



Paper Clone



Paper Clone – Tutorial

In diesem Tutorial erkläre ich, wie man sich selbst aus Papier nachbaut.

Das war auch schon der letzte deutsche Satz – Viel Glück.

Ever considered to create life not only in a virtual world but also physically, so that you can have your Alter Ego right beside you?

Create a clone and experience the joy of a buddy that is never mean and always loyal and patient, and, most important of all, resembles you if you want him to. That is what makes him unique and proves your skill undeniably.

Put him behind a window and he will bring the joy forward to anyone on the street. It is really interesting to see the point where people realize that this is not a person watching them. Put him in your bed and he will bring the joy forward to the next one who sees him (including you, if you have a weak memory).

Therefore he is highly qualified for the receiving of a Halloween party or the first contact of the Trick-or-Treat-Gatherers.

The figure was exhibited on the *Paper and Pulp – Gathering a Community Exhibition in the Salt Space in New York until 10/18/2010 and on the Maker Faire.*



Step One – This is what you need:

Paper. Not any paper! NO paper that only weighs 80g/m² (22 pound paper), which is normal. It should be at least 160g/m² (40 pound paper), which is a popular sort, I used that because it is simply the cheapest alternative. Using paper that weighs over 250 g/m² (66 pound paper) is also no good idea. *Price: You will need 80-120 sheets. 250 sheets cost about 10-15 Euro (~15\$), so: 5 Euro

Glue. Not any glue! DON'T use a glue stick. Seriously. What you will experience: „Hmm.. It is cheaper to buy a glue stick.. Oh it works, it holds together!“ But after 2 weeks you can say Goodbye to your friend, because the load is too heavy for a glue stick. Double-sided tape is even worse. The best alternative is simply 2 tubes of all-purpose glue like UHU (or another popular brand). No special edition, just a simple tube of the well-known glue. It needs to be liquid because you often have to get it into gaps.

*Price: You will need about one tube, which costs 2-3 Euro (3\$).

A camera. It should produce good photos, DSLR would be nice, but any compact camera will do it (But please not less than that, an iPhone-camera is really too bad)

Cardboard. Not much, 2x DIN A 3 is enough.

A printer. You can print from your home PC, that's no problem when you find a good setting for the quality.

*Price: Depends very much on your printer and the price for the cartridges. Half of each cartridge may be used, which costs from 2 to 20 Euro (3-25\$)

A computer with the following programs:

A modeling program (I use Anim8or and will explain the process on this example): freeware

Pepakura (which unfolds your model - no alternative): shareware (not a problem, the only function you can't use is saving)

An image editing program (I use Paint Shop Pro X): If you don't have one, use GIMP, which is freeware.

For the crafting you also need:

- Scissors
- Those little clothes-pins
- Tweezers
- Sticky tape
- A cutter



Step Two – Photo Session



I personally don't like photos of myself, but it is kind of important when you want to build a clone.

Try to achieve a nice, even light situation, where you stand completely in the light, while the light source has to be behind the camera. I recommend to use a tripod.

You need at least 12 photos:

From your **full body** from all 4 perspectives (front, back, left, right)

It should be clear that you always do the same pose. Putting your hands in the pockets is a very good idea, because hands aren't very easy to model, texture and build.

From your **head** from 2 perspectives (front, side)

From your **shirt** laying flat on the floor (front)

From your **trousers** laying flat on the floor from 3 perspectives (front, one side, back)

From your **shoes** from 2 perspectives (side, top)

**Why do the clothes have to lay flat on the floor? When you use your photo as a texture, you have the problem of an unnatural light and shade, because your body is round (well, kind of) and gives the clothes dark or light areas on the sides. This looks weird when put together and you will have problems with texture clipping.*

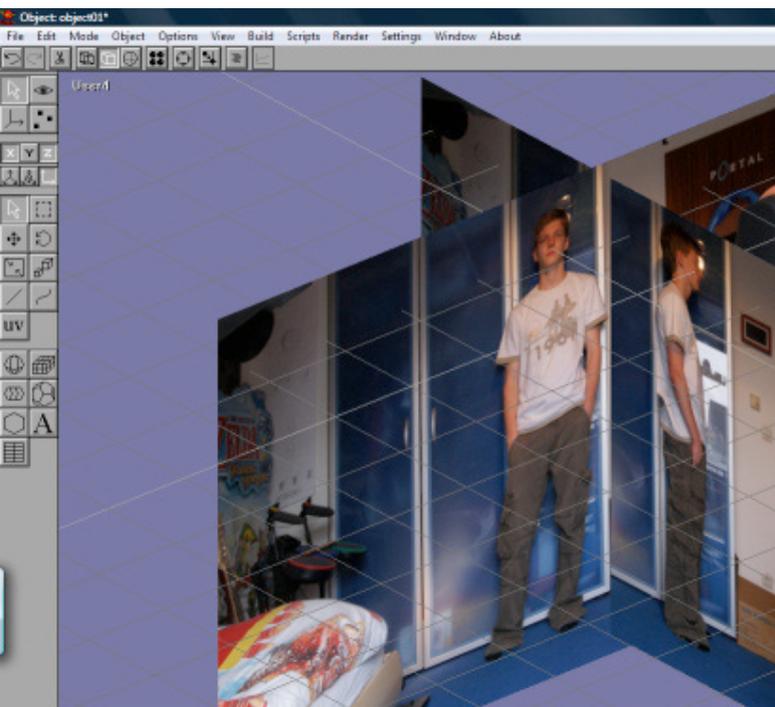
What you can do is give the clothes a few natural wrinkles as if they were worn. You can achieve a higher resolution when taking more pictures of smaller parts and putting them together in your image program.

Step Three – Modeling The Head

If you don't have any experience with modeling, I recommend you to use **Ani-m8or**, which you can download for free. There are a few functions which make you able to model your head.

When you don't want to do it yourself, you can download my whole model and just change the face and the body a bit and put your textures on it. The link is at the end of this instructable.

When you are absolutely not familiar with the program, please make at least the modeling a hand-tutorial on <http://anim8or.com/main/index.html> first, so that you get into the program.



At first load 2 full-body-images (front and side) into the scene. Go to front view and load the first one with Build - Reference Image. Go to a side view and load the other one. Put the images a bit away from the middle, but first make sure that your body has the same size on both of the images. Scale the images with the scale-tool if necessary. It should look like on the image below now. If you want to be sure that your head is correct, you can additionally do the same with the photos of your head, make them smaller and put them over the original photo (what I recommend if you don't want to have trouble in step 5).

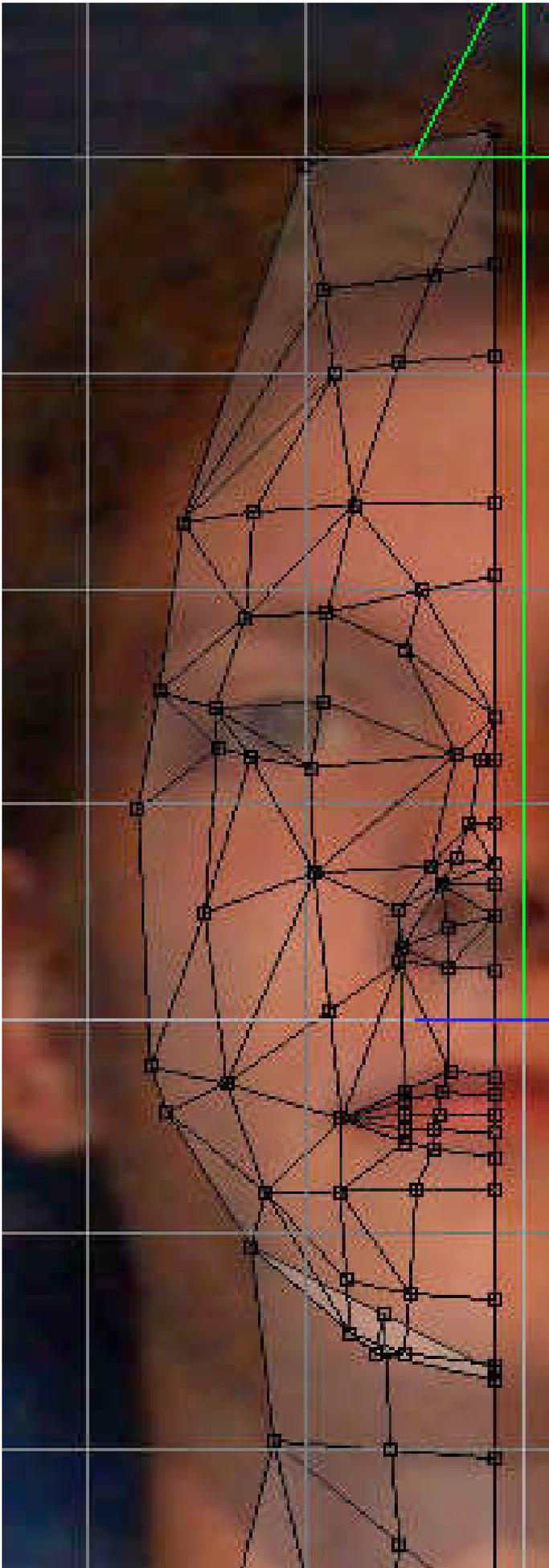
In front view, first draw a rectangle that has your full height, as you see in the third picture. This guarantees that the parts will later fit together.

The head should be the most detailed part of the body, especially the face should have UV-faces (see below for explanation) of the size of coins.

I recommend to do the head with line-modeling instead of box-modeling. That means that you draw a grid of lines along the „edges“ of your face, fill them and move the points to the right place. The picture below shows the process, a whole head-model-tutorial can be found here: http://members.multimania.nl/jonim8or/head_tut.html

This head-model is a bit too undetailed. These are the tools you need for modeling a detailed head:

Step Three – Modeling The Head



The Arc-Rotate-tool (Ctrl R): Move the camera around the model.

Hide (h): if an object is in the way, click on it and hide it. Shift H lets it reappear.

The Add-Edge-tool (left side, middle): Draw the contours of your face first with this tool

The Drag-Select-tool (d): Select a few points in the front view mode, switch to the side view and move (Move-Tool; m) the points where they belong. Using more than one perspective at a time (view - All) is very helpful.

The Cut-Faces-tool (Shift C): This is for adding details. When you cut a face, points are added. When you cut a line, The line is divided into 2 lines. You often have to turn the camera in order to prevent wrong cuts, f.e. on the backside of the object.

- **The Fill-Holes-tool** (Shift J): Select your wire-frame in edge-select-mode (e) and fill the holes to add faces between the lines.

The Extrude-Faces-tool (Shift Y): Select a face in face-select-mode (g) and extrude it, so that you can add an ear for example. You could also do that with adding edges, but this is much faster and more accurate.

The Merge-Points-tool (Shift J): Merge 2 points that are close together.

Summing up, the process is: Draw a few lines, move the points where they belong, fill the holes. Add lines, move points, fill holes, etc.

Try to use a structure with many triangles, because then nothing can go wrong with bad folds in rectangles (Because you can fold a rectangle along 2 different diagonals).

Tip: Do only one half of the face. Then mirror it, select both sides and „join solids“, select the points in the middle and merge them.

Step Four – Texturing The Head



Now you need both of your head-pics as textures.

Color the head with the following material:

Ambient: 1

Diffuse: 0.5

The rest: 0

and a color of your choice.

This creates a material without shades, what makes it easier for you to compare the textures and prevent clipping mistakes.

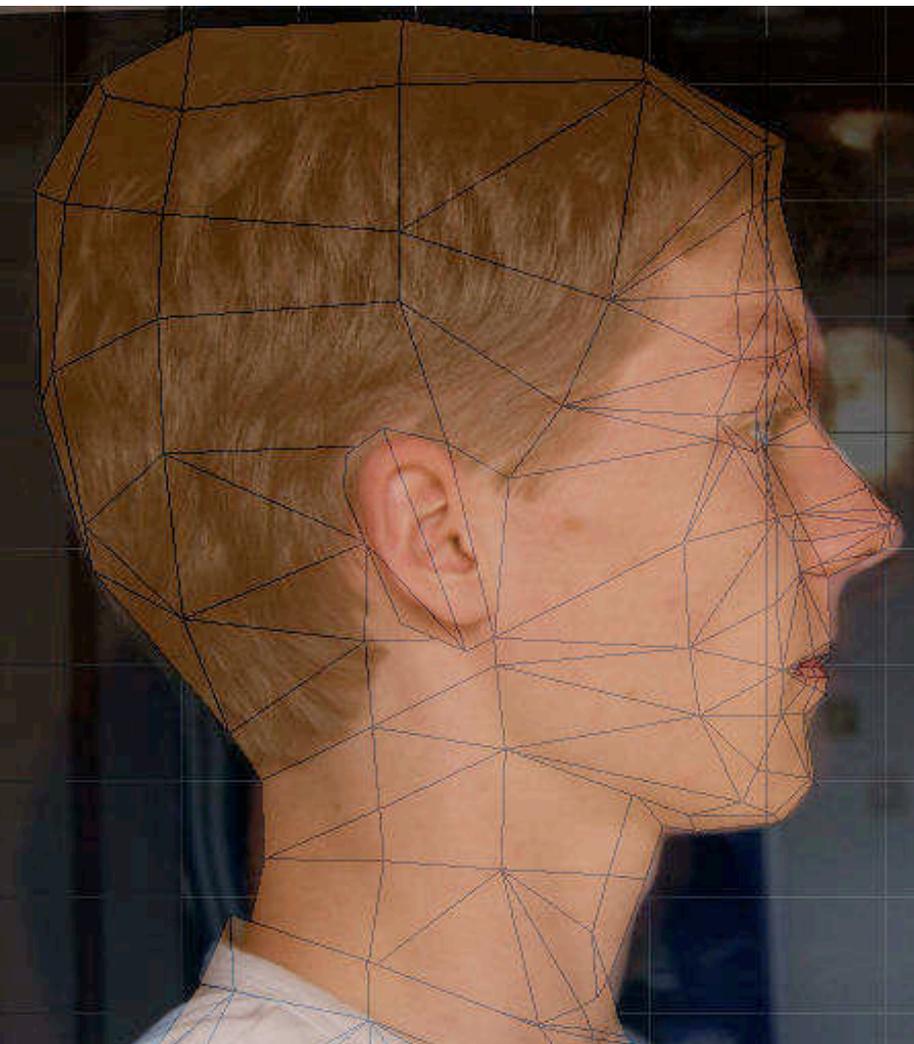
Now you can prove your Photo Shop skills. Go into the Flat-Shaded-view (Ctrl F) and make a screenshot. Crop the image, so that you only see the head. Then make the image 300 - 400% bigger, copy your head-photo over it and make the 3D-image a bit more transparent, so that you have it as a reference. Use the warp-brush to adjust your photo to the model (without making it look ridiculous).

Very important: The head must everywhere be

bigger than the original model, or you see the background on the model. You can see that I made the ears smaller; I will refer to that later.

Save the photo, which is now a texture, but don't forget to make the reference image transparent. You can't use a png or tiff, so just save as the best jpeg possible.

Go back to Anim8or and open the material you colored the head with. Click on texture, load the texture and save the material. It should look weird now, so choose Texture UV (v) in side view and adjust the texture to the head.



Step Four – Texturing The Head

Quick UV-guide:

- Right click within the circle moves the image
- Left click outside the circle turns the image
- Middle mouse button zooms the image (inside circle: x/y not constant)

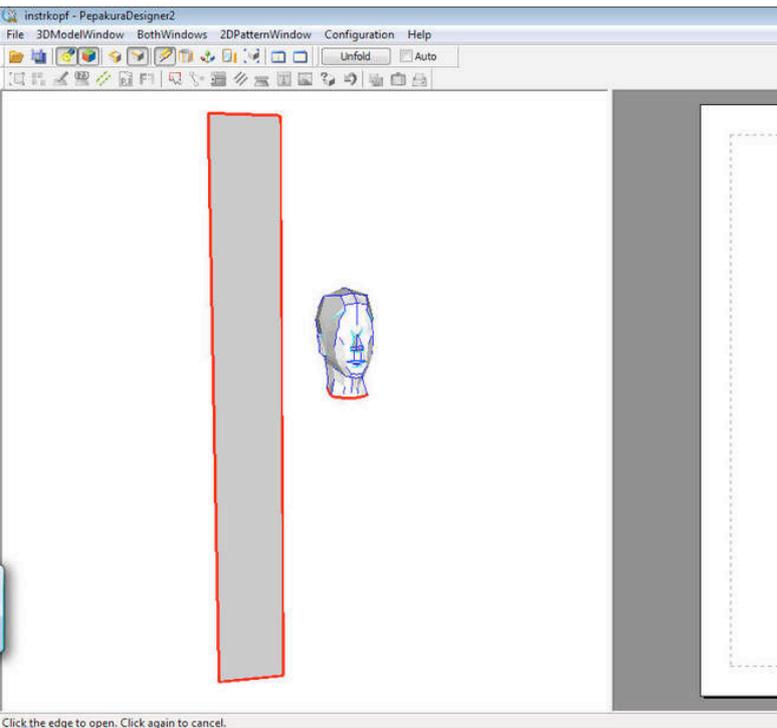


Select only the ear in Face-Select-mode (g) and press UV again. Then zoom in a bit and make it look real. This prevents that that the texture of the ear is also behind the ear, which would be wrong.

If you want a face like a pixel-zombie, you can go to the next step. If not, make a screenshot of the front and paste it into your image program. In Anim8or, select your face's faces and color them with a new (here: green) material that has the same values as above. Make the same screenshot as before and paste the images on one image. It should look like below now. Make them again 300 - 400% bigger and copy your face-front-photo in. Now adjust the

image in the green area to the model, using the warp brush. When the form is right, use brushes like darken/lighten, tone or saturation to make the edge of the texture fit to the other and create a non-visible transition. Save the cropped image and put it on the face instead of the green material like before. After you have checked your head for mistakes (you can still change the textures), you are done with it.

Step Five – Unfolding The Head



For the next step you need **Pepakura**. Download the trial for free, but include enough time for the unfolding, because you unfortunately can't save it.

In Anim8or, put the „leveling staff“ beside your head, but don't let your head go over or under it. This is important, because then you would get wrong sizes. Hide everything but head and rectangle and export the object as a 3ds-file (Object - Export)

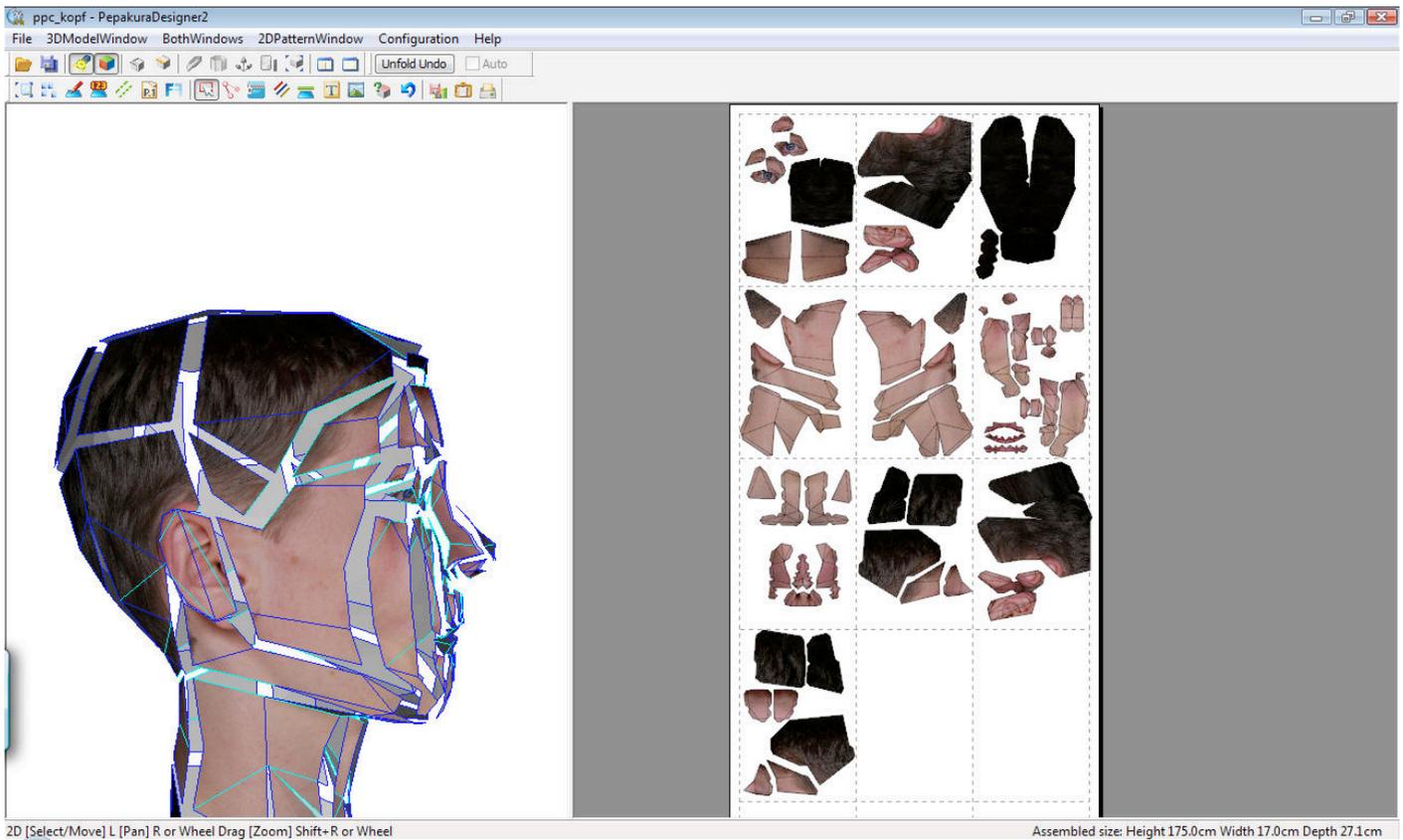
Open the 3ds-file with Pepakura and denie every question except that of joining the edges. If you don't see any textures, click on 3DModelWindow - Texture Configuration and load them again. Navigate around your model with the mouse (zoom is on the middle button) and specify the open edges: Click on the cutter on the toolbar (it should be selected already) and click on all the edges of the head that you want to cut along later. You don't have to specify all open edges (not as many as on the image, maybe like 30% of them), only the ones that need to be open. Choose a more vertical structure, that makes you thinner ;) Edges where the textures change should always be open.

Unhook Auto and click on Unfold. Choose Specify Value. The size should be your actual size, therefore you have the rectangle beside the head.

Now you see a bit of chaos in the right area that you have to get under control, using the right-click-options, especially Join/ Disjoin Face. Finding out by yourself what they all mean is the easiest way to learn to make comfortable Unfoldings.

Don't forget to add flaps to the neck, so that you can attach it to the body. Put the big size-rectangle anywhere on the left of the screen, so it won't be printed.

Step Five – Unfolding The Head



What is also really important for comforting crafting is that the flaps are alternating on one and the next one on the other side of the open edges. Do this as the last step. This keeps the parts in their forms and makes everything more stable, because the parts intertwine better.

When you are done with organizing the parts, click Configuration - Line Style and hook „Hide Lines that are almost flat“ with a value between 0 and 180 degrees (a higher value means more folding lines, which doesn't look nice - 140 degrees is a good compromise). Don't forget to hook „Color flaps with neighboring face colors“ in the Flap Configuration, otherwise your papercraft will have white edges.

Then print your papercraft on the thick paper. You may want to change all quality values to maximum in printer setting and paper configuration, to get the best result. Make a few screenshots of the open model, so you see where the parts go.

Printing it a second time with concept settings on normal paper can't be wrong.

Step Six: Building The Head

Now you can start building your head. When you begin with the back, you can try what technique works best for you.

The following things may be helpful:

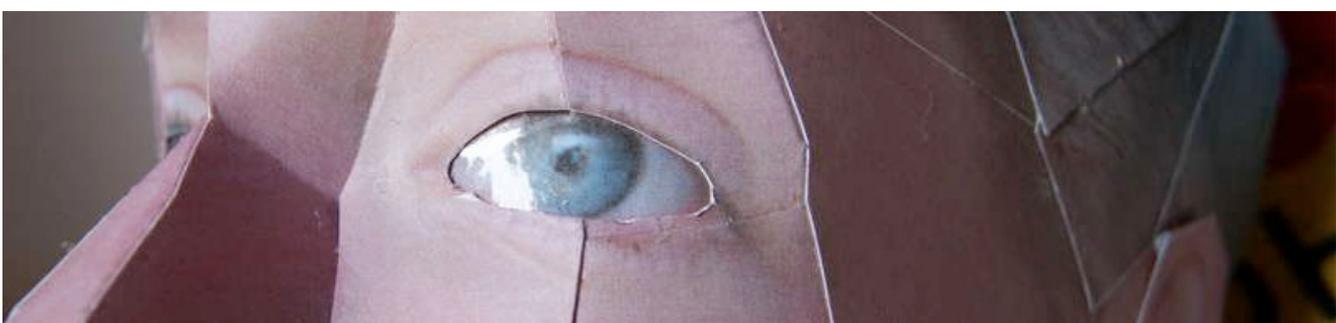
Cut the part out and fold only the vertical folds with the aid of the tweezers. Dotted lines mean mountain folds, dotted and lined lines mean valley folds. Of course you can use tape on the inside. Use the mini clothes-pins to hold something together.

How to glue: You should always have some kind of a narrow piece of paper. Rip it and you have something like a glue-brush. Do a bit glue on it or the flap and arrange it with that piece. You often need less than expected. Press it together

for 5 seconds and it should hold together. Don't do more than one flap simultaneously. When you have trouble with the last parts because the flaps are inside, you can cut a hole into a face, print it again on normal paper and glue it over the hole again.

When you don't know where something belongs, take your model as a reference.

It looks better when you print the eyes twice, cut them out on the original head and glue new eyes into the holes. It looks even better when the second eyes are covered with tape, so that they are shiny.



Step Seven – Modeling The Shirt

Open your head in Anim8or and add a collar to the neck, if you haven't already done this. Save this model as a new file, because you need to delete the head later.

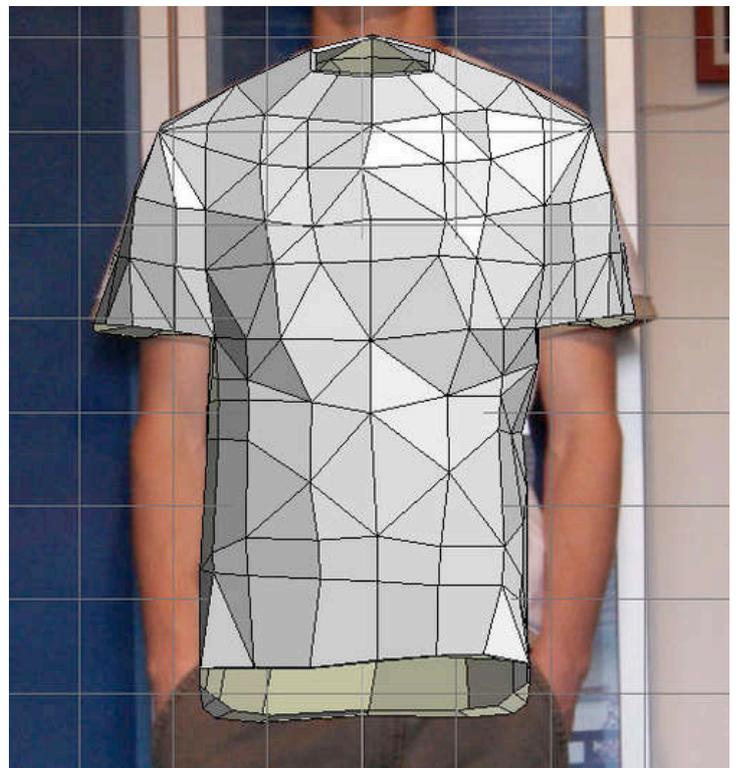
Model your shirt the same way you modeled your head. This means you can model only one half first, mirror it when it is done, join the solids and merge the points. The UV-faces can be bigger now, half or full credit card size as an average should do it.

When modeling, be sure that there are 3 points that come out specifically: Your chest; the middle should be a bit behind the rest; and your belly. Some people tend to do everything too flat, but have the heart to move the points a bit further than where you think they actually belong. As you see on the picture, my original shirt looks really flat, but I modeled it as if I went to the fitness studio every day. In the end, it looks more realistic than the normal one.

When you have merged the 2 sides, create a few differences between both sides, or it looks too perfect. You can adapt the new side to the picture in the background, then it should differ enough from the other side. If they are still too similar, you can make one sleeve more narrow than the other one or you can lean the end of the shirt a bit.

As you see, I added a fold in the back of the shirt, which I recommend you to do, even though you don't have one on the photo, but it has got a strong effect.

You can either let the sleeves open or you can close them, but if you do, please consider to let a circle for the arm free.



Note: It is really helpful when you add the beginning of the arms and the trousers. Save the half-done torso as a new object and delete the arms and trousers from the shirt. Give the parts different colors, so you can easily differ between them.

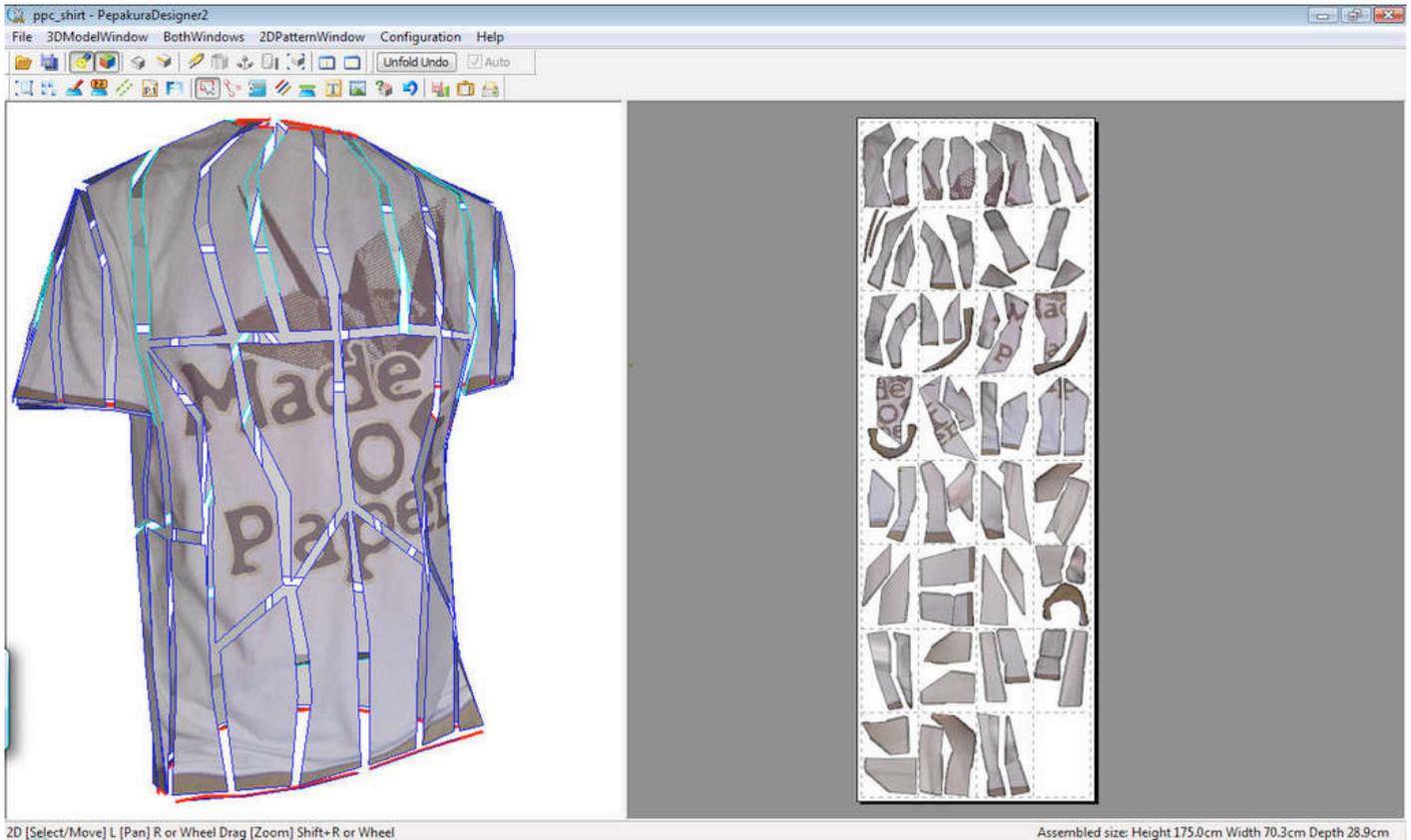
I hope you kept the size-rectangle, if not, copy it back from the head-model.

Delete carefully every point of the head and texture the shirt like you did in step 5, but this time do it like this:

You need a texture for the front and a texture for the back, if your shirt has something on it. Don't use a photo of the back of the shirt, instead shop the pattern away from the shirt and save it as its back. Now you can't get any clipping mistakes.

Select the whole body, add its texture, move the texture to the right place, select its back and add the back-texture without moving it. It should be automatically on the right place.

Step Eight – Making the Shirt



Export the shirt as a 3ds-file with the rectangle and do the same procedure as in step 5. Again do the cutting lines vertically and symmetrically. Don't forget to add flaps to the arm- and leg-holes.

Make 2 plates of cardboard with a hole that fit on the bottom of the shirt as an artificial hip. You can see them on the picture. This makes it a lot easier to join the final 2 parts at the end.

It is up to you whether you already attach the head. If you are not sure, don't attach it yet.



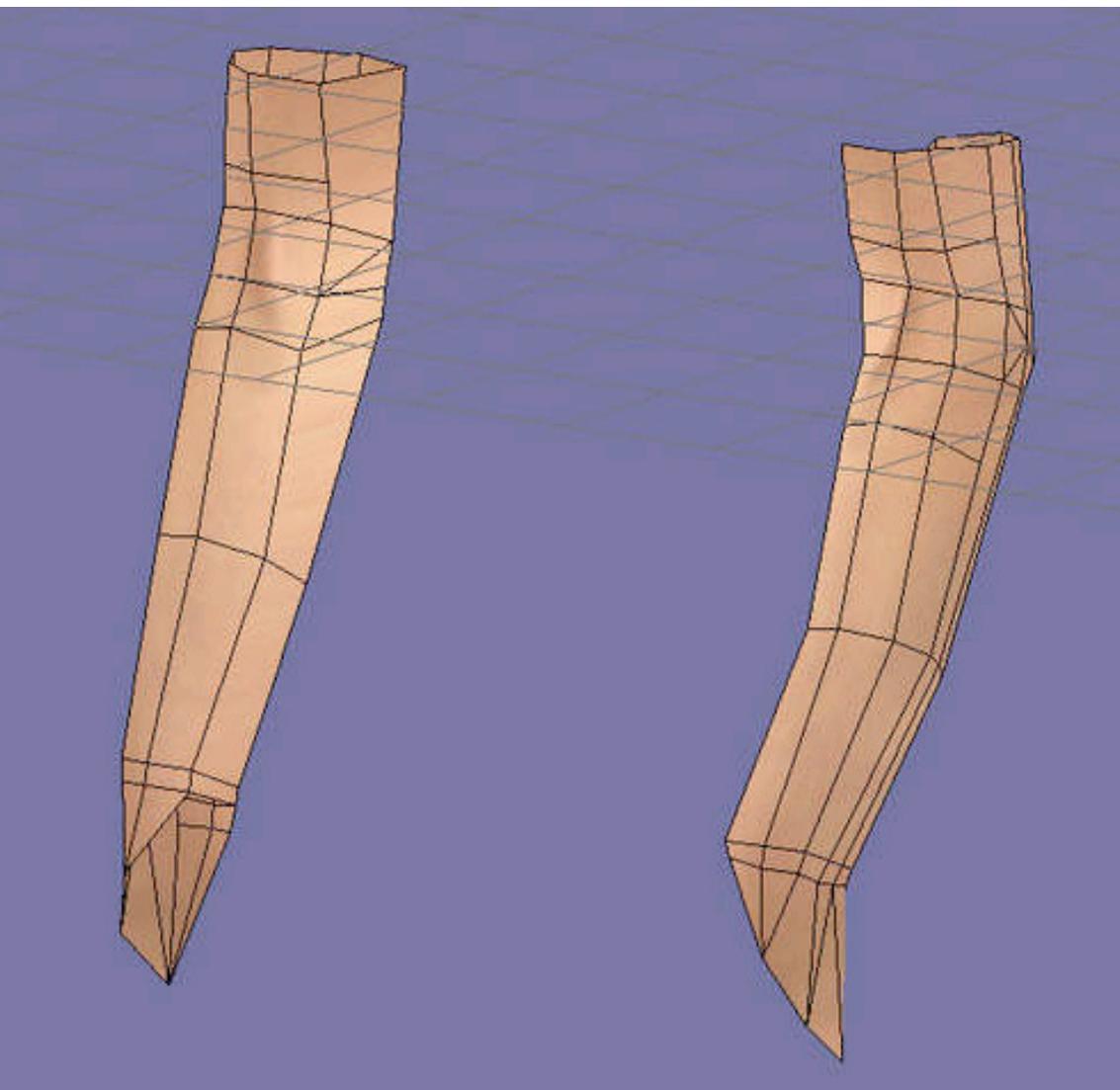
Step Nine – Modeling The Arms

For the arms you can use box modeling instead of line modeling, which means that you start with 2 extruded tubes coming out of the armholes of the shirt, ending in your pockets if you don't show your hands (Don't forget to merge the points to the trousers. If they refuse to merge, try to join the solids or make the value bigger).

Then use the Cut-Faces-tool (Shift C) to divide the arm into 6 - 8 parts and form the elbow and the beginning of the hand. In the top third of both arm parts it gets a bit thicker, that is really important for them. Again exaggerate a bit with the proportions.

Texturing is very easy if you don't show your hands. Simply use a high resolution skin texture and make it a bit lighter in the middle. You need 2 textures, like in step 8. What differs the front from the back texture is only the small but effective inner elbow valley, as shown in the picture. It should be easy to draw with the lighten/darken-brush.

When you are done with the arms, delete the rest except the size-rectangle and export them as a 3ds-file.



Step Ten – Completing The Upper Part



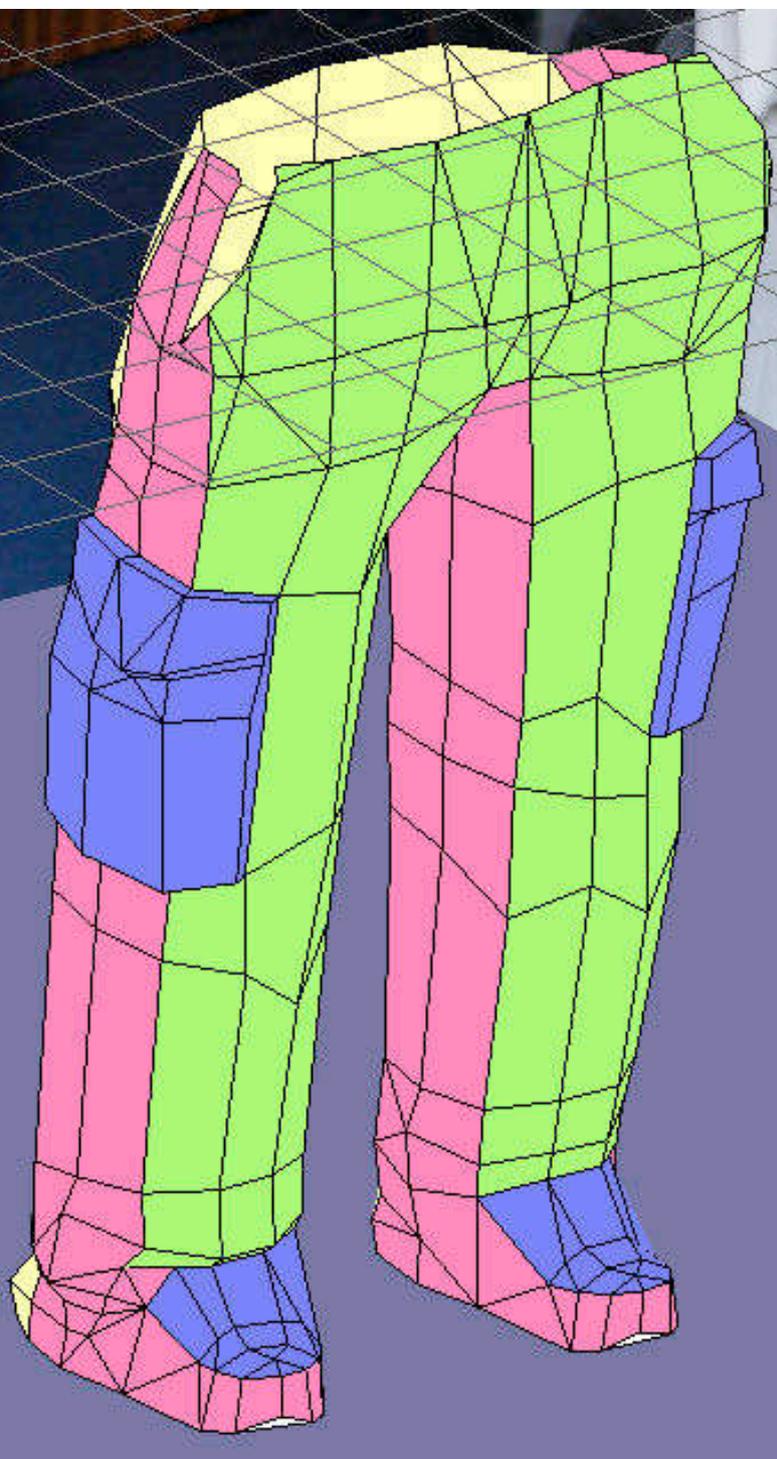
When unfolding the arms in Pepakura, take care that you don't mix the arm-parts. I marked one arm with a letter on the printing sites.

The arms also need flaps on the hand-side if they are in your pockets and flaps on the upper side if you forgot them on the shirt.

It is up to you in which order you attach the 4 parts now. I recommend to do the head first and then the arms, because it is more important for the head to fit correctly; the arms are covered by the sleeves. You can help gluing the arms through the hole in the hip. Use tape on the inner side to fix the arms, that is very effective and easier than gluing.

Step Eleven – Modeling The Legs

Model the legs and shoes the same way you did the arms: Extrude 2 tubes from hip to bottom out of the shirt and divide them into 5 – 8 parts. Then move the points a bit around to create natural folds. Don't be afraid to move points too far away from their original position. As you see on the screenshots, the trousers get more folds on the bottom and where they touch the shoes. The shoes are simple extruded out of the leg-faces on the bottom and made more detailed with the Cut-Faces-tool. Make sure that your soles are absolutely flat on the bottom, so you can stand alone.



Texturing is the same procedure as in step 4. You see the 4 different texturing areas on the picture (front, back, side, top). When you sum up 2 textures, like the blue one for pocket and shoe-top, it looks like that one below. No one will ever take a look at your soles, so you can leave them white. First do the textures for front and back. That means you can use the front texture also for the back, but you have to copy the characteristics of the back on them, like the butt-pockets. Then do the side-textures like in step 4.

Step Twelve – Completing The Clone

Export the model as 3ds, again with the size-rectangle beside it. Unfold it in Pepakura, again with the vertical cut-structure and the settings used before. Do one leg first and then the other, don't bring parts of both legs on one site. Mark the parts of one leg on the printing sheets with a letter that you don't mix them up.

The open side has got to have flaps to fix the artificial cardboard-hip, as seen on the picture.



Don't fix the soles yet, they are done at the very ending.

After you have glued it all together, cut a hole in the cardboard-hip-plate and glue it to the trousers like on the picture. Before you fix the soles, you have to join both halves.

Therefore, let your lower body stand on the floor alone (If it doesn't stand safely, it may help to glue the soles already)

and carefully put your upper body on it to test if it fits. If it does not fit, you have a problem. Then try to make parts smaller with cutting along the glue lines and gluing it tighter.

If it fits, give a good portion of glue onto the lower cardboard hip and put the upper body on it. Then glue the hands into the pockets of the trousers carefully flap by flap. Skip flaps and glue them later, don't do them in a row. It is important that you first gain stability, then you can care for optical issues.

You can still help out through the bottom of the shoes. If you are desperate about not getting things glued, cut a hole in a face, help through this hole to glue faces together, and print this face again to glue it over the hole.

When you are done, let it dry for 5 minutes, carefully try to lift it. If it holds together, lay it flat on the floor (a bed or something soft would be nice) and attach the soles. Cutting a hole into them before your fix them like on the picture is strongly recommended to prevent frustration attacks.

Lift him up again and admire his appearance.

Things To Do With Your Clone

There are plenty of things you can do with your silent brother. Although he seems contained and shy, some people experience a shock when they see him, recognizing his non-fleshiness.

But first you should make a few photos to load on your iPhone and show your friends, because he unfortunately can't accompany you into your favorite pub and he can't participate in a football match.

My clone seems very thoughtful, so I put him behind a window to let him take a look at what he will never experience. When you observe people walking by, discovering him, you sample some funny reactions.

What might be more fun is putting him in front of the door of a friend, ring, and seek shelter (equipped with a camera). But I personally am too afraid of my buddy to be punched in his fragile face by the air draft of the slammed door and rolling down backwards the stairs to do this.

Or you can do another funny art project, like that one of the men in trees, which is all about the people's reactions. In general, it is better for your clone to be far away from the crowd, being hard to identify as a paper model.

