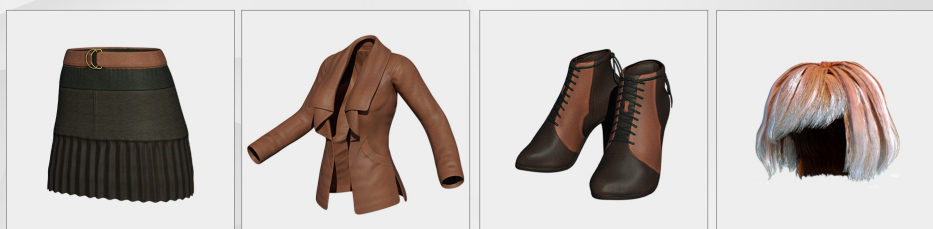




# THE FREEDOM TO CREATE YOUR OWN OUTFITS

Clothes. Hair. Shoes. Accessories.



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# 1 Asset Creation Preface

Character Creator assets come in four types each with their own file format: cloth, shoes, accessory, and hair. A developer can either bring each object into CC individually or batch import several assets at once.

## 1.01 What's Included

The following files are included with this documentation to help you familiarize with the CC asset creation system.

Source Files	Purpose
Body Templates	Includes male, female, and neutral base bodies for reference.
Examples	Working example ccProject and iAvatar files mentioned in this Guide.
Examples / FBX	Working example FBX file mentioned in this Guide.
UV Checker	Includes 4 test maps in square and wide formats.
UV Templates	Includes 6 UV maps to facilitate head and body based texture map creation.
Hair Strand Brush	Photoshop brush to facilitate the painting of hair strips.
Hair Feather Brush	Photoshop brush to facilitate the painting of hair scalp.

## 1.02 Software Requirements

Developers are free to use whatever 3D tools they are comfortable with in conjunction with Character Creator and iClone. Below are some of the tools Reallusion uses internally:

Software	Version*	Range of Application
Autodesk Max, Maya, Etc.	2013	Modeling, skin binding, export, etc.
Pixologic Zbrush, Etc.	--	High poly detail modeling
xNormal	--	Projection and texture baking
Reallusion Character Creator	1.5	Store assets in iClone formats
Reallusion iClone	6.5	Soft Cloth Settings

\*Minimum version required, latest version recommended.

Recommended 3<sup>rd</sup> party 3D computer graphics software:

Software	Developer	Difficulty	Platforms	Price Range
Blender	Blender Foundation	High	Windows, Mac, Linux	Free
LightWave 3D	NewTek	Easy	Windows, Mac, Amiga	Medium
Cinema 4D	MAXON	Easy	Windows, Mac, Amiga	Medium
Maya	Autodesk	High	Windows, Mac, Linux	Very Expensive
3DS Max	Autodesk	Medium	Windows	Expensive
DAZ Studio	DAZ 3D	Very Easy	Windows, Mac	Affordable

## 1.04 Poly Count Restrictions

iClone works best at medium level poly count. This means keeping poly count within reason for decent animation frame-rate while high enough for pre-viz rendering. Here are a few rough estimates:

Asset Type	Poly Count ( Quads )
Sleeve-less shirt	2000 to 2500, regular t-shirts are in the upper range.
Shirt with collar & sleeves	4000 to 5000 depending on the presence of buttons, pockets, etc.
Shorts and Skirts	500 to 2000, skirts are in the lower range and cargo pants on the upper range.
Pants	2000 to 4000 depending on the number of pouch pockets.
Jacket	4000 to 5000, depending on pockets and whether its hooded.
Shoes	500 to 2500, depending on coverage and presence of zippers, laces, etc.
Under Wear	500 to 1500, bras are typically in the upper range.
Hard Accessory	100 to 1000, some accessories like ear rings can be well below 100.
Gloves x2	Around 3000, 1500 for each hand.
Plain Hair	3000 to 5000 depending on the length.
Long Stylized Hair	Around 9000 and not over 10,000 due to performance considerations.

## 1.05 Opacity Map Input in CC

CC and iClone's Opacity channel will take into account the texture's alpha channel and have it override the color data of the map. This can be especially confusing when the texture is a mono-channel gray-scale image where the alpha channel is non-existent, so the opacity will be entirely white and opaque.



CC will extract the alpha data from RGB channels.

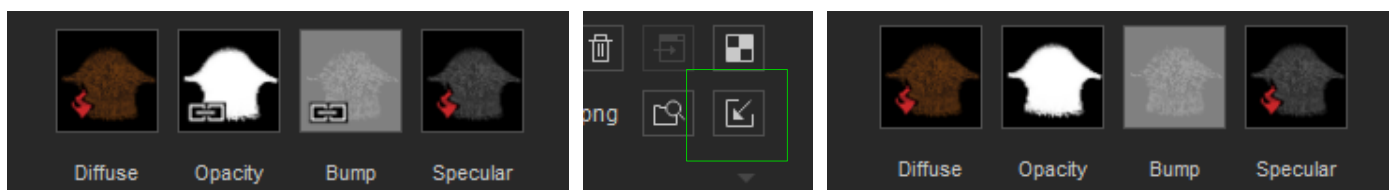
Each channel can carry it's own alpha bits.

Index color mode will carry an alpha layer.

The alpha for gray-scale is non-existent.

## 1.06 Embedding Textures in CC

Character Creator will link external textures whenever possible, for instance, when it's not being generated procedurally by **Appearance Editor**. Make sure to embed the external textures to ensure maximum interoperability.



The link icon represents a read-in texture.

Embed Texture →

The maps are now embedded in the project.

## 2 Body Templates

### 2.01 Template Files

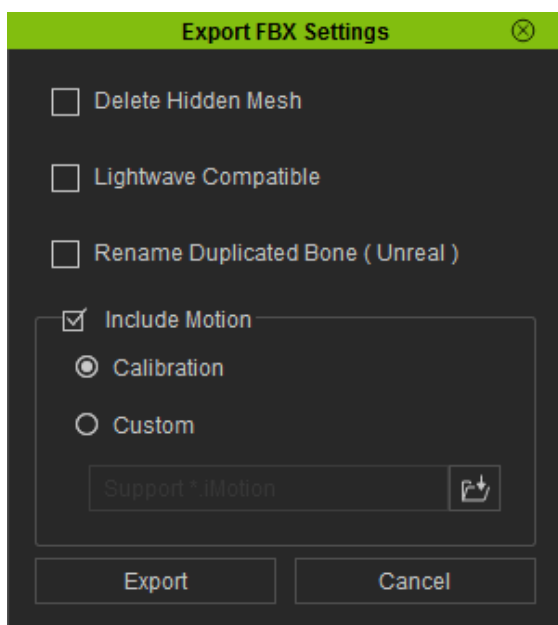
Developers should use either the male or female body model as a guide ( found under **Source Files/CC Base Body** ). Assets should be designed to fit the pose at frame 0 in the time-line. Joint orientations, foot contacts, and hand contacts should also be adjusted at frame 0. The Base Body Template should always be prefixed with “CC\_Base\_”, and during export should not possess any changes to the nomenclature. Name spaces are also prohibited.

**A change in hierarchy or naming of the Body Template will cause CC importer to fail.**

In some circumstances, one may want to use the neutral base model which is a gender-less body. This is useful for assets that don't need to conform to very gender specific body shapes like breasts, enlarged hips, upper body muscle tone, etc. Assets such as these can include certain uni-sex clothing, uni-sex hair styles, etc. Under rare circumstances, one may want to design assets for a certain body type. If this is the case, one should export a body template directly from CC after the morphs have been applied.

### 2.02 Pipeline Export from CC

Developers who have purchased the Pipeline version of Character Creator are encouraged to directly export the body template from the application via **File > Export to Fbx > Clothed Character**.



**Delete Hidden Mesh** will remove any faces that are hidden by the **Edit Mesh Mode**. Always disabled this option when creating the standard character body template.

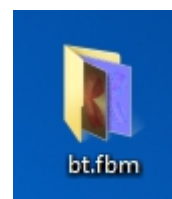
**Lightwave Compatible** should only be enabled if the destination 3<sup>rd</sup> party application is indeed LightWave 3D. Otherwise make sure this option is disabled.

**Rename Duplicated Bone ( Unreal )** should only be on when working with the Unreal game engine development kit. Do not enable this option if one is creating a standard body template that will be brought back into Character Creator.

**Include Motion** will export, along with the character template, an animation. One can use **Calibration** which will animate the character with a default set of test motions for skin weighting or **Custom** for loading their own iMotion files.



A fbxkey file will also be created by the exporter. This is the **Decrypt Key** file required when bringing the same character back into Character Creator, therefore avoid deleting it. An additional fbm folder will be created when the fbx is used in a 3<sup>rd</sup> party 3D application. This folder will contain all the textures that were embedded with the fbx file and unpacked as a result of the import.



**Do not delete the fbxkey file. You may need it later for Character Creator.**

## 3 Clothing Creation

Items that are bound to the bone weights, usable with **Appearance Editor**, influenced by Conform Clothing, and saved in the .ccCloth format fall under the Cloth category.

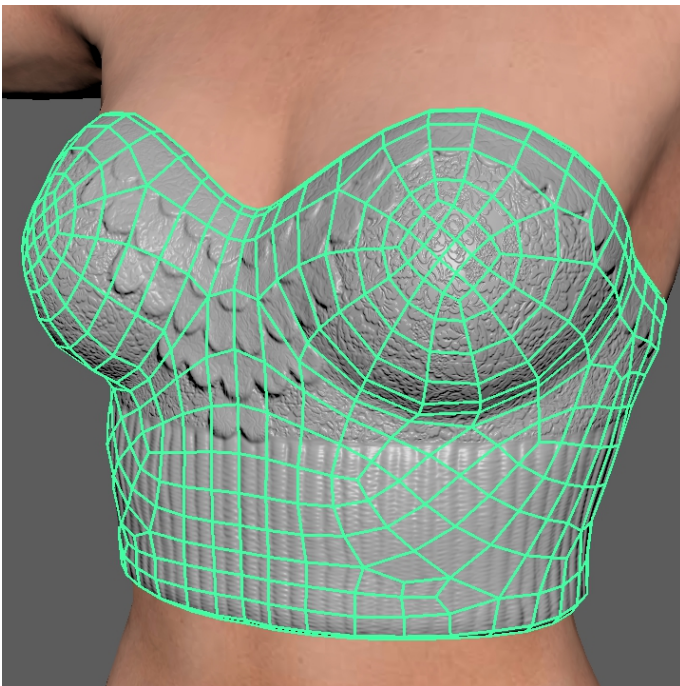
### 3.01 General Work-flow

Typical clothing creation steps:

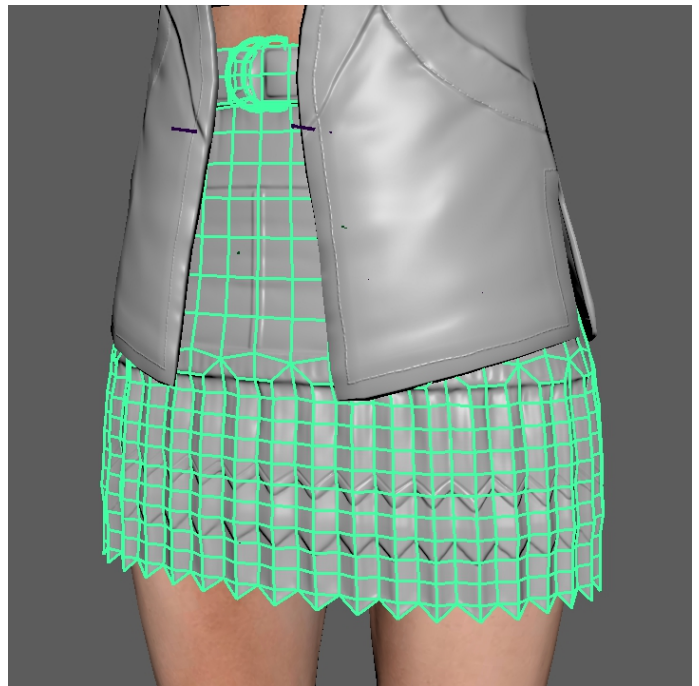
- 1) Select a gender among the two base bodies for a guide.
- 2) Create a new or fit an existing low poly garment based on the guide
- 3) Bind and modify / transfer skin weights from the body to the garment.
- 4) Export the garment along with the base body as a FBX file.
- 5) Load the FBX file into CC and select the appropriate **Source Character**.
- 6) Adjust the layer ordering (refer to the chart in sec. **8.02 Collision Level Assignment**).
- 7) Apply custom textures to the **Appearance Editor** and adjust its settings.
- 8) Store the garment as a separate object in **ccCloth** format.

### 3.02 Low Poly Topology

Attempt to mirror the edge flow of the body mesh for the breasts, crotch, shoulders, elbows, knees, and armpits because these areas are very malleable when animated. Cloth that will have soft-cloth applications do well with evenly spaced grid-like mesh and generally have higher mesh density than their stiff counterparts.



Skin tight clothing, such as this tube top, should have similar edge flow to the underlying body.



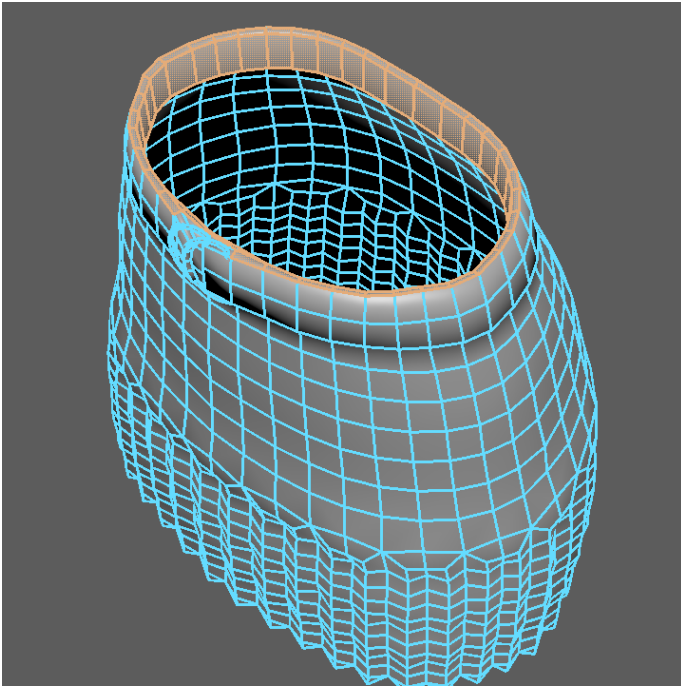
The bottom of this skirt has more grid-like, denser mesh which is suitable for soft-cloth physics.

Keep the following tips in mind when creating the low poly mesh:

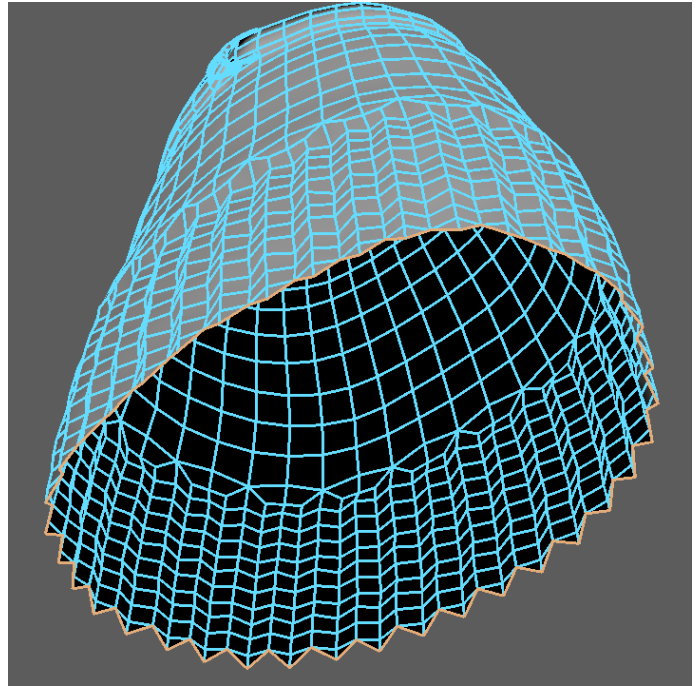
- When making a set of outfit make sure the meshes do not intersect at the static model level.
- Tight fitting clothing should have similar topology flow to the body to support deformations.
- Attaching the suffix "Mesh" to every asset name is recommended for prevent naming conflicts.

### 3.03 Edge Folds

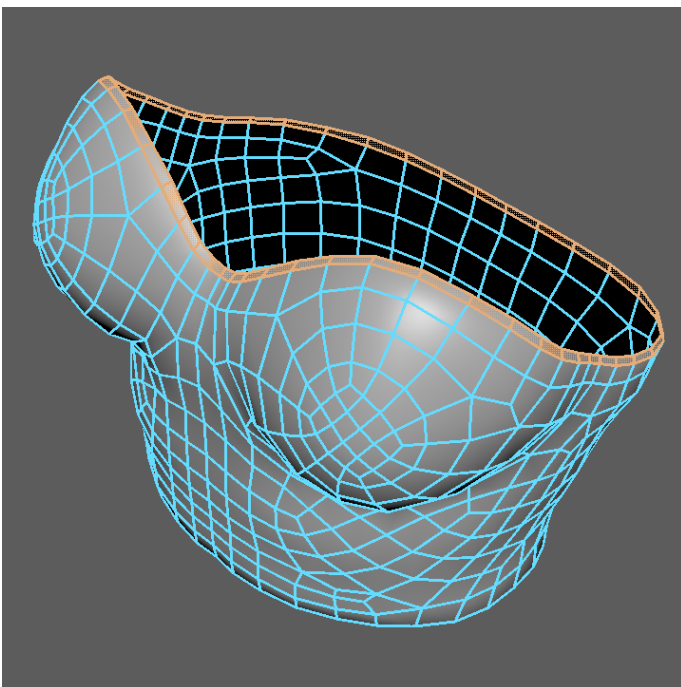
The open borders of a garment (collar, hem, cuff, etc.) need to have a slight thickness and, may at times, need a double sided thickness. Soft-cloth portions of a cloth should only have one-sided geometry and its rendering method set to double-sided inside iClone.



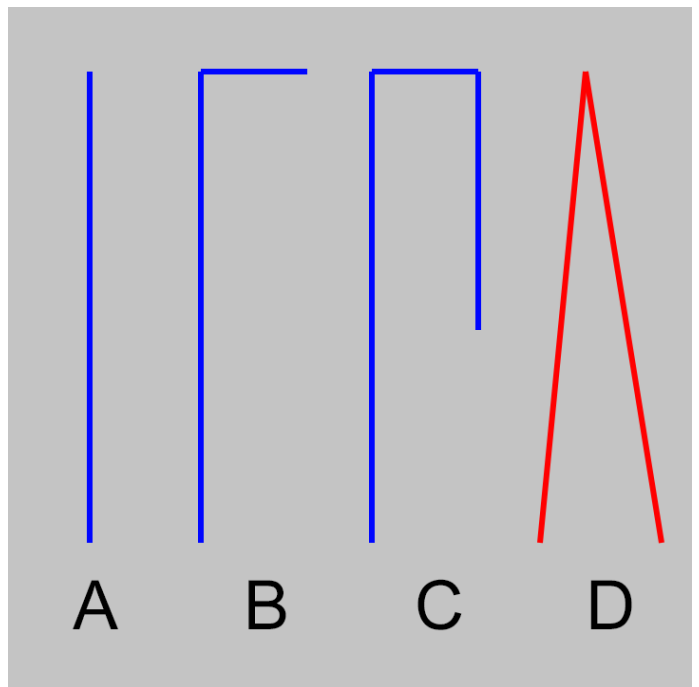
The waist of the skirt is double sided thick in case there is spacing between it and the body.



The hem of this skirt is single-sided thin, ideal for soft-cloth settings.



Form fitting clothing, like this tube top, needs only a single-sided thickness that hugs the body.



A) Single-sided thin. B) Single-sided thick. C) Double-sided thick. D) Avoid double-sided thin.

A Soft-cloth portion of a geometry with thickness will tend to unfold creating an “inside out” effect. See **section 3.12** for more information on Soft-cloth dynamics.

### 3.04 Buffer Space

Try to leave a bit of distance between the garment and the skin surface to prevent mesh penetration caused by morphing.



At default proportions everything looks fine.

Problems appear when the “Heavy” morph is maxed.

Areas with penetration problems need to have a buffer distance.

Developers can choose to use the **Mesh Edit Mode** under the **Modify** panel inside CC to pull out problematic areas of the mesh. However do not rely on this technique for drastic changes to the shape of the clothing as drastic edits can lead to problems with the skinning and animation.

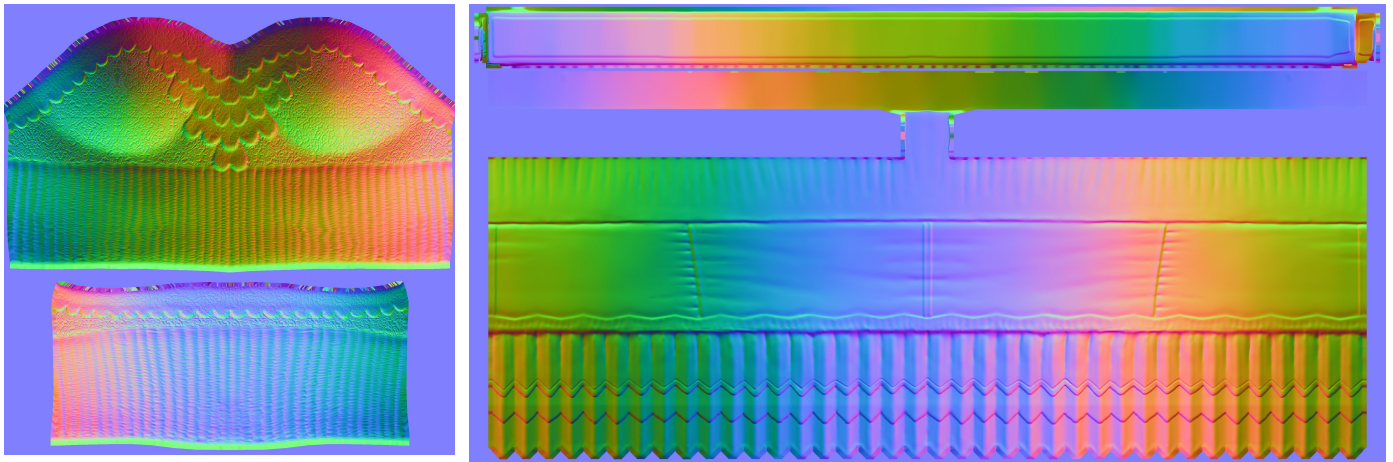
### 3.05 Texture Resolution

Try to use the lowest acceptable resolution settings for the texture maps. At its essence, iClone is a real-time animation software where frames per second should be given special consideration.

Texture Type	Color Space	Resolution
Diffuse	RGB	512x512 – 1024x1024 – 2048x2048
Specular	Greyscale	512x512 – 1024x1024
Normal	RGB	256x256 – 512x512 – 1024x1024 – 2048x2048
WS Normal	RGB	512x512 – 1024x1024
Ambient Occlusion	Greyscale	512x512 – 1024x1024
Opacity	Greyscale	512x512 – 1024x1024
Color mask	RGB	256x256 – 512x512
Physics mask	Greyscale	512x512 – 1024x1024

### 3.06 UV Mapping

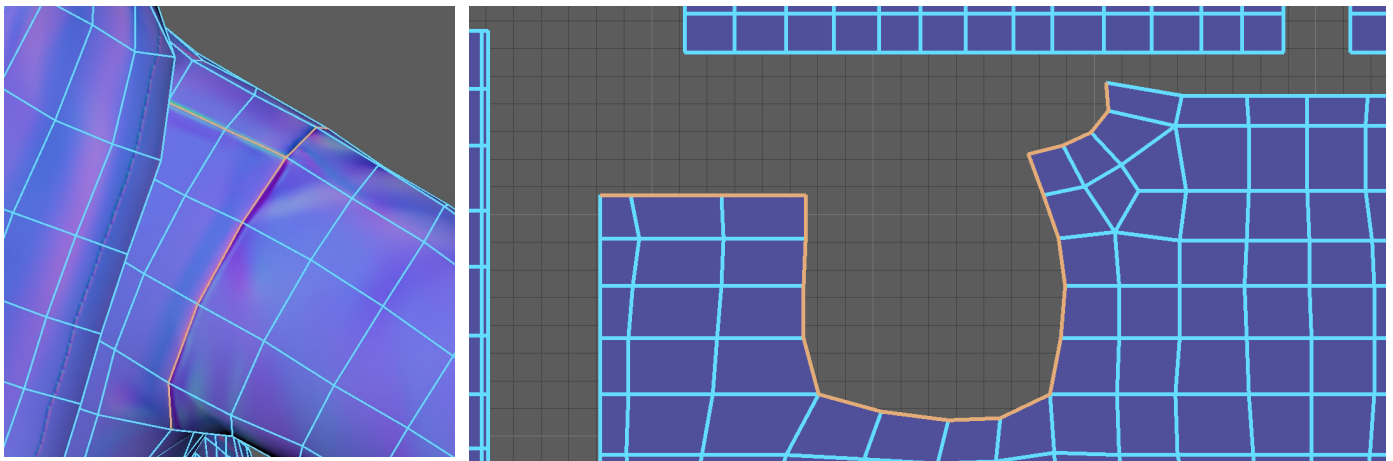
UV spacing will always be re-sized to a square format, however the aspect ratio of the texture maps can either be 1:1 or 2:1. The maximum, preferred size for texture maps are 2048x2048 or 2048x1024.



Always strive to use 1:1 aspect ratio texture maps.

2:1 aspect ratio maps are suitable for instances where the UVs do not pack tightly into a 1:1 aspect ratio space.

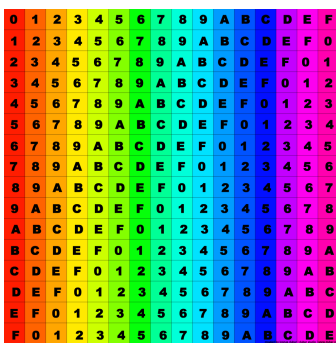
Strive to match UV seams with physical seams for better visual quality. When generating the normals map, pick one side of the UV seam, avoid crossing over multiple UV islands.



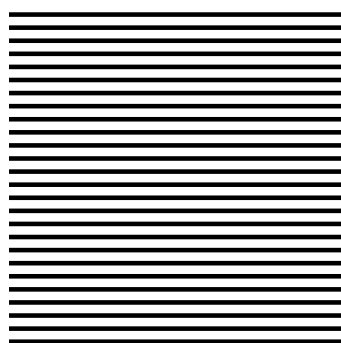
Shoulder seam on the jacket.

UV seam matches the shoulder seam of the jacket normals map.

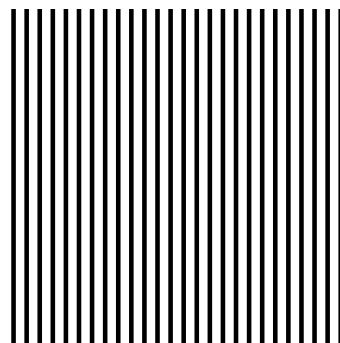
Garments inside CC use the Dynamic Appearance system powered by Allegorithmic Substance material. This procedural generation system have strict UV requirements. Developers should use a variety of texture maps to test for UV layout compatibility ( found inside **Assets/UV Maps** folder ).



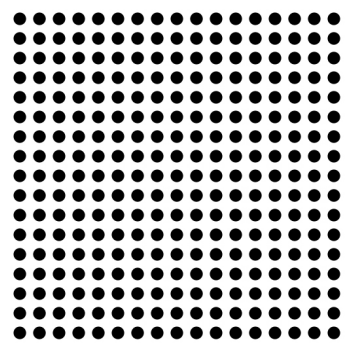
Comprehensive UV checker for general purpose applications.



Horizontal stripes used for testing Substance horizontal plaid layout.



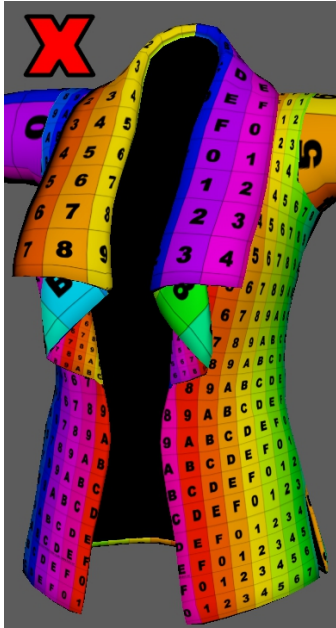
Vertical stripes used for testing Substance vertical plaid layout.



Polka dots used for testing Substance pattern uniformity and layout.



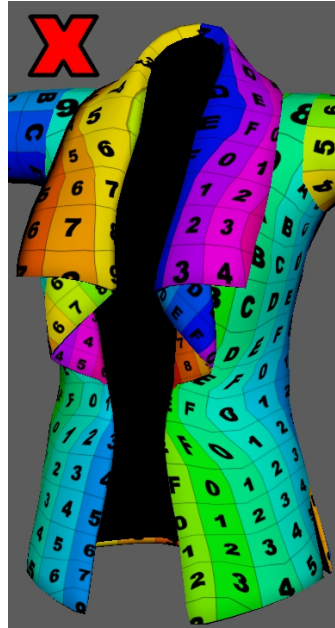
The UV orientation should be upright and uniform when the garment is viewed from the front. Slanted and/or warped UVs should be avoided.



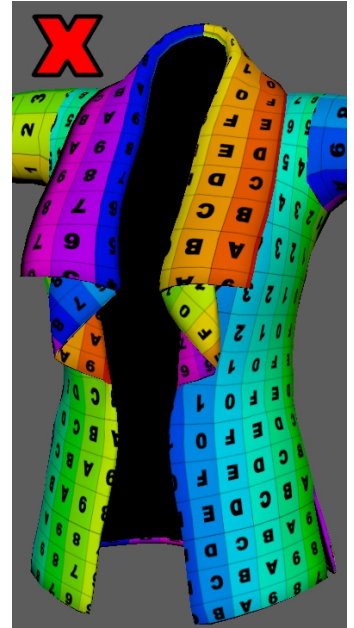
Avoid divergent UV density.



Avoid slanted, rotated UV Islands.

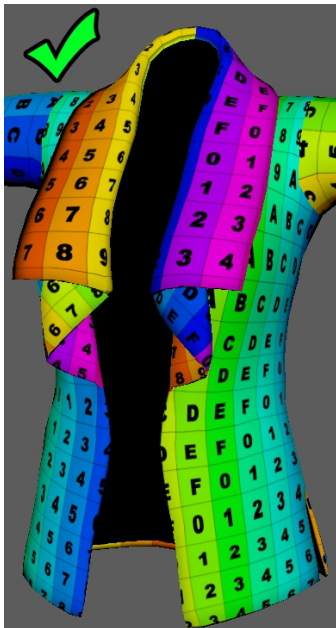


Avoid warped, disorderly UVs.



Make sure UVs are correctly oriented.

UV mapping must pass several tests to be compatible with CC Appearance Editor.



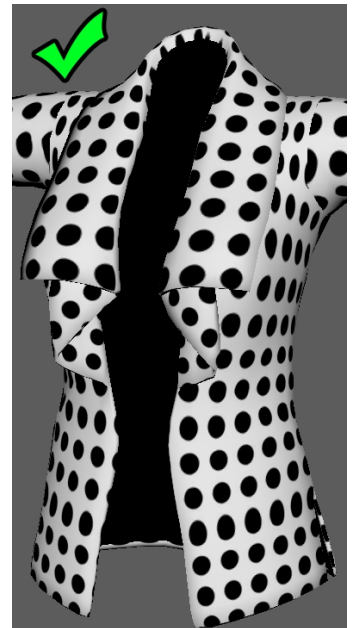
Strive for upright, uniform UVs.



Make sure to test for horizontal stripes.



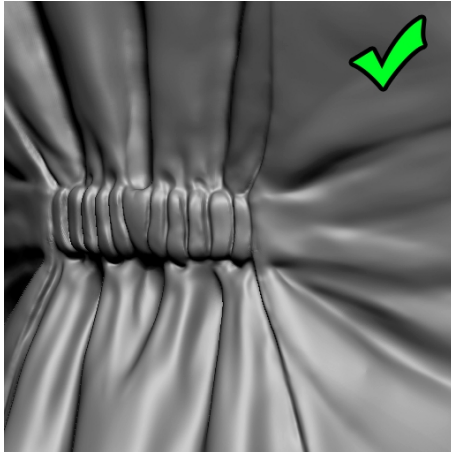
Make sure to test for vertical stripes.



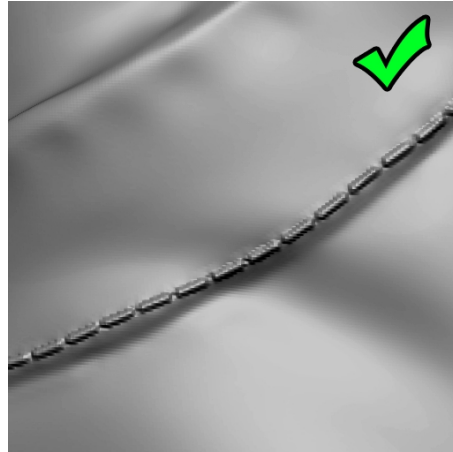
Make sure to test for repeat patterns.

### 3.07 High Poly Sculpting (Optional)

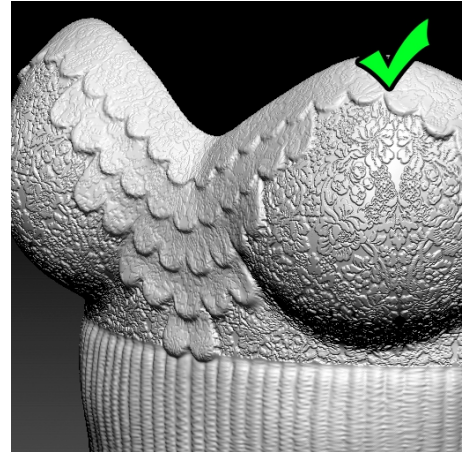
Projecting detail from a high poly to its low poly version is the preferred method for generating texture maps. In-depth knowledge of high poly sculpting is required. Avoid modeling fabric details into the high poly sculpt, instead adjust the **Appearance Editor** inside CC to generate this level of detail procedurally. Sculpting broad wrinkles, embroidery, and seams is encouraged. Below are some does and don'ts of high-poly sculpting.



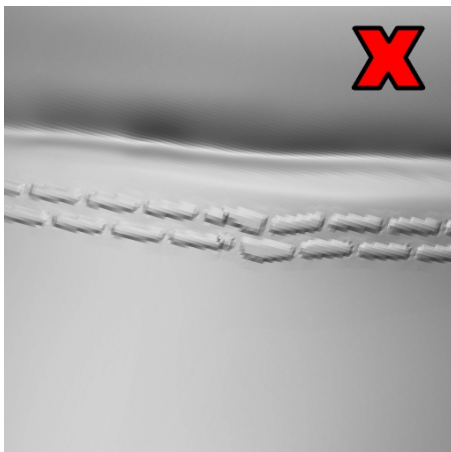
Do sculpt in broad wrinkles.



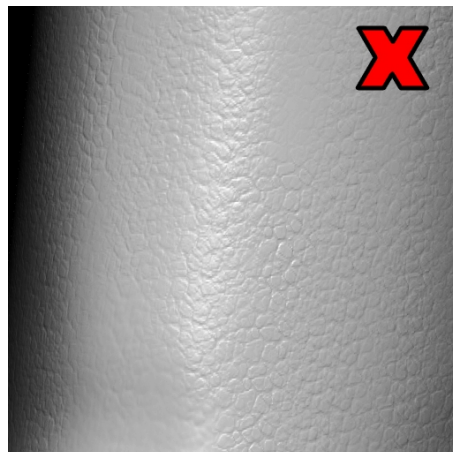
Do sculpt stitches and seams.



Do sculpt in embroidery.



Avoid distortions.



Do not sculpt fabric details.



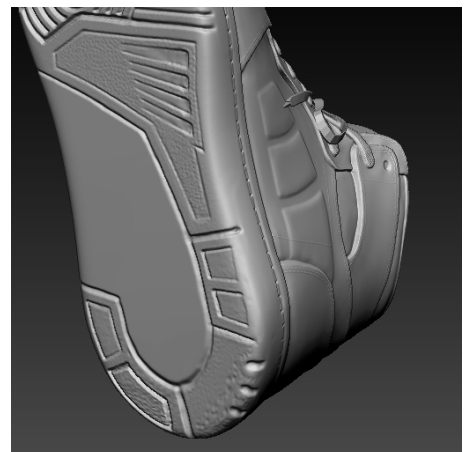
Do not sculpt micro wrinkles.



Strive for accurate bevels.



It's okay to sculpt macro details.

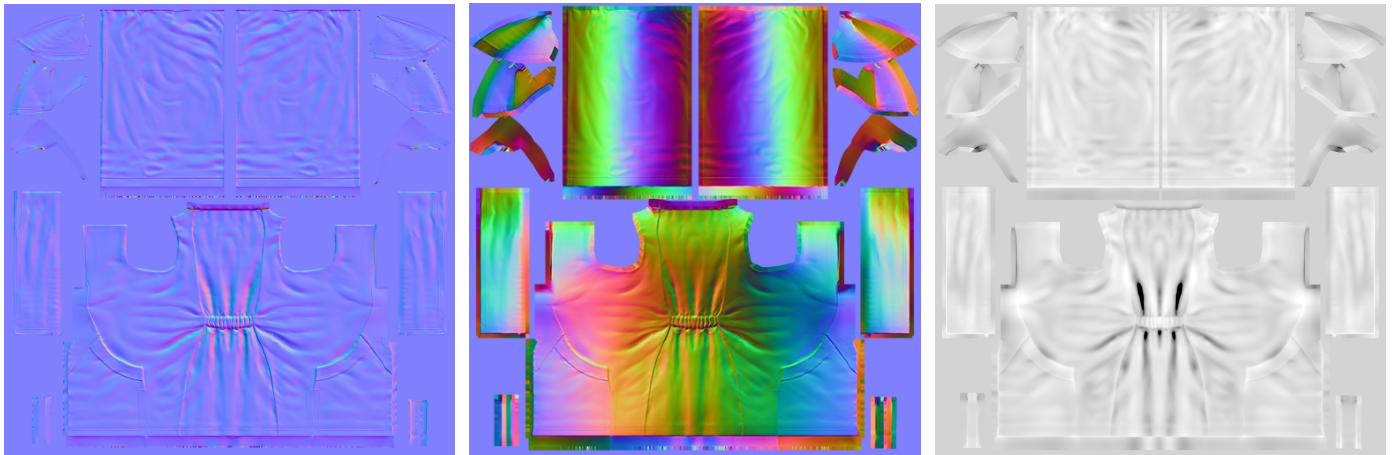


Try to cover all angles.

**Never use a high-poly mesh inside CC or iClone. Use a low-poly retopology instead.**

### 3.08 Texture Maps

Texture maps can either be in 1:1 or 2:1 aspect ratios, must be in power of 2 (64, 128, 256, 512, etc.), and may not exceed 2048x2048 in resolution. CC Cloth dynamic materials use 3 types of source textures to generate a myriad of visual possibilities, they are the following:



Normal map.

World Space Normal map.

Ambient Occlusion map.

**Normal and World Space Normal maps should have coordinate swizzle of X+ Y+ Z+.**

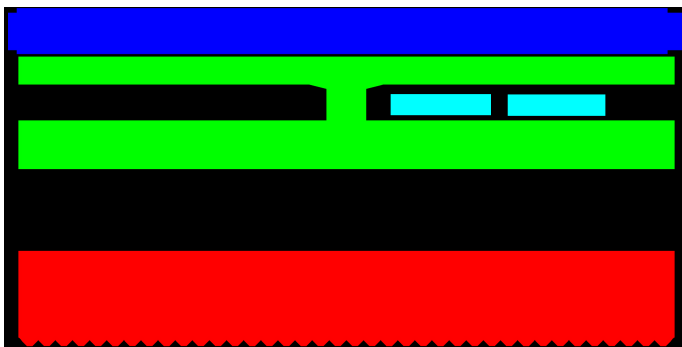
CC Cloth dynamic materials uses a 7 channel color mask to greatly enhance it's visual appearance. Developers will need to create this type of mask by manually painting with pure color values.



Swatch	Name	Color	Value
	Base Fabric	Black	0-0-0
	Fabric 1	Red	255-0-0
	Fabric 2	Green	0-255-0
	Fabric 3	Blue	0-0-255
	Fabric 4	Cyan	0-255-255
	Fabric 5	Yellow	255-255-0
	Fabric 6	Magenta	255-0-255

Each color channel represents a different fabric material. Color values have to be pure even at the border lines.

Appearance Editor assigns a fabric to every color.



RGB-CYMK color mask for the skirt.



Color masks allow for multiple materials.

Color mask can also be used to colorize different regions of the garment using the same textile type. For more information on texturing in CC refer to sec 2.11 Appearance Editor.

### 3.09 Material Settings

Every 3D software handles material settings differently, therefore, it is sometimes impossible to have the values correspond correctly with CC. Generally, one should use whatever is available on the Phong material system. Refer to the chart below as a starting point for the material settings:

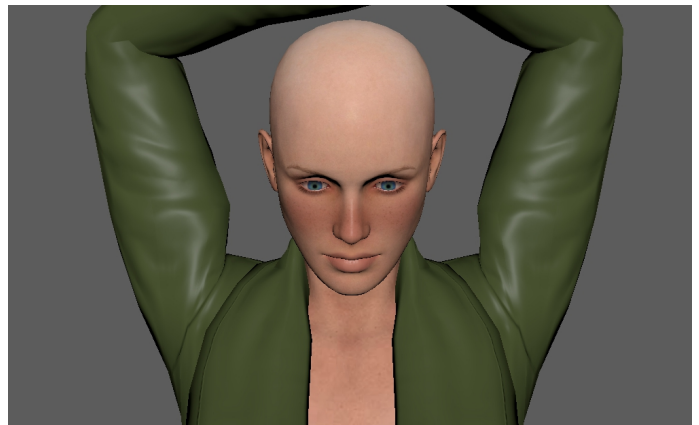
Material Attribute	RGB Value (0 - 255)	RGB Value (0 - 1.0)	Value ( 0 - 100)	Value ( 0 - 1)
Diffuse Color	255 - 255 - 255	1.0 - 1.0 - 1.0	100	1
Ambient Color	150 - 150 - 150	0.6 - 0.6 - 0.6	59	0.6
Specular Color	255 - 255 - 255	1.0 - 1.0 - 1.0	100	1
Specular Level / Roll Off	26 - 26 -26	0.1 - 0.1 -0.1	10	0.1
Glossiness / Cosine Power	26 - 26 -26	0.1 - 0.1 -0.1	10	0.1

### 3.10 Skin Weights

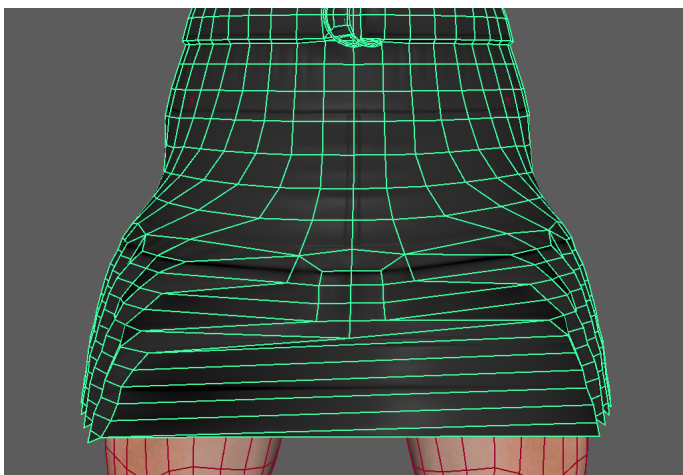
For the best results copy the skin weights from the base body to the garment as a starting point (like **Maya Copy Skin Weights** or **3ds Max Skin Wrap**). Always bind the garment to the skeleton at frame 0 and make sure to bind the entire skeleton hierarchy before copying the weights. When modifying skin weights, it is paramount to exclude all “Nub” bones from the influence list.



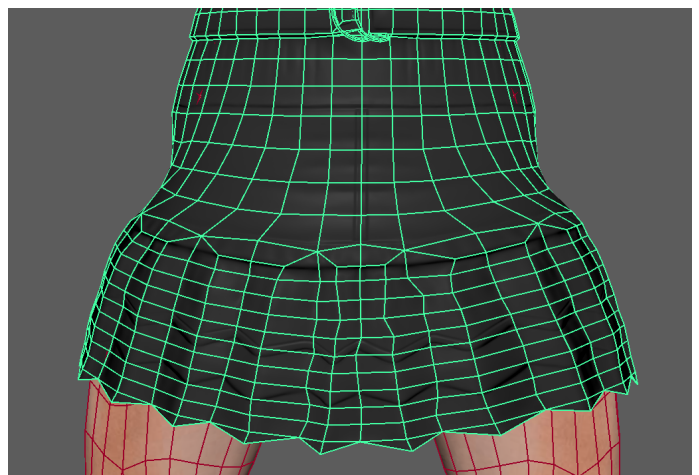
Simple skin weight applications have many intersection issues at default settings.



Copying skin weights can provide a fast and satisfactory solution.



Copying weights can also cause other issues such as the stretching in middle of this skirt.



The copied skin weights will sometimes need manual readjustments.

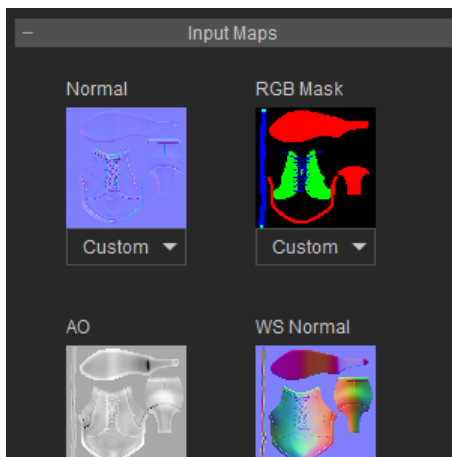
**Always max skin influences and copy weights by name association for best results.**

### 3.11 Cloth Appearance Editor

The most compatible CC cloth rely on **Appearance Editor** for texturing. Cloth **Appearance Editor** breaks down into five main parts ( shoes use the same texturing system ):

Input Maps	Provides input for normal, world-space normal, Color / RGB mask, and ambient occlusion maps. It has a few ways to adjust the contribution of these maps and a handy diagnostic tool to view the input textures.
Fabric	Provides ways to procedurally render a select few types of fabric textures. The regions that mix materials occupy are dictated by a seven channel Color: RGB-CYMK Mask input. The <b>Base Fabric</b> / <b>Black</b> portions of the mask is the default fabric layer. Cloth fabric can support up to seven different regions and types.
Pattern	Possesses one universal plaid generator and three layers of pattern generators. Plaid generator can also be used to make striped patterns. <b>Plaid</b> and <b>Pattern</b> opacity is controlled in the <b>Fabric</b> category.
Decal	Provides options to add surface level details on top the cloth fabric such as patches, pockets, stickers, etc. Decal positioning is along the horizontal and vertical axis of the UV space. There are three decal layers each one progressively layered on the other.
Effect	Supports a set of weathering effects such as discoloration, tearing, aging, dirt, and holes. The three discoloration channels along with <b>Tearing</b> requires gray-scale mask inputs while the rest are procedurally generated.

The myriad of settings and their usage for Cloth **Appearance Editor** is beyond the scope of this guide. Developers are encouraged to experiment with all aspects of the editor to get a handle on all its offerings.



Appearance Editor relies on the input maps to create certain effects.

Plaid generator can create tartan and stripe patterns.

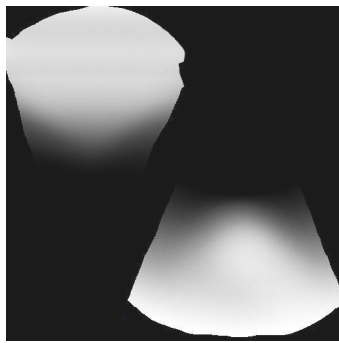
Pattern is great for creating repeat images. Supports randomization.

**Appearance Editor settings will bake into textures when the character is exported**

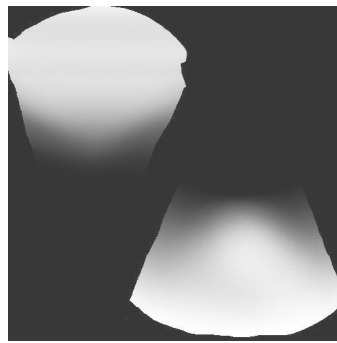
### 3.12 Soft-cloth Physics

Soft-cloth Spectrum Guide		
Black (Skin Weight 100%)		White (Cloth Dynamic 100%)
Great – will preserve original shape.	Shape Integrity	Bad – likely to soften and melt.
Possible – near gray areas.	Mesh Penetration	Not Likely – with Collision detection
Great – no extra calculation necessary.	Performance	Poor – frame-rate may suffer

A garment can have both bound stiff and soft-cloth dynamic portions modulated with gray-scale maps. Soft-cloth texture maps must have pure black areas (RGB 0-0-0) assigned to areas within the UV regions of the body to prevent it from falling down onto or through the floor.



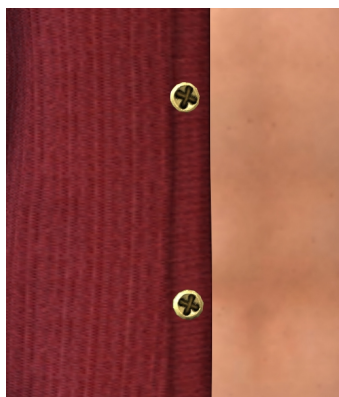
Areas of pure black with RGB 0-0-0 will have no soft-cloth physics, instead will move according to the way it is skinned. Typically the areas should be somewhere in the upper region of the garment to “hang” it on the body.



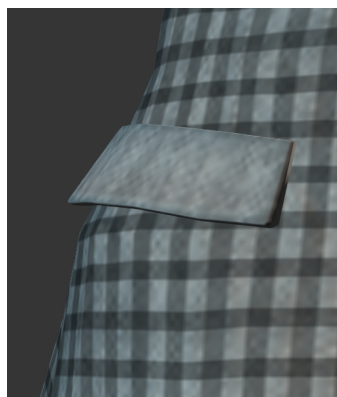
When the Soft-cloth map lacks pure black areas, it also lacks places to “pin” it to the body. Therefore the cloth, subjected to gravity, will simply fall downward through the body.



Some mesh shapes will have structural integrity issues with soft-cloth physics, below are some examples:



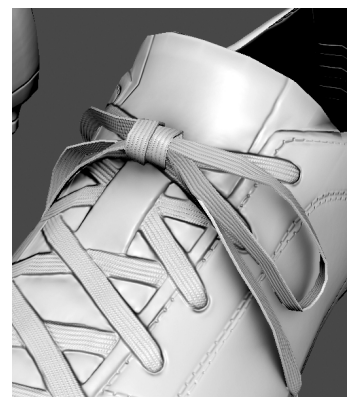
Hard surfaces such as buttons will 'melt' and lose their form.



Separated surfaces will surely intersect or fall apart.



Concave shapes such as this coat pocket will turn inside out.



Tubular shapes such as laces, braids, etc. will flatten out.

**Soft-cloth intersections can be fixed by adjusting the collision shapes of the body.**

### 3.13 Soft-cloth Work-flow

Working from sec. 3.01 General Work-flow:

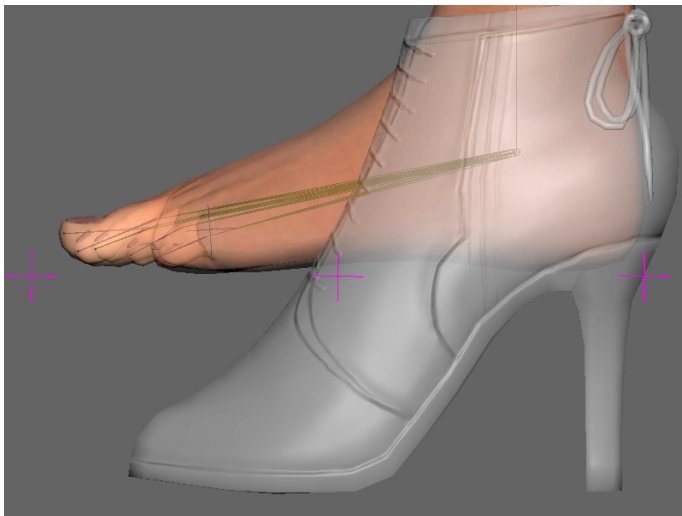
- 1) Apply the newly created clothing to a character and apply a cloth physics weight map.
- 2) Export the whole character into iClone and adjust the cloth physics settings.
- 3) Apply a test motion and adjust the physics collision settings on the character wherever needed.

## 4 Shoes Creation

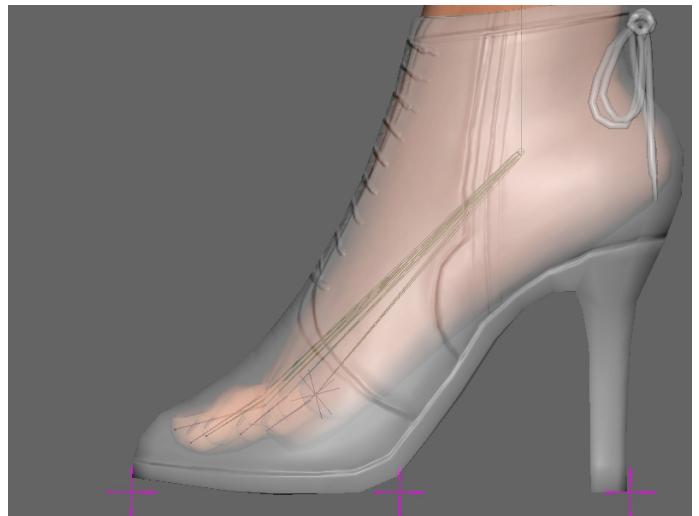
A pair of shoes count as one single model and should be combined and skinned as such. The way to create shoes is similar to creating any other piece of clothing, however shoes have their own .ccShoes format. There are also some additional things to be aware of such as floor contacts and foot binding position. For information on modeling and texturing shoes refer to sec. **3.0 Cloth Creation**.

### 4.01 Foot Binding Pose

For flat soled shoes the foot does not need to be posed, however in the case one is creating raised shoes such as high heels, then the foot needs to be positioned to fit. The ankle can be angled by rotating **CC\_Base\_L\_Foot** and **CC\_Base\_R\_Foot** bone, the toes can be angled together by rotating **CC\_Base\_L\_ToeBase** and **CC\_Base\_R\_ToeBase** bone. These rotations should be done at frame 0.



At default the foot sticks out through the shoes.

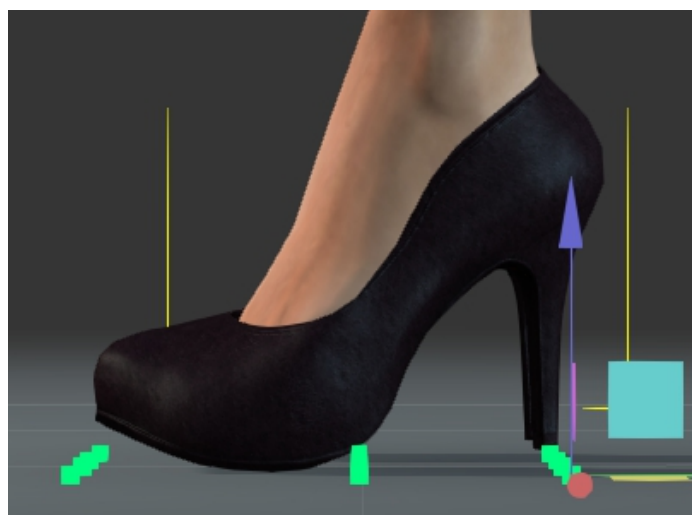
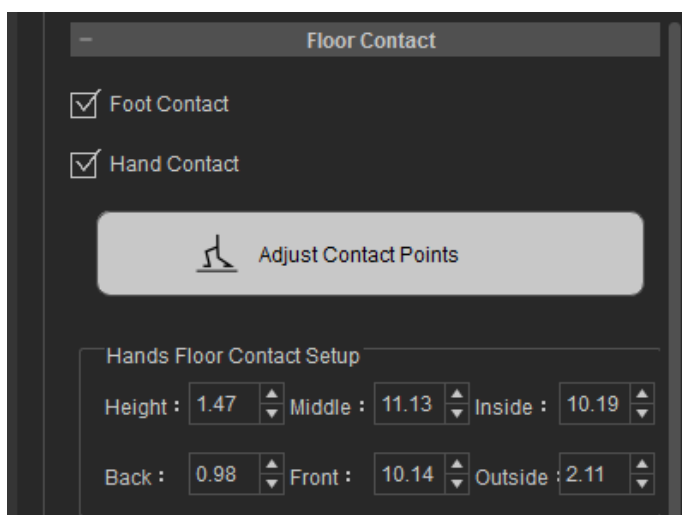


The angle of the toes and ankles now conform.

It is perfectly normal for the feet to stick through the floor plane in the 3D view. Do not at any circumstances, move the body upward or downward to compensate for the floor plane.

### 4.02 Floor Contacts

Floor contacts should be adjusted in Character Creator by activating **Adjust Contact Points** under **Modify > Edit**. Move the points to correspond with the tip of the toes, ball of the feet, and back of the heels.



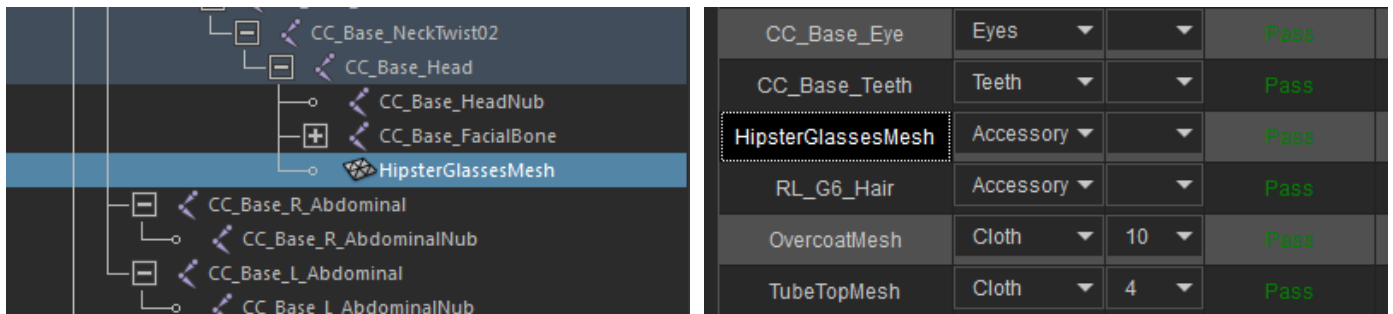
## 4.03 General Work-flow

1. Create or re-purpose an existing shoe mesh.
2. Pose the foot to fit the shoes by rotating the ankle and toe base bones.
3. Bind and transfer weights from the body to the shoes.
4. Export the character template as a separate FBX file (if different from default).
5. Export the character with the shoes as a FBX for Character Creator.
6. Assign the **Source Character** during import as the character template (if different from default).
7. Categorize and assign a layer in the second import window.
8. Adjust materials and textures through the **Appearance Editor**.
9. Store the shoes in **ccShoes** format.

## 5 Accessory Creation

Any hard object that does not need to conform to the body and carries with it its own set of material and textures without the assistance of **Appearance Editor** is considered an accessory. Piercings, glasses, hats fall under this category. Of all the asset types, accessories are the most straightforward to create, however keep the following points in mind:

- Accessories can carry bones but may not be bound to the bones of the body.
- An accessory requires a parent bone to be recognized as such.
- Accessories should carry their own custom textures and materials (no **Appearance Editor**).



Here the glasses mesh is parented to the head bone. Once inside CC, it is recognized as an accessory.

### 5.01 Parent Bone

The bone that the accessory is attached to is the one that dictates its transformations. It is essential have the accessory attached to the right bone in the skeleton hierarchy.

Parent Bone	Recommended for...
CC_Base_Head	Glasses, earrings, hats, etc.
CC_Base_NeckTwist02	Collars
CC_Base_Spine02	Pendants
CC_Base_X_FingerXX	Rings

### 5.02 General Work-flow

1. Attach the accessory under a parent bone.
2. Export as the entire character as FBX to Character Creator
3. Categorize and assign a layer
4. Adjust materials and textures by using the **Appearance Editor**.
5. Store the accessory in **ccAcc** format.



## 6 Conforming Hair Creation

iClone currently does not have a real fur and hair solution, so all hair is made of geometry. There are two types of hair systems in iClone, the **Conforming** and **Spring** type (using Spring and Cloth dynamics together on the same mesh is often problematic). This guide will focus only on Conforming Hair.

### Conforming Hair

- Will conform to the shape of the head.
- Can use Soft-cloth physics.

### Spring Hair

- Will not conform to the shape of the head.
- Carries its own bones.
- Relies on Spring bone dynamics.

The hair mesh consist of the scalp and hair strips around it and they each have their own materials with their set of UVs and textures. The hair mesh is designated as such in CC by its name, therefore always have it named **RL\_HairMesh**. For the sake of clarity prefix the two hair materials with **Hair**, for instance, 'Hair\_Scalp' and 'Hair\_Strips'.

**Always name the hair mesh as RL\_HairMesh else CC will fail to recognize it.**

### 6.01 Modeling Process

Model the scalp first by copying portions of the Base Model head mesh and scaling outwards to cover the base mesh. Keep a few things in mind while creating the hair strips:

- Plan out the hair strips in layer groupings, for instance inner, middle, and outer groupings.
- Always plug the hair strip into the scalp mesh, do not 'float' the strips.
- Leave a small gap between each strip as to prevent problems with dynamic collisions.
- Create a unique strip for a grouping. UV and duplicated it around the head to save time.
- Work from the inside to the outside layer while keeping a small space between the layers.
- The inside layers should have thicker strips while the outer layers have thinner strips.
- The root of the hair strip can have more divisions to support a nice rounded bend.



The scalp serves as a backdrop for the hair.



Hair strips should be added in a layered fashion.



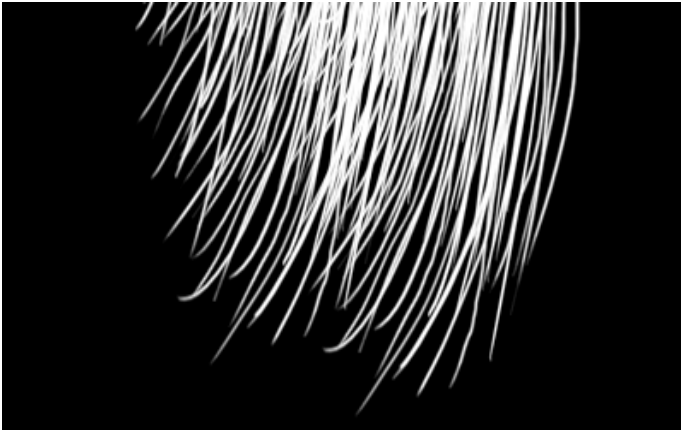
There are a total of 6 layers in this example making a 'fuller' look.

Once the scalp and the hair strips are made combine the pieces together starting from the scalp and attaching one layer at a time from the inside to the outside. This is so to prevent opacity layer disorder in DirectX 9 (this visual phenomenon does not occur in DirectX 11 and above).

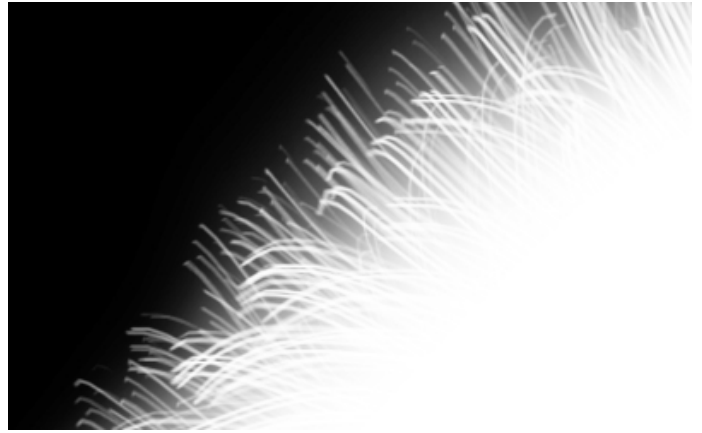
**Avoid exceeding 10,000 quad poly count, otherwise performance may suffer.**

## 6.02 Painting Hair

The rightly configured paint brushes will greatly enhance and ease the work-flow when it comes to texturing the hair and scalp. Generally one would need at least two types of brushes, one for the hair strips and one for the hair scalp. The hair strips need very thin stringy brush while the hair scalp needs a fan brush capable of feathering out several short strands at a time. The following examples were done in Photoshop:



Hair strip strands are crisp and sharp.

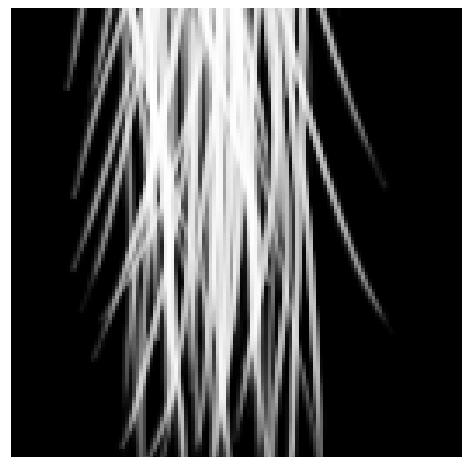
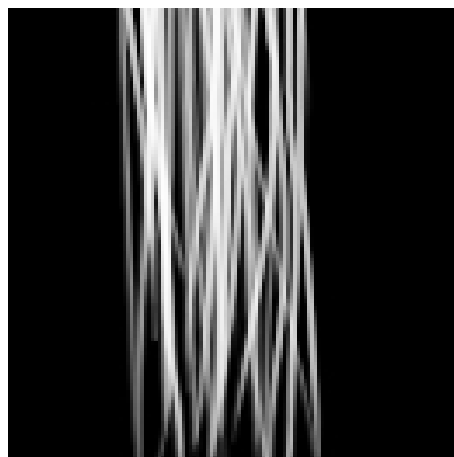
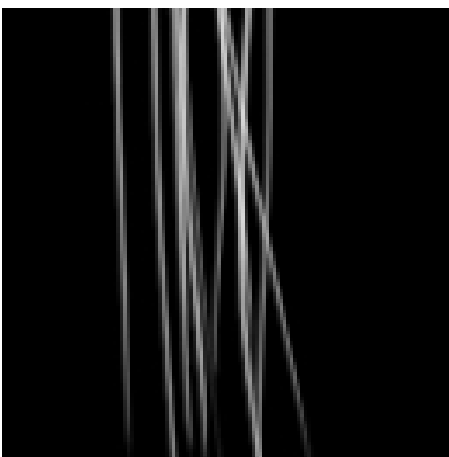


Hair scalp is feathered and blurred.

The hair scalp is a build up of different layers, starting from a shaded fuzzy base:



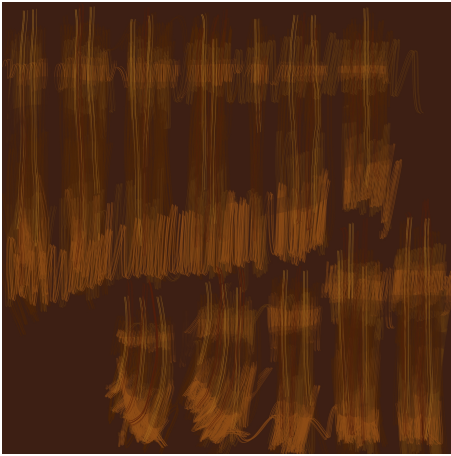
Inner layer of hair strips can be more dense while the outer layers can have a more sparse opacity. For the hair strands build up the layers towards a balance between orderly and erratic:



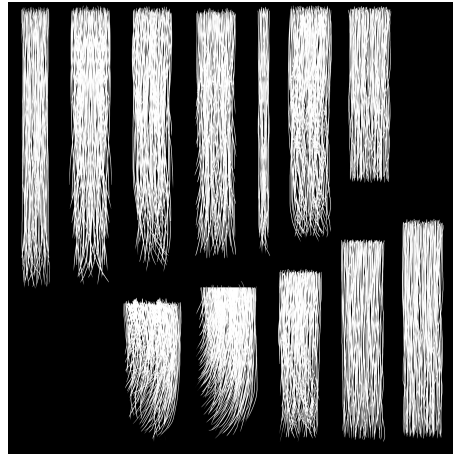
Sample Photoshop hair scalp and strand brushes can be found in **Source Files / Hair Brushes**.

## 6.03 Hair Strip UV and Texture Mapping

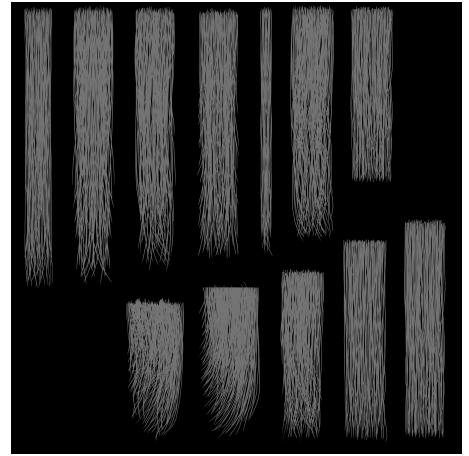
Hair strip UVs should be laid out in an orderly fashion, vertically upright, and with at least 10 pixels buffer distance between each UV island. Overlay similar strips together in the same area to reuse the texture space and soft-cloth gradient. Hair strips material has diffuse, bump, specular, opacity, RGB mask, and physics weight input.



Diffuse map should have a colored backdrop to provide a matte for transparency.



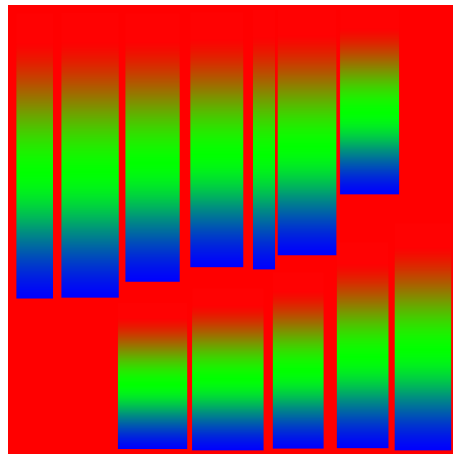
Opacity map should have sharp outlines and high contrast for better performance.



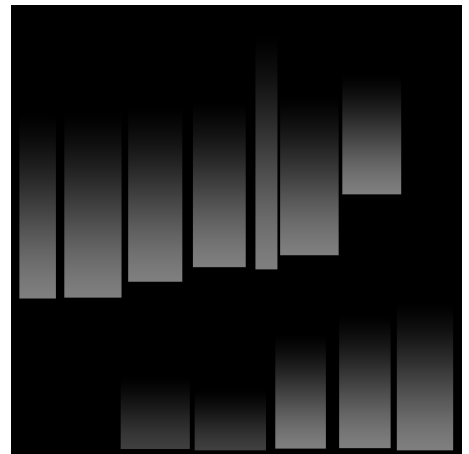
Specular map should have the same opacity cutout to prevent shiny edges.



Bump map should be derived from a gray (RGB: 128-128-128) backdrop.



RGB mask separates the hair into color regions useful for adjusting hue, saturation, and lightness.



Physics weight map should have at least 10 pixels of pure black (RGB: 0-0-0) from the hair root.



Hair strips are grouped according to look and physics settings to economize on UV spacing.



Here the 12 different hair strip appearances combine together for one coherent look.



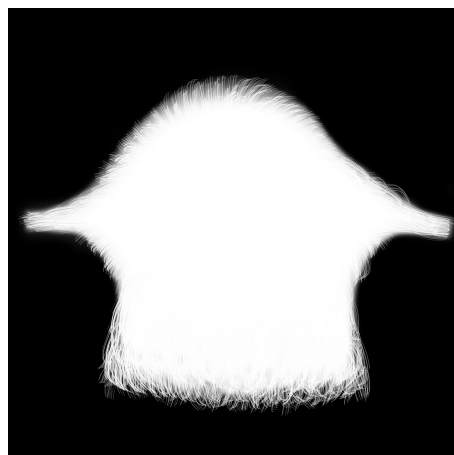
The final look with every input texture and material adjusted inside Character Creator.

## 6.04 Scalp UV and Texture Mapping

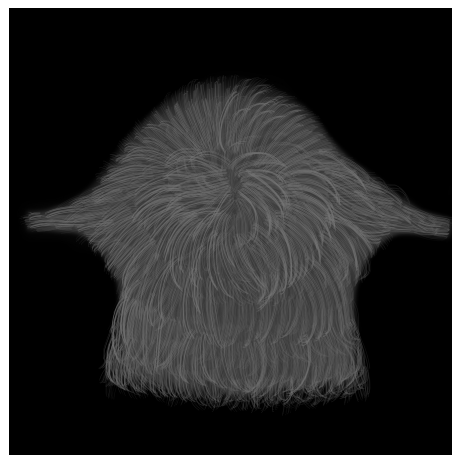
Scalp UV should be evenly laid out. The scalp should not have soft-cloth dynamics. Hair strips material has diffuse, bump, specular, opacity, RGB mask, and Physics map input. Hair scalp material has diffuse, bump, specular, opacity, and RGB mask input.



Diffuse map should be darker than the diffuse map for the hair strips creating an occluded effect.



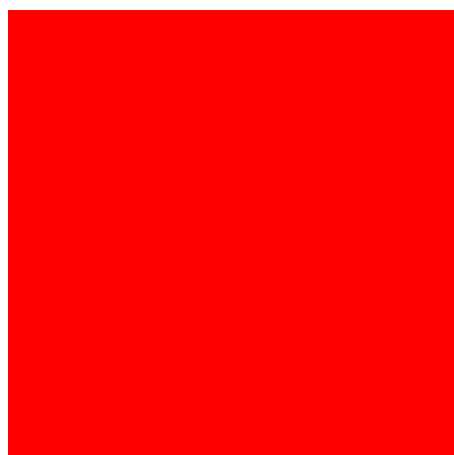
Opacity map should have slightly blurred edges to smoothly blend into the head underneath.



Specular map needs the same cutout as the opacity map to prevent shiny edges.



Bump map should not have values less than gray (RGB:128-128-128) as the hair do not 'dig' in.



In this example the scalp has a pure red color so it will always match the HSL of the primary hair layer.



Pay attention to how the scalp blends in with the rest of the head for a smooth natural look.

## 6.05 Texture Map Resolution

Because the hair can have upwards of 11 texture maps, the performance inside iClone can be negatively impacted. Therefore, do control the resolution and color space of the hair textures:

Texture Type	Color Space	Hair Strips Resolutions	Hair Scalp Resolutions
Diffuse	RGB	256x256 → 1024x1024	128x128 → 512x512
Specular	Greyscale	256x256 – 512x512	128x128 → 512x512
Bump	Greyscale	512x512 – 1024x1024	256x256 → 1024x1024
Opacity	Greyscale	512x512 – 1024x1024	256x256 → 1024x1024
Color mask	RGB	256x256	8x8 → 256x256
Physics mask	Greyscale	512x512	Not Applicable

## 6.06 Skin Binding

Once the hair mesh is completed, make sure the hair mesh pivot is aligned with the **CC\_Base\_Head** bone. Try to have the hair mesh skin bound to as few bones as possible. In the case of hair shorter than shoulder length, having the entire mesh skinned to the **CC\_Base\_Head** bone is sufficient. Normally the skin weights will not exceed beyond the **head**, **spine01**, and **spine02** bones. Not all bones in the skeleton is appropriate for the hair, below is a list of the compatible bones:

Left Side Bones	Center Bones	Right Side Bones
CC_Base_L_Clavicle	CC_Base_Head	CC_Base_R_Clavicle
CC_Base_L_Upperarm	CC_Base_Spine01	CC_Base_R_Upperarm
CC_Base_L_Forearm	CC_Base_Spine02	CC_Base_R_Forearm
CC_Base_L_Hand	CC_Base_Waist	CC_Base_R_Hand
CC_Base_L_Thigh	CC_Base_Hip	CC_Base_R_Thigh
CC_Base_L_Calf		CC_Base_R_Calf
CC_Base_L_Foot		CC_Base_R_Foot

Various 3D applications will have their way of pruning skin weights to zero such as Maya's **Component Editor** and Max's **Weight Table**. Having soft-cloth physics with collision shapes to override the skin binding is highly recommended for long hair.

## 6.07 Soft-cloth Physics

Remember that portions of the hair with strong soft-cloth influence will become 'limp', exaggerating the hair style at the points where the physics has the strongest influence can mitigate this effect to an extent. The hair strip should not intersect with the body mesh, otherwise the collisions will miscalculate.



Hair pieces can 'fall through' if the soft-cloth weight map is not rooted.



If the soft-cloth weight map is too bright the hair can go limp.



Keep tweaking the soft-cloth weight map to perfect the hair physics.

## 6.08 Hair Appearance Editor

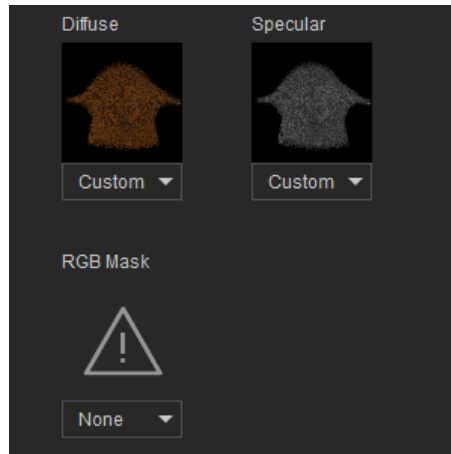
The most compatible CC hair rely on **Appearance Editor** for texturing. Hair **Appearance Editor** breaks down into five main parts including four adjustment layers:

Input	Only has input for diffuse, specular, and RGB mask. The Color / RGB mask demarcate the regions for the base, primary, secondary, and tertiary values.
Base	This layer is always on by default and its regions are set by any color that is not pure red, green, or blue. Only the <b>Base</b> layer does not have opacity or blending options.
Primary ( Red )	This layer will only render on pure red regions of the <b>RGB Mask</b> ( RGB: 255-0-0 ). The red layer will cover the base layer.
Secondary ( Green )	This layer will only render on pure green regions of the <b>RGB Mask</b> ( RGB: 0-255-0 ). The green layer will cover the base and red layers.
Tertiary ( Blue )	This layer will only render on pure blue regions of the <b>RGB Mask</b> ( RGB: 0-0-255 ). The blue layer will cover all of the other layers.

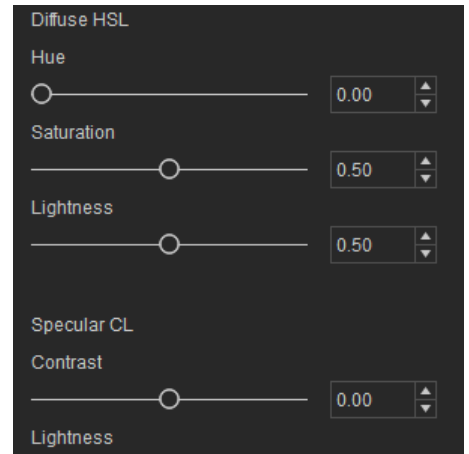
Hair can support up to four different regions.



RGB layers can be used to dye regions of the hair up to four different colors.



If the RGB Mask is left empty then the hair rendering is controlled by the base layer.



Each RGB layer can be used to adjust the diffuse and specular appearance.

The myriad of settings and their usage for Hair **Appearance Editor** is beyond the scope of this guide. Developers are encouraged to experiment with all aspects of the editor to get a handle on all its offerings.

## 6.09 General Work-flow

1. Select either, male, female, or new character base model as a guide.
2. Create the hair strips and scalp mesh as separate geometries.
3. Apply separate material to each geometry e.g. 'hair\_scalp' and 'hair\_strips'.
4. Input the diffuse, bump, specular, and opacity textures for each material.
5. Combine scalp to hair strips into one single mesh and name it **RL\_HairMesh**.
6. Bind the hair to skeleton starting from **CC\_Base\_Hair** bone.
7. Export the entire character as FBX to Character Creator.
8. Adjust the material and load in the RGB Mask into **Appearance Editor**.
9. Set the material to 2-sided. Adjust the **Appearance Editor** if necessary.
10. Input the cloth dynamics weight map via **Modify > PhysX > Edit Weight Map**.
11. Select the hair and save in **ccHair** format.

## 7 Hide Mesh

Differences in topology will often cause the body to intersect with the garment under some unforeseen circumstances, even if the skin weights match up perfectly. The best solution under these situations is to hide the portions of the mesh that lie directly beneath the garment.



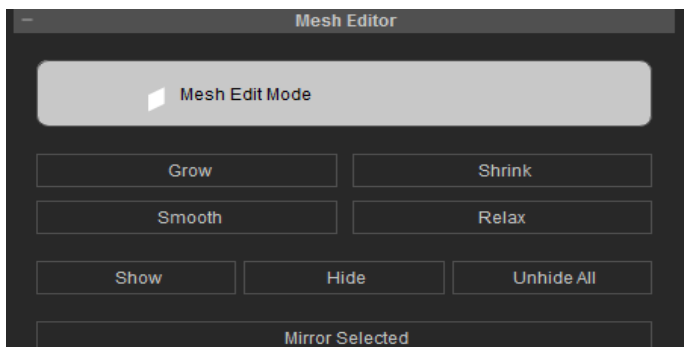
Some intersection problems can not be fixed by tweaking the skin weights alone.



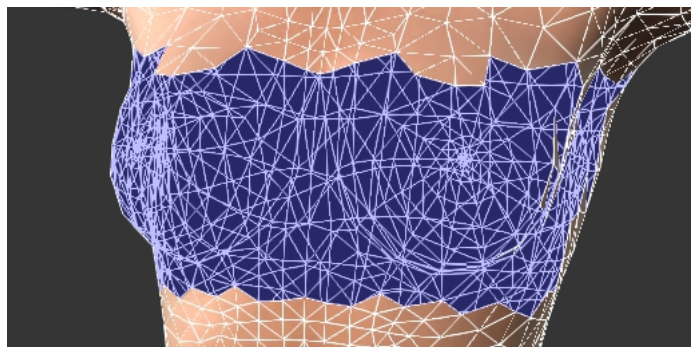
Good skinning along with the ability to hide the mesh underneath provides the ideal solution.

### 7.01 Using Mesh Show/Hide

By far the quickest and most convenient way to hide mesh is to use CC's native Mesh selection feature under the **Modify** panel.



Access the Show/Hide feature under the Mesh Selection mode.



While the Mesh Selection mode is active the wireframe will appear to provide visibility.

Points to consider with this method:

- Hidden mesh is saved on the character, not on the asset.
- Soft Selection has no effect on the visibility regions.
- Hide mesh settings will have to be reapplied on a case by case basis.
- The onus is placed on the end user, unless the content been sold is a character.

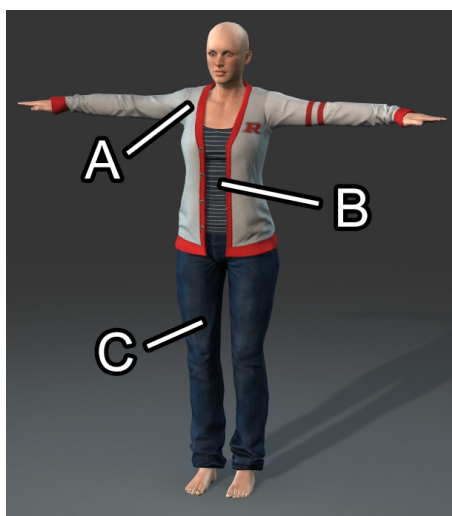




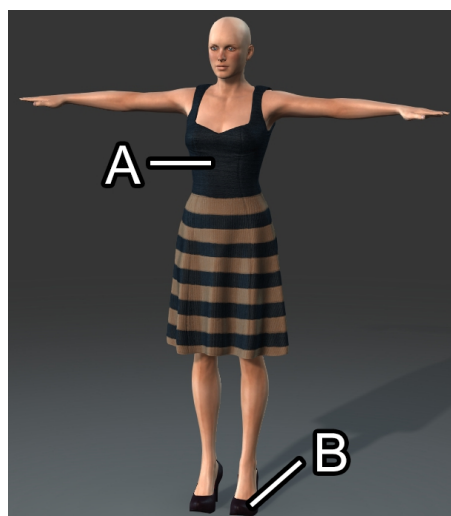
## 8.02 Collision Level Assignment

Character Creator supports 22 collision layers for assets. Broadly speaking there are 3 main categories: Cloth, Gloves, and Shoes. Cloth has 3 subcategories: Upper Body, Lower Body, and Accessories. Collision layer assignment will not fix intersecting geometry at the default state. It does however, come into effect when calculating collisions with the **Conform Clothing** tool and upon loading. Use the layer table and examples below for reference:

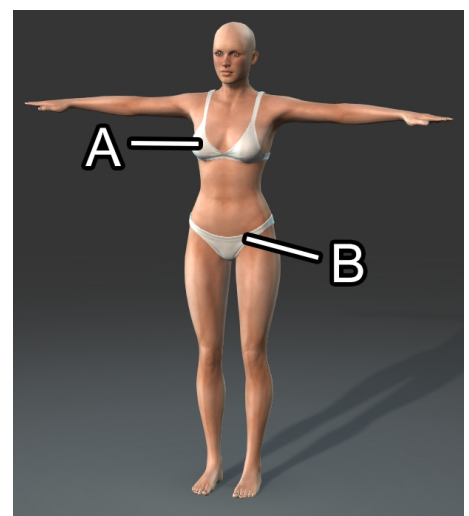
Layer	Array	Import Name	Category	Assignment Recommendation
Cloth 1	0	Upper 1	Tights, Rompers	Underwear, swimwear, tight, etc.
Gloves 1	1	Gloves 1	Gloves	Gloves under clothing.
Cloth 2	2	Lower 1	Tights, Pants, Skirts	Underpants, swimming pants, briefs, etc .
Cloth 3	3	Accessory 1	Other	Socks, headbands, and conforming accessories.
Shoes 1	4	Shoes 1	Shoes	Typical shoes.
Cloth 4	5	Upper 2	Shirts, Jumpsuits	Tucked shirts, tight-fit clothing and dress.
Cloth 5	6	Lower 2	Pants, Skirts	Tight-fitting pants and skirts.
Cloth 6	7	Accessory 2	Other	Arm-wear and medium sized accessories and gadgets.
Cloth 7	8	Upper 3	Shirts, Jumpsuits	Shirts that cover tight-fit clothing (Lower 2). Typical dresses.
Cloth 8	9	Lower 3	Pants	Typical pants.
Cloth 9	10	Lower 4	Shirts	Typical skirts.
Shoes 2	11	Shoes 2	Shoes	Boots, long boots, and shoes that cover pant legs.
Cloth 10	12	Upper 4	Shirts, Jumpsuits	More loose fitting, baggy, clothing and gowns.
Cloth 11	13	Lower 5	Suspenders	Placeholder layer
Cloth 12	14	Lower 6	Apron	Placeholder layer
Cloth 13	15	Upper 5	Overcoat, Other	Thin coats, vests, etc.
Cloth 14	16	Lower 7	Empty	Placeholder layer
Cloth 15	17	Upper 6	Overcoats	Suit, coats, jackets, etc.
Gloves 2	18	Gloves 2	Gloves	Gloves over clothing.
Cloth 16	19	Accessory 3	Other	Cloaks and garments tied to the waist.
Cloth 17	20	Accessory 4	Other	Beard, mustache, etc.
Cloth 18	21	Upper 7	Other	Placeholder layer
Cloth 19	22	Upper 8	Other	Placeholder layer
Cloth 20	23	Upper 9	Other	Placeholder layer



A) Upper 5 B) Upper 3 C) Lower 2



A) Upper 3 B) Shoes 1

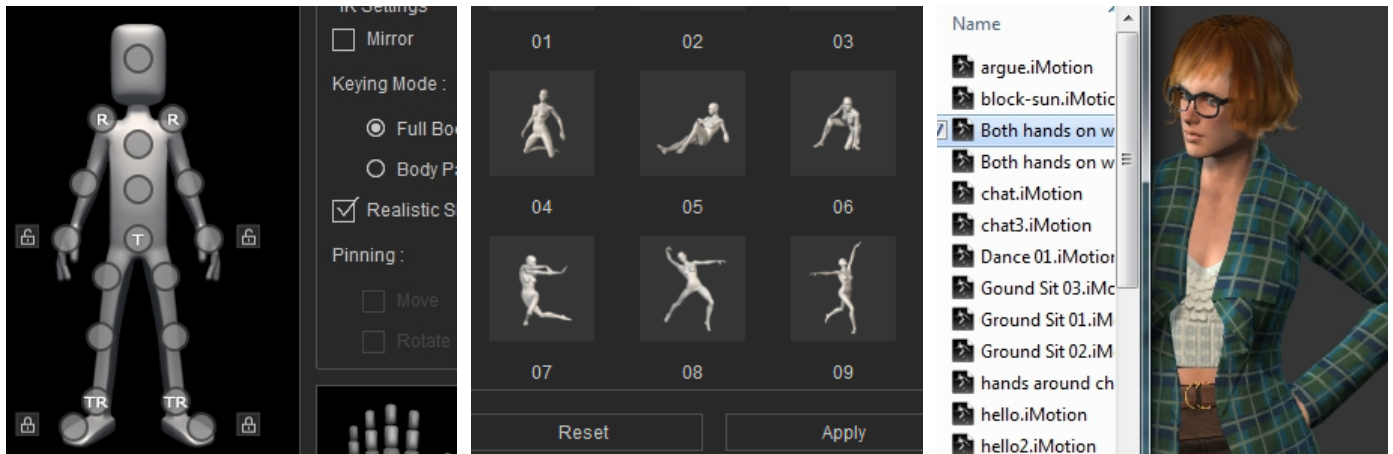


A) Upper 1 B) Lower 1

**A clash on same type clothing collision layer will result in replacement.**

### 8.03 Testing skin weights

Character Creator does not support animations, however it does support single frame poses, useful for testing skin weights. One does not have to be a perfectionist, just make sure the asset conforms well to gestures related to its intended purpose and it should be sufficient. There are 3 ways to apply poses:



Use the **Edit Motion Layer** tool to adjust the IK controls.

Use **Calibration** to apply an instant pose from its library.

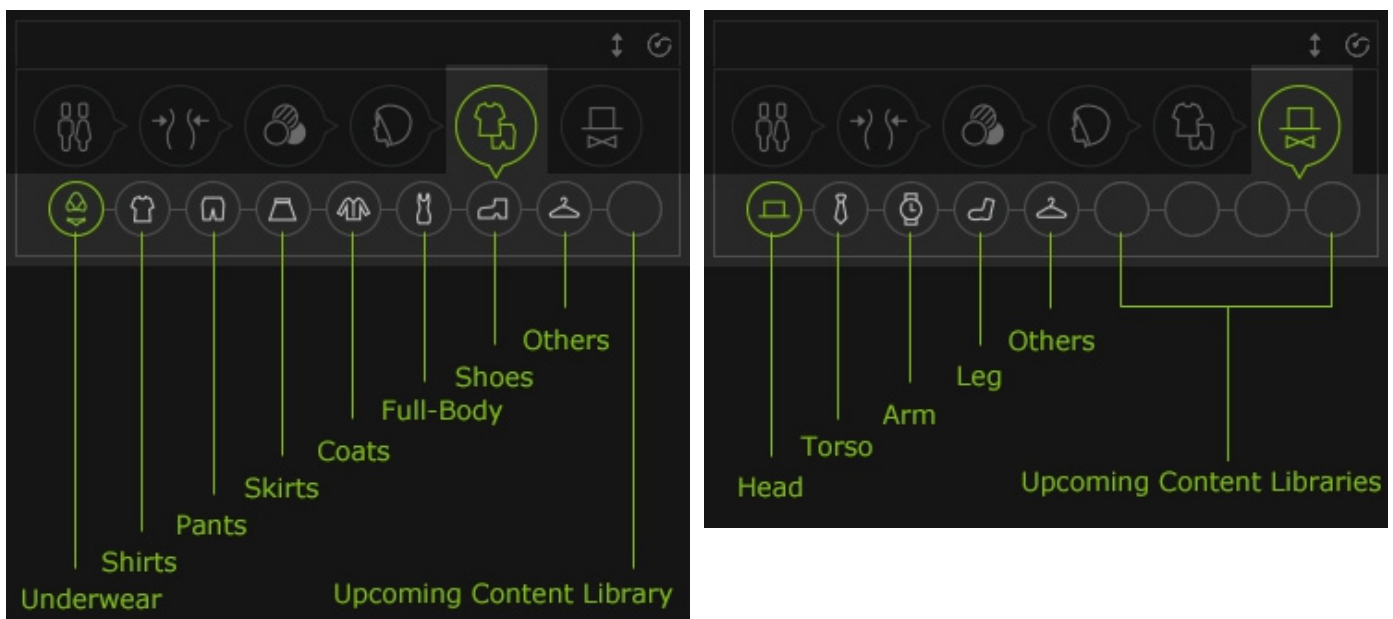
Drag & drop an iMotion file. Only the first frame will be used.

### 8.04 Saving Content

The base body serves only as an import facilitator. Follow the steps below to store an asset:

1. Browse to the appropriate content category by using the **Quick Selection Panel**.
2. Select the asset in the 3D viewport.
3. Press the **+** button under the Content Panel to save out the content and name the asset.

Technically, content can be saved under any category, however for the sake of organization, developers should be familiar with the **Quick Selection Panel**. The selected item in the 3D viewport will save to the **Custom** section of the active category.



**The imported Base Body should be discarded once the assets have been saved.**

Once a CC asset is saved, the textures are embedded with the asset. If one creating an entire character, it is best to create or reload a new character in CC, reapply the clothing and accessories, and save it out in **iAvatar** format or save a **ccProject** file.