

Personal Inquiry Proposal.

Name: James Morgan

Course: MA3D Animation

Subject: Creating simple muscle solutions for game and animation in XSI.

Brief Explanation: I plan to investigate a practical and simple pipeline for simulating muscles in XSI for animation and game assets. By researching these techniques I hope to gain a better understanding of how these modelling and texturing tools work which will then improve my working practice.

Research Method: I plan to research existing literature on the subject and conducting tests in the lab.

Anticipated Presentation Method: Poster.

In the film industry and high budget projects a lot of time, resources and money would be invested in constructing complex rigs with layered muscle simulations that deform muscles and subsequently the skin of a character or creature. This makes the characters become more realistic because of this constant shifting and changing of skin and muscles when driven by the rig\skeleton. These techniques are predominately used in layers with a base skeleton created which is then overlaid with skeletal muscles where the skin is overlaid as described in Siggraph paper (Parent 1997) as shown in Fig 11. They test many areas of these theories in their paper and find the arm area because of its complexity a good area to test their skeleton and muscle tests. In this poster I will take this area too but try and only use out of the box techniques found in Softimage XSI to achieve a similar result. For students and smaller companies these expensive rig setups are sometimes unattainable due to time constraints and funding.

Using textures and expressions on my simple model and rig setup I hope to create a believable final result using a simple setup which is artist friendly.

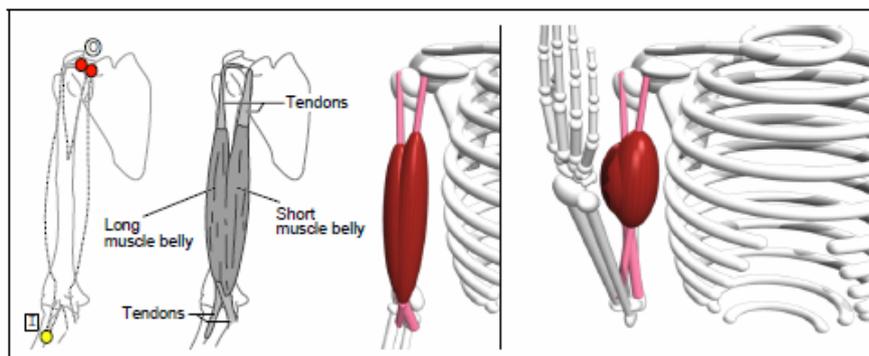


Figure 11: Front view of the biceps brachii and its behavior when the forearm is flexed at the elbow joint.

1997. Page 7, Anatomy-Based Modelling of the Human Musculature Siggraph 1997 Conference paper.

Step 1 Get the correct reference

I intend to focus on the arm of a character so need to get appropriate reference, while there are lots of art books with fantasy characters with defined muscles such as Anatomy for the Fantasy Artists (Fabry 2005) which is great for comics but is a little over emphasized. I will use a great study Fig.1 Giraud, D. Deviantart. 2010 Available from: <http://accad.osu.edu/~smay/Human/human.pdf>. Ideally you would photograph a real subject.

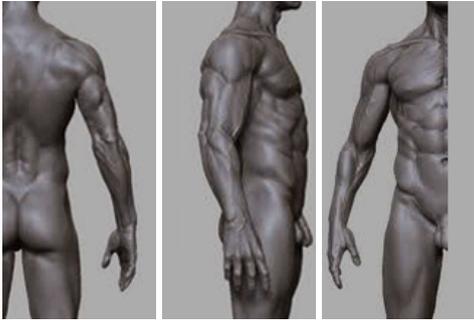


Fig.1

I first line up all the images using the guides and rulers in Photoshop and then crop them into three separate image files named front side and back respectively. I next create a new scene in XSI and use the rota scope function to show all the images in their respective viewports.

Block out arm box modelling then continue to subdivide following muscles to add for using smooth

Step 2 Start to block out the basic shape or the arm

Block out the basic shape of the arm by creating a primitive cube selecting the bottom face carefully watching all of the viewports as you move down the arm and also rotating with the bends in the arm. Once the overall shape is created you will next add extra edges to describe the flow of the muscles you can subdivide the polygons at this stage and use the proportional modelling tool to move multiple points to give your models muscles a more natural feel (Fig.2).

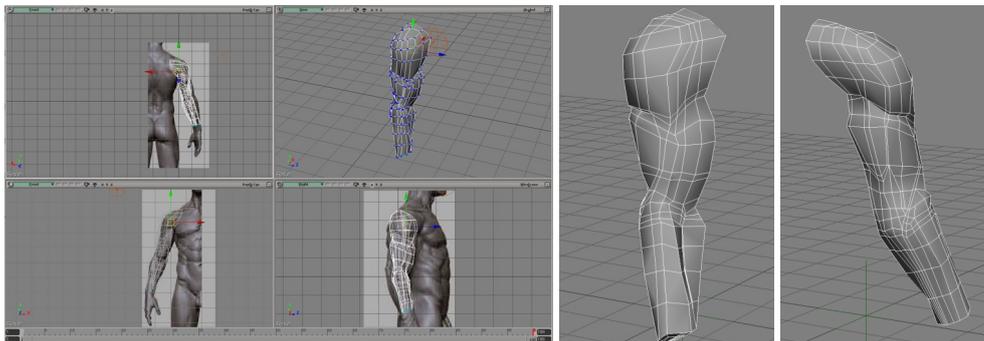


Fig.2

I next checked mesh for any five or three sided faces and converted them into quads. Remember to freeze the object. Finally create a new model null and parent it beneath.

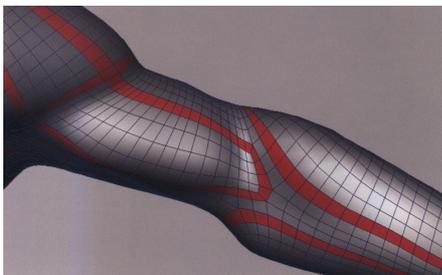


Fig 3 2008.P59 Autodesk Maya Techniques,

Splitting polygons

As Thuriot et al 2008 Explains it is important that your topology of your mesh flows correctly. They describe a great technique of drawing curves over the muscle reference and then using this as a guide. Also colouring the faces in Xsi with a cluster and assigning a different colour you can clearly see the edge flow shown in fig 3.

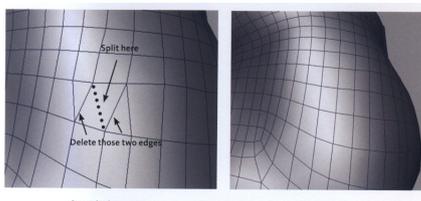
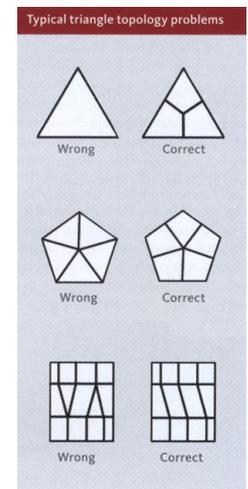
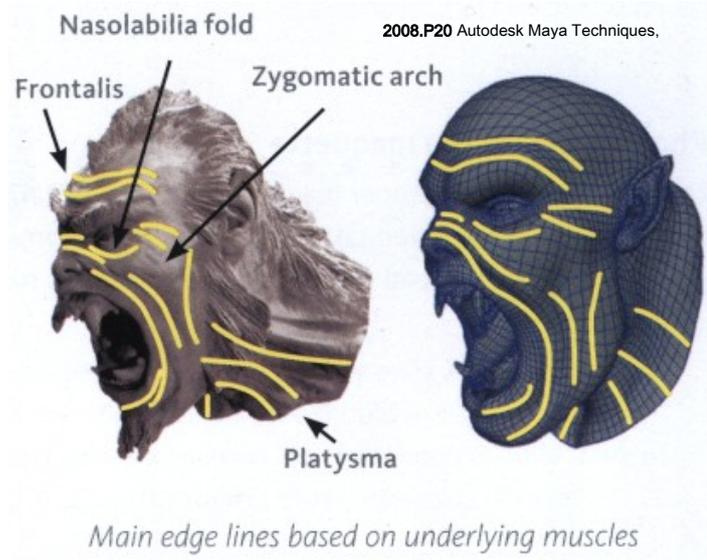


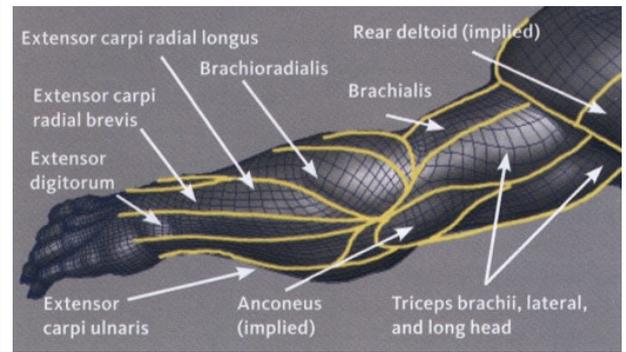
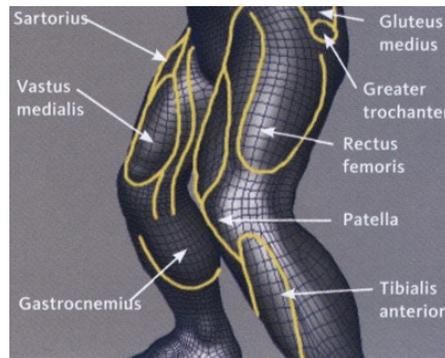
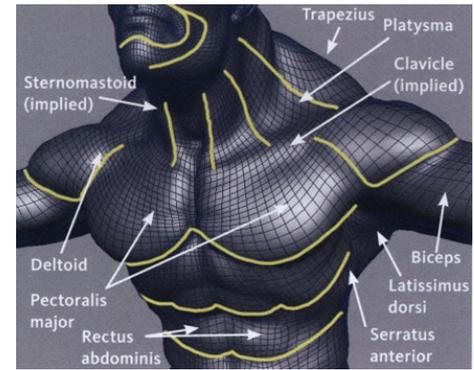
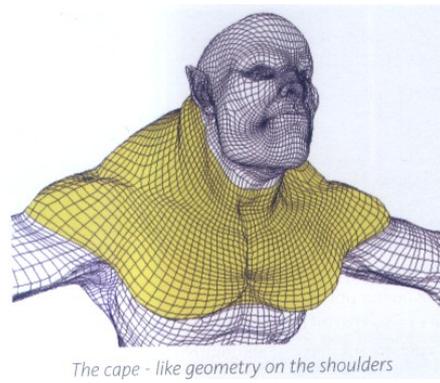
Fig 4 2008.P69 Autodesk Maya Techniques,

Also they highlight a technique by bringing areas or sections that contain areas with triangles together then removing the edges as illustrated and connecting with an edge in between you can create a better flow shown in fig 4.

Here in the images to the right taken from Autodesk Maya Techniques (Miller 2008) describes edge flow topology and the correct techniques of avoiding triangle topology problems

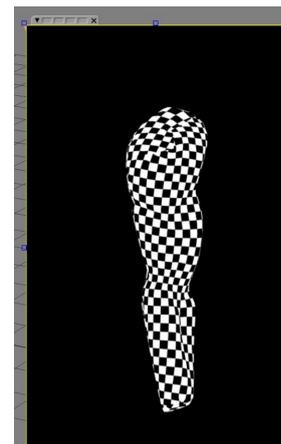
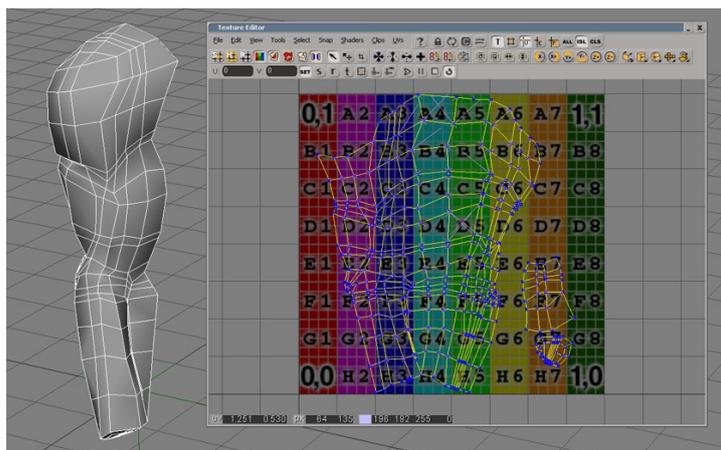


2008.P20-24 Autodesk Maya Techniques,



Step 3 Next time to unwrap

I next unwrapped the model using the very convenient texture projection called unfold tool by selecting edges to create seams and then unfolding a arranging the UV's in the texture editor. Next apply a checkerboard shader to check that the texture resolution is even over the arm. Again freeze the UV's



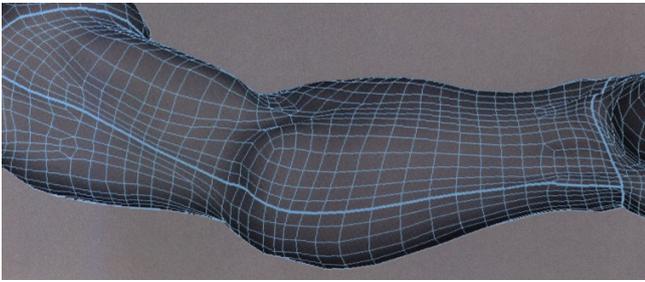
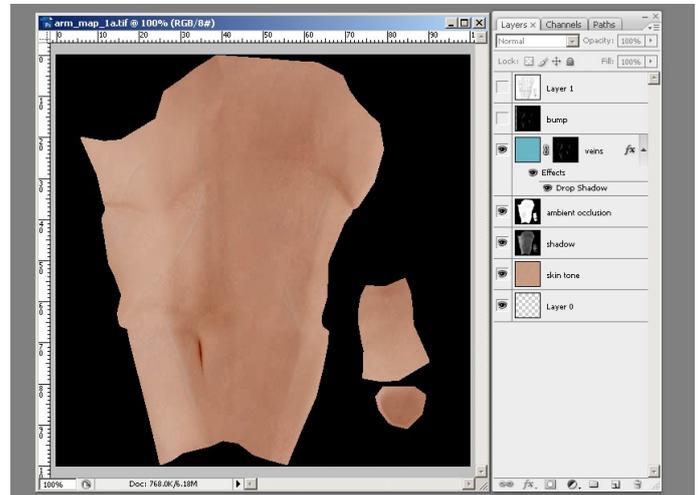
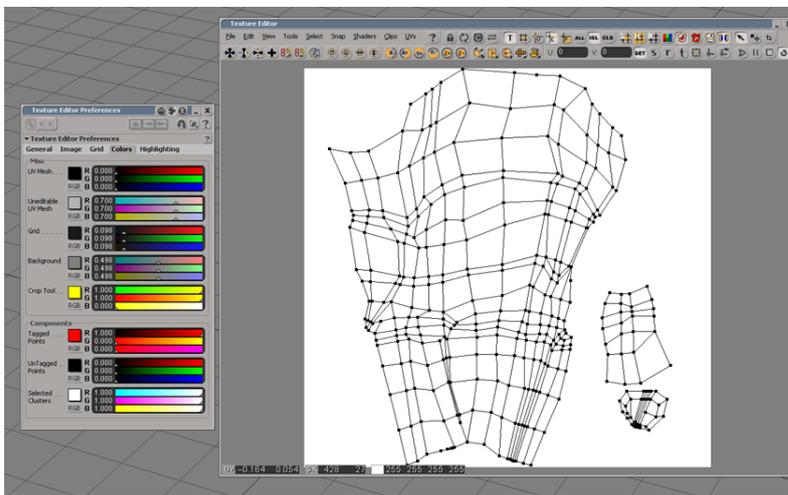


Fig 5 2008.P77 Autodesk Maya Techniques,

As Miller (2008) points out when unwrapping the Uvs it is best to hide seams when doing an unfold in areas at joints and under armpits the bottom of the feet the groin etc shown in fig 5.

Step 4 Time to use render map and render out the wire frame to create a texture in Photoshop

First create a simple light in the scene or a 3 point light setup, I have use a dome light solution that I created for my scripting assignment. Next in Rendermap I rendered off a shadowmap and ambient occlusion map at 512x512 texture with all shadows on and Ambient off. Also in the texture editor you can render your wireframe off and you can change the wire frame colours in preferences to black you can import a white image tiff to place in the background and press e to see the edges. You can print screen this or use the stamp mesh option in the texture editor.



I first downloaded a skin texture from Free Photoshop Textures. Available from :www.tattoodesignsreviewed.com/ then placed my shadow over that as soft light then added the ambient occlusion map as a colour burn. Next I drew a vein mask and created the vein blue colour and applied the mask to it. I also copied this mask into a new layer called bump. I then saved out the bump map on its own then hid the bump flattened the image and saved the texture map. I also added a tattoo from Tattoo designs reviewed. Available from :www.tattoodesignsreviewed.com/



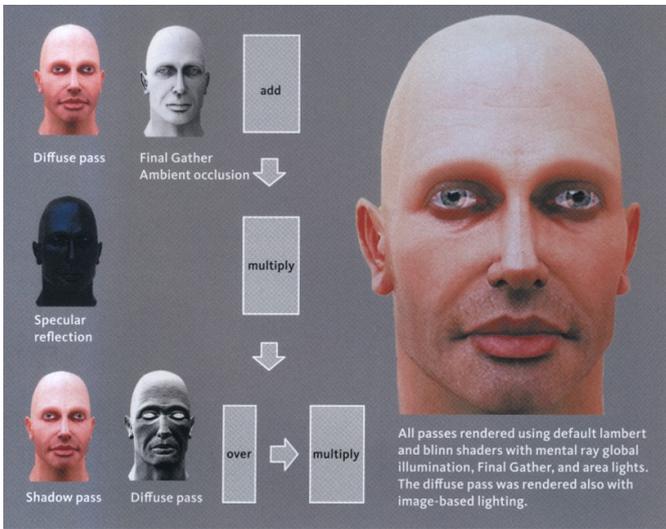
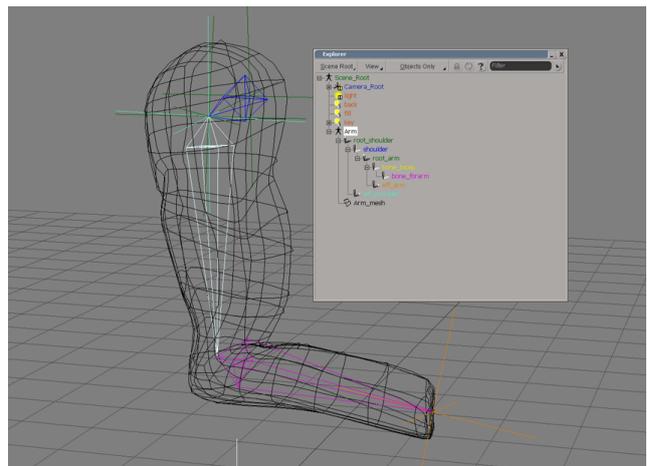
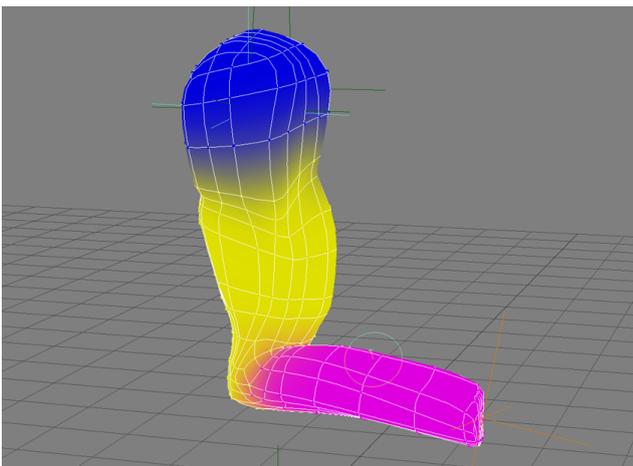


Fig 6 2008.P236 Autodesk Maya Techniques,

Although not used in my example Miller (2008) describes the concepts of faking an effective skin shader using mental ray renderer. First you will need to create a good colour and bump map with little to no specular with the colour map containing natural hues. The diffuse render is to be rendered with mental ray or similar renderer with a group of area lights that have high diffuse values. Then use a light with a light blue/green hue for the specular channel. The specular channel was then occluded in comp using the ambient occlusion and final gathering pass. To finish the final look of the layer the diffuse pass with no bump with the specular with a large bump. The ambient occlusion pass and the final gathering render are used more like specular occlusion see Fig 6.

Step 5 Rigging and enveloping

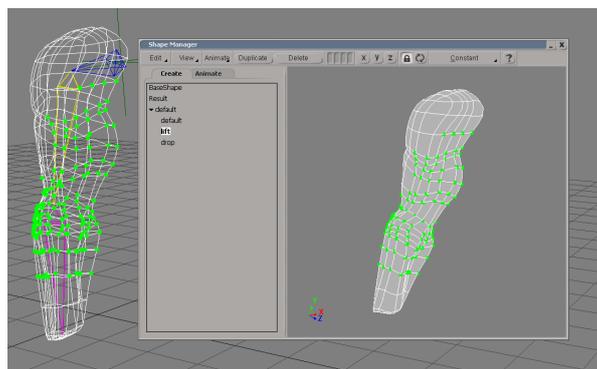
I created a simple IK bone setup for the rotations of the arm and enveloped it which has been an ongoing process throughout the project but initial just paint the rough areas of influence of the envelopes as when the blend shapes are added it will need to be tweaked to correct the shapes.



Step 6 Blend shapes

I next opened shape manager in XSI and renamed the initial default shape to rest then duplicated it twice one named them lift and another drop. Then using reference from here YouTube.2008. Fitnesssolution Channel.

Available from :www.youtube.com/watch?v=kC4xi4-fZ1o



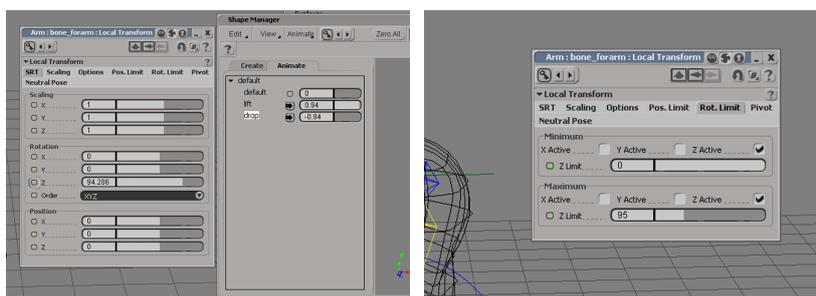
Next I used blend shapes that were introduced to me in one of [Safronius lesson tutorials](#) on blend shapes and then introduced my own expression. Press control K to bring up the rotation properties of the forearm bone and click and drag from the green node to the first blend shape lift and modify the expression to say:

`Arm.bone_forearm.kine.local.rotz/100`

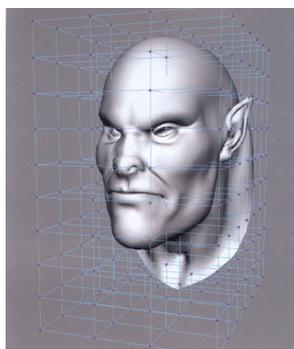
This divide function is used to bring the values lower as the mesh was exploding with the default value. Repeat the step again dragging the z node to the drop blend shape parameter and change the expression to this to reverse the slider and take in the negative value to do the back swing movement.

`Arm.bone_forearm.kine.local.rotz/100*-1`

The *-1 is a great function used to reverse values this could be used to alternate two or more sliders for interesting effect.



Finally Set up rotational limits in z to min 0 and maximum 95 for the forearm bone this isn't a rule but the limits that you want your characters joint to move or restriction of movement you want for a particular shot.



As Miller (2008) shows in his book to create more realism in your character you can add a corrective Lattice to give your blend shapes more realistic shapes and a second layer of control see fig 6.

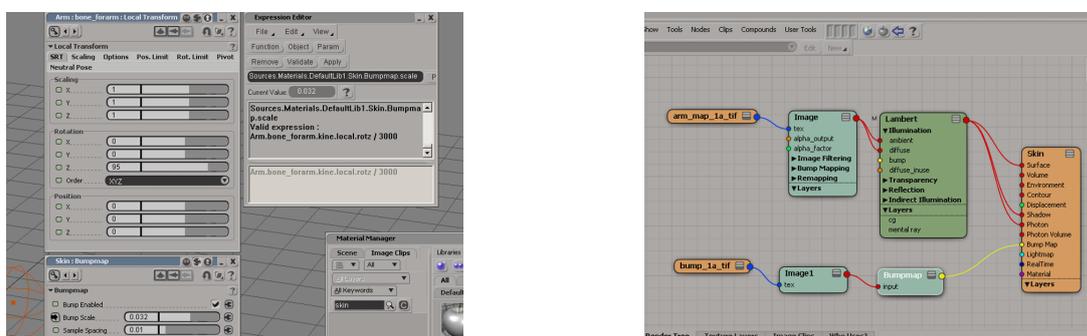
Fig 6 2008.P236 Autodesk Maya Techniques,

Step 6 linking the rotation of the forearm to the bump vein map with an expression

I then also created another similar expression to control the bump map by dragging the z parameter green button onto the bump scale of the bump map node in the material editor entering this into the expression editor:

`Arm.bone_forearm.kine.local.rotz/4000`

This will link the rotation in the z axis to the level of bump applied this could also be used for displacements at render time.



Step 7 animation and render

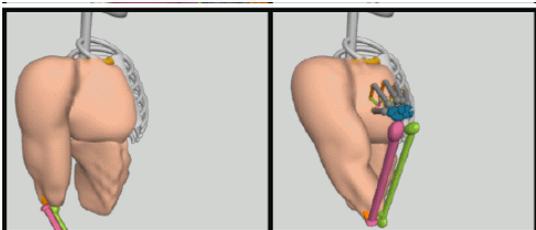
Finally I rendered a short animation to test the movements and expressions effect. I keyed the main poses then offset the movements from the shoulder down to the forearm by one key. Please view the final movie file loop Personal enquiry

Finel_render Arm_flex

Conclusion and where to go further

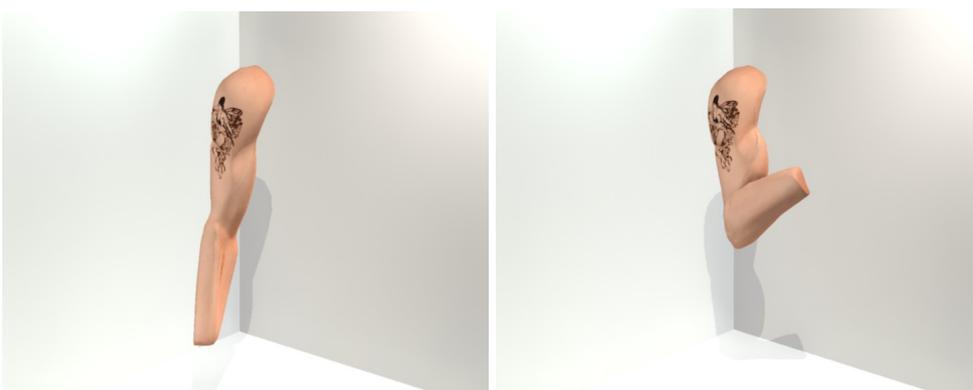
Using simple out of the box techniques you can achieve a good solution for creating realistic muscles which could then be exported to individual meshes for use in a game engine as well as simple low res bump maps to achieve muscle definition and vein detail. I think this technique could be expanded on with for example adding muscle sinew skin colour or material changes such as a characters arm losing colour like lack of blood to a particular areas such as the knuckles. I think further investigation and tests could be done for the twist movements of the arm with separate bump maps relating to the separate bulging muscles. I think it would be great to add more definition to the muscles in the bump map highlighting the change of the muscles state from relaxed to tensed. The material or pattern could change on a piece or geometry such as a characters arm could turn to stone as he raises his arms or could be used in even more abstract ways like animated motion graphics controlled with this type of expression to change it's shader or material. More blend shapes could be created and even be used as offset animation after the arm has been added to give a loose skin effect or fat on the arm. I think this process has been fun and rewarding also being something I could easily implement into my future work.

By studying anatomy reference and creating a convincing silhouette and suitable movement I believe this technique of creating the correct topology accurate blend shapes with corrective lattices can be just as convincing as high end simulations. Then creating realistic textures and then adding a good sub surface scattering shader not used in my example but an area of further investigation. I don't think this technique would replace the techniques used in high end simulations (Parent 1997) as shown in Fig 19 but for smaller projects and where the character isn't in close up it is an interesting area for further investi-



1997. Page 7, Anatomy-Based Modelling of the Human Musculature Siggraph 1997 Conference paper.

Figure 19: Application of a skin and fatty tissue model to muscles of the upper arm and torso.



Images taken from my final test render

Finel_render Arm_flex

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2010. Deviantart.
Unknown author Deviantart.
http://mojette.deviantart.com/gallery/#_featured--2

Tattoo designs reviewed.

Unknown author.
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www.tattoodesignsreviewed.com/

Free Photoshop Textures.

Unknown author.
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www.photoshoptextures.com/human-textures/human-textures.htm

Software used for production:

Autodesk, 2010. Softimage XSI (2010)
Adobe, unknown date, Photoshop (CS3)
Adobe, Unknown date, Premier (CS3)
Microsoft Office, 2006, Microsoft Publisher Microsoft Corporation.