cryengine.

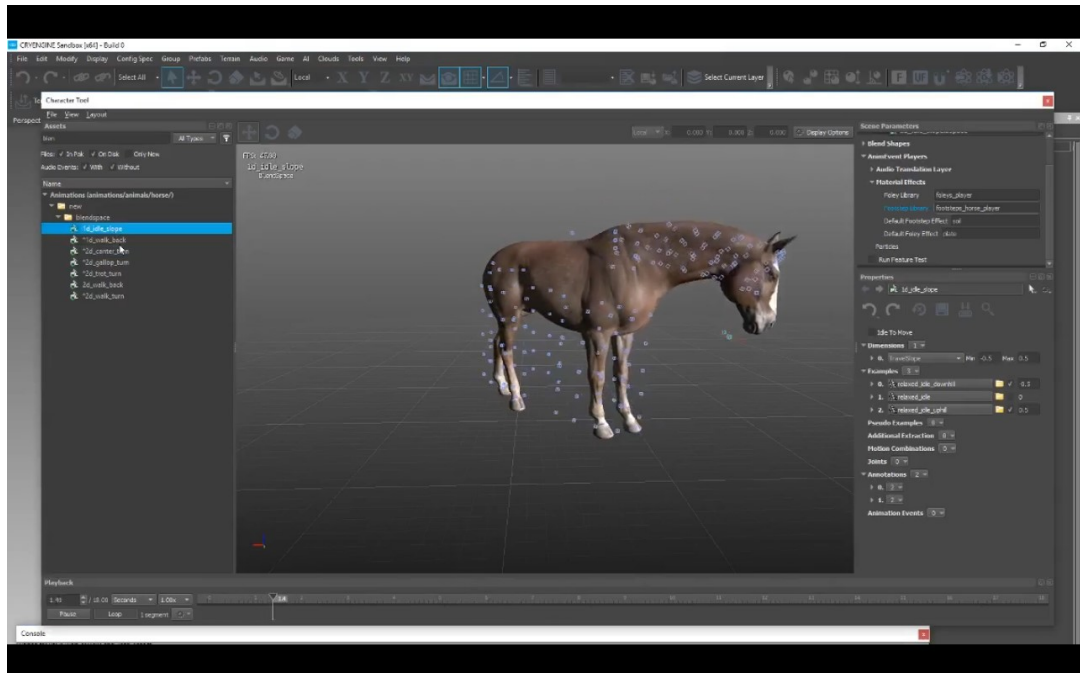


Image 3– Character Tool

2.5 Rendered cutscenes and in-game cutscenes

Cutscenes are small videos that appear once a player reaches a checkpoint, finishes a quest or reaches a certain point in the story. There are two distinct types of cutscenes and it is very important to understand that they are done in a very different way.

The rendered cutscenes are better looking because they are not processed in real time but require additional loading times. They are normally used in key dramatic points in videogames. They are the most important cutscenes and the sound for them is made just like a small movie in *Pro Tools*. They are timeline based and can in most cases be skipped if the player wishes to do so.

The in-game cutscenes do not look or sound as good as the rendered cutscenes but they do not require additional loading times. The sound for these cutscenes is done inside CryEngine and even though they are timeline based there is a bigger degree of interactivity because the sound designer can see the cutscene from any angle he wishes when creating the sound for it. They are normally used for less important cutscenes and are more common than the rendered cutscenes.

The work assigned involved collaborating on a few in-game cutscenes by creating specific sound effects were needed for the expansion “Band of Bastards”. At the time, this meant

creating a few drone synthesizer loops as well as a simulation of a *tinnitus* ringing for a battle scene at the most dramatic moment of the story.



Image 4 – Still from the “Band of Bastards” Trailer

2.6 FMOD as a middleware

FMOD is a sound effect engine and authoring tool software that is used as a middleware between digital audio workstations (DAW) and videogame engines such as *Cryengine*.

Instead of implementing sound effects directly from a DAW into an engine, sound designers have the possibility of using FMOD as a database and engine where all sounds are stored and controlled before being sent to a chosen engine. This means the sound designer has a lot more control over how the sounds will play in the game and can test them themselves.

After being given access to the file that contained all the sound banks in *Kingdom Come: Deliverance* and having the chance to see how Vojta built all the different sounds and attributes, the sound team explained why some things were built the way they were and what some elements such as snapshots or event meant in the context of this *software*.

A great example of how useful FMOD can be is the way the loss of energy of the character can be designed. For instance, if the player runs for too long a very intense sound of the main character gasping for air will be heard. With time, if the player stops, there will be a progressive decrease in the volume and rate of the breathing. The parameters that control this are all set and managed in FMOD.

During the internship, the work never involved working directly with FMOD, but it was

interesting to have an overview of the *software* and to see a real project managed and built around a platform that is increasingly being used in the videogame community.

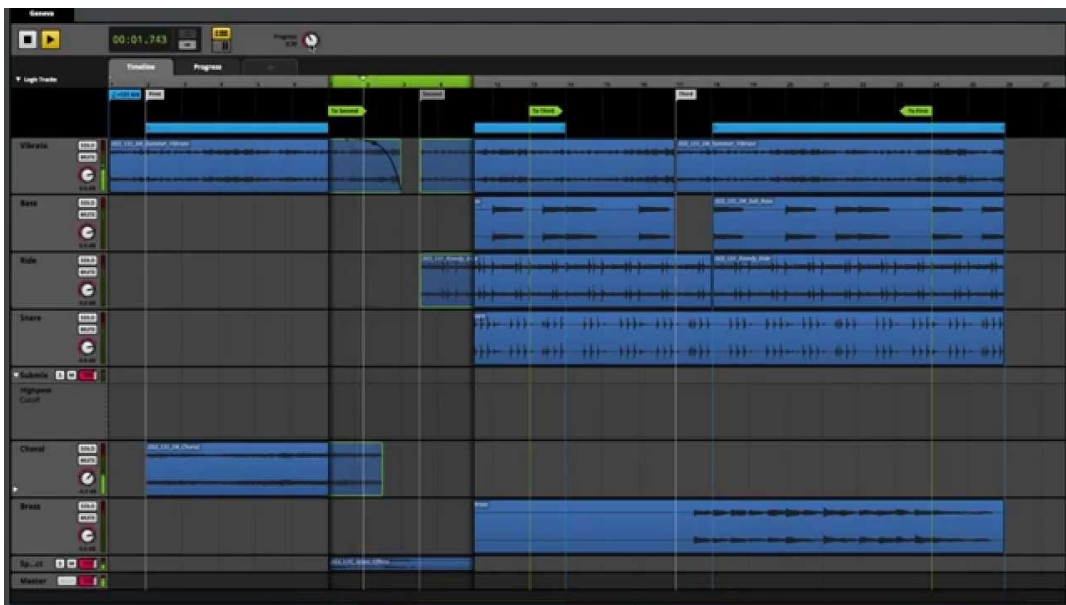


Image 5 - FMOD

2.7 Dialogue editing and implementation

The audio team at Warhorse Studios developed a method for editing and implementing dialogues into the game. It is important to have in mind that the full game has more than 100 000 lines of dialogue in four languages. There are full audio versions of the game in English, French, German and Japanese. This means every single line of dialogue was recorded in all four languages and this applies to all the in-game dialogues as well as all the cutscenes.

In order to manage so many lines of dialogue, the sound and programming team created a system to speed up the process and make the editing faster. It is important to state that all the dialogue recordings were done at an external studio. Besides recording, the engineers at the studio had to press two keys in a MIDI keyboard whenever the actor read a line. A certain key was used for the first take of each line and a second key was used for the final take. This way, our team received the Pro Tools sessions with MIDI notes that made editing much faster. Of course, this method had some problems sometimes, but it made the work easier. One of the recurring problems was the automatic editing not being at the correct place and sometimes including additional lines from other recordings.



Image 6 – List of dialogue lines

After editing, processing and exporting all the dialogue lines, all the files were uploaded to an internal server where each file was assigned to its corresponding line. After this process all the files were cut and edited again to make sure there were no problems. The last step of the process involved a loudness check to make sure all the lines had the same volume.

It was then up to the scripting department to upload all the files into the game and make sure they were assigned to their correct assets. Matous Verner and Adam Sporka are responsible for creating this process and it was Matous, the main dialogue editor of the game, that was responsible for explaining this process.

2.8 Sound design in Reaper

During the time spent at the company, a lot of the work required using Reaper to create sound effects and designing sounds from scratch. While Pro Tools is more intuitive and professional when working with video, it does not work very well as a sound design tool. Most of the assignments were done with the sampler and virtual instrument *Izotope VST Iris 2* as a way of modulating or creating synthesized sounds. For one trailer in particular, a few recordings of a traditional Swedish instrument called “*Nyckelharpa*” played by Nuno Craveiro were used. Instead of simply using the recordings by editing and equalizing them, they were uploaded into

the sampler³ mode of *Iris 2* and then the sound was shaped inside the software. This workflow allows the sound designer to be more creative and also change the pitch of any given sound to fit with the rest of the layers.

The biggest downside of *Reaper* is its stock plugins. While *Pro Tools* is usable without any additional 3rd party plugins, that is not the case with *Reaper*. Most of the plugins present in the software are weak and have a very confusing visual interface so it is always recommendable to have additional plugins installed in the computer. Luckily, the team knew of a few free plugins such as the ones from *Voxengo* that are more than enough to make a good job. The other members of the sound team also recommended a few other plugins such as the *de-noiser* from *Acon Digital* that is always useful when editing a sound, to remove noise or crackle from any recording.

2.9 Mixing in 5.1 surround

In January and February, the studio received the new Japanese cutscenes to edit and mix in 5.1. The files contained all the dialogues recorded by the Japanese team for each cutscene. Vojta was responsible for this work and at this point, all the surround possibilities were discussed, and he explained how all the layers were being positioned in the surround environment.

The studio had received, attached to the files, some notes from the Japanese sound designers saying how they would like the game to sound and some suggestions for the mix. It was very interesting to realize that they prefer to use higher frequencies than the original mix. This led to a discussion on the differences between the Japanese and the European/American videogame sound mixes.

It is easily noticeable that western games have a bigger amount of low/mid frequencies while Japanese games tend to favor mid/high frequencies. This has a number of reasons, one of them being that Japanese games tend to be more *cartoonish* while western games are generally more realistic and try to come close to the sound of real life. Of course, this is not a rule and there are exceptions on both sides.

It is important to state that even though the sound team received some of these indications, Vojta thought it would be better to keep the sound aesthetic present in the mix the same as on

³ Sampler – Electronic instrument that stores sounds produced by the user or the manufacturer.

all other languages and thus proceeded to mix the Japanese voiceovers in the same way he did in all other versions.



Image 7 – Mixing in 5.1

2.10 Sound for trailers

At the final stretch of the internship, some of the supervisors mentioned that they were very satisfied with the work developed over the past 6 months and they offered the opportunity of working alone on an upcoming trailer for the *Royal Edition*. This edition included the original game as well as all the expansions the studio worked on during my time in the Czech Republic. The assignment was very important, because it was the final trailer for the game and it would contribute with an impressive example of sound design to any portfolio.

The trailer was around two and a half minutes long and included a lot of action scenes. The work done on this trailer started during the final week at the studio but finished in the first two weeks after the internship was over.

The sound for this trailer was produced in *Pro Tools* using the exact same methods that would be used if the trailer was a short film. The first step was watching the trailer without any sound and creating markers that represented relevant changes in the video. After all the markers were in place ambiences were added to all the different locations present in the story. These ranged from villages to forests and included noisy locations as well as very calm and soothing images. When working on a project like this, it is very important to always be aware of the shot that appears before and after any given image because the transition between ambiences has to

be smooth and natural.

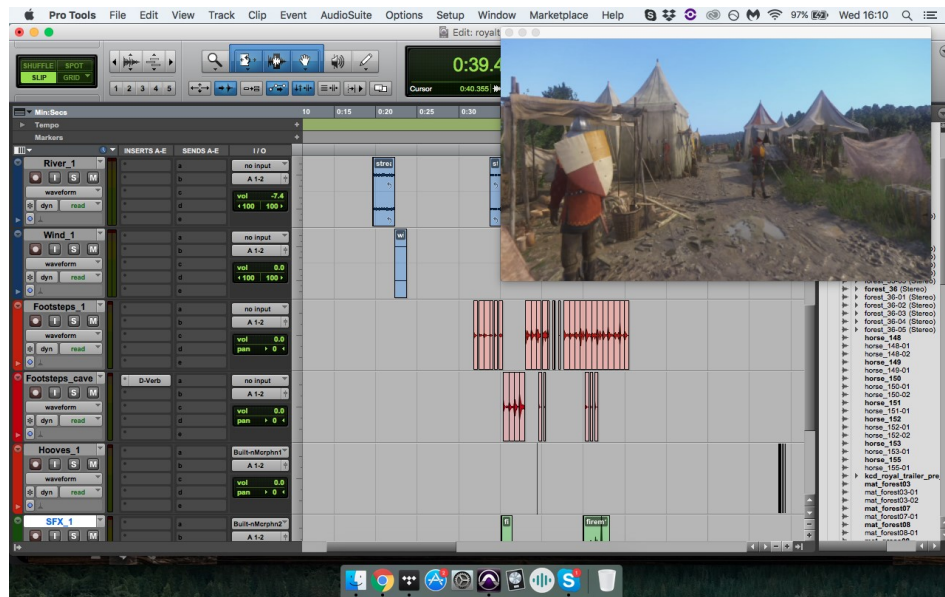


Image 8 – Project in Pro Tools

When all the ambiances were correctly positioned, footsteps were carefully added to all the characters present in the trailer. By watching the trailer, it was easily noticeable that in some parts, the camera went forward with a motion resembling walking, so footsteps were added, fitting the movement as if the camera was representing the first-person view perspective of the player. In the trailer, there were human characters walking on many different types of soil, so the correct sound had to be chosen, corresponding to the material visible in the video.

It is important to state that all the sounds used in the trailer were from the sound bank of the game. By doing this, the trailer automatically sounded similar to the game which is very important if the team wants to have a realistic approach. There are many known cases of companies doing trailers with elements not present in the game and then receiving complaints due to the game sound not matching the customers expectations.

The hardest part of the work came afterwards, when all the sound effects started to be added. The trailer required a large amount of sounds for battle scenes, horses running and even a trebuchet. This phase started by layering all the sounds required for each of these scenes. The amount of layering needed for scenes such as this is easily perceived when one thinks of the simple motion of an armored horse running. To correctly design the sound of this situation, the sound editor needs to have a layer of hoof steps, a layer or several of different foley sounds for the armor and breathing of the horse. The team at *Warhorse* had recorded separate sounds for all this layering when they were working on the original game. They knew it would be helpful

to have as much detail as possible and so they recorded everything separately so that the sound editor could then use as many sounds as necessary.

When the trailer was first assigned, it was mentioned that specific music was going to be used and this should always be kept in mind. Whenever there is music playing over a piece of sound design there has to be a very careful balance between the volume of the music and all the other sound elements. The director of this particular trailer prefers to have the music louder and the sound design more to the background as a support.

When the first mix was finished, the first feedback was that all the sounds were too loud, and this was not the aesthetic the director was looking for. At this point, a new mix was done that had a stronger emphasis on the music and kept all the other sounds to the background as the director asked.

The director and the team spent a lot of time exchanging final versions of the trailer because he had very specific requests regarding some of the moments in the trailer. He wanted certain elements to be at a certain volume and others louder or quieter than what had been anticipated. After a few days, a final version of the trailer was reached which was then sent to Vojta to make sure the sound followed all the necessary rules of loudness and general equalization. The trailer was used to promote the new Royal Edition of Kingdom Come: Deliverance. This was the last version released of the game that includes the original game and all the content that was created and upgraded after the launch in 2018.

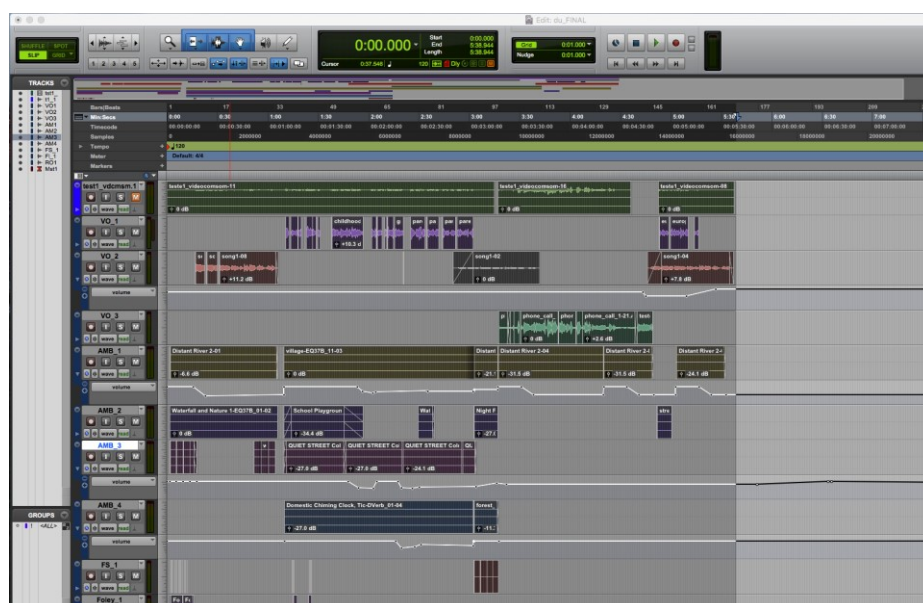


Image 9 – Final mix of the trailer in Pro Tools

3 **Final appreciation and future job perspective**

The knowledge gained during the first year of this Master's degree was essential for the work done during this internship. As mentioned in this report, most of the work was done in Pro Tools, used in most of the classes at this degree. The classes regarding sound and music for videogames taught by professor André Perrotta were also extremely valuable for understanding the different stages of sound production for video games and the differences between post-production studios for films and videogame studios.

After returning to Portugal and reflecting on the work done and all that was learnt during the six months of this internship at Warhorse Studios, it is only possible to make a very positive evaluation. The experience provided by the studio was very complete and allowed to put to practice everything that is taught in theory about sound.

Above all, it is extremely valuable to have the opportunity of working in a real office where the final product is going to reach thousands of people. One of the most important things taught at Warhorse is that the best equipment is not necessary in order to make great work. The sound designers at the company do not have a big budget and they still manage to do everything they are asked with the highest quality.

As described in this report, the team was always friendly and willing to teach any new concept or explain a new workflow that may seem strange at first to anyone that is not used to working in an environment such as this. Every member of the studio was very welcoming, and the interns feel that their work has a real impact in the game.

In the final week of the internship, an opportunity arose to talk with one of the owners of the company and after a long discussion where he asked about the time that was spent at the studio, he offered the chance to return in the future as a full-time employee. It was very pleasing to have been offered this position and it is certainly something to be considered in the future.

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5 Supplements

Kingdom Come: Deliverance – Royal Edition Trailer:

<https://vimeo.com/348341344>

Kingdom Come: Deliverance – A Woman’s Lot Trailer:

<https://vimeo.com/348341152>

Kingdom Come: Deliverance – One Year Anniversary:

<https://vimeo.com/348341313>

Kingdom Come: Deliverance – Band of Bastards Trailer:

<https://vimeo.com/348341114>

Kingdom Come: Deliverance – Epic Music Award:

<https://vimeo.com/348341206>

Password – catolica1

Drive - https://drive.google.com/open?id=1Q5Zrh_2kJWUQ379EbBR5Mdg2kLaUTCt4