

## Real Time Character Modelling Tutorial

Below is a short tutorial showing the method I use when modelling a real time character. This approach can also be adopted when creating subdivision surface models. I hope some of you find it informative and useful.

Thanks to Donald McDade I now have a version of this tutorial in .pdf format for you to download and keep. You can download it here, just right click on the link and select "Save Target As".

A summary of the key points that this tutorial will cover -

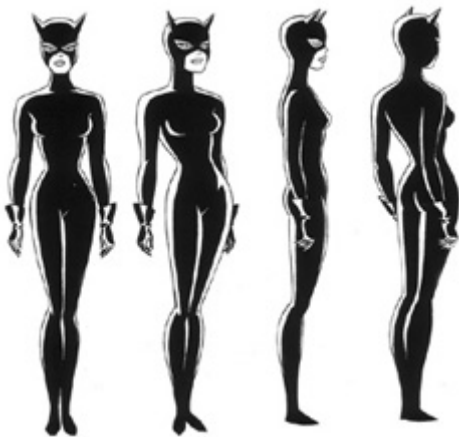
- Start with good reference material and use as much as you can.
- Using your reference as an image plane, block out the rough shape of the character using cylinders.
- When adding finer details make sure to follow the muscle lines strictly.
- You must end up with a nice clean model, symmetrical where possible.
- Try and keep to a grid system, this will give you a neat model to work with, and result in better deformation.
- Do not put polygons where they are not needed, even if this is a high-resolution model.
- Check the edges on your character thoroughly. Make sure they are flipped the correct way, what you need to avoid is faces collapsing in onto each other when the model is animated.
- Adjust the character to its final binding pose.

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### Reference Material

The most important thing you should do before any modelling happens is stock up on your reference materials. This could be scanned, drawn, grabbed from a video, DVD or anything just make sure you have lots of it. Ideally you should have turn a rounds of the character, if these don't exist then use the rest of the images you have collected to generate your own. The ideal turn a round should contain a front view, side view (left & right if possible), rear view and a three quarter view. You should have both full body and a head close up. As well as these you should also have a decent facial expression sheet, showing as many emotions as possible, not only will this be useful when modelling the head but it will give the animator a good guide to work from when generating facial blend shapes.



Example Model Sheet



Example Facial Expression Sheet

As well as your basic character sheets you should ideally have a colour sheet too. This will be used later when you start to texture your model.

**Note -** It is really important that you have this reference material. You may as well be modelling with your eyes closed if you don't use anything to base your model on.

Trying to model without preparation will result in you having to tweak the final mesh for weeks on end until you or your lead are happy with it. At the very least you should have something scanned in and used as an image plane to get the proportions correct.

## Starting Out

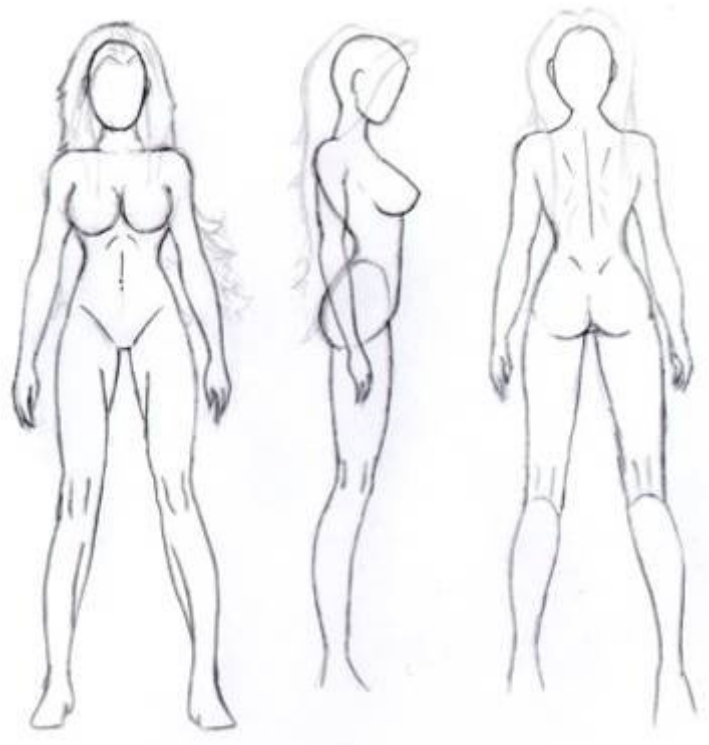
Before starting to build your character you should first make sure you have your turn around scanned in and at the ready. The front and side view should be imported into Maya and used as image planes to guide you.

You should also find out as much about the character as possible -

- Is it an in game model or will it be used in pre-rendered cut scenes?
- You will need a rough polygon count limit.
- Finger amount. Will it have full fingers or a mitten type hand with no fingers?
- Facial detail, will the characters face need to animate to show emotions and talk?

Another point to consider is how many levels of detail are required. If I am to generate a character, which has four levels of detail, I find the best way to work is to model the highest version first. Once this is done you can then generate the lower versions from this simply by removing polygons, it is allot easier to remove polygons and detail from a character than it is to add them. Also working in this order assures you that the lower Lod's (levels of detail) will match the highest perfectly.

To aid with this guide I will model a character myself and show you the process step by step. I have decided on a character I am to produce so I have spent some time gathering various pieces of reference material. I could not find a suitable model sheet so I have drawn out a rough one myself, I shall use this to generate the general shape and proportions of the model.



**My Rough Turn Around**

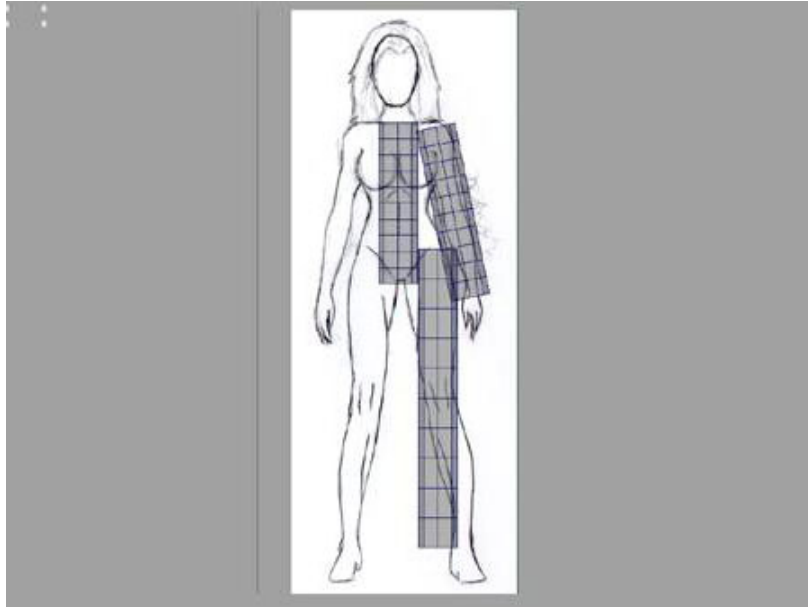
## General Shape

Now you can start to build the character but don't rush in and try to build it a bit at a time, try to fill out the whole shape first as this will help you to get the proportions correct.

### Limbs and Torso

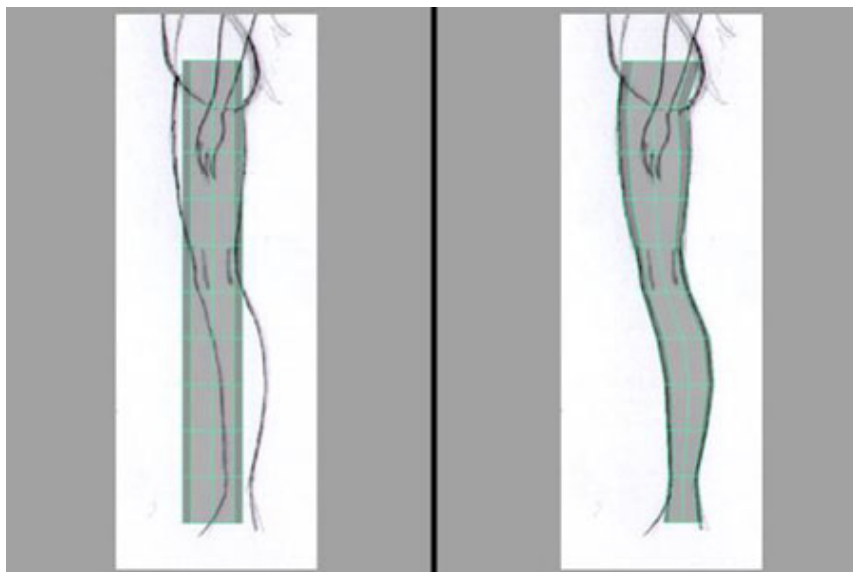
Start by creating three cylinders. Set the height to 8, subdivision axis to 8 and the subdivision height to 10, (this can differ depending on the poly count restrictions on the character, although it is easier to remove polygons later than to try and add them.)

Rotate, translate and scale the cylinders to position them in the correct place corresponding to the left leg, left arm and torso but try to keep a row of vertices lying on the elbow and knee. We only need to model one half of the body as it can be mirrored later to produce the right hand side.

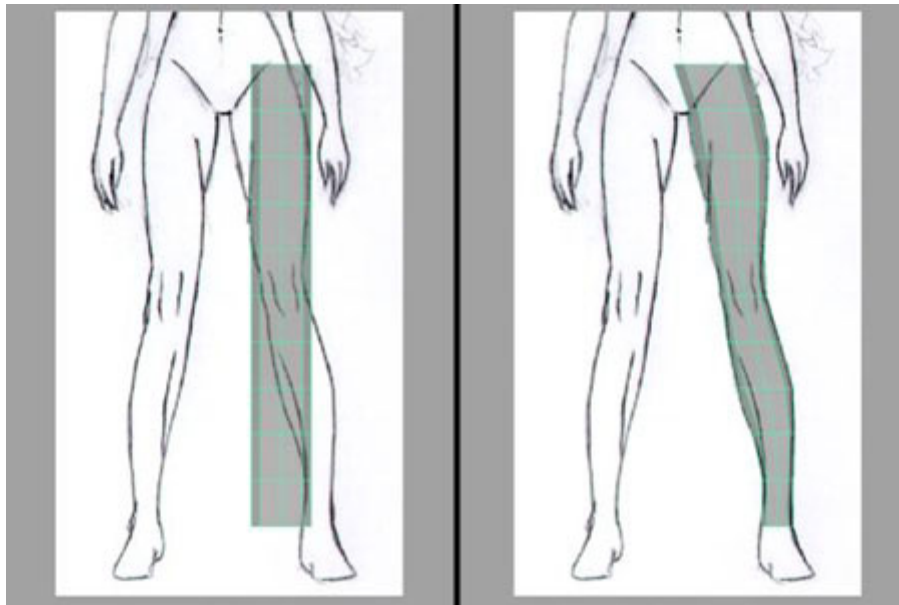


**Note –** It will make scaling the vertices easier if you do not freeze the transforms on the cylinders!

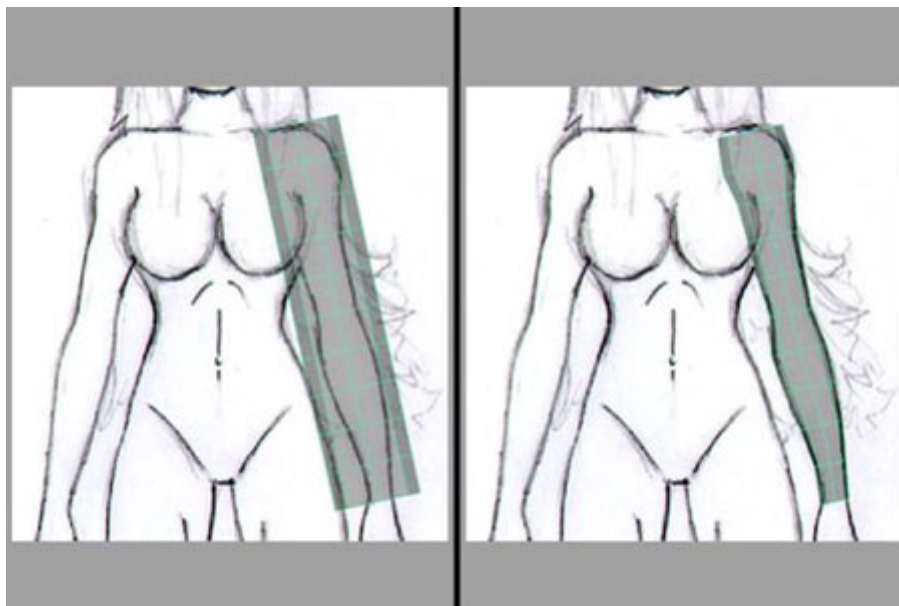
Using these cylinders, and keeping them as quads, view from the side and scale/move the vertices horizontally until the shape of the cylinder roughly fits the leg in the image plane.



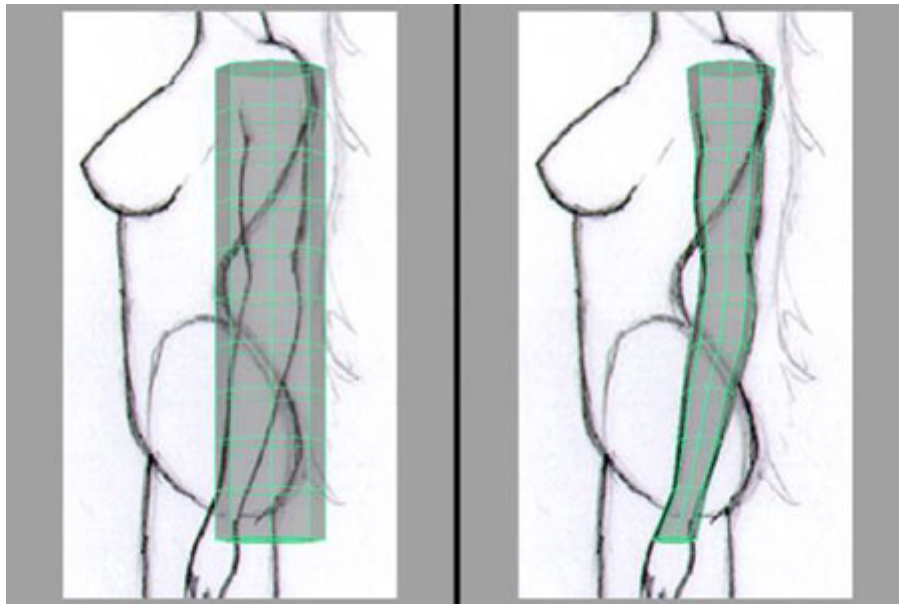
Next switch to the front view and do the same, adjusting them to fit the general shape.



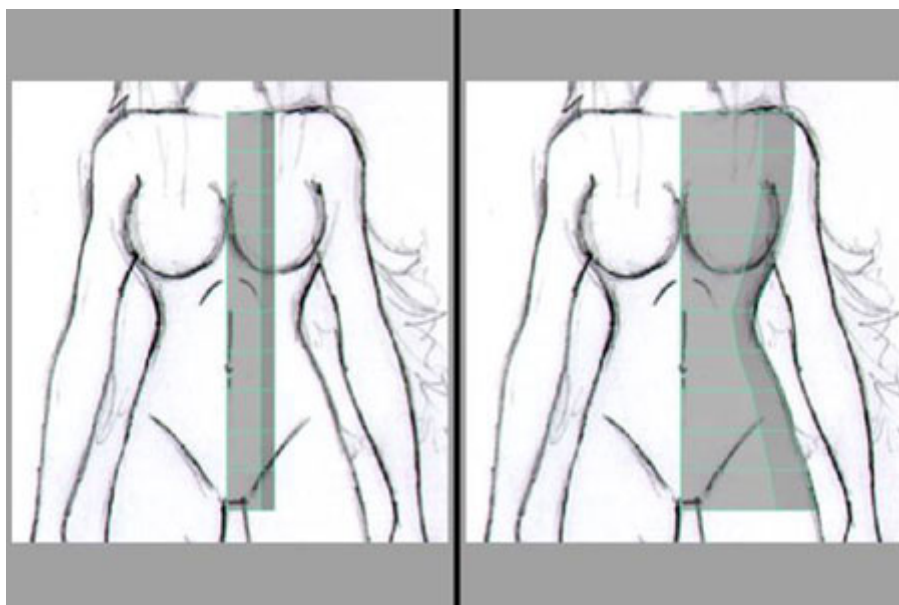
For the arm look from the front and scale the vertices to fit the shape of the reference image.

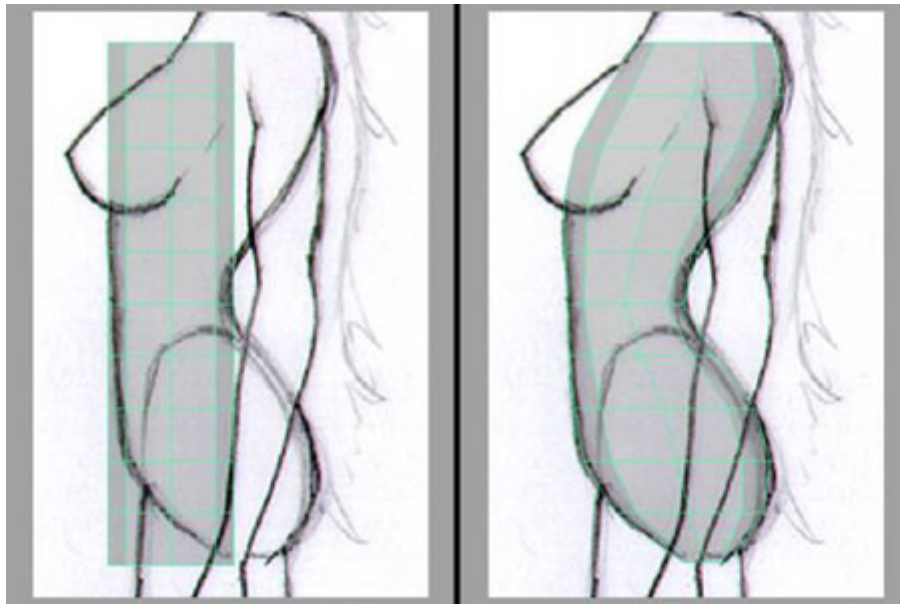


Next do the same from the side view. If your model sheet has its character drawn with the arms out to the side you will probably need to use some other reference material to adjust the vertices from the top view.

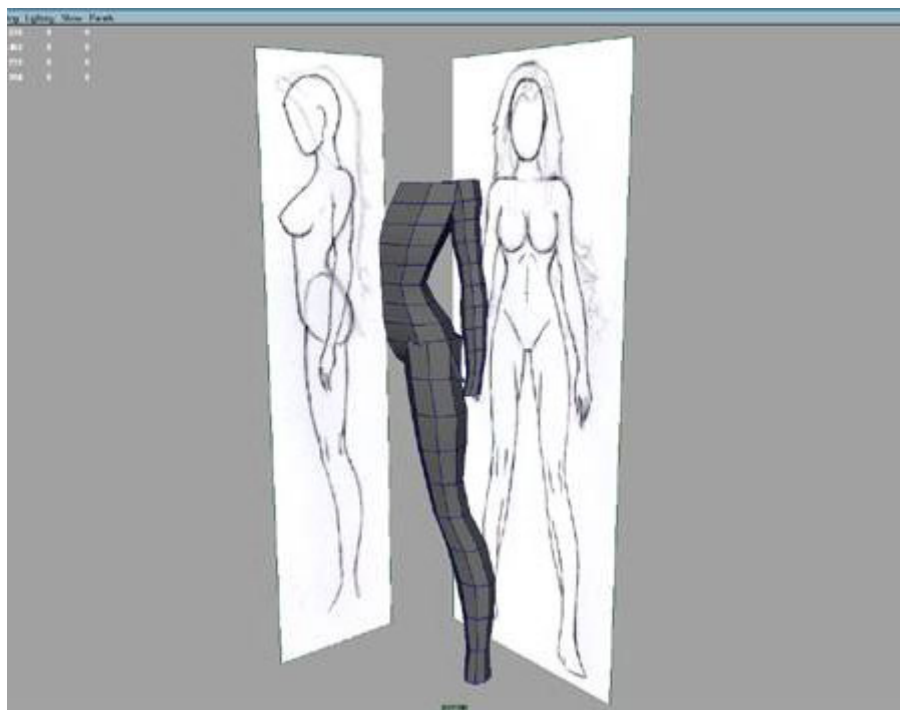


The torso cylinder needs to be split into two, the left side and the right side. Delete the right side, as we only need to work with the left for now. Also delete any cap faces on all the cylinders if you haven't done already. Doing as you have already done with the leg, using the front and side views scale/move the vertices horizontally to get the rough shape of the torso.

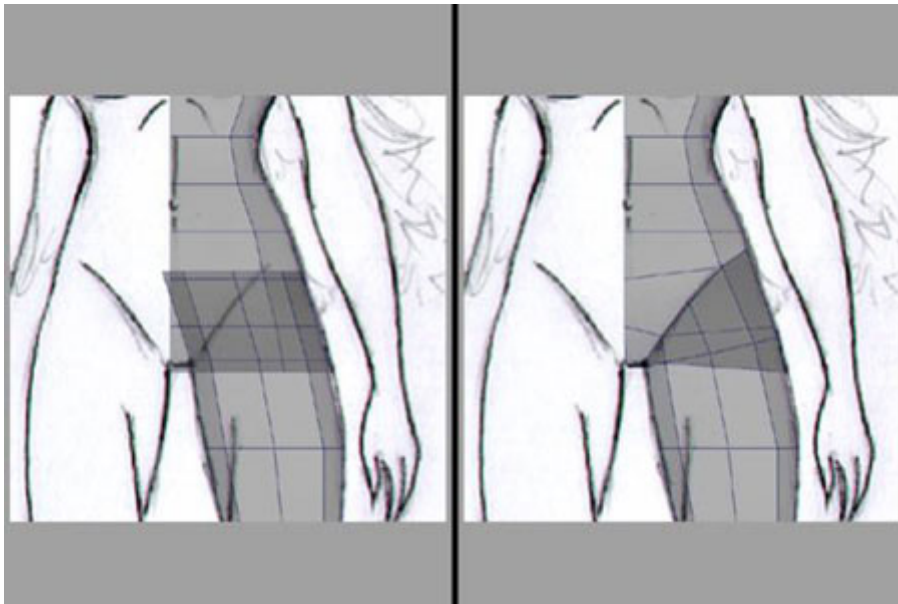




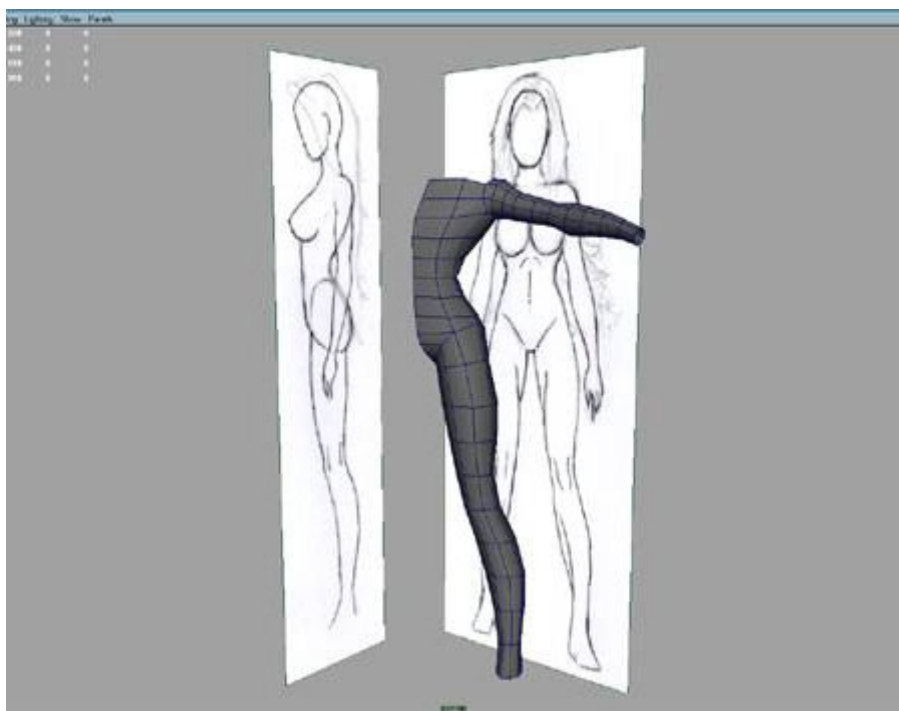
You should now have a clean, grid style mesh that fits the general shape of the left hand side of your character, but it's missing a head, foot and a hand.



Before we add these we need to join the arm and leg to the torso. Start by raising the arm if need be, then move the vertices at the joining ends so that they lie where the joints would crease. Try to get vertices to line up with each other.

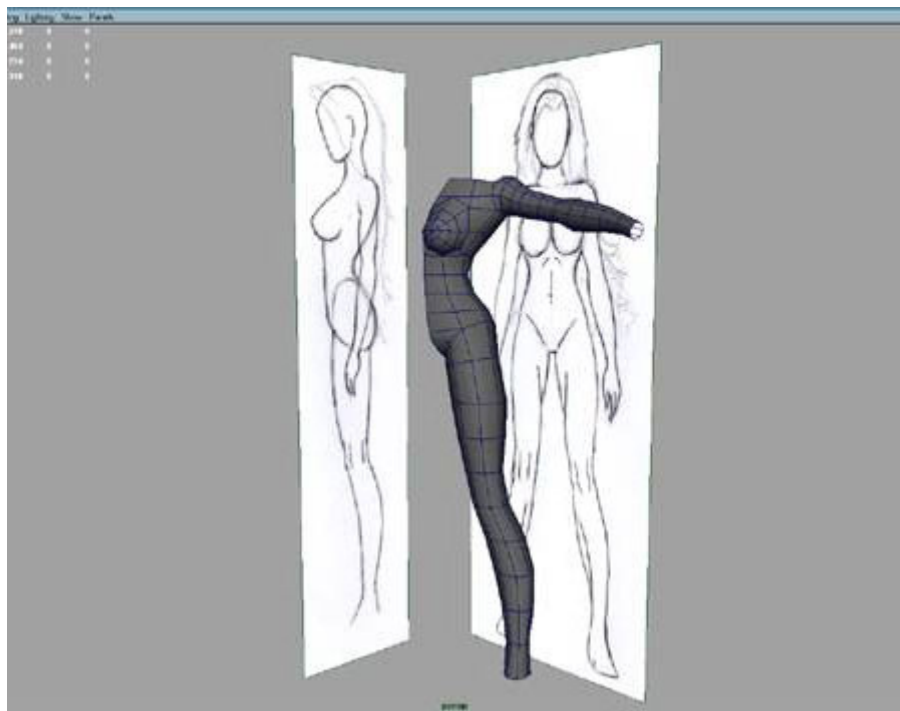


You should start to notice areas where you may need to add an extra vertex, or you could remove some faces to get the limbs to join properly. This is the next stage. Using the Split Polygon Tool to add the vertices, and deleting any unwanted faces make sure the vertices all line up perfectly, then combine the three pieces and weld the vertices.





You should now have a basic body although it may need tweaking slightly to get it back to a desired shape. Also at this stage add any extra bits, like breasts, and attach these to the basic model.

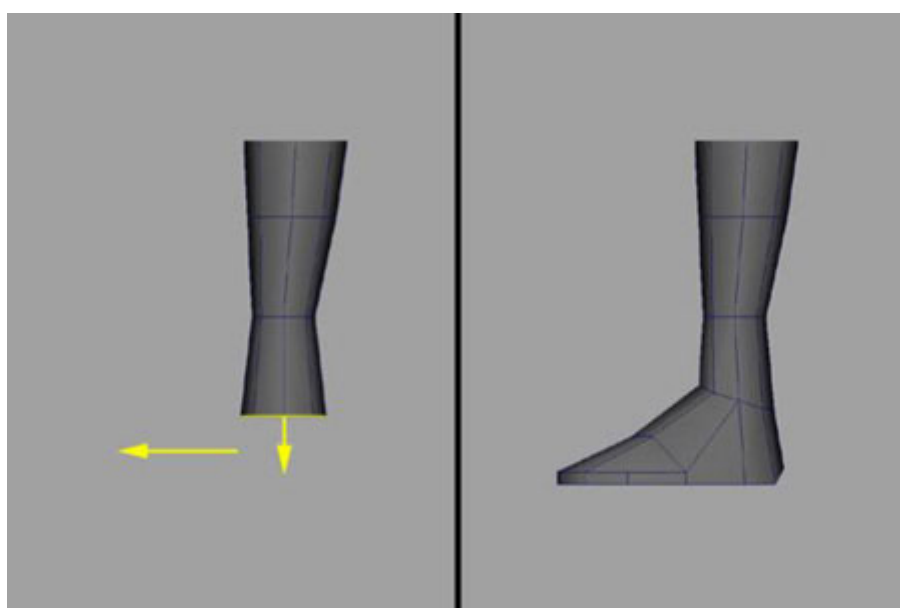


### Hands

To be honest at this early stage I sometimes don't bother roughing in the hands. If I do need to, to get a better idea of proportions, a few cubes will suffice.

### Feet

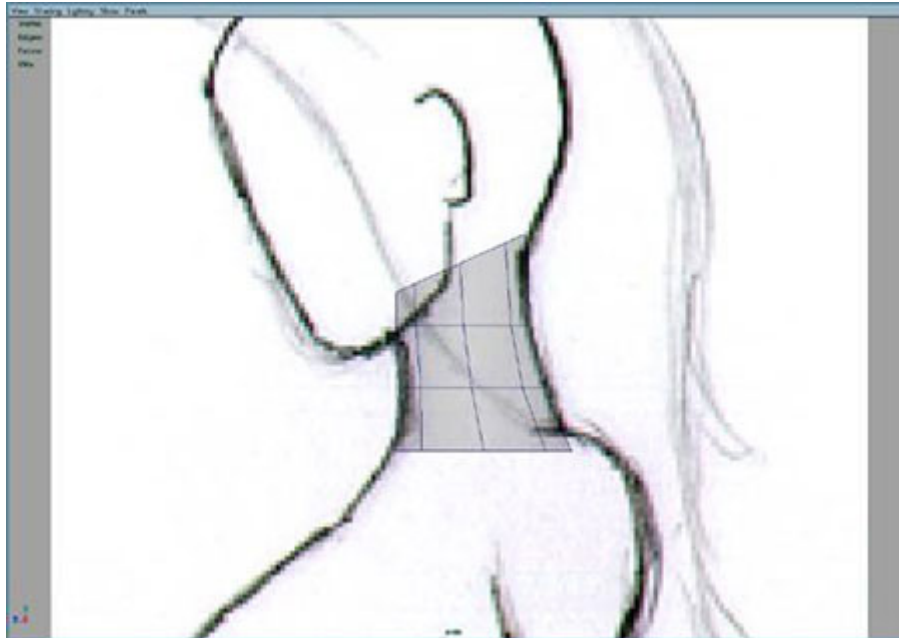
To create rough feet I simply extrude the edges at the base of the leg cylinder. Then I extrude the front of the newly created faces forward, usually having two divisions. It's just a case of editing the vertices then until you get a basic foot you are happy with.



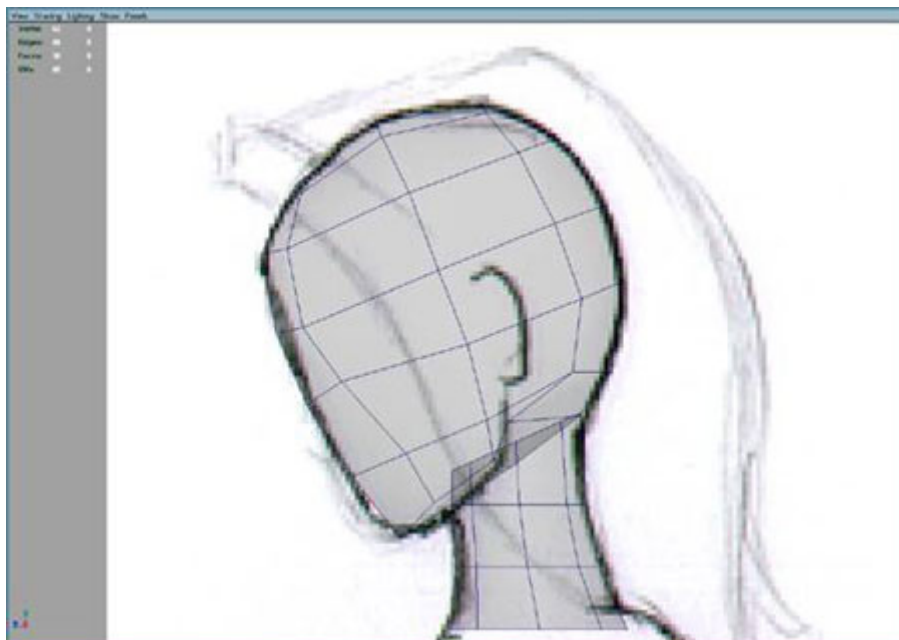


## Head and Neck

At this point the neck can simply be a low polygon cylinder, subdivision axis to 8 and the subdivision height to 3, adjusted, like the torso, to fit the neck in the image plane.



The head should begin as a cube with a few subdivisions, again adjusting the vertices to fit the general shape of the reference head. We don't add any detail to the head at this stage. Once done, weld the head to the neck and then the neck to the body, as we did previously with the torso and limbs.



## Adding Details

By now you have your basic model filled out, it has all the limbs needed as well as a rough head, feet and maybe even hands.

You can now do one of two things, optimise this model for in game use, removing strips of polygons and adjusting it to look like a low resolution version of your character, or you can go in and refine the model, add more detail and fill out the shape until it looks exactly like the reference material.

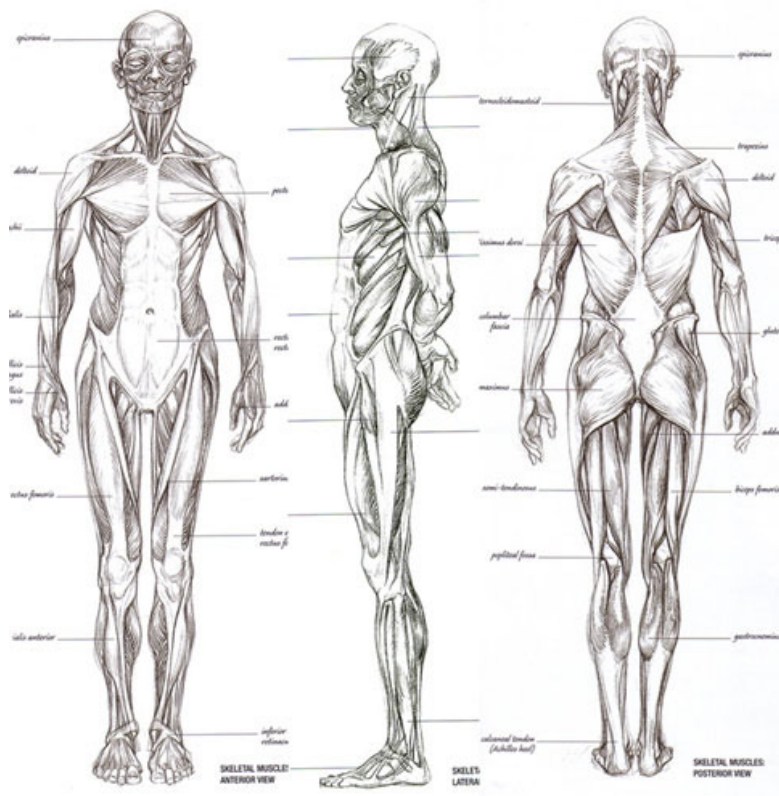
Below are suggestions on the best way to achieve such details.



**Note –** You can achieve a lot of detail with the texture on your character, don't rely solely on polygons.

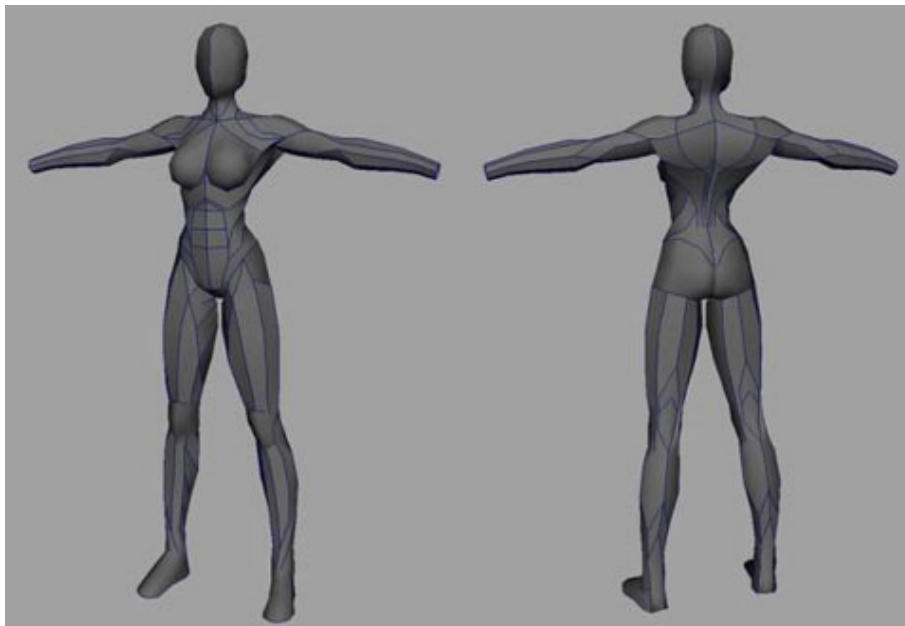
## Muscle Structure

Keep an eye on where the muscles lie on your character, placing edges along the muscle lines will result in a much more natural deformation as well as making your model look better.



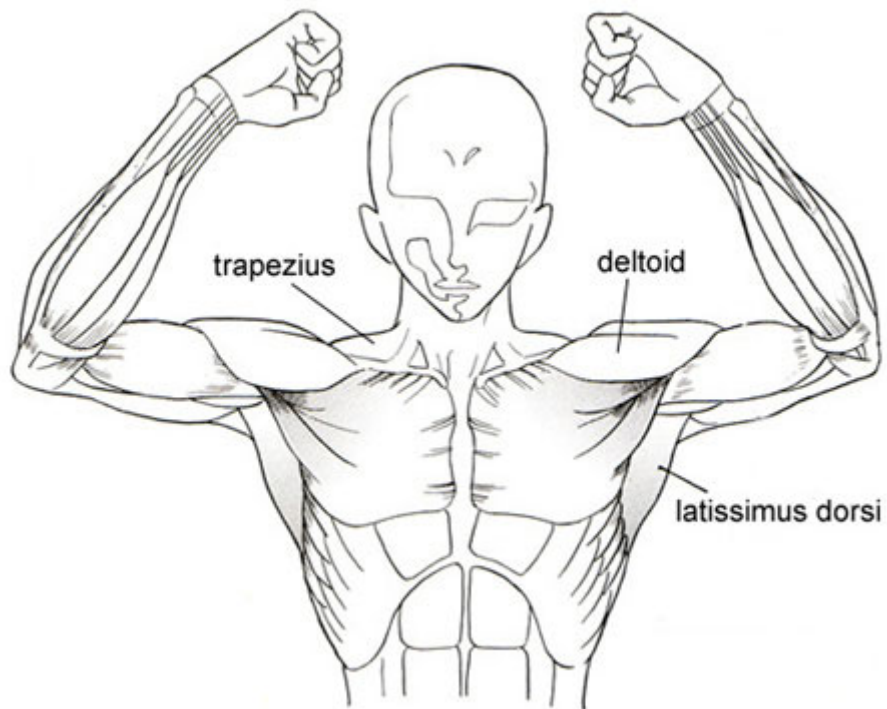
## Muscle Structure

**Note –** It may be worth spending some time mapping the lines onto your model, (as pictured below). Simply go around it and use hard edges as I have done, in some cases you will need to use the Split Polygon Tool but don't be afraid to add a few polygons at this stage.



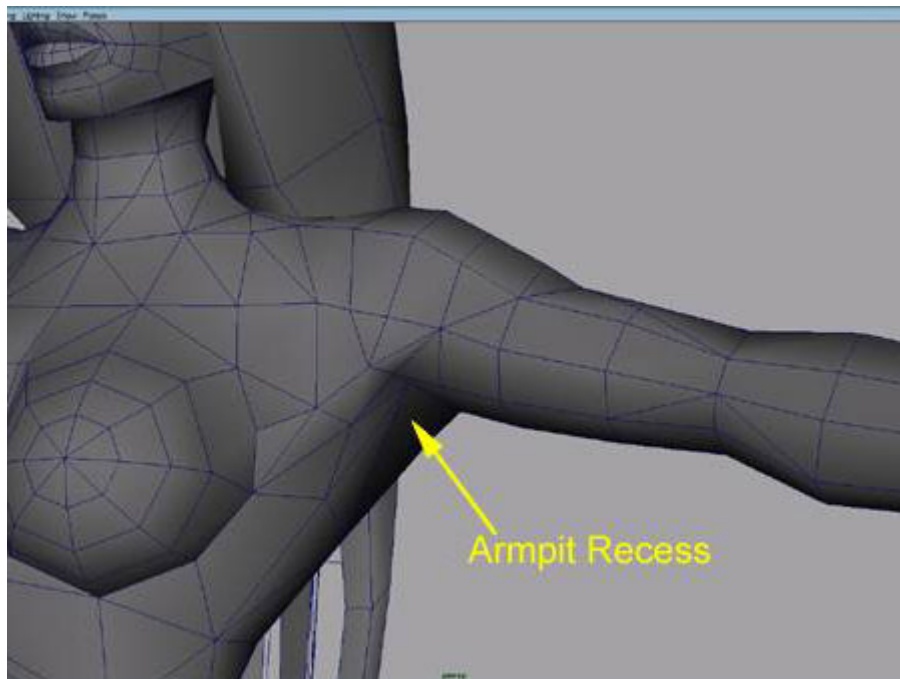
## Shoulders

An area most people struggle with is the shoulder. As you can see in the image below, when the arms are raised the shoulder muscle (deltoid) is more pronounced, bulging higher than the collar muscles (trapezius). Also notice that the big back muscle, (latissimus dorsi) acts like a fan, opening up when the arm is raised and closing again when the arm is relaxed.



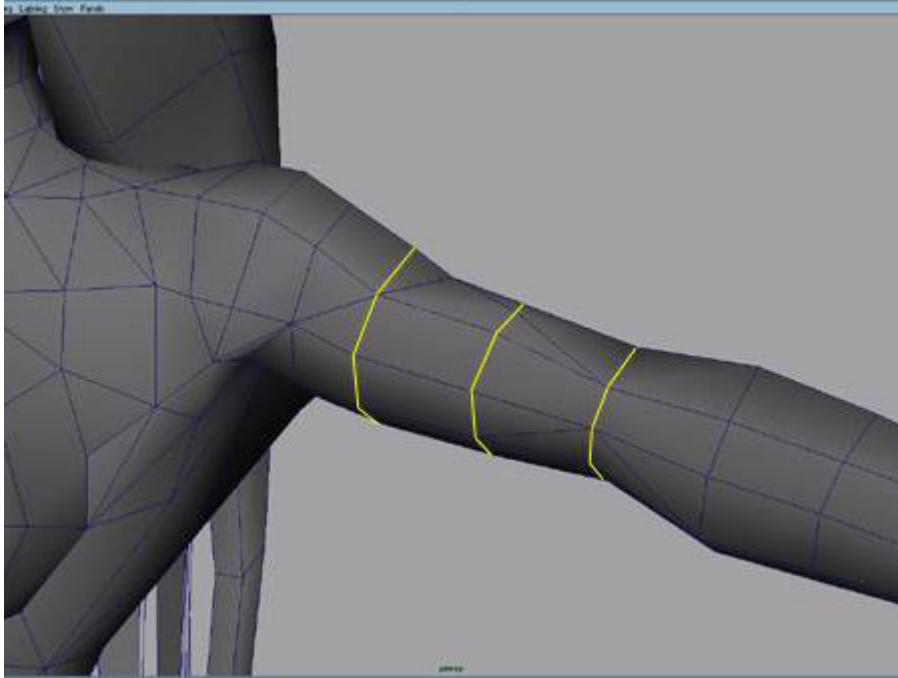
## Armpit

Remember that the armpit recesses into the body slightly.



## Bicep Twist

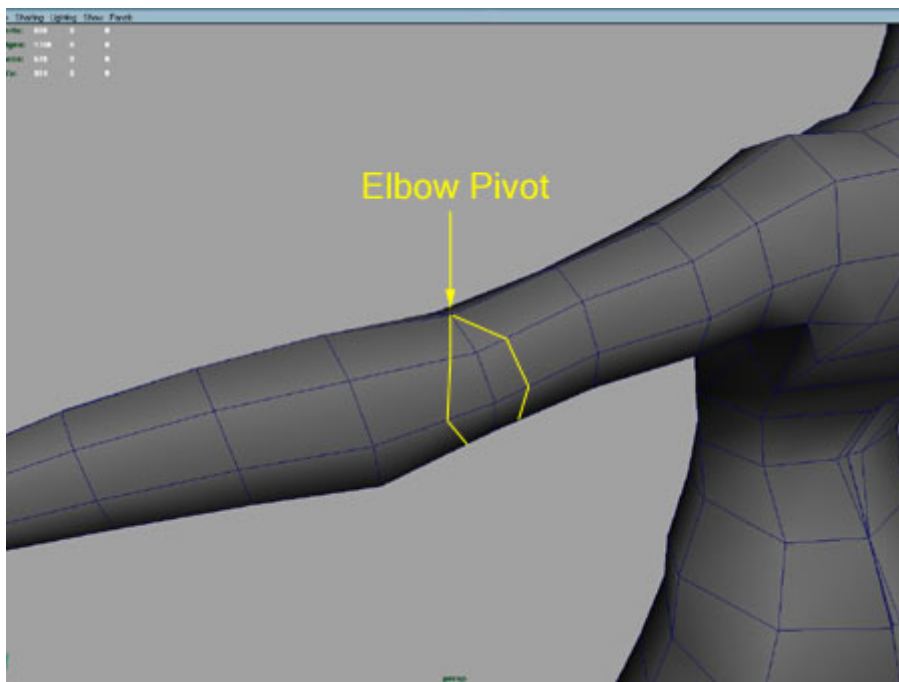
This is a trouble area if modelled incorrectly. When a twist is applied it can collapse and deform horribly but this can be avoided if you keep the polygons around this area in strips.



## Bending Areas

An important part of any character is the areas where it needs to bend, i.e. elbows, knees etc. So go around your model and make sure to put in extra polygons in these areas.

As with the elbow pin point the pivot area and create the polygons behind that point.



## Face Detail

Face topology is very important, depending on what you wish to achieve with your model that is. A good rule, as with the body, is to stick strictly to the muscle structure when placing your polygons and edges. Paying attention to how the face creases, and constructing it according will give you a natural looking face as well as making the creation of blend shapes and animation easier and more fluid.

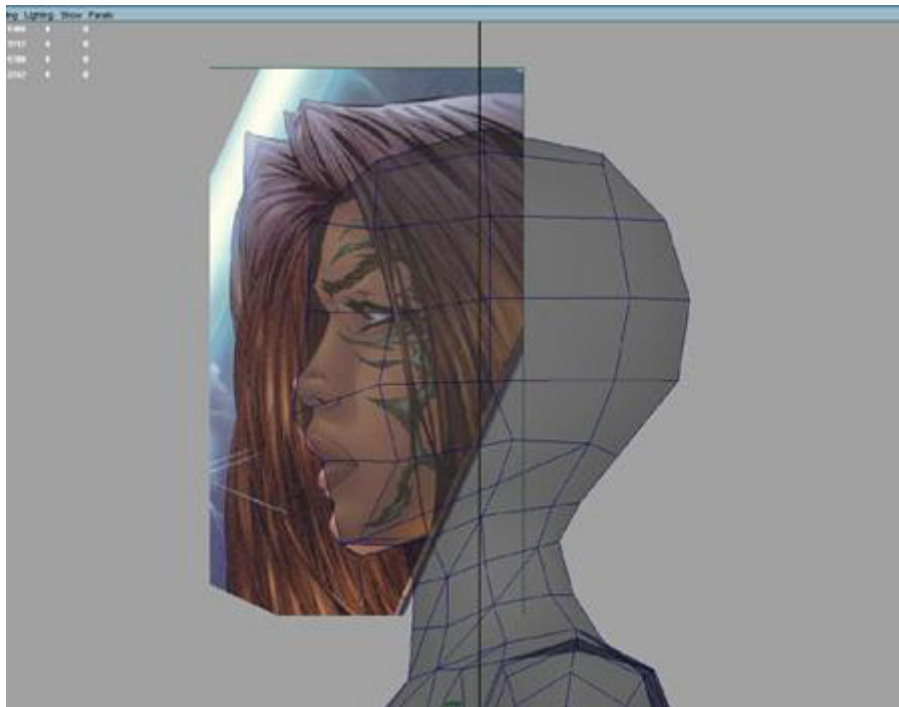


**Face Muscles**



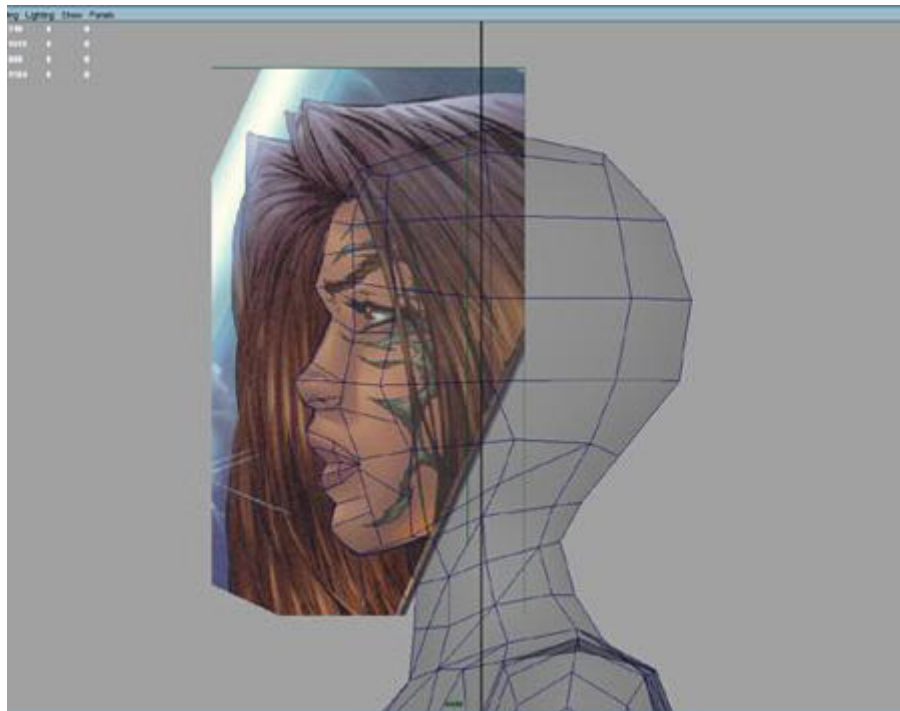
**Face Wrinkles**

Once again, import some scanned in imagery to use as a guide. Scale the image plane to fit the rough head you have created

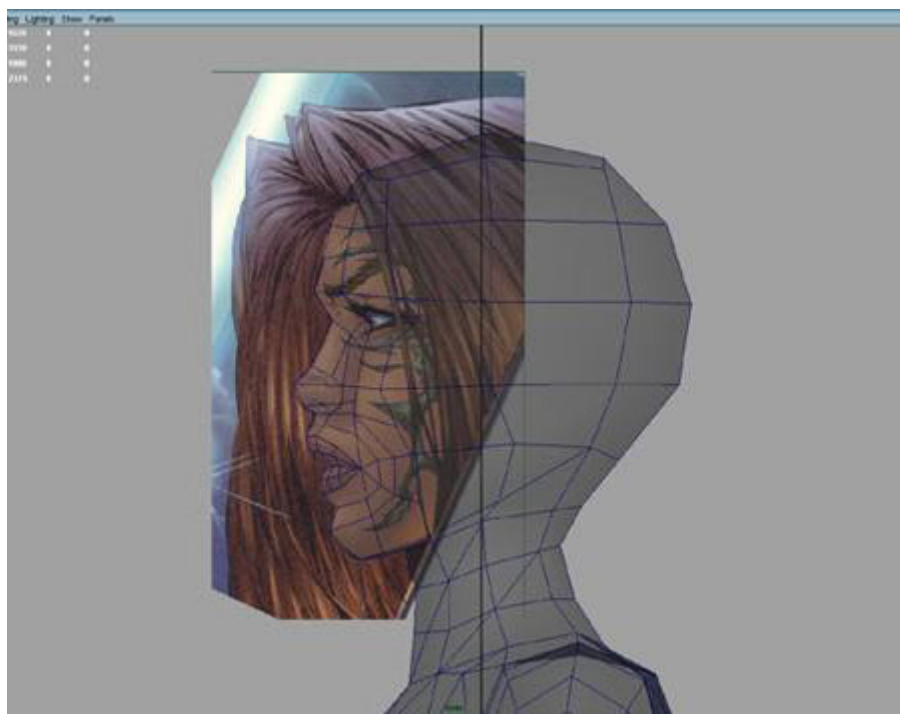




Subdivide the faces at the front and start to move the vertices until you get the general shape. You should also do this from the front view, using another image as a guide.



Splitting the polygons, keep adding more detail until you are happy with the way the face looks, remembering to keep the edges running along muscle lines and also bearing in mind how the face will need to deform i.e. will it need eyes, eyelids, an inner mouth?





## Hands

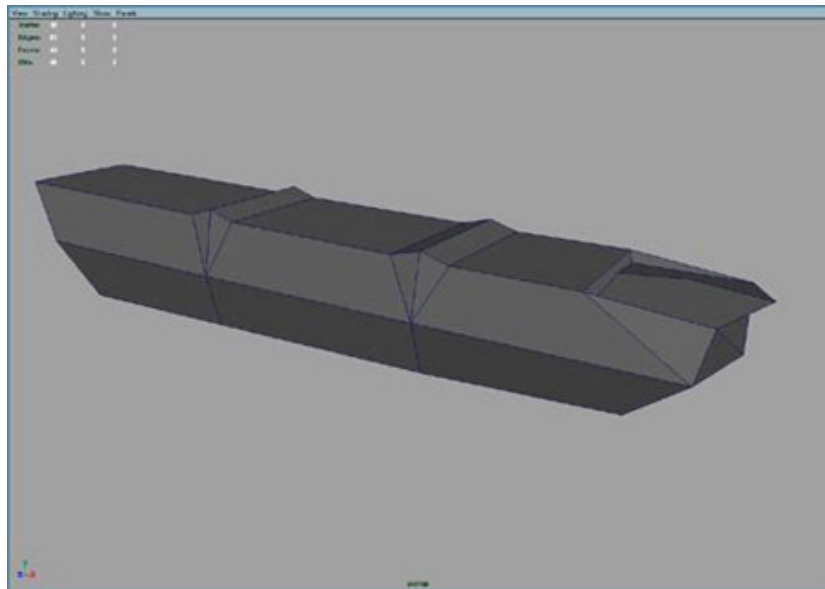
First off, if someone on your team, or even in the studio has already modelled a decent hand, use it. There is no point reinventing the wheel and making more work for you, even if it isn't the right style the structure should be sound enough for you to work with and adjust.

Before you build the hands you need to know what the character is to be used for. If its in game the chances are it won't need separate fingers, just maybe a separate thumb, if its a character for a cut scene then all fingers will need to be modelled.

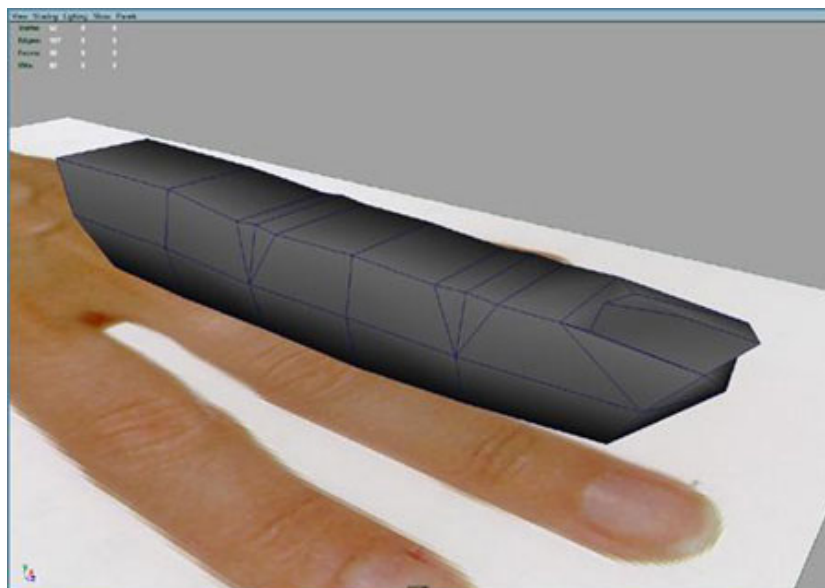
When starting the hand I always begin with a finger, spend time creating a good finger and you can then copy and adjust it for the other three and the thumb. Again, get some images of hands scanned in and use them as image planes.

Start with a cube – Width 6, Subdivision Width 3, Subdivision Height 2.

Using the Split Polygon Tool we now add some details to the finger. For the moment you just want to define the knuckle areas, these just need to be on the top half of the finger (add as much or as little detail as you require, the images represent a medium resolution finger.)



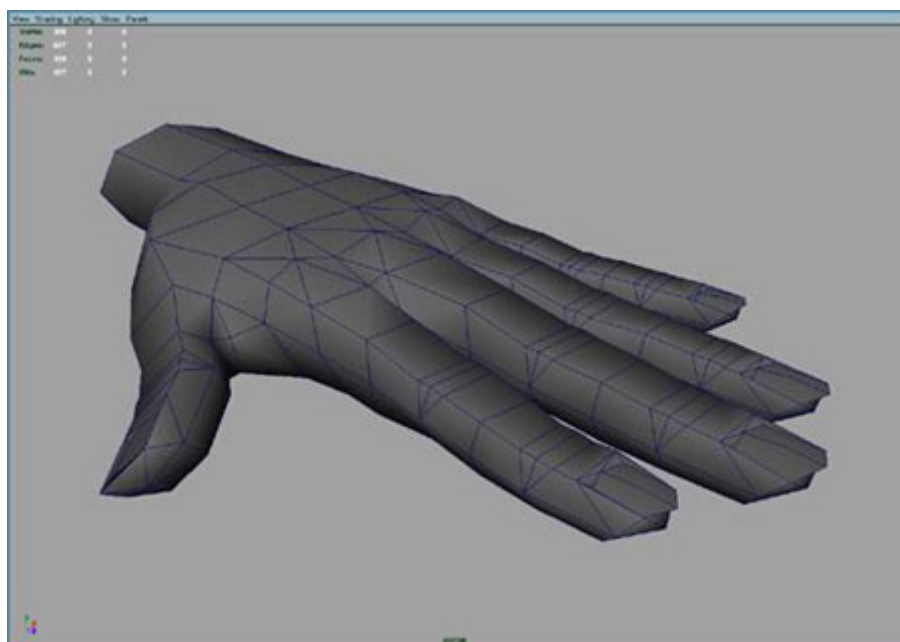
Once done you can play around with the finger to get a general shape you are happy to start working with. Make sure you use the image you scanned in as a guide.



When you are happy with the shape of the finger, duplicate it and adjust it to fit the other three fingers.



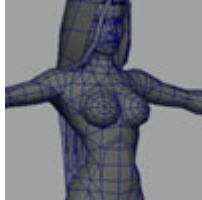
You should now have your basic fingers to work with, duplicate one of the other fingers and adjust it to fit the thumb. Then, using your modelling skills and the reference images add some more details and the rest of the hand. You should end up with something like this -



This hand was modelled using a male hand as reference, no good for the female model I am doing but I can use this as a base and adjust it.

A few things to consider –

1. Its better to initially model the hand flat, this makes it easier to texture. Then you can adjust it later for the final pose.
2. The base of the finger, where it meets the hand, is slanted not flat. If you look in between your own fingers you will notice a small webbing area.
3. Your fingers are not straight so do not model them like that. They are most likely slightly crooked.
4. In women, the ring finger and the index finger tend to be the same length. But with men, the index finger is shorter than the ring finger.



**The Final Model**

The model I created whilst making this tutorial is available below.

To download, right click and select "Save Target As..."

### Final Pose

Before you finalise your model and begin texturing it is probably a good idea to bung in a rough rig and check the mesh deforms correctly. I guarantee you will find a few areas that need tweaking and if you have spent time texturing you will need to alter some UV's.

The aim is to get the final model in as much of a relaxed state as possible, this way when the character is rigged and animated in a relaxed state it will look more natural and as the modeller intended. Having the elbows and knees bent not only helps with rigging but also allows the modeller to refine the look of the joints.

**Note** - You should make sure your model is finished and signed off before putting it into this pose, unless you intend to do a preview bind, in which case save it as a separate file.

Your characters final pose should be as follows and NOT in the standard crucifixion poses -

- Arms - Out to the sides but slightly lowered, (about 35 degrees)
- Elbows - Should be bent inwards at an angle of about 40 degrees.
- Hands & Fingers - Should be in a relaxed position with the fingers slightly bent. The palms should be facing forwards.
- Legs - These should be slightly bent, as if the character is in a slight crouching position.
- Face - The head should be in a rest pose, closed mouth and open eyes.