Graduation CMGT 2018/2019
Building a life-sized game character costume

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Table of Contents

0. Abstract

This report will enclose the approach and process of building a costume of a video game character developed by a game studio, and the presentation of this costume to the target audience of the video game in question.

The main question to reach this goal is:

Which requirements does a real-life costume need to fulfill to create a convincing experience for the game Runescape and its players?

The entire project was set up in phases, in which the first phase was dedicated to the build of a 3D environment of the character in reference to a human body, so an accurate silhouette and appropriately sized assets were created using that reference.
The second phase was dedicated to create the detailed 3d assets for all the parts of the costume, so they could be 3D printed for the costume.
In the third phase, all parts for the costume were created in real life
The fourth phase was dedicated to assembling and disassembling the parts for the costume, the transport and presentation to the event and the experience of the target audience online and at the event. Footage and interaction with the target audience show that the costume was impressive and created a realistic experience for the target audience.

For future projects it is definitely important to keep experience along the way in mind: eventually mostly the experience at the event was the goal, but also exposure online is an important impression to a much larger possible audience than just the attendants at the event. More posts and coordinated blogs could have been made to achieve more reach online.

There was also little time for errors, though many of the approaches that were taken in this project required some initial level of experience. Some approaches such as moulding and casting, were planned without any experience and were ultimately proven to be out of reach for this large project, as such alternatives were already set up along the way.
The execution of a character that was not remotely humanoid except for posture in some way, was also a giant undertaking that allowed little time left to correct any grave mistakes if some were to happen. For future costume projects it is definitely recommended to choose a character that is more suitable for the model that will be wearing it, to avoid unnecessary extra steps that could be costly when gone wrong.

1. Introduction

1.1 Motivation

Almost everyone who studies, works or otherwise is affiliated or involved with the game industry has heard about cosplay. Cosplay is a contraction of the words ‘costume’ and ‘role-play’ which basically means acting as a character while wearing the costume of that character[1]. Cosplay increased in popularity a lot over the last few years, stimulated by an increasing interest of the public to support your fandom of choice, whether that is a game, movie, tv-series, books or other forms of media. It’s the ultimate way of showing your dedication to a fandom[2]. Cosplay has become a part of video games just as much as buying posters, figurines, making fan art and more, mostly seen at events as fans dress up, or as living poster boards for gaming studios and movies[3].

The development of cosplay has been speeding up over the last few years and as such, cosplay became more professional, and is now starting to play a significant feature in modern media. Workshops and companies sprouted, dedicated to making and delivering high-quality costumes and cosplay models for high-end gaming studios, movie premieres and more[3]. Due to personal affinity with the subject, and the growing possibilities on the professional field, I want to investigate more into what is necessary to deliver a high-end costume and cosplay experience for a gaming studio at an event.

I contacted Jagex Ltd to inform if they could provide me a costume project and be the client for my graduation project.

1.2. Company

Jagex Ltd is a game studio located in Cambridge, United Kingdom. They have been developing video games for decades, most notably known for their MMORPG Runescape, run for nearly 2 decades. Runescape is also established as the largest free-to-play MMORPG in the world. Jagex Ltd has over 300 employees maintaining and updating the game Runescape, managing the community and surrounding tasks[4].

1.3. Project description

The project is the creation of a costume from a character in Runescape 3, an MMORPG made by Jagex Ltd. The character was chosen by me after Jagex proposed a few significant lore characters for this year.

The costume will be the character ‘Kerapac’, a draconic-humanoid NPC who plays a large role in the lore of the game and in future quests [5]. Following the development of future quests in which Kerapac will be an important character, Kerapac also received a refreshed update of his original design. As Runescape 3 has been developing over several decades in several stages of the game studio, many characters receive graphical updates along the way, especially if they’ve been involved in the lore for many years before, and many years to come.

The continuation of Kerapac’s story is under way and will be revealed at Runefest in early October. In the universe itself, Kerapac disappeared after acquiring more power during one of the

quests that the player completes. As such, the appearance of Kerapac will be seen during the announcement of the continuation of his story, and then emerging as a costume before players in real life at the event Runefest.

Kerapac's outfit will be created and worn by me, and then presented to Runescape's audience at Runefest, which is the goal of this project. The creation will involve multiple skills learned at Saxion, primarily 3d modeling, 3d scanning and 3d printing. During the project, I will acquire and implement new skills and digital applications for costume building and the translation of self-created digital assets to real-life. New skills include adapting workflow inside 3D applications such as Zbrush and Autodesk Maya for 3D printing, the difference of creating a 3D model for real-life application instead of video games application.

1.4. Report layout

This report will enclose the approach and process of building the costume Kerapac from the game Runescape, for the client (game studio Jagex Ltd) and the capture of reactions of the public (the Runescape players) on social media and the convention Runefest.

In the first phase, research for the costume is done. This includes research and proposed approach on how to build the underlying frame for the costume, and what approach I need to take to design and execute armor, clothing and skin for the costume. The client already provides me with the required design for the costume, including all angles and versions of the design.

In the second phase, design assets for the costume are made in various digital applications. The second phase also shows how these design assets are then prepared for real-life application.

In the third phase, production starts, in which research and design assets from the first two phases are translated to real life assets. Work on making the clothes, skin and final painted parts are also shown here.

In the fourth phase, testing, adjustments of the costume will be done. The fourth phase also expresses the presentation of the costume both on social media and the convention Runefest.

The conclusion answers the main question: What are the results of the costume and what was the experience of the target audience after the costume's appearance at the convention Runefest.

The discussion describes how the entire project has developed along the way, and what parts went great, and which parts may be highlighted when a similar project is to be repeated for future collaborations.

1.5. Main question

The main subject for this graduation report is:

Which requirements does a real-life costume need to fulfill to create a convincing experience for the game Runescape and its players?

This main question illustrates the answer of the project and the path to all necessary requirements to get to this answer.

1.5. Sub questions

To handle the requirements for the creation and experience of the costume, for both myself, the client and the target audience, several parts need to be highlighted individually, so these results can be combined to draw a conclusion on this project.
These parts are defined as sub questions:

1. What problems need to be solved to translate the existing digital design for the character, to a real-life costume?
2. How to use digital 3D designed assets in order to prepare and create the assets for a real-life costume?
3. What is the process to build the costume in real life, by learning and applying costume building methods and products?
4. What steps do I need to take to finalize the costume and present it (and the progress) for the client, events, fans, and publications online?

2. First phase: Research

2.1. Method

To tackle the massive costume it was important to dissect it into various parts so I can approach them step by step, and then analyze and construct the separate parts to be put together later. This approach will make the project more manageable and distinguish a way of approach for each aspect rather than the entire costume at once. Each part will have different ways of tackling the construction, and parts with a similar construction method will be slotted together.

Before starting the project it was important to gain information about each detail in the design for Kerapac, which I gathered using the assets that Jagex provided me. The details in the design are essential to complete the entire look and it is key to reproduce them accurately to make a convincing replica costume.
Kerapac, as each character in video games development, went through stages of concept art and 3d modeling before implemented in the game*(figure 2.1)*. The concept art provided the original look and feel for the character, whereas uncertainties and color choices in the design were then compared with the final 3D model *(figure 2.2)*. More references were provided by the artist team and are seen in Appendix 1.

Figure 2.1 Kerapac final concept art by David Barker, senior concept artist at Jagex Ltd.

Figure 2.2 Kerapac final 3D model render, Jagex Ltd.

After analyzing the concept art and the 3D model, the costume project was dissected into multiple parts that needed a single approach each. These parts were based on the individual methods of approach and parts that needed a similar approach have been grouped together. By grouping parts with a similar approach together, it makes the project better to oversee and execute in steps. Each part will be executed in three steps: method, production/results, and conclusion.

- Shape of the body
- Head
- Hands, arms, neck and feet
- Wings
- Digitigrade leg stilts
- Armor
- Clothing
- Rig/assembly

2.2 Result

Shape of the body

The character silhouette is humanoid in nature but required a lot of modification to translate my own body to that of a draconic creature convincingly. That's why the shape of the body is the first orientation on how to tackle Kerapac's figure. To achieve this, it was important to have a reference level of my own body in 3D. As such, a 3D scan of myself at the Fabrication Lab (FabLab) Saxion was planned to have a good and accurate sized 3d reference to base the costume on.

After various attempts and guidance from FabLab assistants, a workable full-body 3D scan of myself was produced *(figure 1.3, left)* . Some gaps still existed, these were fixed up in Autodesk Maya. The result was still quite bumpy, but the overall shape was clear. It was decided to build a lower poly 3D body replica that fitted my shape exactly *(figure 1.3, right)*. This was easier to work with because the file size is much lower, there were no bumps in the 3d model, the topology was cleaner, it was more symmetrical and straight, and it was easier to bend the limbs and other parts into the right position when necessary.

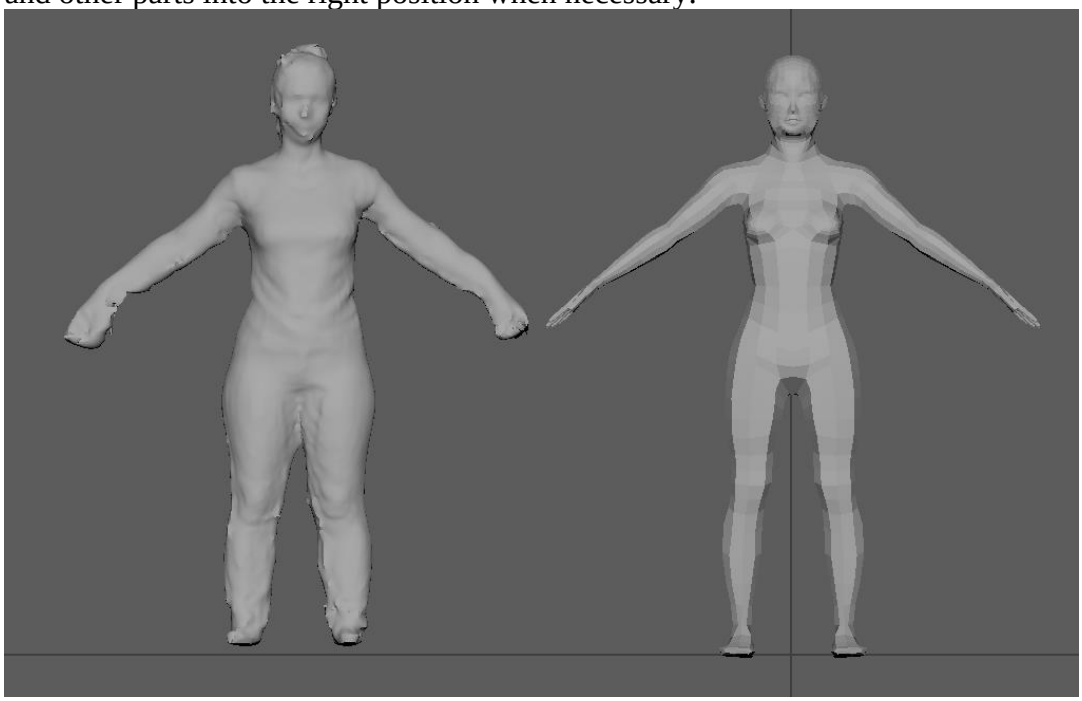

Figure 2.3 3D scan of Merel Eisink (left), 3D female model adjusted to Merel Eisink (right).

A separate 3D head scan was also created *(figure 2.4, right)*. The resolution is much higher and as such more detailed than the body scan, which made any digital designing for the face much more accurate. Both the body scan and the head scan had several bumps that needed some polishing in Maya and Zbrush, and the rotation needed to be fixed *(figure 2.3, left)*.

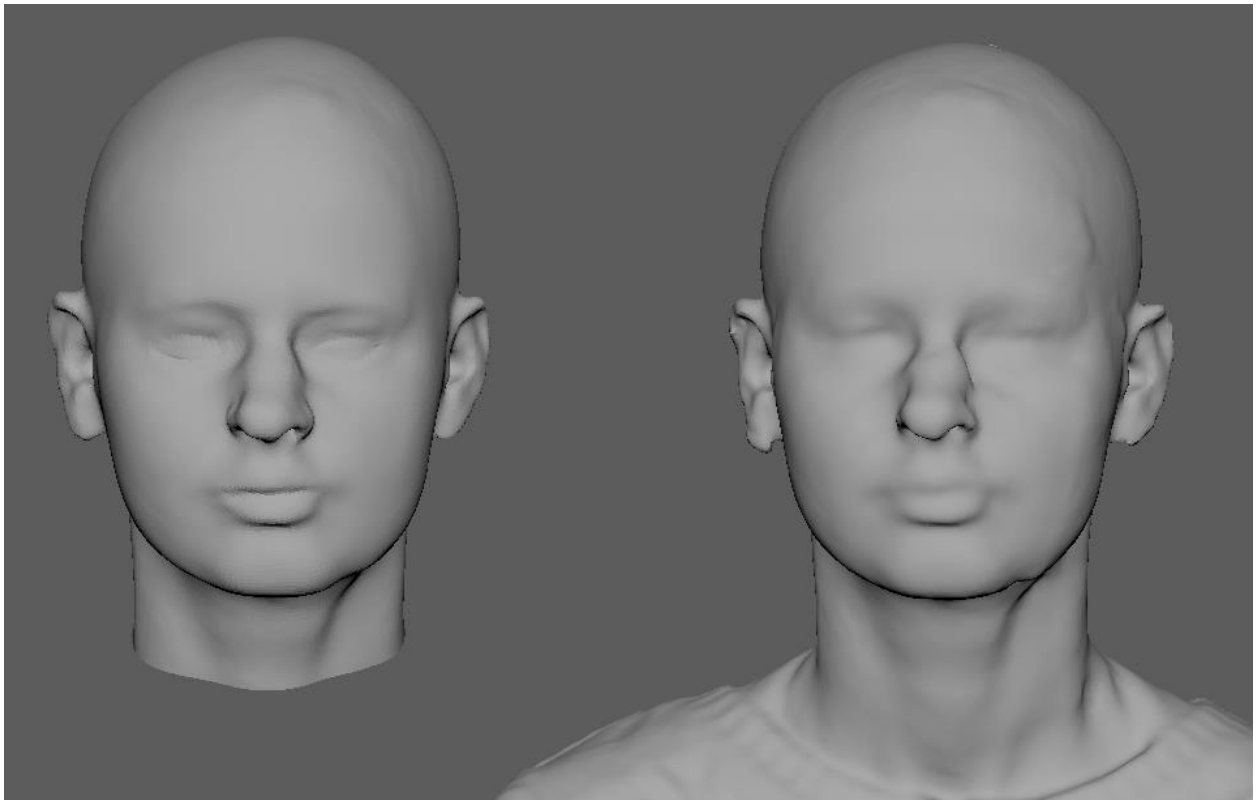

Figure 2.4 Adjusted 3D head scan of Merel Eisink (left), 3D head scan of Merel Eisink (right).

The 3D scans of the body and head were excellent 3D references used to design the silhouette for Kerapac, and make sure that all parts of the costume were designed at a comparable scale to Kerapac's references.

Head

Kerapac's head does not sit fluently on the same spot as a human face, it was thus necessary to develop a rig to allow the head to be worn further in front of the face, and have my actual head sit inside the neck. For this, a frame was designed that matches my head and face accurately as to be able to divide the weight of the head all over my own head. This'll be more comfortable. For this the 3D scan of my head can be used.
Kerapac's head itself was also 3d printed, to achieve maximum detail and accuracy using a digital design, and then mounted on a specially designed frame around the head. To achieve more immersion with the character, the mouth can be moved using the movement of my own jaw.
Eyes were created out of glass resin so they appear more lifelike. To recreate the damaged side of Kerapac's face, the face plate was planned to be modelled separately so it can be removed to reveal the wound, with sockets for magnets.

Hands, arms, neck and feet

The hands, arms, neck and feet are the only other skin that is visible apart from the head. It is important to match the texture of the head for immersion. The planned approach is to 3D print the hands and the feet, and then cast these in latex to achieve a flexible result which will still

match the texture of the head. The arms and neck are less important visual aspects and were directly coated with latex over foam to create a similar, but flexible result that will blend in with the other parts.

Digitigrade legs and wings

To create the animal legs a special frame needs to be designed. The shape of animal legs that Kerapac and many other animals have, due to walking on their toes, is called digitigrade legs (digitigrade animals). To imitate this movement, some stilts need to be built to extend the legs and support toe-walking while wearing a large costume.
A frame for the wings also need to be designed at scale, that requires a large amount of support for the size necessary, and yet lightweight at the same time.
The stilts and wing frames that will be necessary, are important to start researching early on since they'll make or break the entire costume and will require extensive testing for durability and comfortability.
They need to be strong and comfortable to carry an entire costume and my own body weight. This costume will definitely be difficult, heavy and warm to wear, so these appendages will also need to be able to remove quickly in case of need.
Extensive research on materials was done for stilts and wings, and ended up with the decision that aluminum would be light and sufficiently strong to create stilts suitable for my weight and the size of stilts I need to make. Wood was also a viable option, because it is easier to work with, but more length and height is necessary than most wooden stilts found online. Steel would be too heavy to wear, and very difficult to modify with regular tools.

To create the stilts, the decision was made to use aluminum extrusions, strong but lightweight. Aluminum extrusions are universal, many accessories have been developed to fit them. This made it very easy to create a modular and suitable base, that can be expanded on if necessary with existing accessories without the need to drill or cut them. ABS plastic sheets was used to make the aluminum construction wearable, with nylon straps with hook-and-loop tape to tie it up, similar to skater shoes.

To create the wings, the decision was made to use PVC piping, with the addition of custom-designed 3D printed parts to achieve the articulation. Wing articulation is a great way to add more movement and immersion to the costume and make it easier to fold up and transport as well.
To simplify the construction, it was broken down into an umbrella-like construction, driven by one linear motor (actuator) on the back, which is easily hooked up to a remote control and a 12V battery. The joint connections to make the construction move, were then 3D designed and 3D printed.

Armor

The armor on the chest, knees, wrists, shoulders and loincloth were planned for the 3D printer. This is the best option to create one-use-only accurate parts for the costume directly from high detail digital 3D assets that were created. The digital representation of these parts also accurately match the real-world scale since it was adjusted to a 1:1 3D scan of my own body.

Clothing

The clothing needed to match the chosen color palette from the original design (concept and/or 3d model), the texture should match the design and fit within a medieval fantasy world. Most of the pieces of clothing are matte colored, and drape along the body. As such, the primary fabric is chosen to be linen fabric, and if the color was unavailable, a material that fits closely was chosen. The golden accents were then created with golden (fake) leather or golden 3D printed accents glued to the fabric.
Some parts of Kerapac's clothing looked visibly reinforced or stiffer (such as the wrists and the shawl around the neck), This was imitated by covering stiff felt or foam with the appropriate fabric choice. This imitates the stiffened fabric parts without having to choose for a different fabric that potentially was not available in that exact same color.
The patterns for the clothing were derived from low poly models designed along the 3D scans, which will make sure that it fits accurately. The plan was to use UV mapping with very little distortion or papercraft 3D applications such as Pepakura Designer to create these patterns to real scale to paper patterns.

Rig/Assembly

It is important that all these parts come together into one comprehensive worn costume. All armor parts need to be chained together and draped or fastened to the base layers of the costume. For the wing frame it was planned to use two strong hooks hooked over my shoulders so they can easily be lifted up and removed when necessary.
The stilts would be fastened using hook-and-loop belts so they can be adjusted and removed quickly and easily.
To make sure that all parts are attached to each other and stay in the right place, many hook-and-loop pieces are then used. It could easily be sewn on and glued to pieces of armor. Also all these parts needed to be able to disassemble for air transport and cleaning.

2.3 Conclusion

A plan was created for the methods and materials necessary to create all the individual parts for the costume. Using the results and research done in the first phase for each identified aspect of the costume, with detailed steps on how to approach the several parts, and accurate references collected, the plan is now complete to start the design and create the assets for the costume in the second phase.
The 3D scans were a great base to create a virtual silhouette of Kerapac that makes sure that each part was going to be designed with the right scale and shape.

3. Second phase: Design

3.1 Method

Materials were gathered that were researched in the first phase that are necessary to put the costume together.
A few kilos of standard PLA 3D printer filament were purchased to print all the pieces on my 3D printers. For the clothing, several sites and fabric stores were visited to gather accurately colored linen and gold vinyl.
Gypsum and latex were purchased in the event that 3D printed parts (such as the hands and feet) were to be made into latex prosthetics, which are a lot more flexible and skin-like.
All the hardware necessary for the stilts and wings were purchased. Some new tools to work with aluminum hardware were also acquired, such as a drill, metal drills and a tap-and-die set (to create threaded holes).

All individual parts are then to be designed in virtual space, using my 1:1 3D scans from the first phase. The 3D applications to be used are Autodesk Maya and Pixologic Zbrush. Prior experience with these applications were the main reason to choose for these, and affinity with prior 3D printing projects it's not difficult to use the standard file formats for 3D models, to be used for 3D printing as well. To design 3D models for a 3D printing goal in mind, some things need to be taken into mind to make sure that the models are usable. Each model needs to be watertight, without any gaps or reversed faces visible. The application Autodesk Netfabb is then used to easily check for these errors before the 3D models are used for the 3D printer. Autodesk Netfabb is developed as a connection between 3D applications and the 3D printer [6].
The resulting 3D models are then prepared with standard lightweight settings for the 3D printer, which will print them.

In this phase, the entire base silhouette for Kerapac, before covering it with clothes, armor and the rest, was also created. This includes the shape of the body, the frame for the wings, and the frame for the legs and feet. The shape of the body was created using upholstery foam, a lightweight and voluminous material that'll easily bulk up to the right proportions and silhouette where necessary. A 3D model based on the body 3D scan was used to illustrate how much foam was needed to add to the shape.
The frame for the wings was built using PVC as researched, and a 3D design needed to be made to create the 3D printed joints for the wings. The wings were to be controlled with a 12V motor that extends and folds the wings similar to an umbrella *(figure 3.1)*.

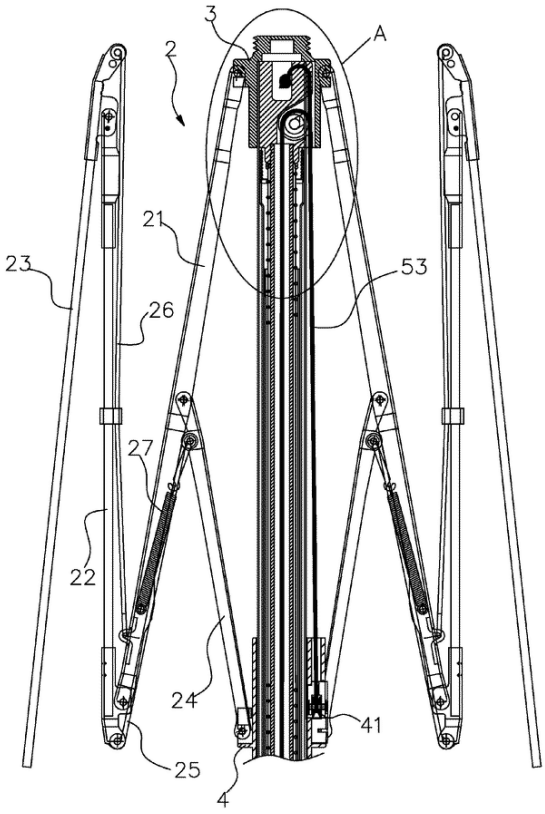

Figure 3.1 A design drawing for an umbrella, in which linear movement in the middle is used to extend the beams sideways in a wing-like movement.

The frame for the leg stilts was first designed in 3D and then translated to aluminum extrusion beams, with added hardware to achieve the desired shape.

3.2 Result

Shape of the body

The 3D body reference from the first phase was used to build up shapes for Kerapac in Autodesk Maya, to make sure that everything had the right size, how the body should be positioned and where extra padding and prosthetics needed to be added. The base models for all the parts of the costume were designed in Autodesk Maya *(figure 3.1).* These base models were exported separately so they could individually be used to create detailed 3D models in Zbrush.

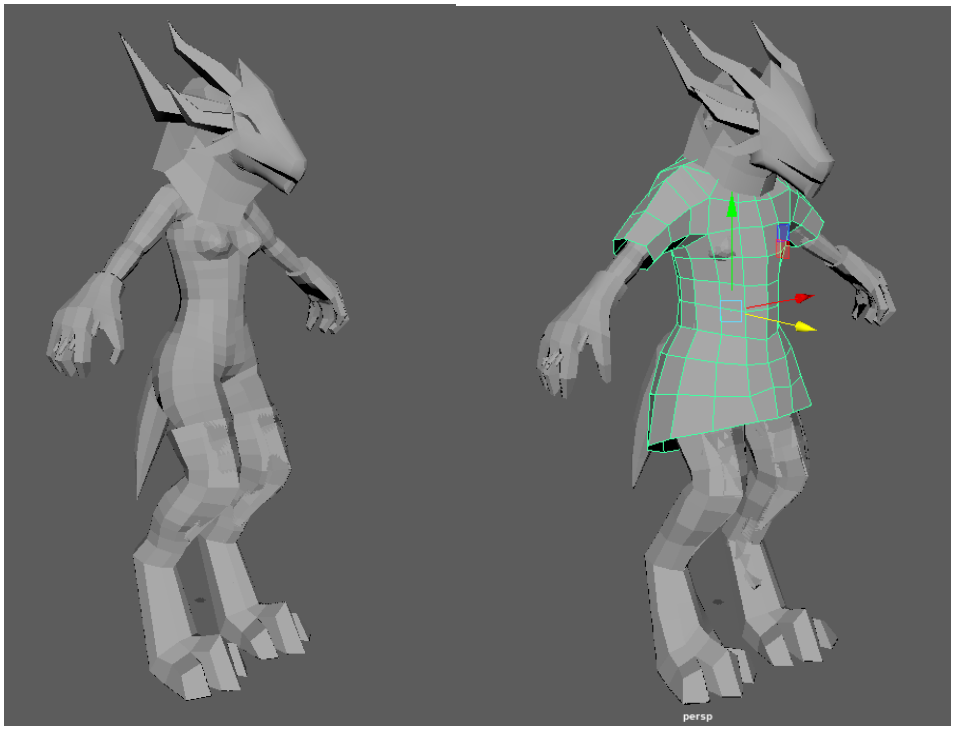

Figure 3.1 Position of the body double and base models for several parts of the costume, in Autodesk Maya.

By using the body reference with proper topology instead of the raw 3D body scan, it was possible to visualize the position of the legs inside the costume and still maintain proper dimensions and proportions in regards to Kerapac's design. The body reference was also useful to determine where extensions or body padding was necessary to achieve the desired silhouette according to Kerapac's design.
Base models created on this body shape were then ready to be detailed in the next design phase using Zbrush/Maya. The base models for clothes and parts that were not going to be 3D printed, were used to create 2D paper patterns for sewing and to provide a size reference for the remaining parts.

Head

The head for Kerapac was designed in Zbrush *(figure 3.2)*. Several parts, such as the horns, jaw, and eyes were modeled separately to accommodate the volume of the 3D printer better.
Structural and mechanical parts were added later in Autodesk Maya, such as the pivot point for the jaw, the addition of the face plate and the hollowing of the head so it is not printed as a solid block of plastic. The frame around the head, that connects to Kerapac's head was also modelled in Autodesk Maya, using the detailed head 3D scan from the first research phase.

Figure 3.2 High detail 3D model of Kerapac's head in Zbrush.

Hands, arms, neck and feet

The hands and feet were similarly designed to the head: a base model in Maya which was then detailed in Zbrush in high resolution *(figure 3.3)*. The hands did not include the nails, they could later be added onto the final glove, with relevant (harder) material such as thermoplastic to simulate nails better.

Figure 3.3 Right hand 3D model for Kerapac, in Zbrush

Digitigrade legs

The stilts to imitate the toe walking (digitigrade) design of Kerapac were created using aluminium extrusions *(figure 3.4)*. Base models on top of the 3D scan created in the first phase were made to see what angle and length were necessary to create convincing stilts of the right shape. The central aluminum beams were then supported by sufficient hardware around the toes and legs (similar to a ski shoe) to make sure that they were comfortable to balance and wear. The entire build is specified in a blog written for my website, found in the appendix (10).

The frame was then subjected to several physical tests to see if it would break down or bend before using it in the final costume. The metal used near the ankles was bent in the tests, and then replaced with stainless steel metal, which proved durable enough to withstand forces.

Figure 3.4 The aluminum toe walking stilts designed and built for Kerapac

Wings

The frame for the wings was built out of PVC pipes to keep things lightweight. Simple joints were designed using the dimensions of the chosen PVC pipes to create an umbrella-like construction. These joints were then 3D printed using strong structural 3D print settings to ensure they would not break during use.

Figure 3.5 The PVC pipes and final set of 3D printed and assembled joints for the wing frame

The joints were assembled after cleaning off excess plastic from the 3D printer process. Some joints had to be redesigned to get the tolerances right: not too loose around the rotational axis, but not too stiff either.
After preparing all the parts and lengths of PVC *(figure 3.5)* they were glued together and a linear actuator motor was installed to provide the linear movement *(figure 3.6)*.
The entire build is specified in a blog written for my website, found in the appendix (10).
The frame was then subjected to several physical tests to see if it would break down or bend before using it in the final costume.


Figure 3.6 The wing frame assembled, folded (right) and extended (left)

Armor

Base models for the armor pieces were created to scale using the same scene *(figure 3.1)* in which all base models were created on the body reference. The armor pieces were isolated in a different Autodesk Maya scene, and further detailed by indicating what edges and valleys needed to be sharp looking or smooth looking *(figure 3.7)*.

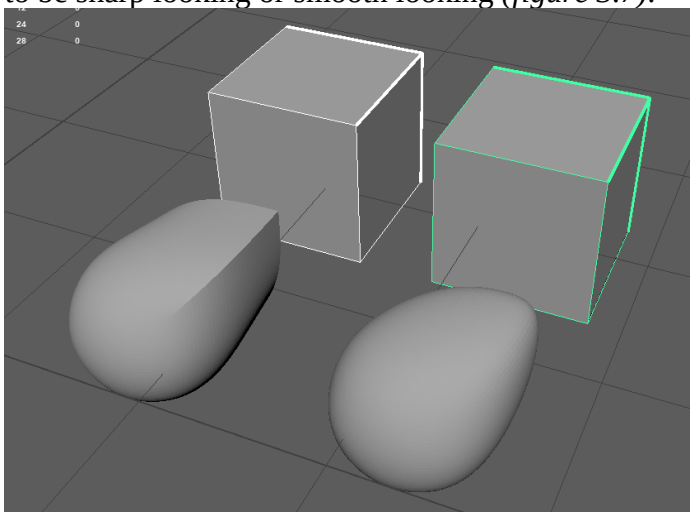
Figure 3.7 By indicating how sharp a certain edge needs to be, high resolution models can then be created from a fairly simple structure, to one with the exact desired shapes

This approach to hard surface high detail 3d modelling was applied to all hard surface parts on Kerapac's assets. Because models have to be watertight for 3D printing, they were then exported as OBJ format files

into Autodesk Netfabb to check for errors. Autodesk Netfabb has automatic operations to attempt to fix errors in models, before exporting them for the 3D printer.

Clothing

The application Pepakura Designer (originally used to create paper sculpture patterns from 3D model files) was used to create fabric patterns from the 3D models, for the tunic and other clothes *(figure 3.7)*. Pepakura unfolds a 3d model similar to UV mapping techniques, but maintains exact projection for all pieces, and keeping the scale at 100%, which are properties that'll make it easier to use than UV mapping itself. The polygons are not exactly stitched together, but these overlaps and corners are negated when unfolded as straight as possible. When smoothing out the contours, a fabric pattern is achieved and can then be printed on paper. This process was repeated for each fabric pattern that was needed. These paper patterns were prepared to be used for the sewing of the clothes in the third phase.

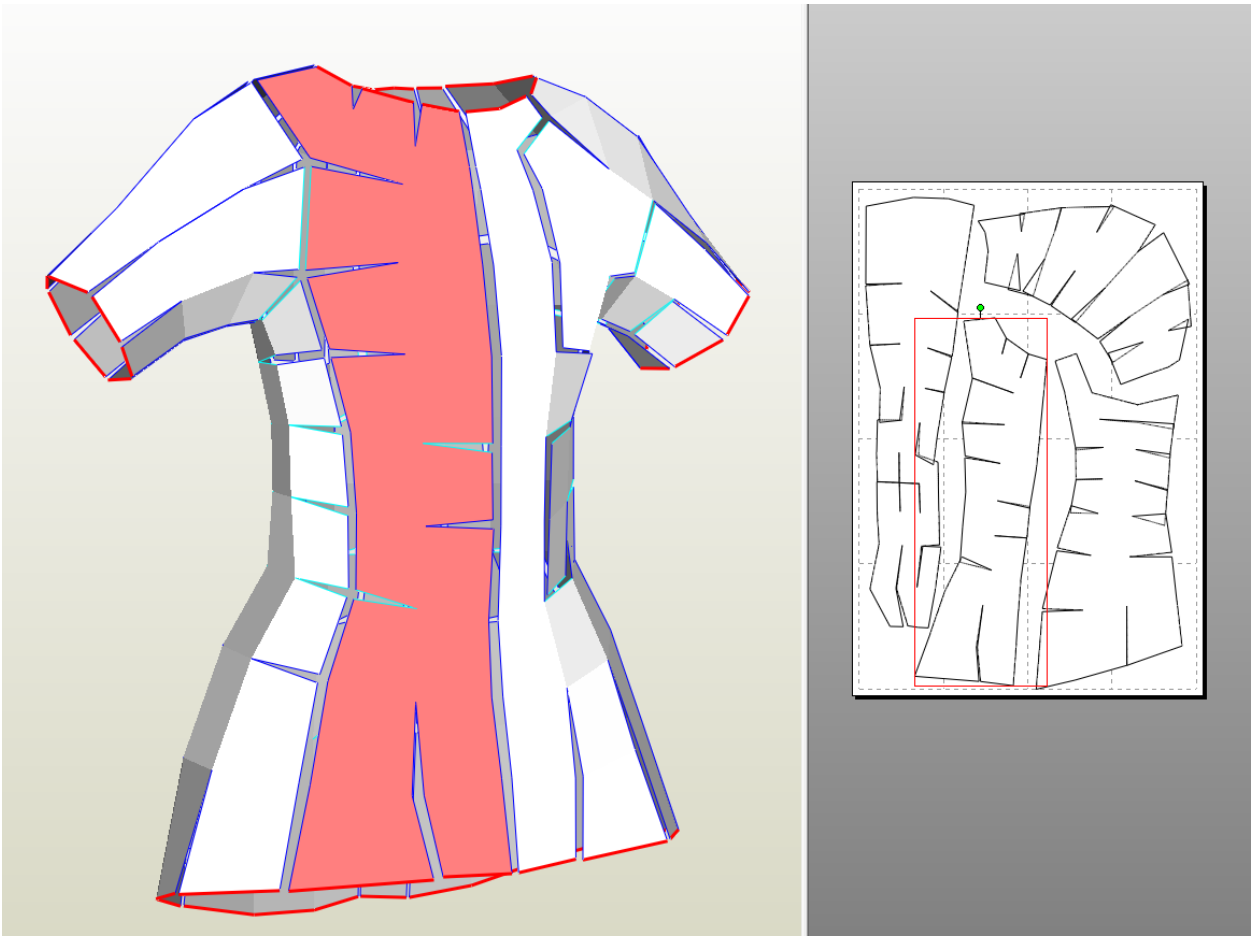

Figure 3.7 Unfolding of the base model for the clothing in Pepakura Designer.

3.3 Conclusion

Planning out the entire base frame was extremely important to make sure that the total silhouette for Kerapac was similar to it's design as intended by Jagex. As such, strong and comfortable base frames for the wings and legs were created, and virtual body shapes were created in this second phase to serve as a good base to create the visual parts of the costume on top. The wing frame, leg frame and virtual representation of the silhouette for Kerapac are now suitable to be used for the production phase.

4. Third phase: Production

4.1 Method

The production phase entails the creation of all the visual aspects of the costume to be fitted to the base silhouette and frames built in the second phase. 3D designs from the second phase were then 3D printed and post-processed. The post-processing for the 3D prints was a lengthy and repeating process of cleaning off excess plastic, sanding and smoothing the surface. After that, acrylic paint was applied and a varnish to protect the paint from damage.
The head was 3D printed and assembled according to the digital plans created in the second phase.
Clothes were sewn according to the paper patterns that were created from 3D models in the second phase.
The skin for the wings was applied with fabric and foam to keep things flexible around the jointed parts.
The skin for Kerapac at the neck, arms, tail and hands was created with liquid latex mixed with tissue paper on top of a foam base, using the 3D virtual silhouette created in the second phase as a base reference.

4.2 Result

Shape of the body

Upholstery foam was glued to a shirt until the desired silhouette for Kerapac was achieved *(figure 4.1)*. A zipper was installed in the back of the body since it was quite stiff to get in and out after the foam was applied. The body has visible skin area on the elbows and upper arm, so extra care for detail was applied in that area. Afterwards, the elbows and upper arm was covered in liquid latex with tissue paper, in the same manner as the neck and hands, to create monster skin.

Figure 4.1 Foam was glued to a long-sleeved t shirt to build up volume for Kerapac

Head

The detailed 3D design for the head created in the second phase *(figure 3.2)* was 3D printed in multiple pieces and then glued together. Excess plastic from the printing process was removed and the artifacts from 3D printing is sanded and smoothed down before it was painted with acrylic paint and airbrush.

After the head was painted, a foam tongue and glass eyes were installed *(figure 4.2)*. The glass eyes were quite deep inside the head, and since the presentation venue was going to be dark, it was decided that to make the eyes stand out, some lights were installed. Eyes are always an important aspect to any character and it is important to highlight them wherever possible.

Figure 4.2 Kerapac's head after it was painted and assembled.

The head was mounted to the 3D printed frame that was to be worn on the face *(figure 4.3)*. A cable between the jaw, with a pulley around the top, was then connected to a jaw piece on the face. When moving the jaw, the jaw of the mask would then move as well.

Figure 4.3 Kerapac's head is mounted to a face helm, with a cable between the jaw pieces to move the jaw

Hands, arms, neck, tail and feet

The hands and feet were similarly designed to the head: a base model in Maya which was then detailed in Zbrush in high resolution *(figure 3.3)*. The hands did not include the nails, they could later be added onto the final latex hand, with relevant (harder) material such as thermoplastic to simulate claws better. However, due to time pressure and little experience with making latex moulds, it was decided to create the hands similar to the approach for the neck and arms: with foam which was then covered in liquid latex with tissue paper. A mould was not required and the eventual 3D printed hands from the 3D design *(figure 3.3)* was not used.

It was a more ideal solution for the neck to be flexible, and since it's such a large part that's mostly covered up, it was decided not to 3D print and cast it in latex. A mould is a lot of effort and skill to create that wasn't yet in my area of expertise. As such, the neck was instead made with the same foam as the body shape, and then covered in liquid latex with tissue paper *(figure 4.4)*. The neck 3D model created in the second phase *(figure 3.1)* was used to create the pattern. The latex on the foam created a monster skin-like texture while also keeping excellent flexible properties. Some pigment was mixed in the latex to immediately get some color inside the skin, it dried much darker than the wet mixture looked like, so it was later painted a lighter, matching color.

Figure 4.4 Kerapac's neck was made out of foam covered in latex with tissue paper

Due to the great results with the foam and latex neck, the same approach was used for the hands mentioned before, replacing the planned approach to 3D print and then mould and cast these in latex.

The tail was made with the same approach as the neck and hands. The pattern for the tail was derived from the 3D model from the second phase, so a hollow and accurate (to the design) tail was created, then covered in latex. Because the foam shape was now hollow, it was very lightweight. It was later attached to the belt which made it easy to wear.

The feet did not necessarily need to be flexible and would be more durable in hard plastic, so these were printed using the high detail 3D design from the second phase. Then post-processed and painted.

Wings

The frame for the wings created in the second phase was covered in foam and fabric *(figure 4.5)*, this to keep it flexible around the 3D printed joints that made the wings fold and extend. The fabric was airbrushed to match the tint of the skin to the rest of the skin of the costume. The wing membrane was dyed with fabric dye to match the magenta tint of the reference.

Figure 4.5 Kerapac wings after the fabric and foam was attached to the frame, in extended position.

Armor

The armor for Kerapac designed in the second phase was 3D printed and then excess plastic from the process was removed. The parts were glued together and then post-processed, which includes sanding and smoothing down any artifacts from the 3D printing and glueing process. After that, the armor was sprayed with a plastic primer spray and then painted in silver, gold and brown *(figure 4.6)* with a varnish to protect it from scratches. The armor pieces were then ready to be assembled in the fourth phase.

Figure 4.6 Kerapac's armor in the process of spray painting silver and gold. Masking tape was applied to paint only the right sections.

Clothing

Using the base 3D models for the clothes created in the second phase, paper patterns were made in Pepakura Designer. This application creates paper templates for papercraft (folding and glueing paper patterns) but was in this case also applicable to create paper templates to be used for fabric. The linen tunic was then sewn using these paper templates and details were stitched on top *(figure 4.7)*. Fabric wraps were also created for the hands and neck and the pants were sewn out of linen. All wraps attach with velcro to the costume and wraps around the neck and hands have stiff felt backing to simulate the stiff wraps in the design for Kerapac. Hook-and-loop tape was sewn to the clothes to attach the armor. Some fake leather wraps, with regards to the original design for Kerapac, were made to go around the base of the feet to hide the stilts, also attached with hook-and-loop tape.

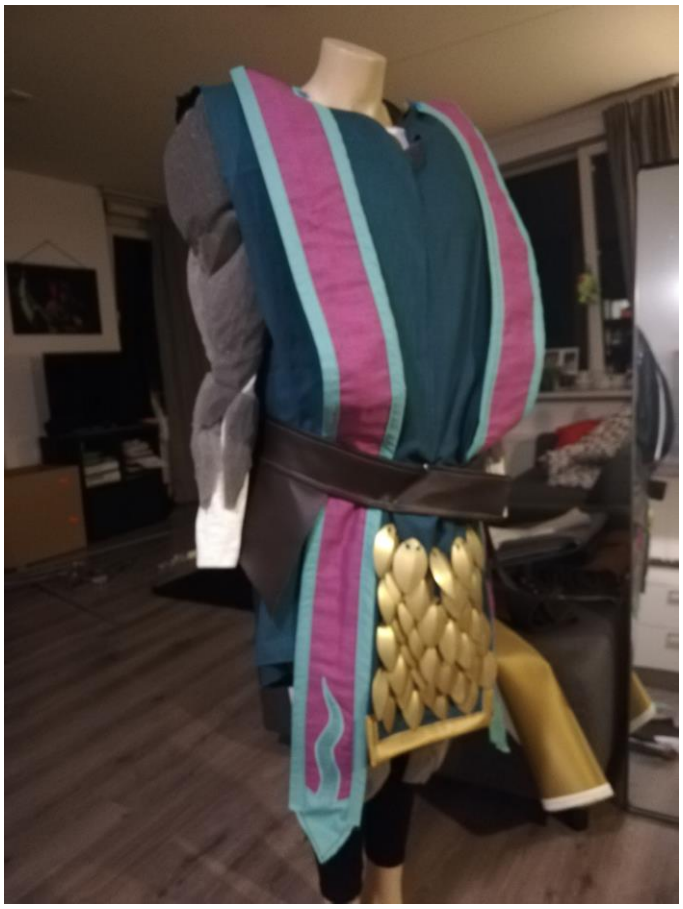

Figure 4.7 Kerapac's clothing in progress. It was draped and modelled around the body shape created in the first phase to make sure everything fit.

4.3 Conclusion

All the pieces for the Kerapac costume were created in this phase, mostly according to the researched approach that was determined in previous phases. The approach for the latex hands was changed due to pressing schedule and missing experience, but ended up with a similar approach already executed for the neck, arms and tail that was more fitting for the project. Digital assets previously created for the hands were not used.
The rest of the parts for the costume were executed as planned with little revisions necessary thanks to the planning of the parts inside virtual space using the 1:1 3D body reference. Some spacing of the structural parts for the head and the jaw needed to be adjusted to fit properly in real life, as padding had to be added for the helmet to wear it comfortably.
All the costume parts for Kerapac, namely the body silhouette and skin, the head, the wings, legs and feet, the armor and the clothing, are now ready to be assembled in the fourth phase.

5. Fourth phase: Presentation

5.1 Method

To prep the costume for wearing it at an event a few things had to be taken in mind: All the parts that were created so far needed to be able to be taken apart and assemble it again to fit in crates for airplane transport. The parts also needed to be durable enough, so it was better to take apart fragile constructions into their separate base pieces. Taking apart pieces of armor and fabric pieces would also be desirable, to make those individual pieces easier to clean.
As such, it was planned to have individual parts, such as armor and feet, stay individual parts as much as possible, and use hook-and-loop tape and buckles to assemble them back together into the final costume.

During the production of the costume, various work-in-progress footage was created in the form of photos and videos, to be published before the event on Runescape's social channels and news. This was a great way to let the Runescape audience know what project was in the works and let them live along the way of the creation of an iconic character in the game, to a real world appearance.

After the final plan to assemble the final costume, it would then be transported in airplane checked luggage to Gatwick airport in two large crates, and moved to RuneFest early October, to be worn at the event. Most of the costume was easily put on by one person, but a handler was brought due to minimal vision inside the costume and for mounting the wings, and to record footage at the event.

5.2 Result

Rig/assembly

For the armor it was essential that all parts were put together so they would fit in the right place on top of the silhouette for Kerapac, while still being able to be taken apart for transport.

The head could be removed from the frame around the face so both can be transported individually, since the head in itself is already quite large. Two bolts were used to attach it.

The shoulders would sit in place using a strap along the back and front. The strap in the front was then used to attach and remove the armor pieces in the front as well. The entire armor could then be put on like a poncho, and could be disassembled later for transport using buckles under the armor in between the straps.

A space on the bodysuit was left over so the wing frame could still be placed around the shoulders. The wing frame itself could be disassembled using bolts, so each wing could be removed and transported separately.

The belt included all the details around the belt that had to be worn around the waist, this made it easy to wear them all at once while only needing one belt buckle to put them on. Parts that were attached to the belt were the loincloth with scales, tail and leather details on the tunic.

The feet had to be fitted to the leg stilts. Foam was used to build up the missing space between the feet and the stilts, then hook-and-loop tape was installed on the stilts and inside the feet so they could easily be fit together.

Presentation of the costume on social media

During the production of the costume, various work-in-progress footage was created in the form of photos and videos, to be published before RuneFest, on Runescape's social channels *(figure 5.1)* and news[7]. Website blogs were created on how the frame and stilts were made for the followers who wanted to have more insight into the building process of engineering these parts of the costume (see Appendix 1 and 2). More footage about the creation of the costume was then posted in more detail on my social media channels.

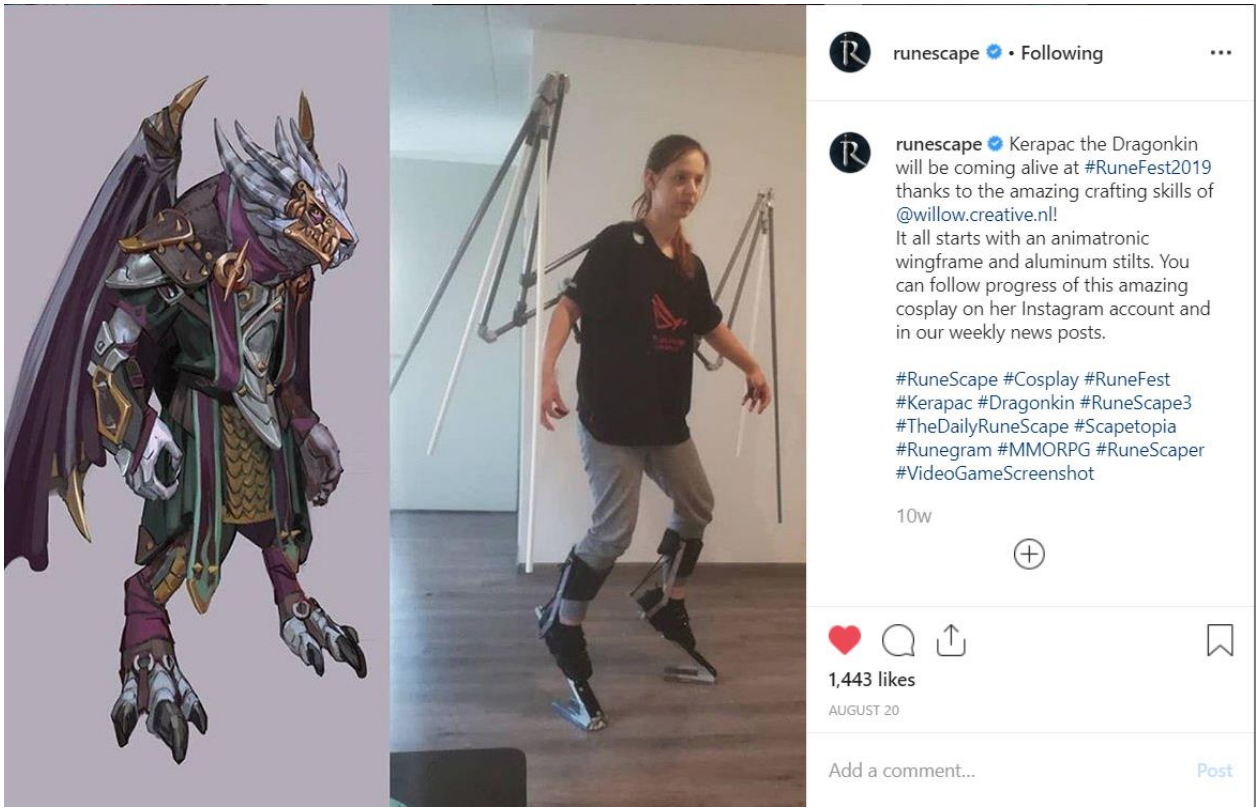

Figure 5.1 First post of the Kerapac costume in progress on Runescape's official Instagram

Presentation of the costume at RuneFest 2019

The plan was to transport Kerapac inside two large crates in airplane checked luggage to RuneFest in the United Kingdom. This went as planned, with the exception of some small damage to the spikes on the armor, which were proven to not be too durable to resist transport. After checks and assembly, Kerapac was then ready to walk around RuneFest, able to endure

multiple hours (up to 2 and a half hours per session) inside the large and warm costume. Many people took photos and stood to chat with one of the iconic characters of Runescape and were impressed at the look of the recreation of Kerapac. Staff members, including the art team of Runescape, expressed their excitement of the costume as well and took photos together:

"It's always amazing to see any cosplay costumes created by the players, but we were all mega excited to see how this turned out in particular knowing that we had sent out assets to you to help work your magic.

Seeing you approaching the art area at RuneFest for the first time was a real jaw dropping moment, not just for myself but for all the artists, as you would have known by all the pictures we each had taken next to you.

Such a great representation of Kerapac, every detail captured wonderfully. I showed Danny, our Character artist who made the in game Kerapac model who was genuinely really amazed at the quality you managed to achieve.

RuneFest wouldn't be the same without the players love of creating costumes for the event. It takes the immersion for the players and staff to a whole new level, and Kerapac really was on another level.

Thanks Merel for entertaining us with your talent, we all look forward to seeing what you come up with in the future!"

- Alec (Lead character artist at Jagex Ltd.).

Attendants at the event took a lot of pictures with the costume. iEventMedia, hired by Jagex to cover the event with footage, also took some pictures *(figure 5.2).* More pictures of Kerapac can be found in Appendix 4.

Figure 5.1 A full body photo of the costume Kerapac at RuneFest 2019, made by iEventMedia

5.3 Conclusion

The assembly of all the parts of the costume was executed and it still fit within the crates to transport it through air to the event. Some small parts were damaged due to the flight but the costume was suitable for presentation at RuneFest 2019. Before the event, social media and news have informed a lot of attending fans about the appearance of the costume. The costume has gained significant attraction on those social media and news posts, and at the event RuneFest, hosted by Jagex.
Exposure on social media and the event has been outstanding in comparison to their usual numbers and hosted events.
Many fans and staff were excited to see and photograph the costume in real life and expressed their compliments to the recreation of one of Runescape's iconic characters.

6. Conclusion

This report searched for the approach and ultimately the presentation of the costume creation of Kerapac from Runescape 3, a game built by game studio Jagex Ltd. Research has been done to plan and produce the costume, and then the reaction of the public to the costume on both social media and the event Runefest has been observed.

The main subject for this graduation report is:

Which requirements does a real-life costume need to fulfill to create a convincing experience for the game Runescape and its players?

Results in the research, production and presentation of the costume have shown that costumes have a positive impact on the virtual and real-life experience for Runescape players and staff, and provided a positive and convincing real-life experience.

During the approach of the costume 3D applications have deemed invaluable as tools to translate the design for Kerapac to a real-life setup. Similar 3D applications have then been used to create all the assets necessary to compose the costume in real-life. The chosen applications provided a good workflow and virtual presentation to assure everything would come together into a representable product, with very little revisions necessary.

The costume has gained significant attraction on social media and at the event RuneFest, hosted by Jagex.
The client Jagex sees value in the addition of building hype and showcasing on-hand real-life costume experience for their players. Exposure of the costume project and reception of the costume presentation on social media and the event Runefest has been outstanding.

7. Discussion

The undertaking of Kerapac's costume has been immense and imposing at the start, and as expected, it took longer to execute than the duration of the project, but was completed before the crucial event date of RuneFest 2019, which was the priority. Unfortunately some opportunities to display and present the progress of the costume along the way, online, were missed and more opportunities would have been desirable. More posts and coordinated web blogs with Jagex could have been created to achieve more reach online.
However those publications that were posted online have reached a large amount of people, more than expected and beyond the target audience of Runescape's fan base, encouraging many to even check out the game again based on the costume work they saw and connected with. To wear and experience the reactions of the target audience at the event at own hand was great and very motivating as closure to this costume project. At the start of the project, especially when the first phase was completed and the base frame was set up, but none of the pieces for the outfit were yet put together, it seemed like an impossible task, and to eventually see this come together as the final costume exceeded many of the reactions of the target audience.

Because this costume project was so much larger than a humanoid character, there was also little space for errors, though many of the approaches that were taken in this project already required some initial level of experience so the room for error was smaller. Some approaches such as moulding and casting the latex hands, were planned without any experience and were ultimately proven to be out of reach for this large project. Alternatives were set up along the way based on other methods, and actually reduced the amount of different methods that were needed to create all the costume parts, which was beneficial to the flow of the project.
The execution of a character that was not remotely humanoid except for posture in some way, was also a giant undertaking that allowed little time left to correct any grave mistakes if some were to happen. For future costume projects it is definitely recommended to choose a (humanoid) character that is more suitable for the model that will be wearing it, to avoid unnecessary extra steps that could be costly when gone wrong.

8. Thanks

I want to express my thanks to various people who helped me along the project and bring it to completion:
Luuk Bolander, for always bringing me into contact with the right people at Jagex, assisting me at the event and getting the right feedback for me, and making sure I know exactly what was needed and when.
Johannes de Boer, my college supervisor and great at analyzing my report to make sure it meets the standards and helping me set up the structure of my research.
Christopher Sintes, my handler at the event, helped me into the costume, made sure I had something to drink, and recorded footage there.
The social media team at Jagex, they were great to pick up on my progress towards the event and loved to present it to the players of Runescape.
The artist team at Jagex, for giving me the motivation to bring one of their amazing creations to life and be able to present it to them.
Chaos Costumes, for guidance and support on creating my leg stilts.

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10. Appendix

1. **3D reference of Kerapac as provided by Jagex' artist team**

2. **Build log of the leg stilts, posted as a blog on my website http://willow-creative.nl/build-logs-tutorials/build-log-digi-stilts/**
3. **Build log of the wing frame, posted as a blog on my website http://willow-creative.nl/build-logs-tutorials/build-log-animatronic-wings/**

4. Photographs of Kerapac taken by iEventMedia (hired by Jagex to cover the event) at RuneFest 2019


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