

Advanced Character Animation-

Lewis Duggan

by Lewis Duggan

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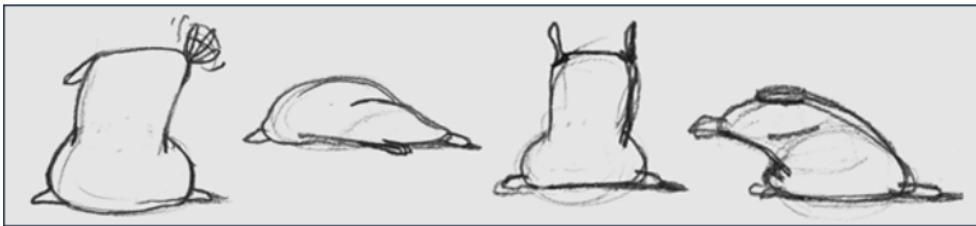
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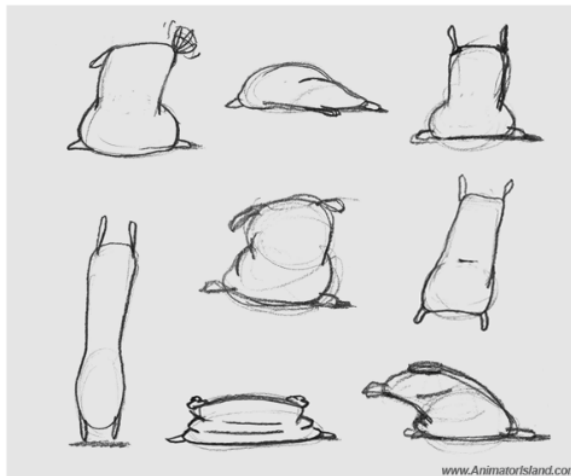
Module: Advanced Character Animation

Research

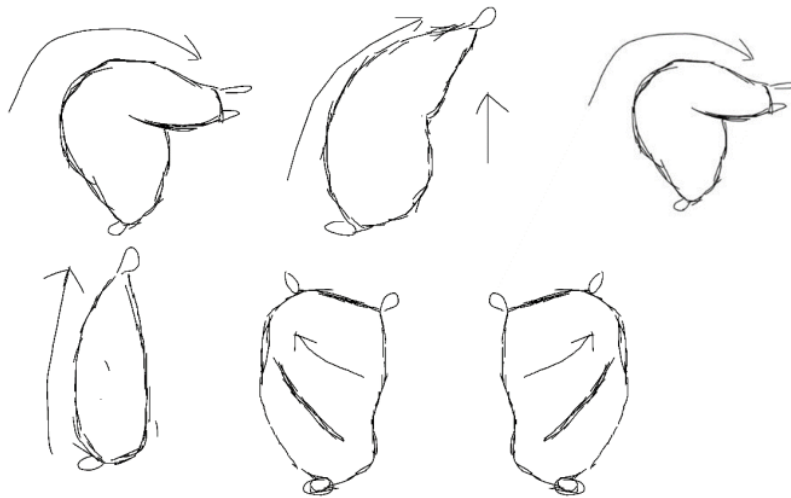
Starting this project, I realised I needed to analyse and conduct a series of sequences using keyframes in Maya animation. Unfortunately for myself I did not know exactly what I wanted to do. Realising that I needed to bring inanimate object to life I thought what better way to start my research then go back to the 1900s using a flour sack. In the 1930s the flour sack has been a stamp in the animation industry and acted as an icon. This is because animators were able to practise weight and pose with expression using a flour sack. It was simple yet effective and you could then truly master animating anything. It states in an article from animator island 'the flour sack is simple to learn but takes a lifetime to master. Truly the simplicity of a flour sack doesn't allow an animator to hide behind anything' (Riki, 2011). What this means is that there's no complicated expressions to allow the viewer to be blindsided by a shabby animation or some possible incorrect timings within the animation. Therefore, this animation needs to be clean and crisp otherwise there will be shaky principles involved and it will be easy for the viewer to point this out. Below is one of the simple design sheets used for one of the 1930s animation for the flour sack.



These started off as a simplistic sketch but had so much more meaning behind it. For example, from stationary position there would be weight distribution for the flour sack leaning and a 'spring' for when it's jumping or being squished. This is a step up from the bouncing ball method which gives the inanimate object life. The flour sack ends can be symbolic to limbs such as arms and legs which gives me another avenue to go down which can provide more life for the object. It can possibly grab things, walk, run, or even climb surfaces. Here is another example from the article below providing exactly this.



I conducted a little experiment myself using Photoshop to create my own storyboard of animation and began the starting sequence towards it. I took reference from animation island as it is not only a trusted source but a very reliable one as well. Using the diagram above I was able to successfully create the six keyframes to start off my animation using Maya. The arrows in the storyboard sketch represent how the joints move on the body motion of the inanimate object. A clever idea which I had taken from this was to use the sacks ends as limbs and use human body language to implement life into this object.



Disney- The 12 Principles of Animation

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Squash and stretch- This technique is considered the most important of the 12 principles it provides your animated characters with the 'illusion of gravity weight mass and flexibility' (Coron, 2021). A good example of this is thinking of a rubber bouncing against the floor. The gravity and the impact together squish the ball which makes the surface area a lot bigger on impact. I will then need to make sure but horizontally the shape is bigger and vertically the shape will be smaller but will contain the same density.

Anticipation- This technique is used to keep the player or viewer on edge and keep them guessing on what about to happen. This can be used to create tension. An example of this would be whether something tips over or not and is teetering towards the edge.

Staging- This technique is related to the artwork. You need to use a visible motion to catch the viewers eye with a non-motion effect on the character. This could be a surprised expression with marks coming off the characters face to show an exaggerated or surprised expression. Remember to keep the focus on what's important within the scene and 'keep the motion of everything else of non-importance to a minimum'(Coron, 2021).

Straight ahead action and pose to pose- These two techniques have their own benefits but often put together the straight-ahead action has one state of drawing frame by frame from the beginning to the end. This creates the fluidity in the animation or movements.

Pose to pose frame is what I'm currently doing whilst animating my project. I start off with the beginning frame and the end frame then select keyframes in the middle. Maya will then autofill the missing frames in which they think is best suit ready for the next keyframe. This saves time but can be dangerous as it may not have the effect you want on the animation.

Follow through and overlap- This action means when an object comes to a standstill after moving. When an object moves, everything moves. It has a different rate/speed which means parts of an object will stop at a different rate. This creates the follow through of when something causes friction against the surface e.g when brakes are applied from underneath bottom of the object, it will stop first, and the top will follow through further than the underneath which can cause something to topple over.

Slow in and slow out- This is basic momentum and acceleration. When something accelerates from a standstill it begins moving slowly and increases in speed when it gains momentum. It will hit its peak and then when slowing down it does the same but reverse. When at maximum speed they will begin slowing down eventually until it comes to a standstill. Therefore, it starts off slow and will end slow giving the phrase a literal term and definition.

Arc- This is related to the earth gravity and accuracy towards the laws of physics. For example, when something is tossed into the air it will hit the peak point of an arc which means it will gain maximum height and then slow down. Once it's hit the pinnacle point, gravity will take over and it will then start to descend gaining speed.

Secondary action- This doesn't apply to me but will involve another object within the animation other than the primary one. An example of this would be a 'character's hair flowing in motion' (Coron, 2021) when walking of primarily is focused on the character itself walking rather than the hair.

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Timing- 'using the correct time and allows you to control the mood and the reaction of your characters and objects' (Coron, 2021).

Exaggeration- Sometimes this technique can be used to put emphasis on movement or action. If the animation can be too boring or bland sometimes animators push the limits toward the characters and what it can do. in this case a good representation of this would be eating with their mouth or even jumping. it makes the animation stand out and pop which draws attention.

Solid Drawing- This is basic knowledge of 3D drawing and must remain consistent.

Appeal- The character or object needs to have a personality towards the animation and simultaneously tell the story you want through the animation itself.

Ongoing practical

Starting this practical project allowed me to venture to certain websites classed as my secondary resources and secondary research to gain free rigs online for me to animate. The website will be linked below long with the creator's name. This rig was almost identical towards the one I first referenced from the 1930s flour sack. This was very practical for me because I can further my animation skills and gain knowledge using such a simplistic object and ensure that there are no mistakes or errors within my work. As mentioned above because it's so simplistic I have no room for

error as it's very visible towards the viewer. It also gives me the opportunity to learn weight distribution through the object and further animations and lead onto much more complex inanimate objects or even distort a Character themselves quoting from the book 'Stop Staring: facial modelling and animation done right' about Elastigirl which is below.

In the book stop staring facial modelling and animation done right John Wiley mentions about 'squash stretch and secondary's' in chapter 13 of his book. This is an excellent example of help in characters or animate objects push its limits within animation. The quote 'we can make characters turn themselves into parachutes (like Elastigirl in the Incredibles) if we want to' (Osipa, 2010) supports this indefinitely. Through many years of animation whether this is through games or film and TV animators have pushed the physical limits and it's shown clearly. Providing a few examples off the Incredibles, Aladdin with the magic carpet and even bringing a beast to life from beauty and the beast.



This relates back to the actual rig I will be animating. I was torn between 2 pieces of rig. This was the juice box and the original flour sack. Unfortunately, due to complications with the juice box I was unable to re scale, move or rotate any of the joints and I was unable to fix it. I looked at different tutorials online suggesting for me to use a locator in the rigging part of Maya but could not rotate the joints after putting everything in the locator. On the other hand, I was able to move and re scale but it's not what I needed.

After beginning this project and opening the scene in Maya, I realised instantly an error message popped up showing there were unknown nodes within this project folder from the flour sack. From research I can tell you but there are many different types of nodes.

Types of Nodes:

Shape nodes- 'Holds an objects geometry attributes other than the objects transform node attributes' (Help, 2019). It is the child of a transform mode, and a transform node has only one shaped node.

Auxiliary nodes- A variety of nodes which are hidden to reduce the clutter and editors in Maya. They are not normally useful to me by seeing or editing it but I need to show but I can present these nodes if I want to reduce further clutter.

Controller Nodes- I cannot manipulate controller nodes and a controller node can be any type of object such as 'a mesh, joint, user defined shape or transform' (Help, 2019). This one applies to me as I'm using an existing rig, but I can use a controller node to transfer new feature which can support the old controller. This gives me full control of the mesh, so I can animate it.

Hidden Nodes- These are very relevant towards any object which is hidden you can use display>hide in which Maya will hide the default cameras such as top, front, side, and perspective.

Underworld Nodes- These types of nodes come in a pair which is below a shape node. Maya will create an underworld transform mode when you develop a curve on surface. Underworld nodes have positions which has UV coordinates on the surface rather than the coordinates in the local space.

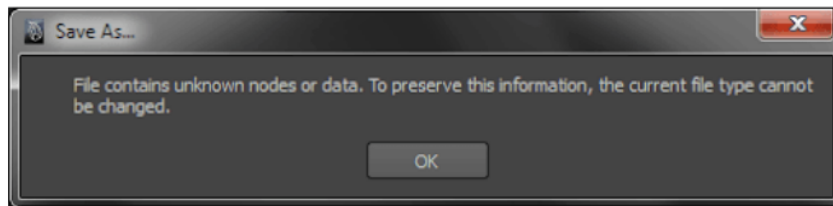
Rendering Nodes- Materials or textures which are applied to an object in Maya have nodes which has attributes that can control the way they look. For example, applying a texture has a placement node which controls how it is fitted to a surface or face.

Asset Nodes- These types of nodes can assemble multiple nodes together for a special purpose and can also simplify the nodes related to a certain rig within the Maya scene. I can create these and modify these using the hyper graphs edit menu or the toolbar.

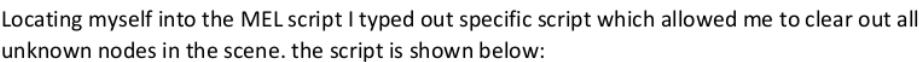
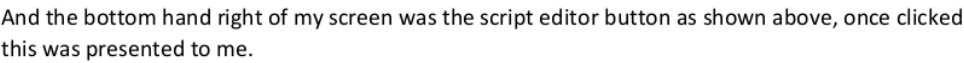
Utility Nodes- These provide extra functions I can use for a character rig such as multiplying or dividing nodes to alter inputs and outputs between others. This is very useful to reduce clutter and keep my workspace neat.

Script Nodes- This is a way of storing an MEL file script. This is the node which I used to help me recover full access and control over the rig and scene itself.

Using the script mode enabled me to delete any unknown nodes within the scene and I can use this to execute its payload within a response to various events such as before or after rendering a frame or animation.



This is the message shown when I tried to save or change anything within the Maya scene once loaded. After certain keyframes I tried to include and save as much as I can to prevent the loss of work, but this would always show up. This means the unknown nodes are preventing Maya from converting this scene into an ASCII file. It may be created by a plugin that is not supported by the operating system or it's a third party plug that is not loaded in the scene. An example of this would be a scene opened which contains a vector render global node which is only supported by the 32-bit versions and unrecognised in the 64-bit installation of Maya. To resolve this, I ended up going into the script and deleting the unknown nodes.

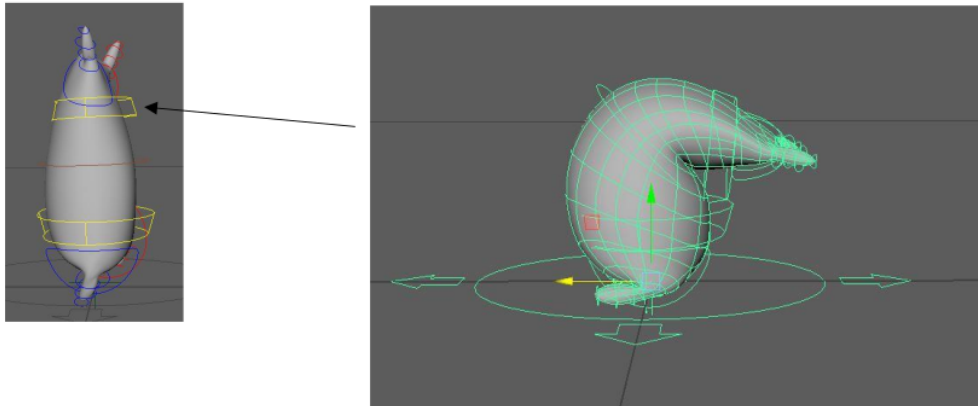


```
{
    string $unknownNodes[] = `lsType unknown`;
    for($node in $unknownNodes){
        if($node=="<done>")
            break;
        if(`objExists $node`)
        {
            int $lockState[] = `lockNode -q -l $node`;
            if($lockState[0]==1)
                lockNode -l off $node;
            delete $node;
        }
    }
}
```

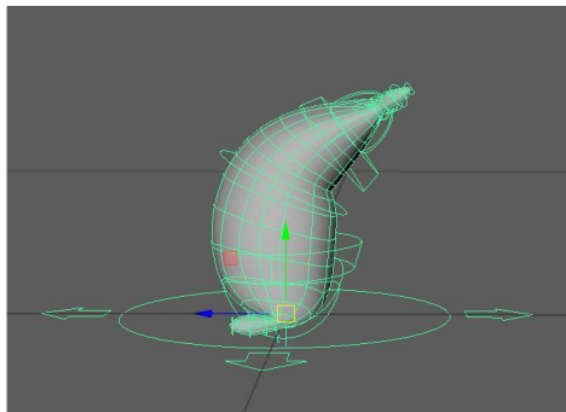
Once I hit the enter on the keyboard it runs the script. On top of this I went into my outliner display unticked DAG objects only. I then selected the unknown node shown in the outliner and manually deleted it from the scene. Once this was complete, I was able to gain full access to the rig again and then save it off as my own file. This would be an essential skill to learn within the gaming industry relating to professionalism as it can help prevent further problems in future projects and the current project they're working on. This is because there could be issues related the rig or scene itself. if they have the updated version of Maya which is the 64 bits, they may encounter this problem due to an outdated rig.

Process of the key Frames

Using the storyboard, I completed in Photoshop as reference I was able to complete the starting pose very easily using the rotation of one joint. After rotating this on its Axis I was able to then focus on the legs and feet at the bottom of the model. I began to rotate the legs and feet behind the object which gave the stance of kneeling whilst being hunched over. I wanted to replicate that the object began stationary and lifeless and then with a spark of light was given life. To do this I needed to ensure it came from a 'state of sleeping' or which looked similar. As if the flour sack just arose/ woke up from a sleeping position.

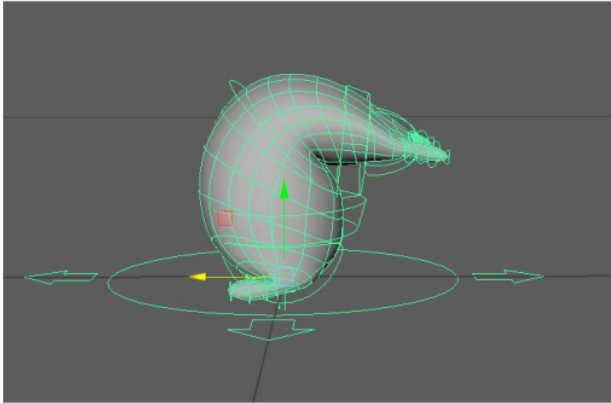


Having that crease in the flour sack symbolises the 'floppiness' in the limbs of the object suggesting it's unconscious or sleeping. Another symbol would be the legs and knees bent touching the floor causing a hunched or top-heavy stance.



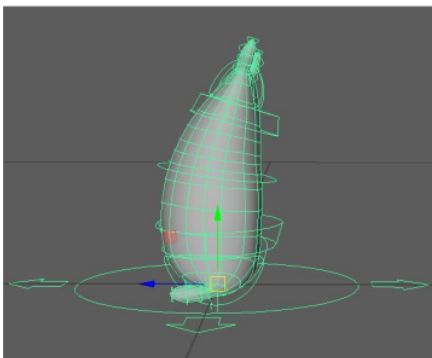
This is the second keyframe in my animation. I used 40 frames in between to show that the object is just now gaining consciousness and slowly awakening. this is accurate towards the human body as the body needs time to adjust from when being in a subconscious state such as sleeping. I continued to use the same joint to move this as it represents the head movement and upper body movement

of the character. This would be useful in animation to provide an accurate outlook on movement towards a character.

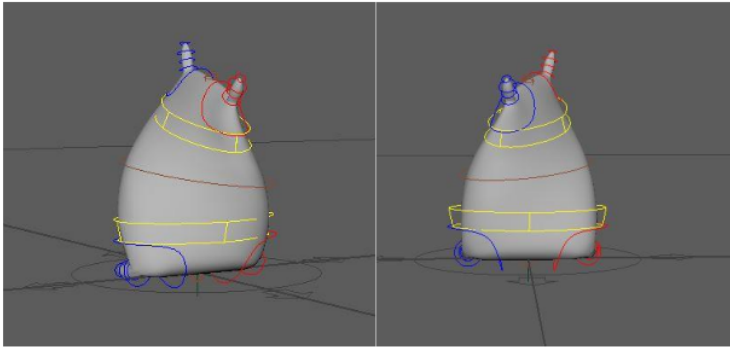


I copied and pasted the first keyframe to frame 80 to turn to the original position of subconscious state to again resemble the awakening of the character. This was much easier to do as I can retain the position, axis and rotation up the joints and model itself. All I need to do is right click- copy and then paste it onto the set keyframe I wanted. This saved a lot of time.

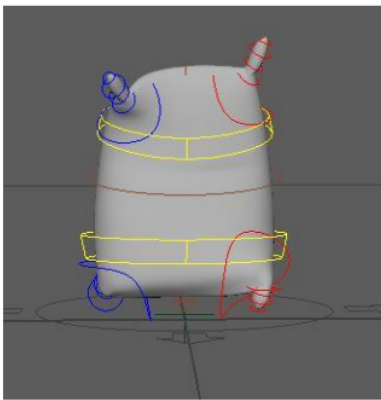
Whatever distance is between frames means that the auto fill animation will get the model the next set keyframe much quicker if it's a shorter distance. Therefore, from 80-90 frames would be a much quicker transition than from 80-150 frames.



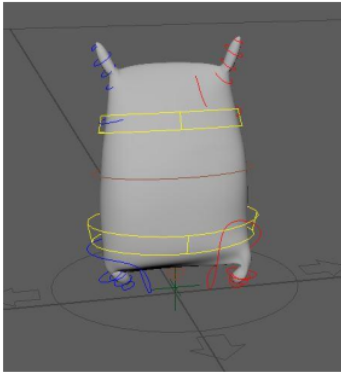
The feet and legs are still in the same position as Keyframe 1 meaning the object is still adapting to the surroundings. The limbs haven't started functioning yet. The eyesight is the first thing that you are aware of once in a conscious state. When a human wakes, they check their surrounding to see if there is any danger and check they are in the location they were before heading into the subconscious state.



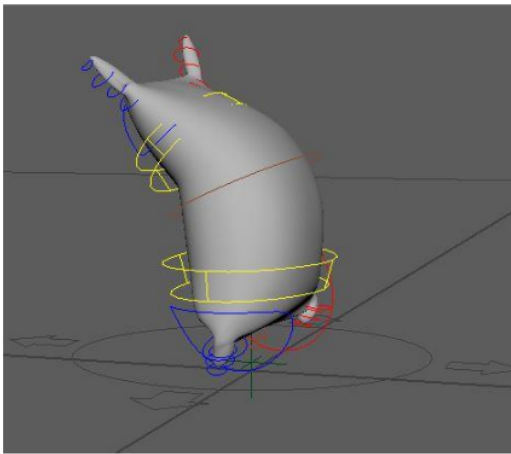
These next key frames shows that the object is looking to their left and right. After gaining full consciousness and realising they have been given life they check their surroundings completely to discover where they are as they are discombobulated. I repeated this for both sides and just copied and pasted the same rotation for both but changed one into the minus rotation to have the same effect just on the other side.



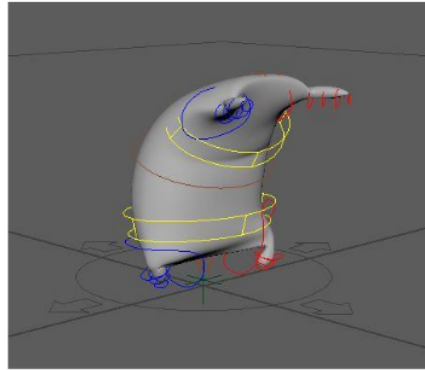
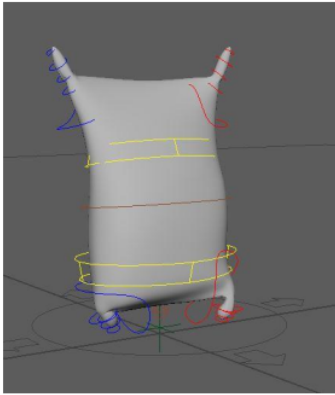
After returning into the stance where they are looking forwards, by copying and pasting the key frame once again. I began to animate them trying to stand up using the lower joints of the body. To do this I rotated the feet and moved the upper leg joint forward whilst lifting the characters whole rig up ever so slightly to gain height proving they have stood up. I bent the opposite arm forward towards the feet to counter act the weight distribution of the body whilst getting up. I repeated this for both legs.



The next set of frames relates towards the human bodily functions yet again. This time I have implemented a stretch animation. A common action for humans to do when they have woken up is to stretch their limbs such as their arms or sometimes stretch and click their back. Using the most common joint I have figured out I rotated it into the negative values bending this the other way. This gives clarification it went from bend over forwards and slumped to a climax stretch.



On top of this I raised one of the characters legs a when stretching people's limbs can move without our bodies telling them too. This causes unbalance from the use of one foot meaning the weight is distributed onto one leg causing a tilt in the body. Whilst still focusing upon the stretching element of limbs I distorted the rig by moving the joints manually with the move tool. By creating distortion, I have implemented the research provided above containing 'Elastigirl' by using Exaggeration in Disney's 12 principles of animation.



Video on Youtube:

<https://youtu.be/OC3Qvg3ohqA>

Bibliography

⁹ Riki, J., 2011. *Animation Secret: The Flour Sack*. [online] Animator Island². Available at: <<https://www.animatorisland.com/hello-world/>> [Accessed 6 December 2021].

Coron, T., 2021. *Understand Disney's 12 principles of animation*. [online] Creative Bloq. Available at: <<https://www.creativebloq.com/advice/understand-the-12-principles-of-animation>> [Accessed 6 December 2021].

¹⁰ Osipa, J., 2010. *Perlego eReader*. [online] Ereader.perlego.com. Available at: <<https://ereader.perlego.com/1/book/1007257/0>> [Accessed 6 December 2021].

⁴ Help, A., 2019. *Node types | Maya 2019 | Autodesk Knowledge Network*. [online] Knowledge.autodesk.com. Available at: <<https://knowledge.autodesk.com/support/maya/learn-explore/caas/CloudHelp/cloudhelp/2019/ENU/Maya-Basics/files/GUID-21B83FF0-0435-4087-8C2E-23B420028B71-htm.html#GUID-21B83FF0-0435-4087-8C2E-23B420028B71>> [Accessed 7 December 2021].

Support¹¹, A., 2019. *"File contains unknown nodes or data" when saving a Maya scene in ASCII (.ma) format | Maya | Autodesk Knowledge Network*. [online] Knowledge.autodesk.com. Available at: <<https://knowledge.autodesk.com/support/maya/troubleshooting/caas/sfdcarticles/sfdcarticles/Unable-to-Save-Scene-as-MA-file-or-Maya-crashes-when-saving-as-MB-file.html>> [Accessed 7 December 2021].

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