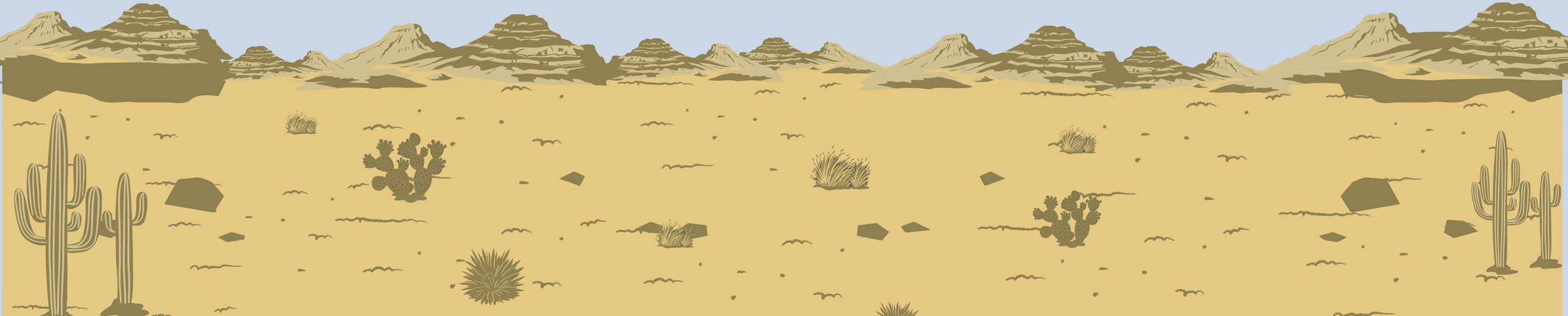
# THE MAKING OF HORSE ANIMATION

by Hollie Tyler
T015721M



# Contents

# Introduction

The problem I am trying to solve is the inaccurate representation of horses in video games. These are games that are heavily marketed at the equestrian community and thus, subject to their scrutiny.
These faults include how the animal moves (animation), the model (conformation) and the equipment (saddles and bridles).
For my project, I have focused solely on the movement, and creating an accurate to real life walk sequence.

# Aims, Objectives and Deliverables

The aim of the project is to examine how horses are incorrectly defined in video games - specifically in movement.
To address these inaccuracies, I have produced an industry standard worthy quadruped walk cycle of a horse that is scientifically and anatomically accurate.

Objectives:

- analyse existing portrayals of horse movement in games
- research equine realism including biomechanics
- develop a realistic walk cycle using industry standard software
- feedback, testing and improvement through equestrian sources and lecturers specialising in quadruped animation

Deliverables:

- research into equestrian based video games and analysis of the faulty animations
- reference library including real life horse walk cycle and diagrams of anatomy
- realistic horse walk cycle demonstrating correct movement
- side by side comparison of the animated walk cycle and the reference video

# Research 1 - 3D Horse Simulator

The first thing I looked at within this game is how the horse was animated when moving in a tight circle. I admit this is a good effort but it doesn't look quite right to how a horse would move in real life.

Firstly, there isn't enough reach under with the inside leg. This is the leg that is on the inside depending on which direction the horse is going. For this example, in the video snapshot taken from the game the first inside leg is the left, and then it changes direction so then the right becomes the inside leg.

From the youtube videos I've sourced, these show this reach under very clearly, it is a crossing over of the hind legs whereas in the game its more of a step to. As if we as humans are side stepping, touching our heels together, then moving our other leg rather than crossing our legs over.

# Research 1 - Continued

The other thing I noticed is that the weight appears to pivot around the front inside leg. It is very clear from the 'Rocky assessment' video that the horse in real life will stance its front legs, widen them, in order to stay balanced when moving around tightly. And how the outside front leg swings around to come close to taking the place of where the inside leg was.

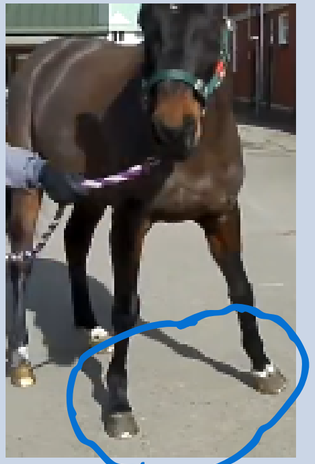
And lastly, the hind quarters of the horse animation have this funky snapping action. This is probably just due to how its modelled/rigged as it looks like the hind leg sections go all the way up to the top of its rump, instead of having the legs and rump as separate entities.

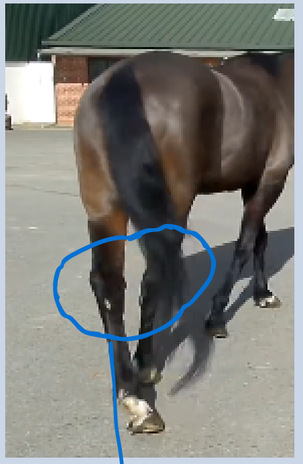
# Research 1 - Continued

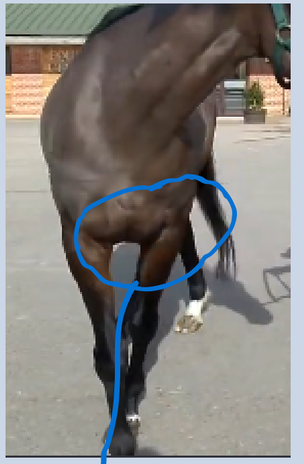
The hind end here has a dip and a turn which does not convey the movement of a real horse.

The hocks click together instead of reaching under and through.

https://youtu.be/EDKnrTTJY0U







Front legs widen the stance when turning instead of pivoting on the inside leg

The hocks do not touch and the reach under is very clear when on a circle.

# Research 2 - ROAM: Wild Horse Simulator

I started by looking at the animations again and whilst there was some improvement to the last game, there were still a few small issues.

I noticed when the horse was going in a circle at all speeds there was this drift to it, and it had a really wide turning circle. My guess is it could be an issue with the pivot point being too close to the head, which makes it look like the hind end is swinging out, which made it a bit hard to turn around in tight spaces.

The overall animation of turning was good. There is much better hind end action but the front end doesn't seem to swing around enough (as mentioned before with the 'Rocky assessment' video)

There were accurate sounds to accompany the hoofbeats, distinguishable as 4 for walk, 2 for trot, 3 for canter and 4 for gallop

# Research 2 - Continued

Improvements I would make:
Have the horse change the lead its cantering/galloping on, as movement on the wrong lead can cause loss of balance.
Move the pivot point closer to the centre to avoid it looking like the hind quarters are swinging out.

Hindquarters drifting out on the circle

The leading front leg here is on the outside while the body is bending inside on the circle

# Research 3 - Jumping Horses Championships 3

First thing I noticed was the model was a bit off. The legs on the horse look too fat to be normal and looks like a condition called lymphangitis.

The walk does look accurate enough, although there seems to be a bit of snapping on the legs when moving which could just be due to a bigger gap on the keyframes when the animation happened . There is also a stiff tail flick when the horse is galloping.
Depending on the length of the tail, the movement happens towards the end of the tail and not the top which is due to incorrect follow through of movement.

# Research 3 - Continued

Improvements I would make:
Change the controls so jump is SPACE and not Q, and make a speed gauge, so one press on W is walk, 2 presses is trot and so forth.

Slim the legs on the horse model so there is more definition and they don't look like tubes.

Have more follow through on the tail so it flicks up and down below the tail bone on the gallop.

Implement lead changes on direction change.

# Research 3 - Continued

This animation is showing the head nod wrong. The chest should rise on the front legs passing position but this video shows the opposite.

Anatomically, this would be the horses dock bone so it would be impossible for it to bend this high up. The flicking motion would happen towards the end of the tail.

# Documentation of Production

The original plan for the project was to 3D scan a live horse, Gypsy, clean up the rendering and make a model out of it. From there, add a rig and keyframe the walk cycle by hand. However, this was a lot of work in a seemingly short period of time for someone with no experience with the former, and having only completed level 4 animation it was advised to use a ready made rig and learn the process of quadruped animation from there.

# Documentation of Production

I conducted a MoSCoW to help with the process

Must have

Basic, low poly 3D model. Rig and animation.

Should have

Accurate movements that reflect on the reference videos used.

Could have

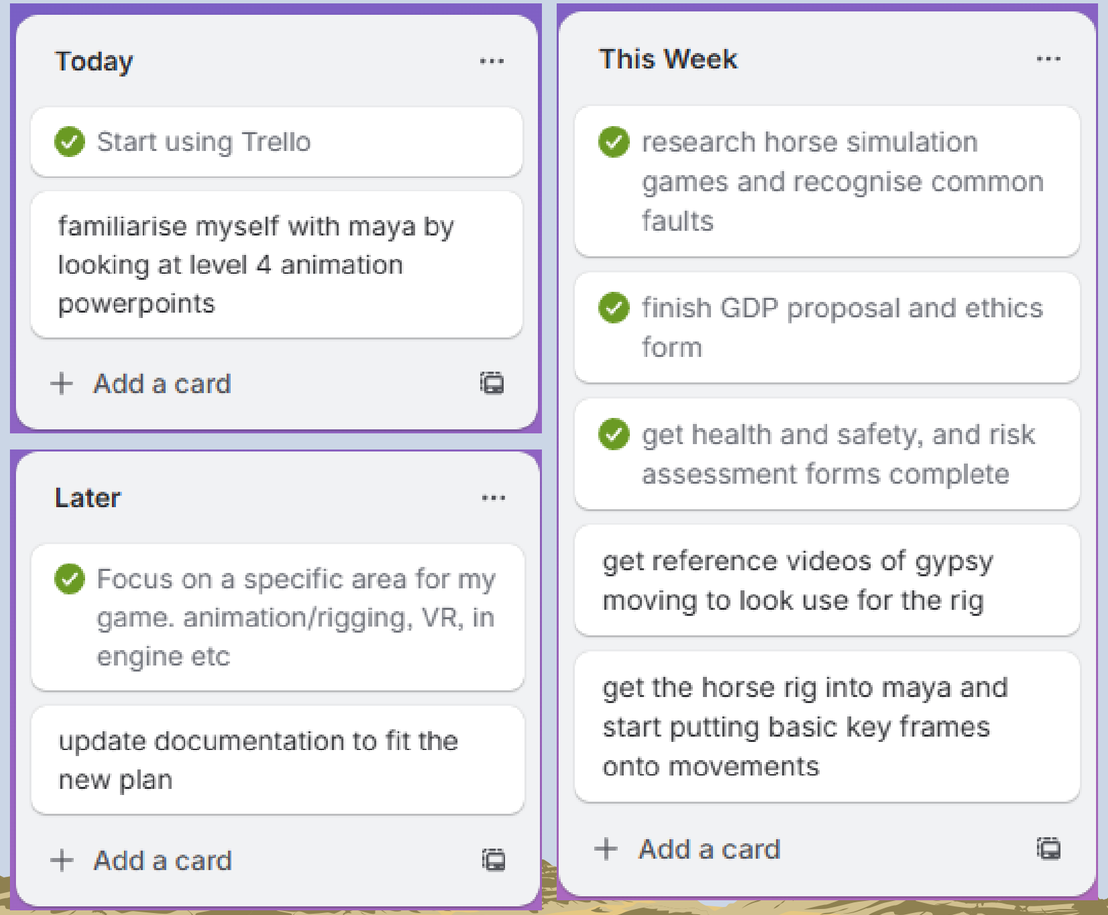
3D scanned version of Gypsy as the base model. Different ground textures (grass, sand, concrete etc) with different sounds to match that. Sounds to match the movement

Won't have

Any human models in the final concept (rider, groom etc). No riding animations, just free horse movement.

# Documentation of Production

Trello Boards help to keep track of the process

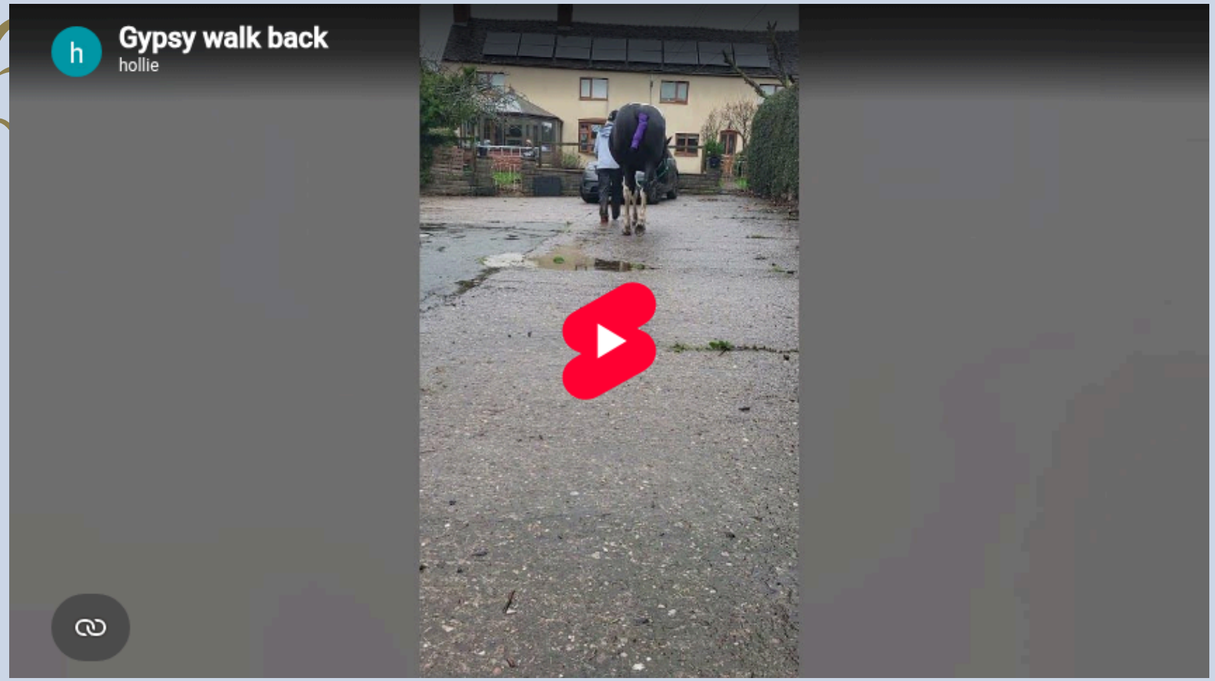


# Reference Videos

The next step in planning was to get the reference videos. This is the one used most for the referencing, however, there are videos of Gypsy from every angle.

https://youtu.be/lC1V-NA-fog

# Reference Videos

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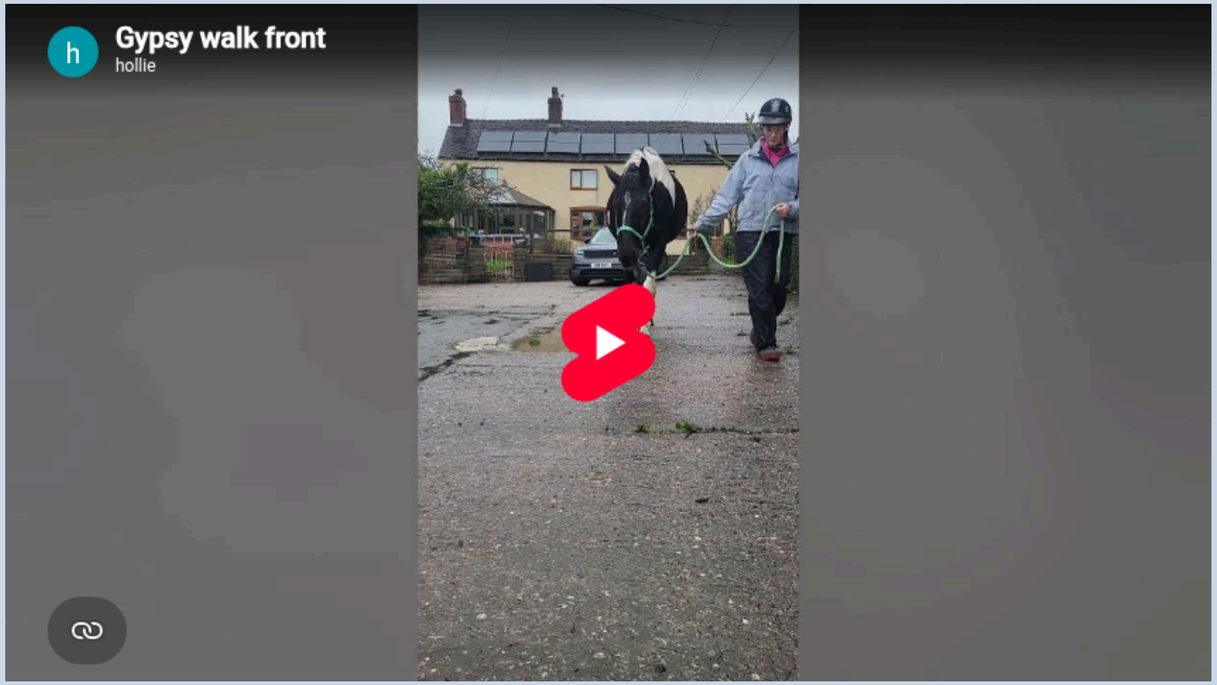


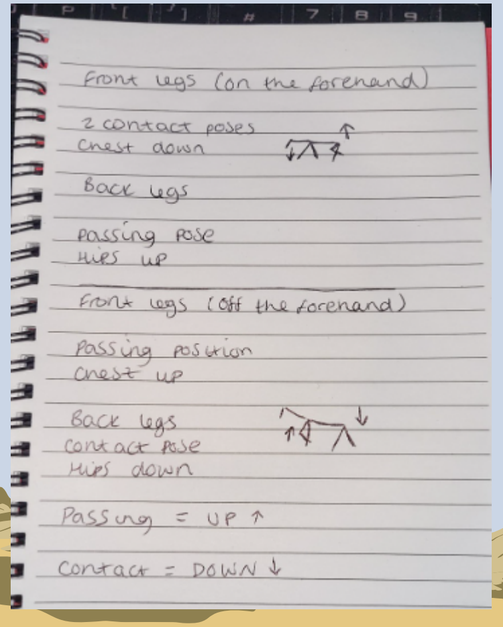

https://www.youtube.com/watch?v=WIZdGTk3Fwc

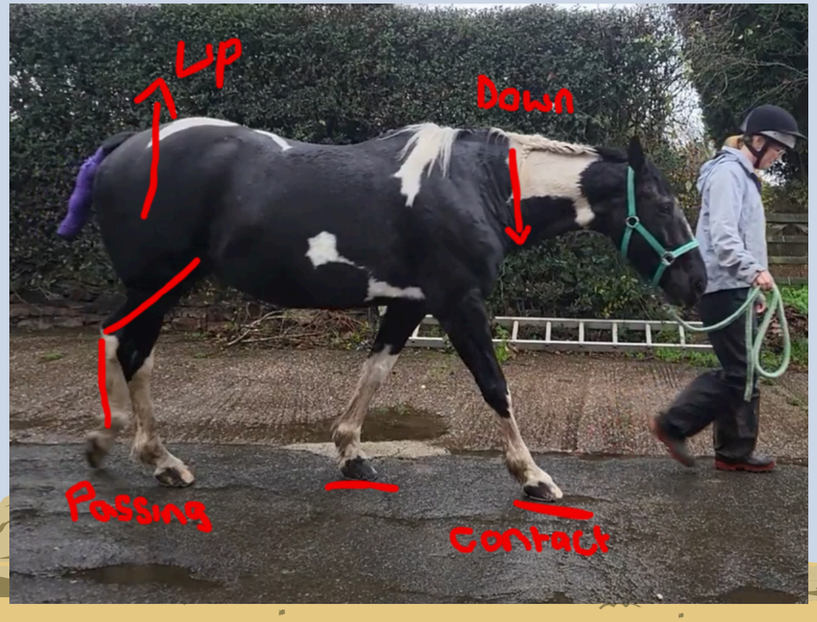
# Refining Reference Videos

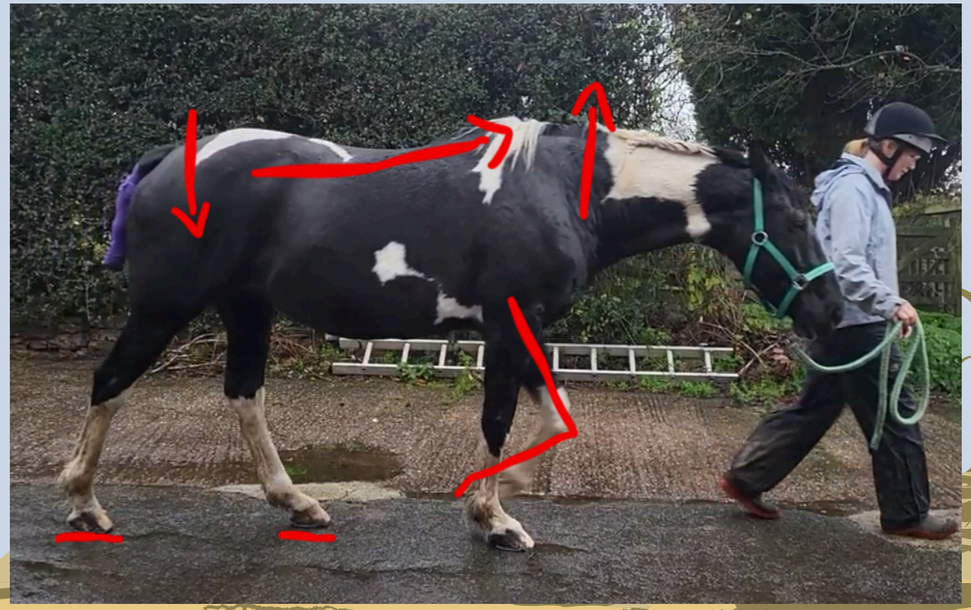
To start working on my project properly, the reference videos were broken down and edited in SyncSketch.

To break it down for myself, I drew some terrible diagrams.

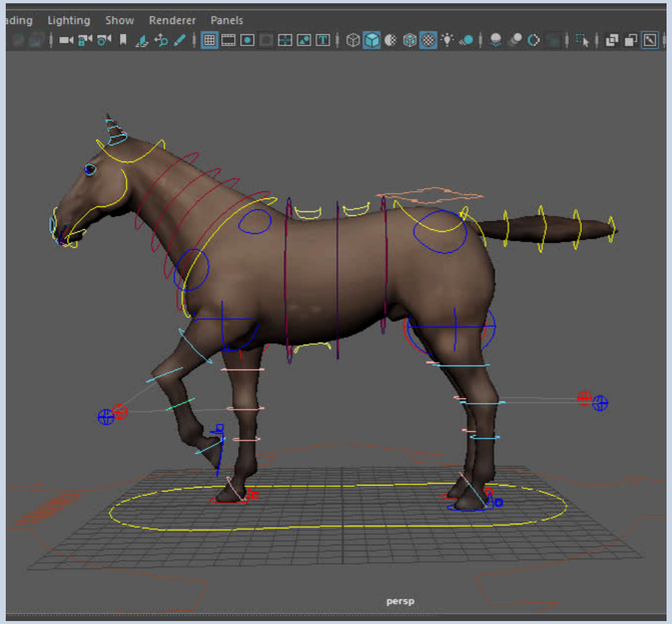
I used the term 'forehand' to help me understand in horsey terms. The forehand is the front of the horse, being ON the forehand means all their weight is at the front, and being OFF the forehand means they are carrying their weight in the hindquarters (back legs).

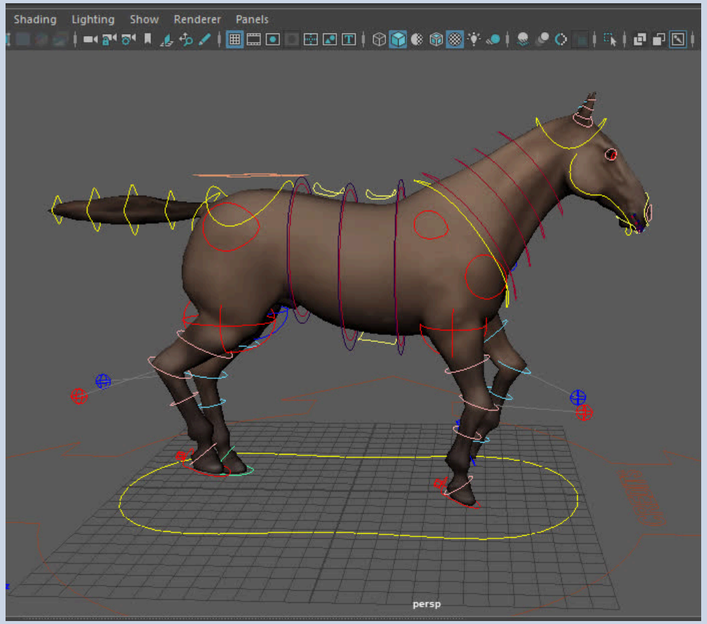


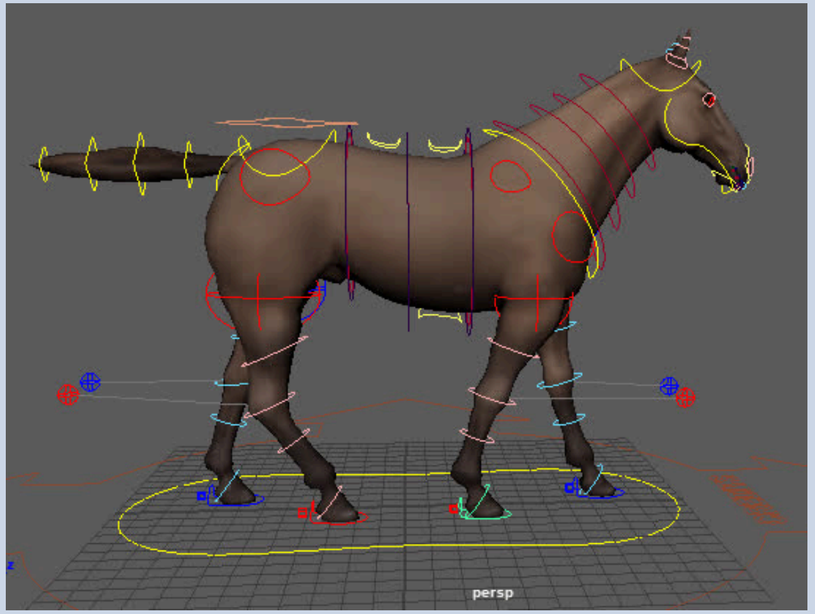



# Understanding The Rig - First Iterations



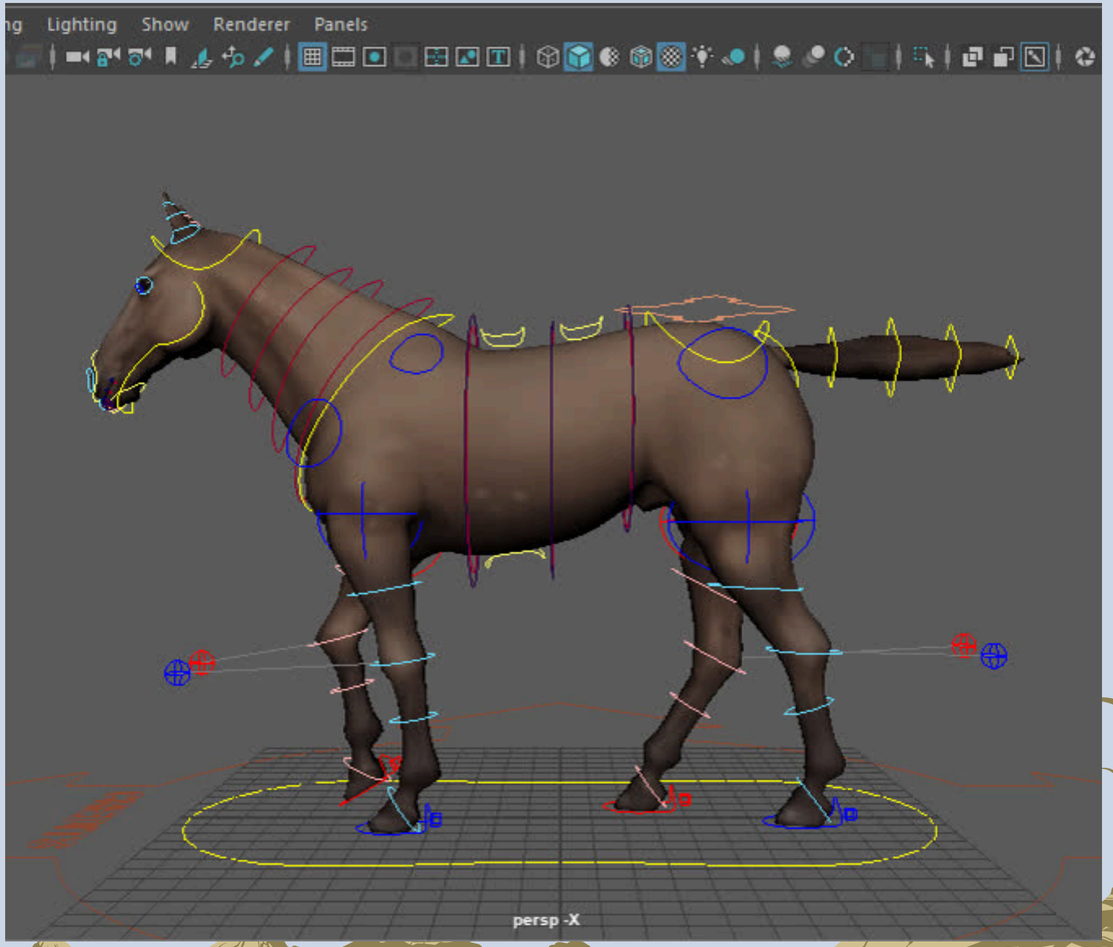

https://daf.staffs.ac.uk/topic/80237-tyler-hollie-t015721m/#comment-1148824

# Understanding The Rig

After getting the basic poses down, I've been looking at the Gypsy reference videos and really looking at how she moves through all her body. The chest and rump move at different times, and her head bobs in time with the chest rising and falling, but in the the opposite direction with her head coming up when her front legs are in contact and dropping when her front legs are passing.

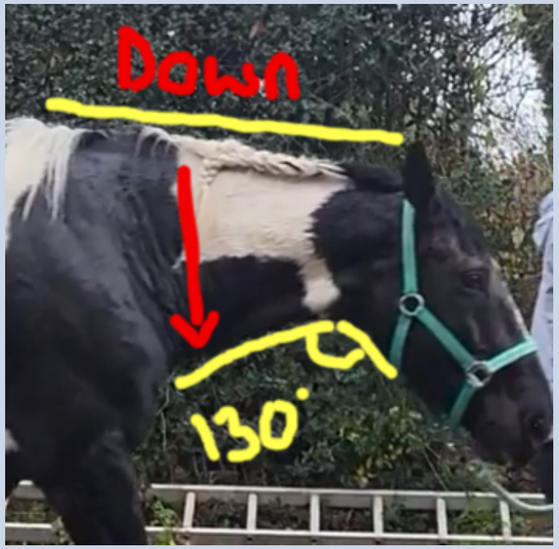
# Adding The Details

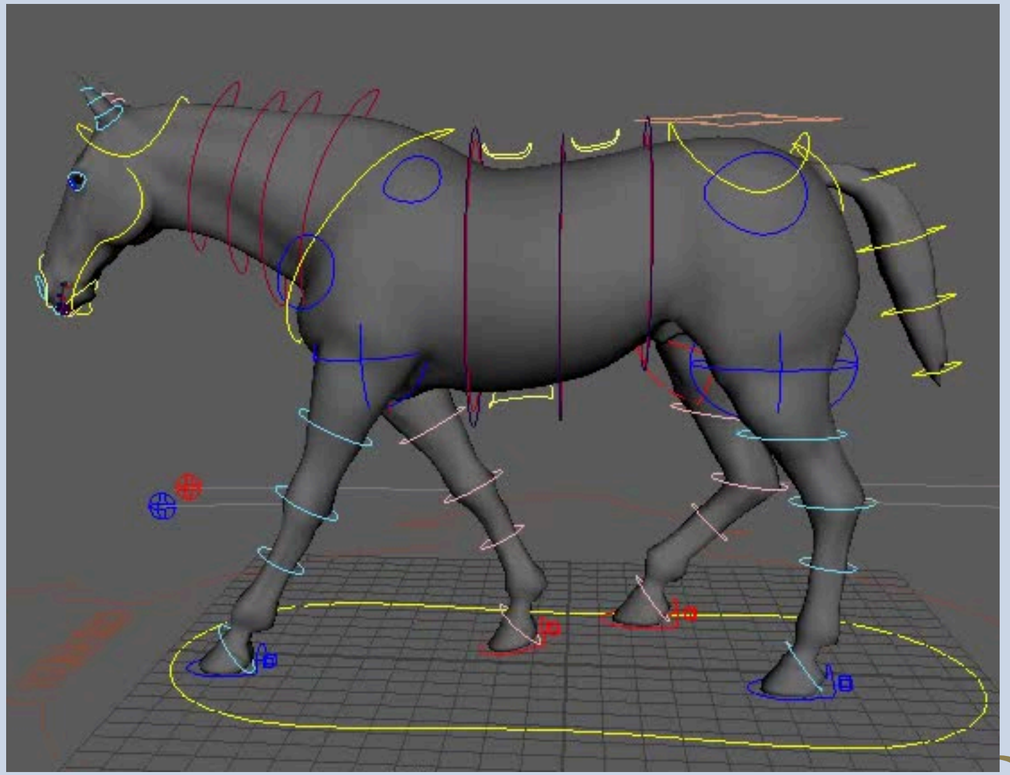
The main poses are down, and after adding the head bob and the elevation on the hind quarters it is already coming together.



# Adding The Details

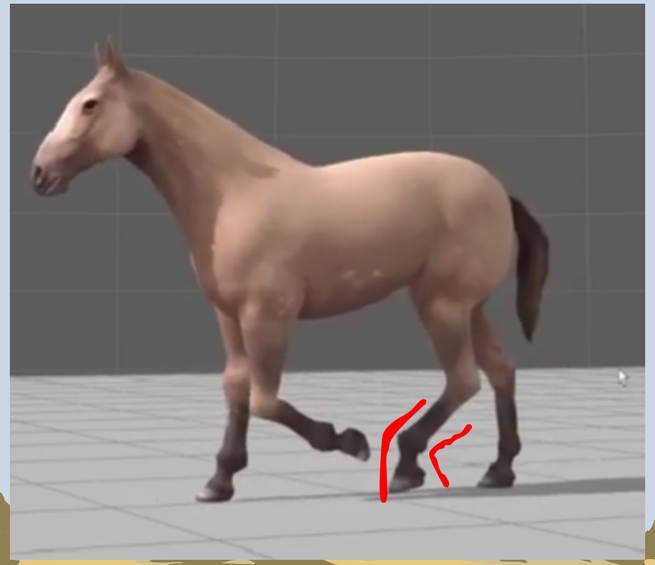
Gypsy is very relaxed by nature and therefore she carries her head quite low. As seen in the reference videos, she usually has a straight line from the withers (the pointy bit at the base of her neck before her back starts) to her ears, or a downwards line. This is making the animation as close to the reference videos as possible. Rotation added on the hips.



# Cross Referencing - Legs

To initially learn the quadruped animation cycle, I had to do lots of research. One video I found shows it very clearly, however I found some issues. From an equestrian point of view, the legs making contact with the ground didn’t look completely accurate. The horse will have its hoof extended in anticipation for making contact with the ground. Of course, there is flexion in the fetlock joint to make the bend like that, but it isn't at the timing the above animation suggests/shows, as horses land heel first. The rest of the foot follows through after (its a very quick action) and the suspensory ligaments take the weight through the movement.

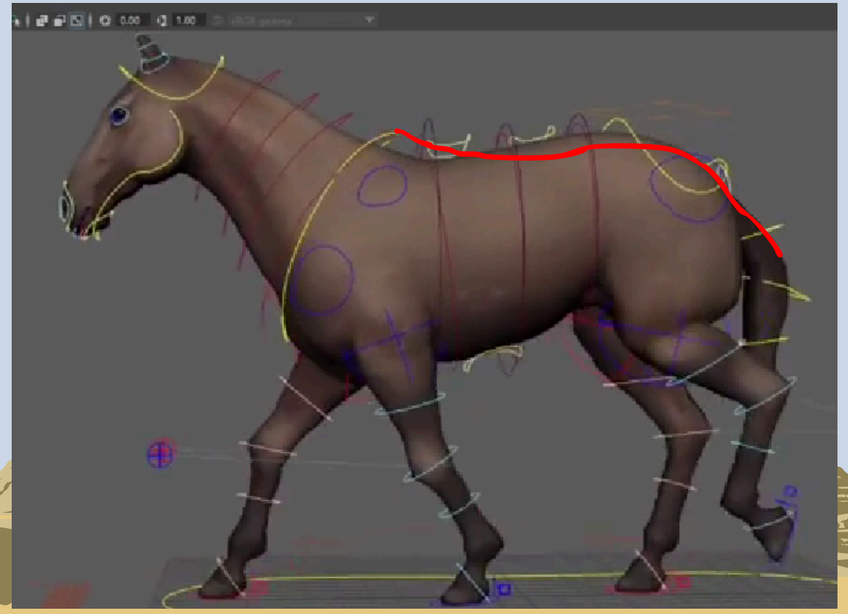


https://www.youtube.com/shorts/N-RA78fLV_c

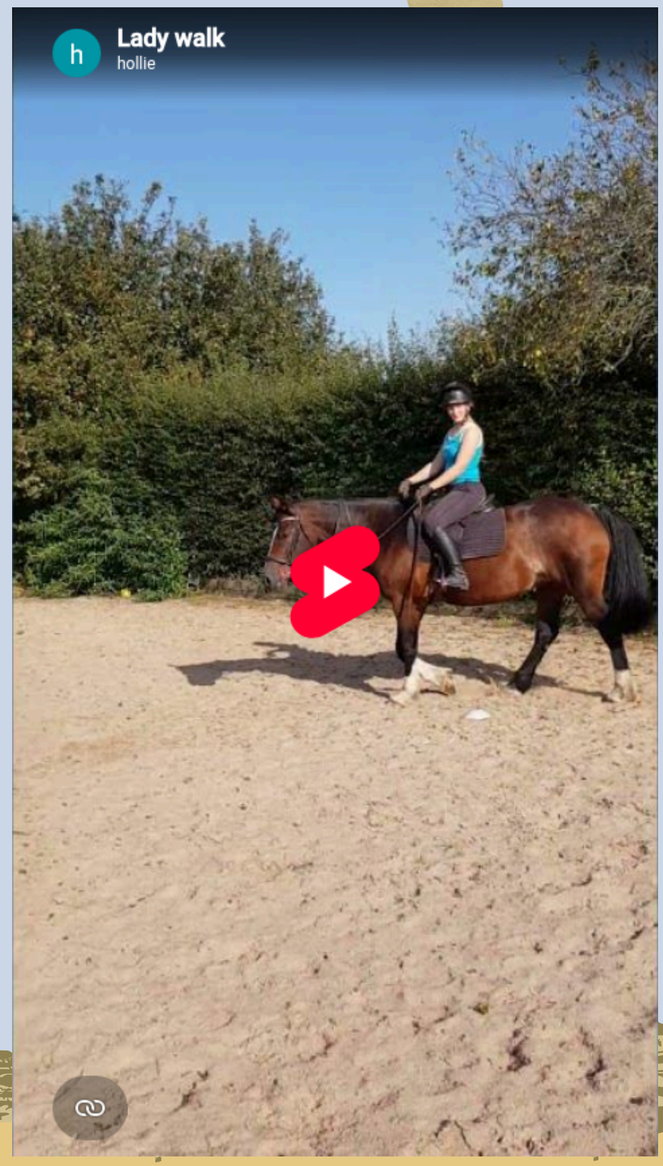
# Cross Referencing - Spine

The back just looks too round for natural movement. It is possible to achieve a round back on a horse, but this would mean the horse is taking the weight onto their hind quarters, which this stage of the animation isn't showing. After looking at Lady's walk cycle in the video, neither horse rounds their back to the extent shown in the animation, making it unrealistic to the equestrian view.

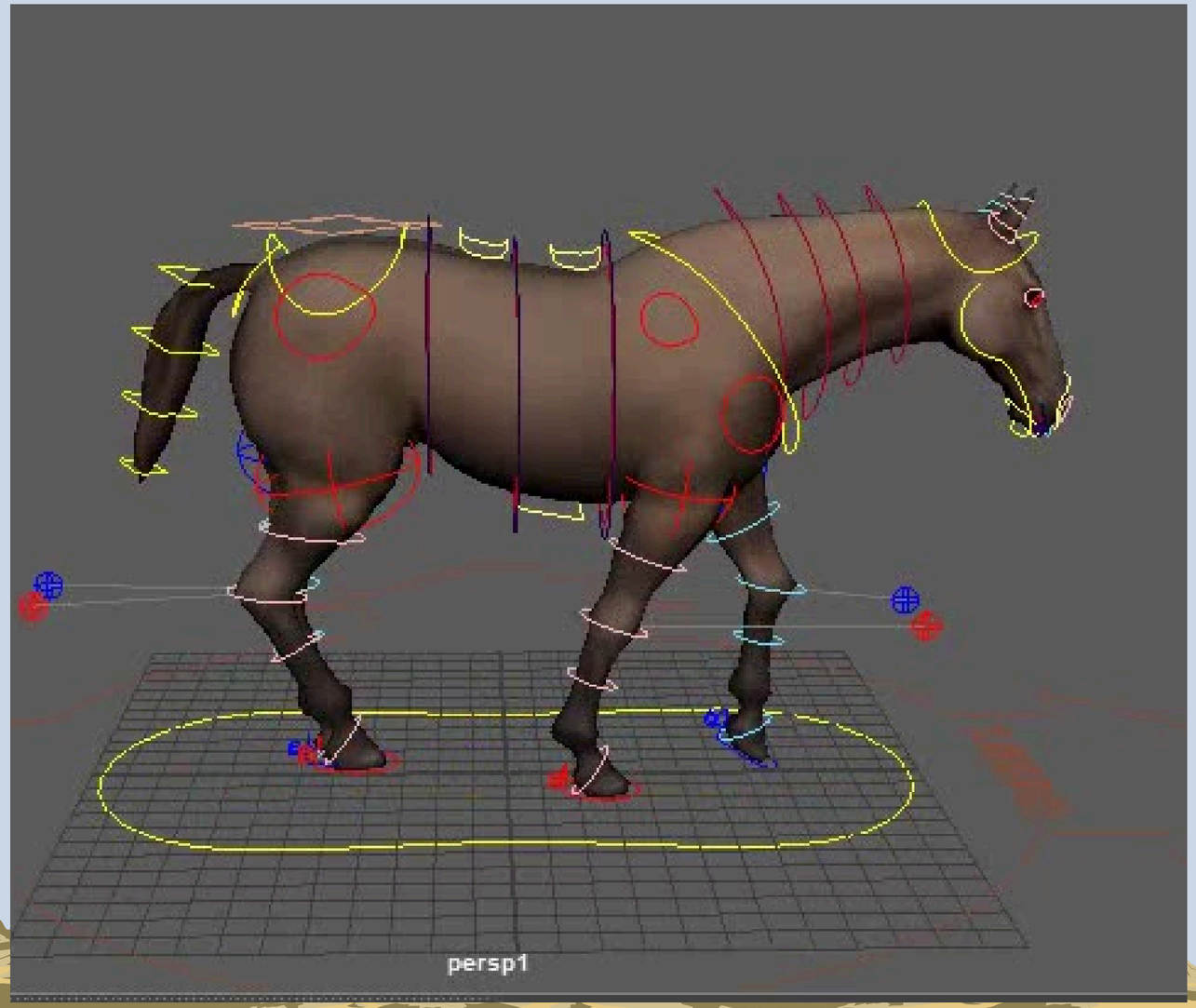
The horse should still have a dip in the spine during the natural walk.



Round back shown here as the horse takes its weight into the hind quarters.



# Further Development




https://youtu.be/yFIAFdhafy0

After checking all the reference videos and the quadruped animation powerpoints, The things left to add were little details. When I was working on the yard and leading horses in from the field, I noticed their hocks (the ‘knee’ joints for the back legs) tip in a small amount. This was added. along with shoulder rotation, pelvic rotation, the tail drag and a more subtle head sway.

# Feedback

Consent was given to share these comments by the authors.

**Kristian Melnychuk**
I think it looks great! Are you planning on completing the foot movement with a little more kick back? I notice your back pastern doesn't flip back, pretty minor detail but it might help feel more natural. Also your horse seems slightly butt high? When a horse propells forward their shoulders kind of come up and they push with their back end, your horse appears to have the energy coming the same way for all four feet if that makes sense. Youre doing an incredible job, I really had to pick this apart to find anything weird.

**Carly Harman**
Excellent job. I like the movement of the body and the gentle head sway. Getting a quadruped walk cycle down is so difficult. One thing I might adjust that goes along with the other comment, is that the pasterns kinda flip forward/up like a human foot before they land, but really they should stay bent until the hoof is almost parallel with the ground and makes contact.

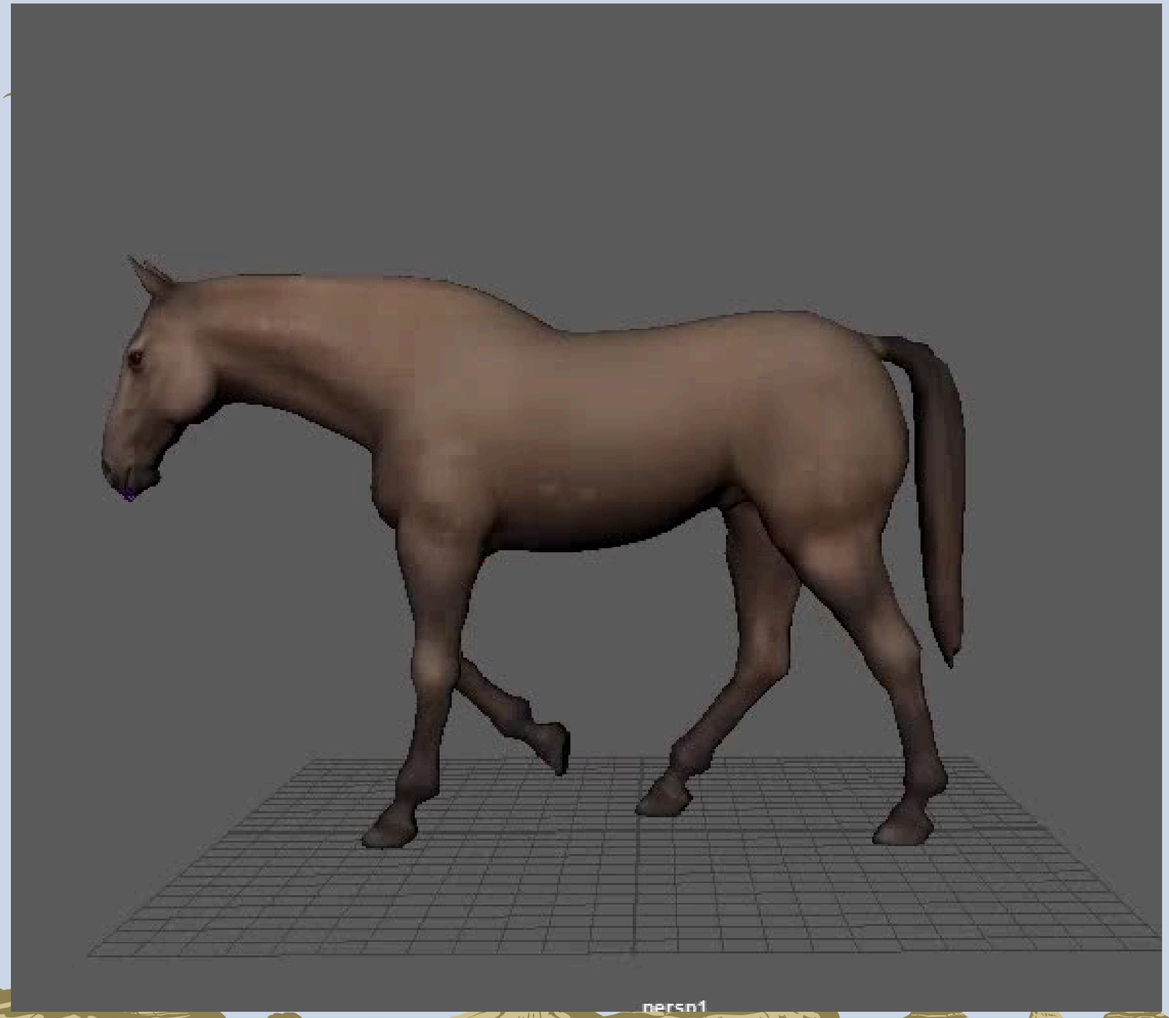
The animation looks good though, I see what you mean with the feet, the only thing I might add is the tail when watching from the side doesn't really move but it swishes when you view from the back, I don’t know if there's anything you can actually do with the tail but it's perhaps a tiny bit stiff? - Charlotte Hassall

I think the back legs 'step' too high, and don't push forward in the stride enough. I also dont like the front knees when they bend? BUT please remember I don’t understand how limited you are on the animation? I don’t know how close to real life it can get?? - Tracey Axon

It looks good, the only thing I've noticed is the steps 'skip' when one foot goes down and one leg is lifted like it doesn't understand the crossover. In the vid of Gyp, her back hoof falls where the front leaves as it should but the animation doesn't know how to do that/can't do that so skips slightly where the 2 limbs cross over/touch. Other than that, it looks pretty accurate.
I like the bum wiggle you got going on with it though and the overall look of it! I'd say you've done a pretty good job - Georgia Stocks

# Further Development

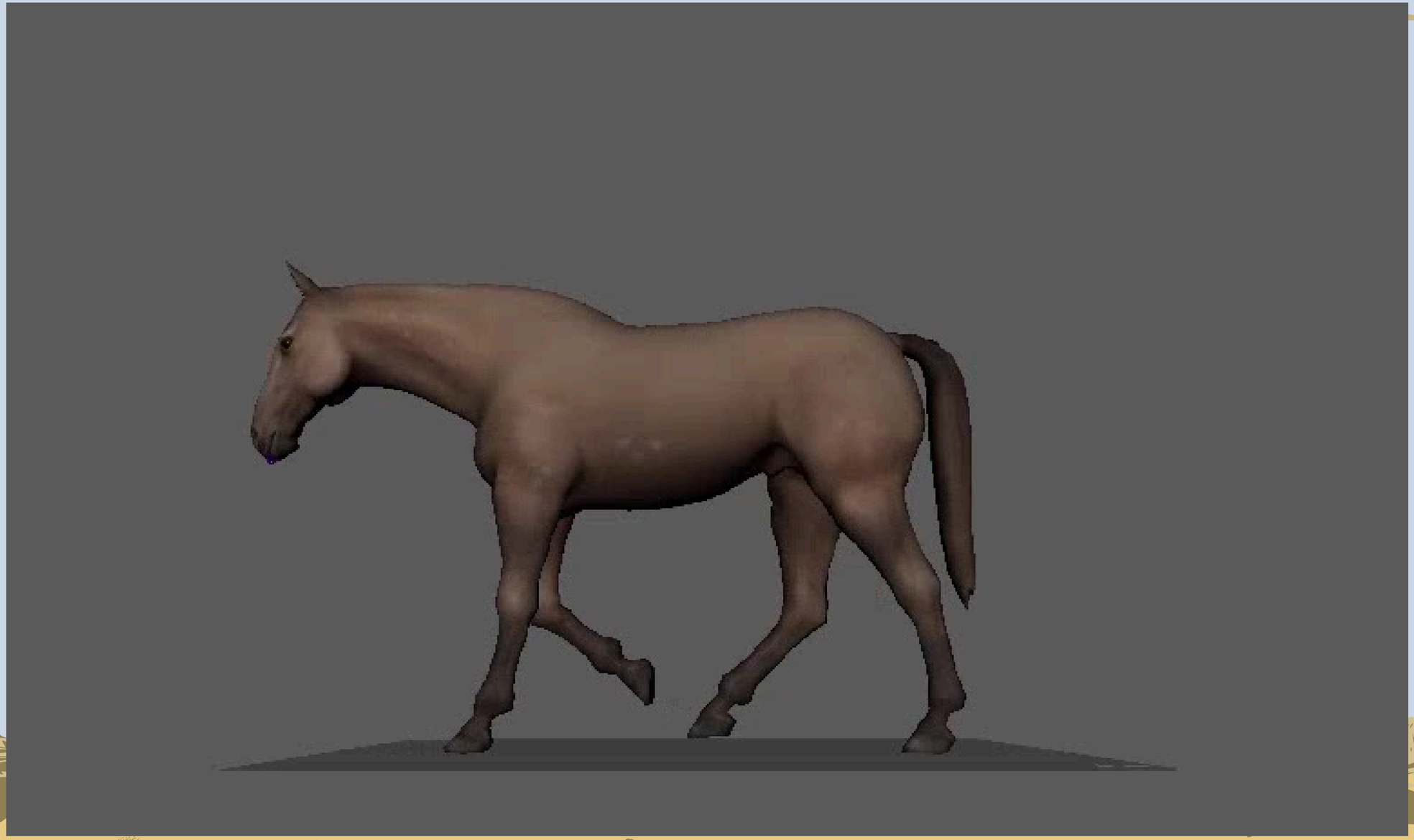
https://youtu.be/yFIAFdhafy0




After receiving feedback, I edited the legs and added the little snap of the heel which was picked up on by all the viewers. There was nothing to be done about the sharp knees unfortunately, as it appeared the same in the animation reference video I watched. I added length to the tail and sway with the movement. It was a bit hard as the horse doesn't move it's tail much in walk and for neatness purposes I had bandaged Gypsy's out the way to make her leg movements clearly visible.

https://youtu.be/LBNKPhgEZQM

# Final Artefact



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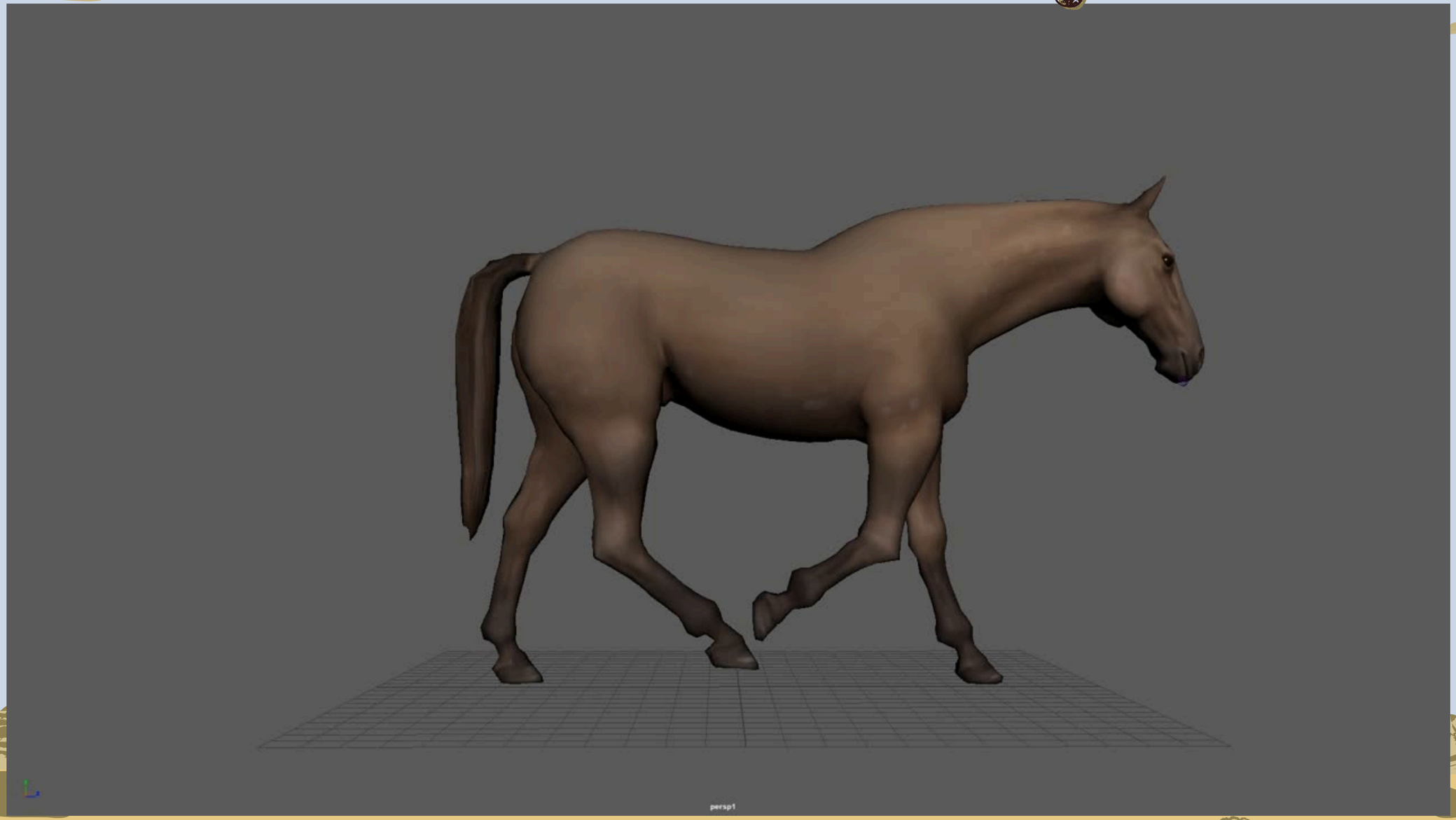
# Final Artefact - Playblast



# Evaluative Review

The animation turned out well and is an accurate representation of a horse walk cycle. The hardest part for me was adding all the details but it looks so much better having them there. The feedback gathered really helped and having my own horses to constantly reference is useful to further development.

A lot of trial and error helped me see what was good and what wasn't. The slight foot flip that looked out of place, the tail being too stiff and others. Being able to sit back, evaluate and improve has been the most important factor with the development for this project. I am also lucky to be surrounded by people who would compare the animation to the reference video and say what looks good and what can be improved.

To continue working with this rig, I would like to add more gaits, trot, canter and gallop. I also would like to show it off in Engine, however my knowledge on the fact let me down this time as the rig and skeletal hierarchy still confuses me. This is has given me purpose to strive to be better and carry on my knowledge of this subject after this semester.

I would also experiment with other rigs and influence the movement on different breeds of horse, and to see if I could achieve the same result.

I would still love to return to my original plan of 3D scanning Gypsy or modelling her myself and adding the rig and animation that way.

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# THANK YOU

By Hollie Tyler