



Documentation

Hair Designer

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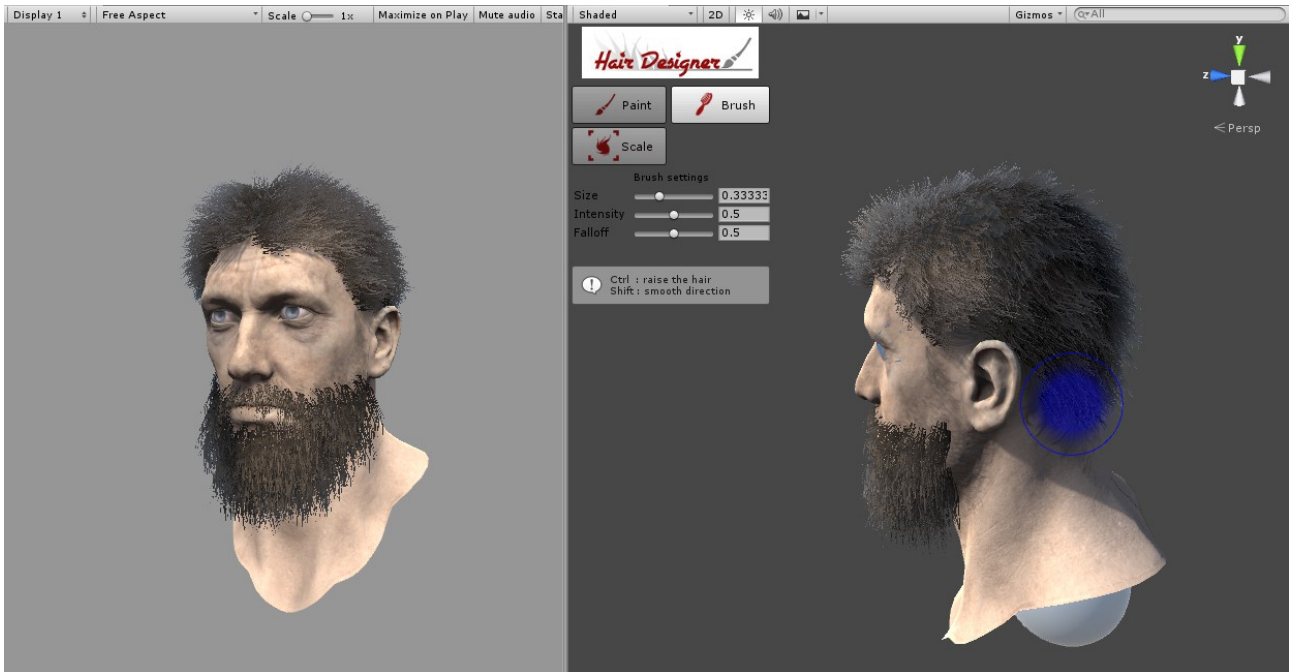


What is Hair Designer

Hair Designer is a new way for creating haircut or fur within unity engine.

You can paint hair strands on the mesh and control the design.

Hair & fur are dynamic, motion and the gravity effects are computed by a compatible shader.



Timelaps video : <https://www.youtube.com/watch?v=eLUjmbSEZwM>

Forum : <http://forum.unity3d.com/threads/hair-designer-dynamic-hair-fur-tool.431393/>

How to start

First, select the gameobject with one of these components : MeshFilter or SkinMeshRenderer.
The mesh will be the base for the hair creation.

Add the HairDesigner component to the gameObject, from the menu :

Menu → Component → Hair Designer → Hair Designer

Layers

The *Hair Designer* extension is based on a layer system, each layer will generate a mesh including all the hair strands. A layer can be enable or disable with the checkbox.



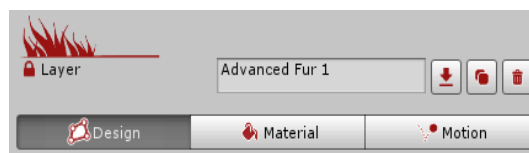
Click on the layer for opening the edition mode.
In this mode, the name is editable and the delete button is available.

Each Layer is defined by a type :

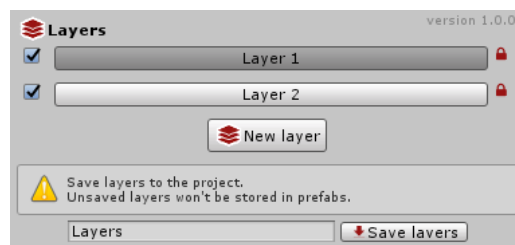
- 'Short Hair/fur' : paint strand on the mesh surface.
- 'Long hair' : create hair using a curve tool.
- 'fur' : generate shells.



The edition mode is divided in 3 tabs :
Design, Material and Motion.



A layer must be locked when the design is over. Locking the layer allow you to save all the meshes to the project. If you need to create a prefab or to duplicate the gameObject, you must save the layers.

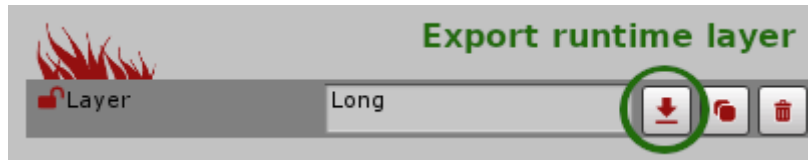


For locking/unlocking a layer, go to the Polygons tab.

If one of the layer has been modified, the 'save layer' panel will be displayed.

Runtime layer

The best way to use HairDesigner is to create the layer in a specific scene and export each layers as runtime layer.



Runtime layers are saved in a project folder as a prefab and can be loaded at runtime by using the component '[HairDesignerRuntimeLayerLoader](#)' or a custom script.

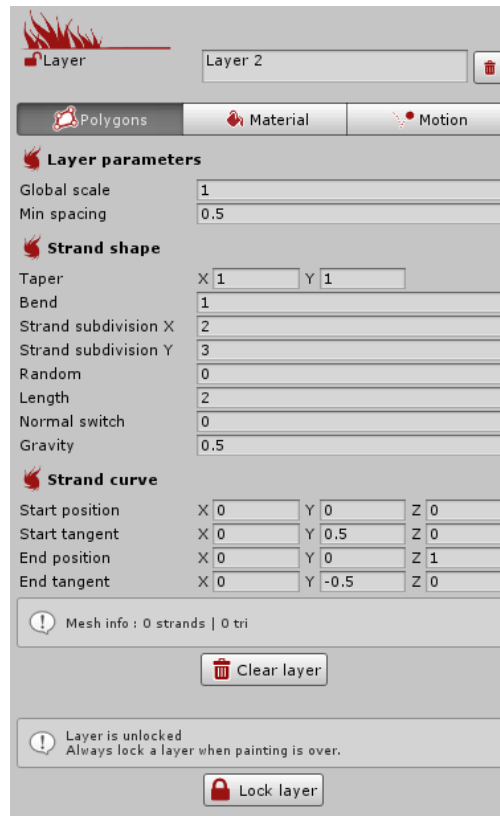
The runtime layer can be deployed on a character with the same structure of bones and hierarchy.



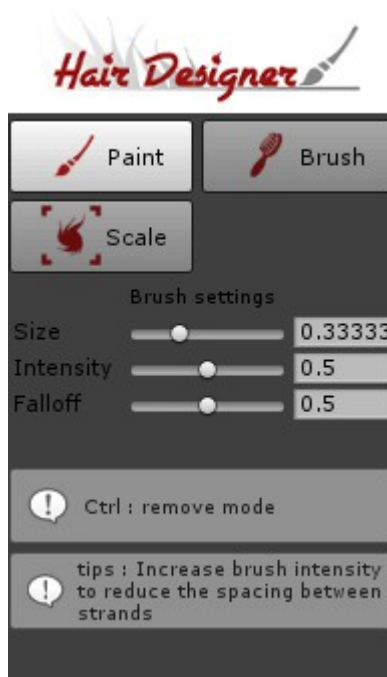
Layer : Short hair & fur

Design tab

The design tab contains the modeling options of the tool, and a panel is available in the sceneview with the painting tools.



- **Global scale** : the scale of the hair strands for the current layer.
- **Min spacing** : the minimum space between strands, this value is modulated by the Intensity of the paint brush.
- **Taper** : the taper value for the bottom(x) and the top (y) of the strands.
- **Strand subdivision** : each strand is defined by a quad mesh. Increasing subdivision set a better look and feel, but add more triangles to the overall hair cut.
- **Random** : a random amplitude factor for each strand.
- **Length** : the length of the hair strands
- **Normal switch** : switch normal from the normal of the face (0) to the tangent of the curve (1). Use this parameter to change how the light react on the hair.
- **Gravity** : the gravity factor
- **Strand curve** : the curve fo the hair strands.
- **Clear layer** : remove all strand from the layer.
- **Lock Layer** : lock the polygon creation and compute the final mesh.



Paint tool :



This is the tool for creating hair strand on the target surface.
Strand spacing is defined by 'Min spacing' parameter and the intensity of the brush.

Ctrl : Remove the hair strands .

Brush tool :



This tool set the hair strand direction.

Ctrl : Raise the hair strands.

Shift : Smooth the hair strands' orientation.

Scale tool :



Scale up the hair strands.

Ctrl : Scale down.

Shift : Smooth the hair strands.



The hair edition can be assign to different layers.

The current layer is highlighted, all the other layers won't be impacted by the hair tools.

Each layer can be hidden, the unvisible layers won't be included in the final mesh.



Material tab

The material tab define the material used for the mesh and all the instance parameters defined in the shader.

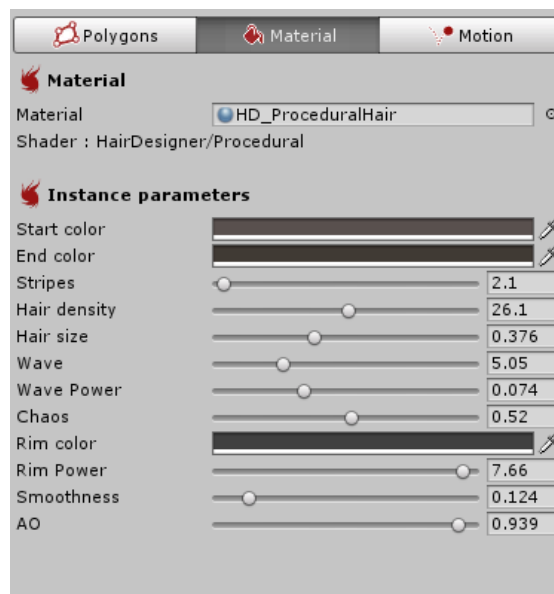
The default material is 'HD_TextureAtlas' with the 'HairDesigner/Atlas' shader.

Any material can be used, but only a compatible shaders will have instance parameters.

The compatible materials are located in the folder 'hairDesigner/Materials'.

Drag & drop a material in the 'Material' field, and the 'Instance parameters' panel will be available for the compatible shaders ('Hair Shader' section).

The instance parameters of the material define a unique settings for the layer, all theses settings can be modified at runtime (see the 'Runtime API' section)



Tips : Switch between Design tab and Material tab for tuning the haircut design, then lock the layer.

Motion tab

Hair Designer is a dynamic hair system, the motion system requires a motion zone. The motion zone encapsulates the hair mesh and is attached to a gameObject. For SkinMeshRenderer, motion zones have to be attached to a bone. The motion zone detect the motion of its parent and apply it to all the hair strands in its range. You can add many motion zones (up to 50) for a more complex effect.

Position & hierarchy :

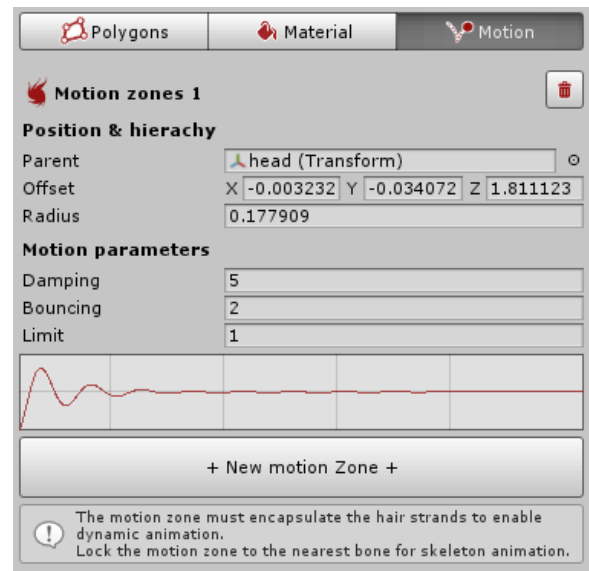
Drag & drop the parent transform or choose it in the bone list (SkinMesh renderer only)

Offset and Radius are defined by moving the zone in the scene view.

Motion parameters :

The motion is defined by a curve, defined by the damping and the bouncing parameters.

The limit parameter fix the motion amplitude.

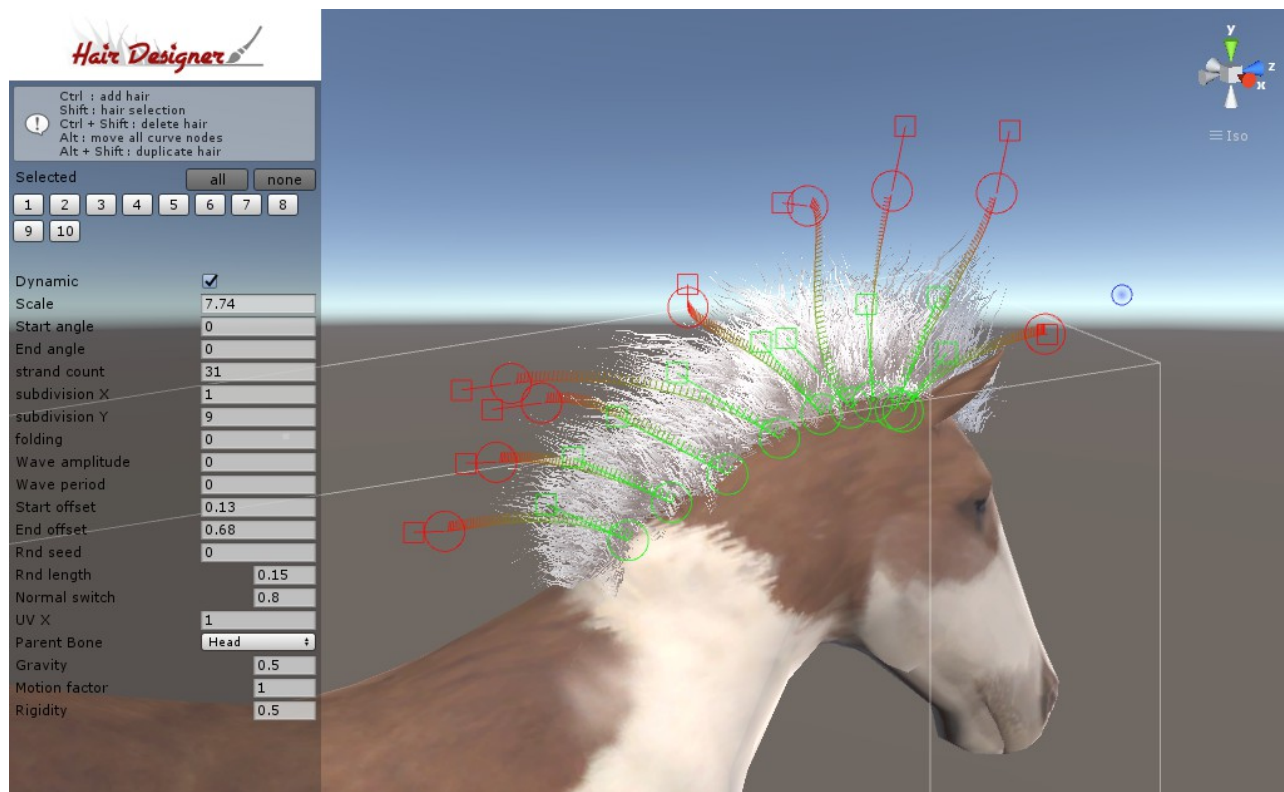


Note : a section on the curve represent 1 second.



Layer : Long hair

Design tab



This layer is composed of polygons defined by curves with procedural parameters. Each curve can be modified in the sceneview.

The tools functions are :

- **Ctrl** : Add hair curve to the model.
- **Shift** : show hair selection buttons in the scene view .
- **Ctrl + Shift** : show delete buttons for each curve.
- **Alt** : move all node of the current curve.
- **Alt+ Shift** : show the duplicate buttons.

Note : the selection button of an unselected curve is hidden when a curve is on the back, change the camera view to see them.

When several curves are selected, you can change their global settings in the scene view, or change each parameter individually in the inspector tab.



Curve parameters :

- **Scale** : the scale of the polygons on the curve.
- **Start angle**: Start angle of the strands.
- **End angle** : End angle of the strands.
- **stand count** : number of strands following the curve.
- **subdivision X** : subdivision for the width.
- **subdivision Y** : subdivisions along the curve.
- **Folding** : use this parameter for wavy hair, according to the 'wave' and 'wave power' parameters in the material tab.
- **Wave amplitude** : amplitude of the wave along curve.
- **Wave period** : period of the wave along curve.
- **Start offset** : Start offset in a circle at the start of the curve.
- **End offset** : End offset in a circle at the end of the curve.
- **Rnd seed** : Random seed of the hair strand, use this to change the look of the strands.
- **Normal switch** : switch normal from the normal of the face (0) to the tangent of the curve (1). Use this parameter to change how the light reacts on the hair.
- **UV X** : duplicate the UV,x for simulating more strands on the same strand.
- **Parent Bone** : lock the curve on a specific bone. Try to lock to the closest one.
- **Dynamic** : if checked, the curve will move according to its parent's motion.
- **Gravity** : how gravity will be applied on the bones, from 0 to 1.
- **Root rigidity**: how the root of the strand will react to motion.
0 → full motion / 1 → static
- **Rigidity** : how the base of the hair (start tangent) reacts to motion.
0 → full motion / 1 → static

note: gravity, root rigidity and rigidity are multiplied by the global parameters in the motion tab, you should modify them only if the strand doesn't react like the others.

Mirror tool



The mirror tool can be applied to the edition layers.

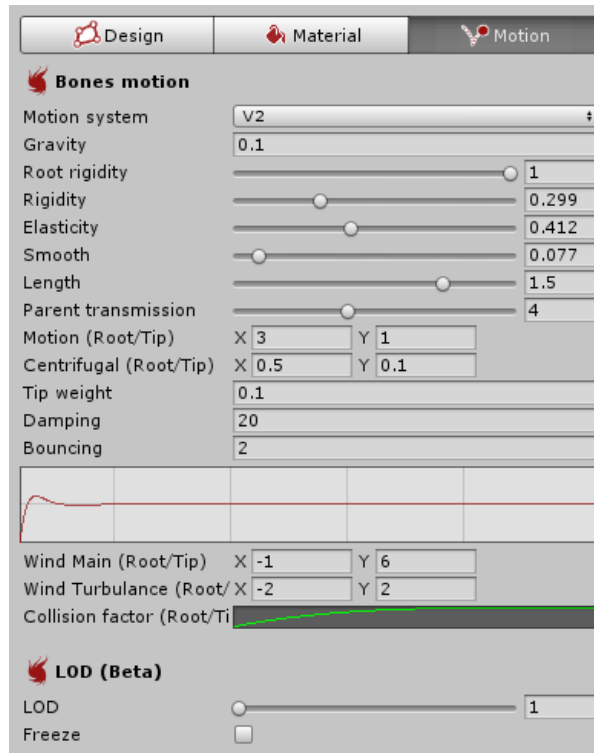
You can change the axis and the offset of the mirror.

When the mirror is updated, the transformation of the selected layers are applied to the mirrored instances. Auto-update should be disabled on complex models.

When the mirror is applied, the mirrored instances become original instances that can be edited, and the mirror modifier is destroyed.

Motion tab

The motion tab looks like the short hair motion tab, with some additional settings for the bones and cloth motion.



Motion system : V1 is now deprecated

Gravity : how gravity (Physics.gravity) will be applied on the bones.

Root rigidity : how the strand root react to motion.

Root rigidity : how the strand react to motion.

Elasticity : how long the hair length can be deformed.

Smooth : a smooth parameter applied on the current stand pos and the last computed.

Length : Change the length of the bones.

Parent transmission :How the motion is transmitted through the bone hierarchy.

Motion : Motion factor of motion for root and tip.

Centrifugal: Centrifugal force factor for root and tip.

Tip weight : How the bone hierarchy react to children position.

note: gravity, root rigidity and rigidity are multiplied by the strand parameters in the design tab.

LOD :

The motion system V2 includes a LOD parameter for improving performances when the character is far from the camera, or not rendered.

You have change the LOD value with the API :

```
HairDesignerGeneratorLongHair layer = m_hair.GetLayer(0) as HairDesignerGeneratorLongHair;  
layer.m_motionData.lod = 2 ;
```

Colliders :

A list of capsule colliders that will react with the hair bones and the Physics cloth component.

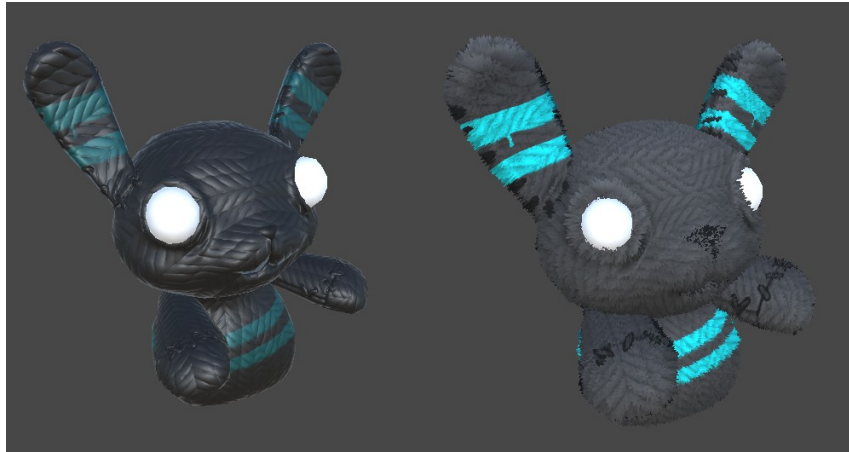
Cloth Physics :

You can generate a cloth component for the layer.

The cloth component can change between two versions of unity.

Layer : fur

The fur layer is a powerfull and easy tool for generating an amazing fur effect to your characters.



Material tab

The material slot enable or disable the fur effect for each material of the renderer.

Main texture : the fur texture, it could be the original mesh texture, or another one.

Density texture : this texture generate the fur implantation, the tiling defined the thickness of each strand.

Mask texture : this texture contains the length and the direction of each strand on the mesh. The texture is generated by the painting tools.

Color texture : this texture contains additionnal colors. The texture is generated by the painting tools.

Fur length : he maximum fur length.

Thickness : extra thickness

Gravity : gravity factor

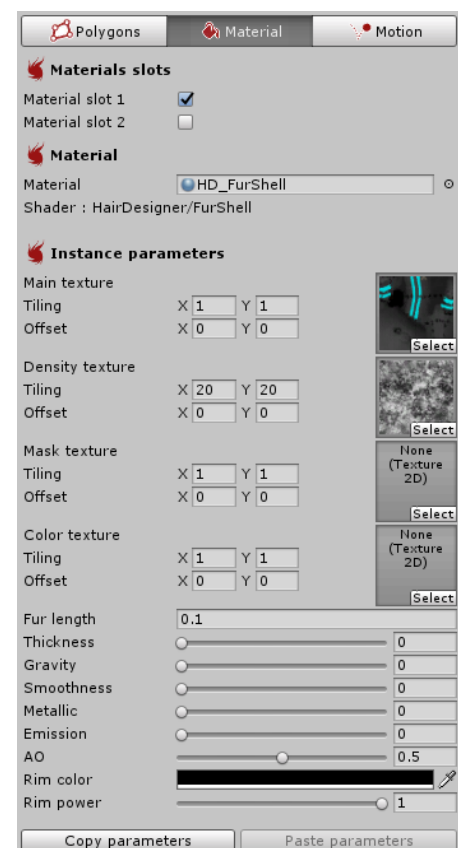
Smoothness : PBR smoothness factor

Metallic : PBR Metallic factor

Emission : Emission factor

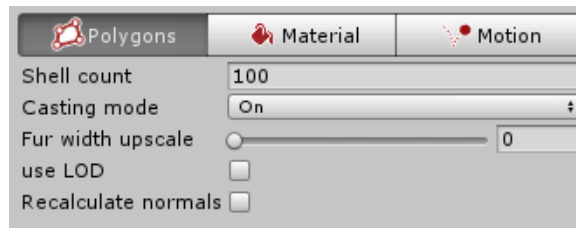
AO : ambiant occlusion for the root of the strands

Rim color & Rm power : settings for Rim effect.



Design tab

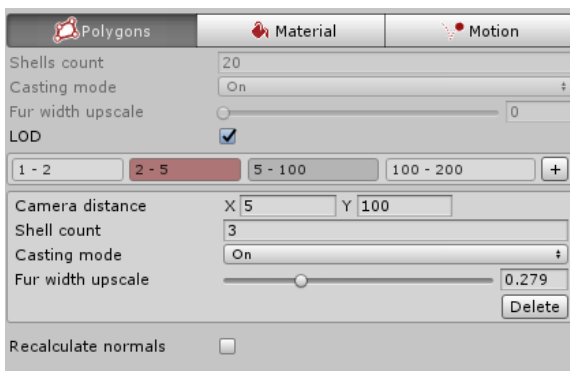
This layer use the shell technic, so you can change the shell count to increase fur quality. A high shell count will use more ressources, try to set it to the lower as possible.



The casting mode defined if the type of shadows for the fur, it could impact the FPS depending of your lighting settings.

LOD system

When the camera is far from the gameobject, the shell count can be decrease to improve performances. The fur width can be upscaled for keeping the look of the entire fur with a lower shell count. When the LOD is enabled, the parameters are defined according to the distance of the camera. The current LOD (red) depend of the sceneview camera, you can adjust each LOD group by zooming the camera in the sceneview.



The '+' button add a new LOD group, each LOD parameters can be edited and are linked to the last sceneview rendered.

Note : If the original mesh cast shadows, you don't need to enable shadows for the fur when the camera is too far.

The 'recalculate normal' parameter can be checked if there's some problem with the original mesh normals.

Painting tools : Fur mask

This layer is driven by textures that will be used by the shader for the fur generation.

First you have to create a mask that will be stored to the project. This mask define the length of the fur in the UV space of the mesh.



When the mask is created, the paint tool is enable. You can paint the fur on the model itself. The brush can be clamped between 2 values for a better control of the design. The toggle 'lock no mask' avoid the brush to paint on empty zones.



It's possible to fill all the mask with the min or max values, or use a texture mask, based on the model UV.

Brush options :

Ctrl : decrease the fur length.

Shift : smooth the fur length in the brush area.

The texture need to be save to the project.

Painting tools : Fur brush



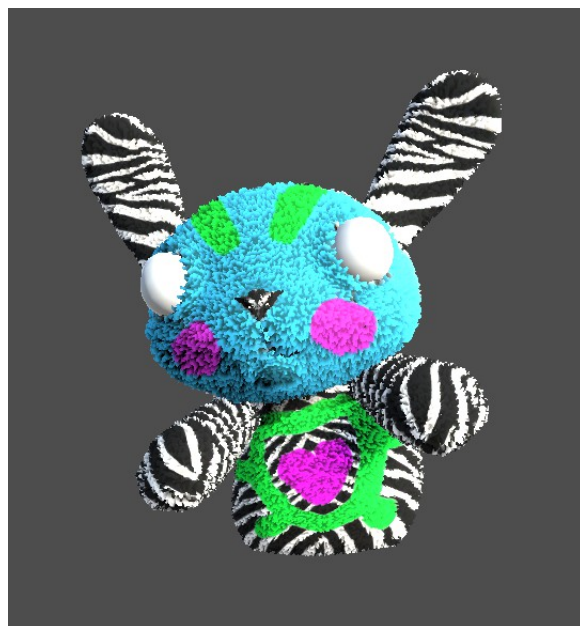
The brush tool define the fur direction and the height for each vertex of the mesh.

Brush options :

Ctrl : raise the fur or decrease the height

Shift : smooth the fur direction or smooth the height in the brush area.

Painting tools : Fur color



Fur color is fully customizable, the 'Replace/Mix' parameter define how the color is combine with the main texture, you can mix with it or override it.

Ctrl : back to the original texture.

Shift : smooth the color in the brush area.

Motion tab

The motion tab is the same than the short hair motion tab.

Layer : Advanced fur

The advanced fur layer generates strands by using a DX11 shader and a compute shader for the motion system. It requires a DX11 compatible build target in the project settings. The layer extrudes the strands from the original surface, and also creates shells.



Design tab

The design tab use the same workflow than the fur layer, so you can use the textures generated by the fur (shell) layer or create new textures in the design tab. The textures can be generated by the texture generator.

Material tab

You can enable the strand generation and the shell generation for each sub mesh of the model. The material tab is splitted in 4 parts : Textures, General, Strands and Shells.



- **Textures**

MainColor : texture of the model surface.

Shell density : density of the shell based on UV

Strand textures : textures of the generated strands (compatible with the texture generator)

Design textures : texture generated by the design tab : mask, brush and color.

- **General**

It contains the general settings : length, gravity, motion factor, smoothness, etc...

- **Strands**

Strand color : root and tip colors with a threshold parameter.

Density : this is a tessellation parameter, a high density will impact the performances.

Width : max width of the strands

Constant/per face : define if the strands are bigger on large faces of the original model, or if the size is constant.

Random length : a random size factor applied on each strand.

Strand subdivisions : the Y subdivision of each strand.

Strand flexibility : it defines how the strand will react to the brush and the motion system.

Orientation : it defines how the strand are oriented according to the brush settings.

Normal switch : 0 : normal of the surface → 1 : normal of the strand

Wave : add an additionnal wave FX to the strand UV.

Pinch : size of the tip.

- **Shells**

Shells color : root and tip colors with a threshold parameter.

Shell count : number of shell generated.

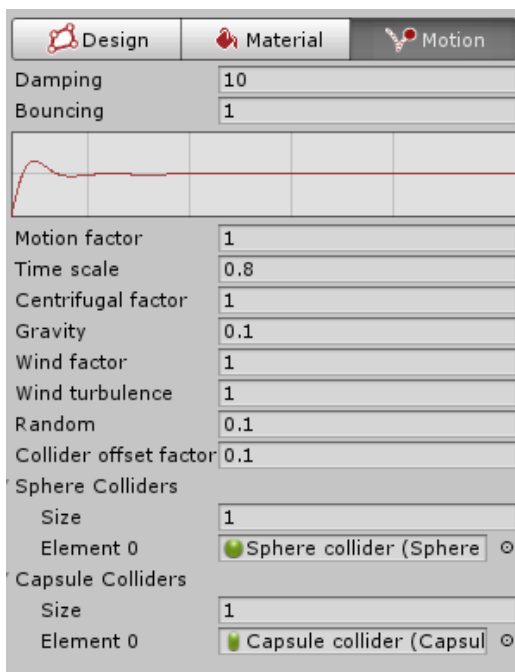
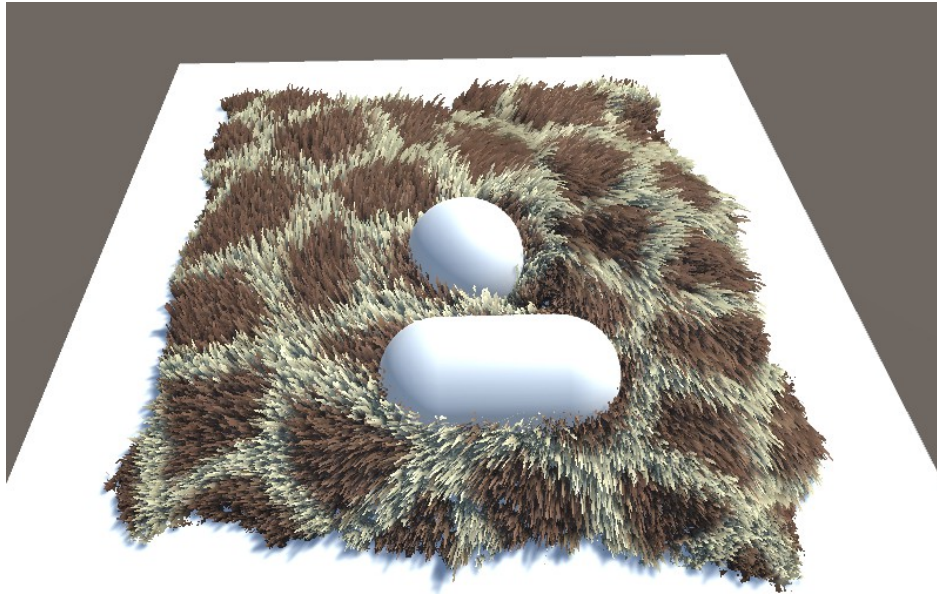
Shell height : size of the shell according to the 'Fur length' parameter

Coverage : add an extra coverage to the density texture.

Thickness : reduce coverage of the tip shells.

Motion tab

The advanced fur layer use another type of motion system : the vertex displacement is analyzed by a compute shader, when a vertex of the model moves, the fur react to the motion. The system include the interaction with sphere colliders and capsule colliders.



Damping & Bouncing : define the motion reaction.

Time scale : a specific time scale for the simulation

Centrifugal force : reaction to rotation.

Gravity factor : gravity force in simulation

Wind : wind parameters according to the windzone settings.

Random : add an extra factor to prevent uniform motion.

Collider offset factor : extra distance for fading collisions.

Colliders lists : Colliders activated for the simulation.

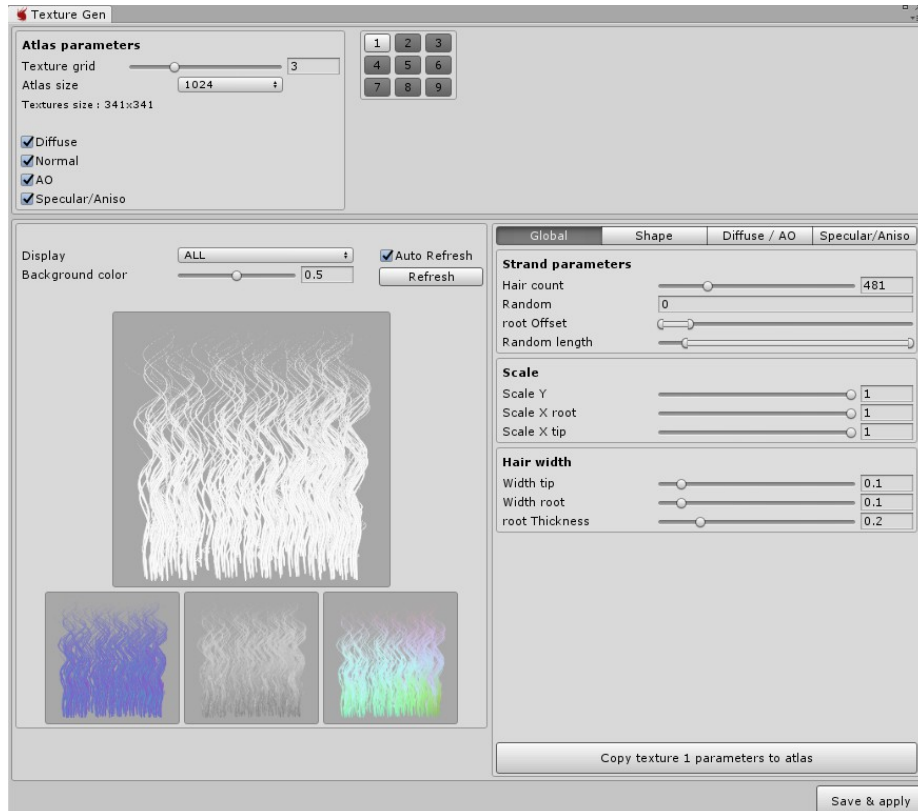
Texture generator

The texture generator is a usefull tool for generating hair textures atlas.

The Texture generator is available in the material tab of a compatible shader

(ex : 'HD_TextureAtlas') or from the unity menu : Window->HairDesigner->Texture Generator.

When the tool is opened from the material tab, all the settings are stored into the hair layer, and the generated texture will be assigned to the textures slots of the material.



Atlas parameters :

Texture grid : the size of the texture grid

Atlas size : the size of each generated texture

The texture generator can create the following textures :

- Diffuse : the main color of the hair.
- Normal : the normal shape for each hair.
- AO : the ambient occulsion for self shadowing.
- Secular/Aniso : the texture conatian the lignthing parameters for the specularity.

Texture parameters :

Each hair texture can be edited and previewed in the tool. The texture parameters of the current texture can be copied to all the others with a different random parameter. So the main workflow is to set the global look of the haircut by duplicating the same parameters (with a random factor), and then add some modifications on each texture.

Global panel:

Hair count : the number of hair to draw.

Random : the random parameter for all the min/max parameters.

Root offset : the min and max value of the root offset (0 : bottom / 1:top)

Length : the min/max length of the hair.

Scale : the scale of the strand (height, root width and tip width)

Hair width : the width for each hair.

Shape panel:

The wave parameters are defined by the amplitude, the period and a min/max value.

Strand : wave amplitude and period for the strand.

Hair 1 : first wave applied on each hair.

Hair 2 : second wave applied on each hair.

Diffuse / AO panel:

Noise : a scaled noise applied on the diffuse and the AO textures.

Color : 3 colors can be defined, the gradient is defined by the root color, the tip color and the bias.

AO : the AO contrast, this value will be multiplied by the shader AO parameter.

Specular / Aniso panel:

Specular : the specular gradient for the root and tip.

Aniso shift : the anisotropic texture define the reflection according to the light direction and the camera view. This parameter is defined for the 2 specular settings of the atlas shader.

Aniso Mask : This mask is applied on the second specular settings of the atlas shader.

Save & Apply :

When the textures edition is done, you have to click on the 'Save & Apply' button. All the textures will be saved in the project folder and assigned to the material slots of the HairDesigner layer. You can easily adjust the settings and see the result on the mesh by one click.

Hair shaders



Atlas Shader

This shader uses the texture generator outputs and provides per instance parameters. This is the fastest hair shader of the package and the more realistic.

Procedural & Procedural V2

All the hair are generated by the shader, the Hair density should be as small as possible for better performances. You can use the parameters 'UVX' and 'Hair per pass' for simulate more hair and maximize the performances.

FurShell

This shader is required for the fur layer. This is a specific shader using the shell technic to simulate the fur.

Fire

This is a procedural shader, a flame is generated on each strand.

Standard

This is a cutout version of the standard shader. There's no instance parameter, so a new material must be use for each variation.

Wind zones

The Atlas shader, the fur shader and the long hair layer are compatible with wind zones. Drag & drop the windzone gameobject in the inspector slot, or use the API to set it (HairDesigner.m_windzone).

Atlas shader & Fur

the compatible shaders have 2 parameters for the wind settings :

- **wind** : this factor define how the wind will react (0-> no wind).
- **Wind turbulence** : set the turbulence factor (0-> no turbulence).

Long hair layer

The long hair layer has a specific setting for the wint in the motion tab.

- **wind** : this factor define how the wind will react (0-> no wind).

Note : You can combine the settings for the long hair using the Atlas shader.

Custom Shader

The compatible shaders uses the Hair Designer vertex program function.

Here a way to include it in your custom shader :

1. Change the name to 'HairDesigner/shaderName'
2. Add the include file : 'HairDesigner.cginc'
3. Add the vertex program function :

```
void vert (inout appdata_full v, out Input o)
{
    HairDesigner(v);
}
```

or include the function in your existing vertex function.

How to include instance parameter to the Hair Designer UI :

1. Create a class with the name : HairDesignerShader + ShaderName

```
public class HairDesignerShaderFire : HairDesignerShader
{
    //HERE THE MEMBERS
    public float _NbFlame = 5f;
    public Color _Color1 = Color.yellow;

    public override void UpdatePropertyBlock(ref MaterialPropertyBlock pb)
    {
        //HERE THE PROPERTY BLOCK UPDATE
        pb.SetColor("_Color1", _Color1);
        pb.SetFloat("_NbFlame", _NbFlame);
    }
}
```

2. Create the associated Editor class : HairDesignerShader + ShaderName + Editor

```
[CustomEditor(typeof(HairDesignerShaderFire))]
public class HairDesignerShaderFireEditor : Editor
{
    public override void OnInspectorGUI()
    {
        HairDesignerShaderFire s = target as HairDesignerShaderFire;

        GUILayout.Label("Render", EditorStyles.boldLabel);
        s._NbFlame = EditorGUILayout.Slider("Details", s._NbFlame, 1, 50);
        s._Color1 = EditorGUILayout.ColorField("_Color1", s._Color1);
    }
}
```


Runtime API

All the shader parameters can be modified at runtime.

Here a code sample :

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using Kalagaan.HairDesignerExtension; // use the namespace

public class ChangeHairColor : MonoBehaviour {

    public HairDesigner m_hair; // this is the reference of the hairDesigner instance

    void Update()
    {
        HairDesignerGenerator layer = m_hair.GetLayer(0); //get the layer by id or by name

        //the shader parameters have to be casted into the shader class used by the layer
        //All the shader classes can be found in the folder "HairDesigner/scripts/"
        HairDesignerShaderAtlas shader = layer.GetShaderParams() as HairDesignerShaderAtlas;

        //all the shader parameters can be modified
        shader.m_tipColor = Color.white;
        shader.m_rootColor = Color.red;
        shader.m_length = .5f;
        shader.m_alphaCutoff = .8f;
        //...

        //The layer must be flagged to apply the modifications
        layer.m_shaderNeedUpdate = true;
    }
}
```

UMA compatibility

HairDesigner is compatible with UMA (Unity Multipurpose Avatar) by using the Runtime layers.

How to create runtime layers :

- Create a new scene
- Create an instance of 'Male_Unified' or 'Woman_Unified' from the UMA package
- Add the HairDesigner component on the SkinnedMeshRenderer.
- Create the layers
- Export the layers as runtime layer.

How to use runtime layers with UMA:

- Import the package 'HairDesigner_UMA' from the 'HairDesigner/Addon' folder
- Add the component 'HairDesigner UMA Loader' on the UMA Dynamic Avatar gameObject.
- Drag & drop the runtime layer into the list
- The layer will be added at runtime

HDRP Shader

The package includes an additional package for HDRP compatibility (HairDesigner/Addon).
The HDRP shader is compatible with ShaderGraph 5.13.

How to use the HDRP shader:

- Import the package 'HairDesigner_HDRP_SHADERGraph' from the 'HairDesigner/Addon' folder

If you want to upgrade a layer from a non HDRP scene, you have to :

- Drag & drop the material 'HD_HDRP_Atlas' in the material tab.
- Switch to Design mode