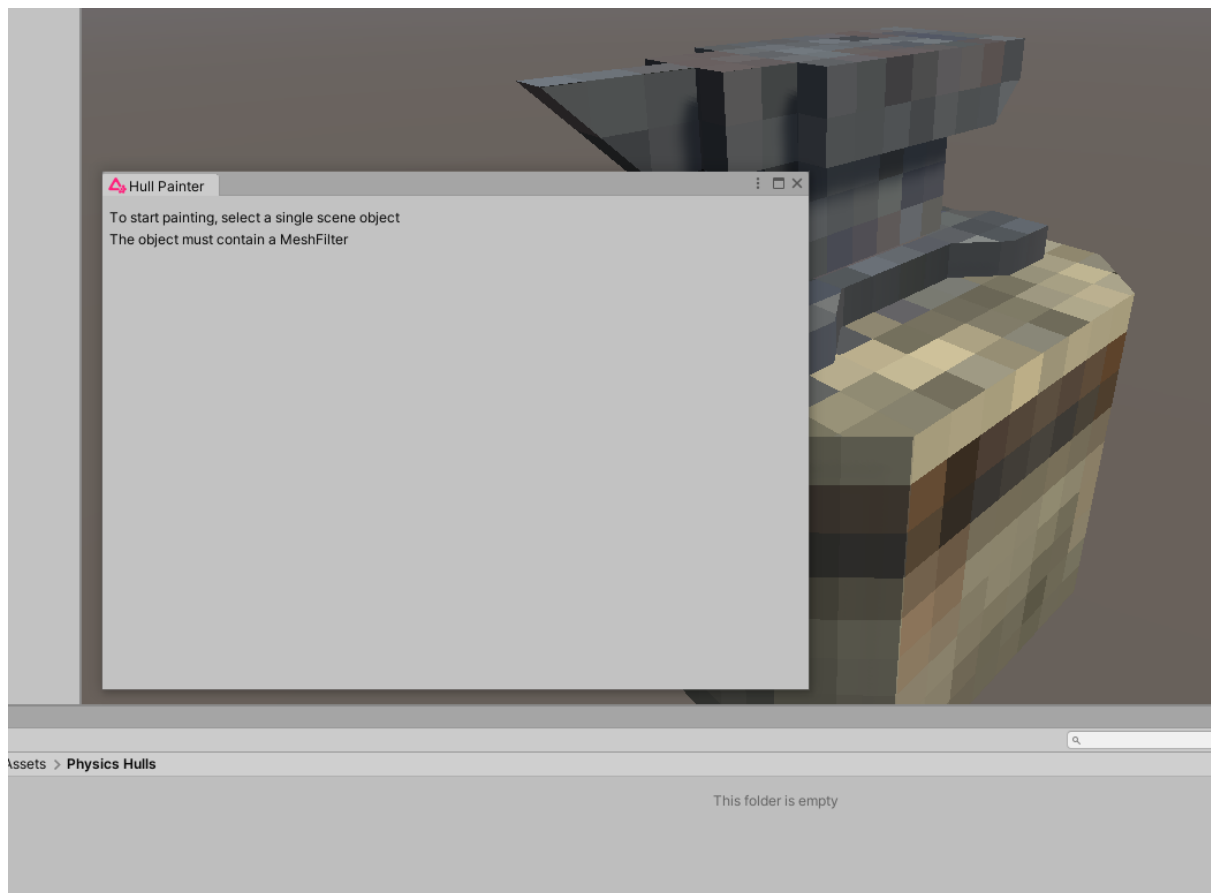# Technie Collider Creator

Instructions And Setup Guide

Quick Start

As Technie Physics Creator is an editor tool, all you need to do is import the package into your project. Then open the `Hull Painter` window via the `Window` menu. Move this somewhere handy as you go through the quick start guide.


Hull Painter window with no object selected

Now select a single object in your scene that you want to paint physics colliders for. The object must have a MeshRenderer component on it, this is what we'll paint onto. The Hull Painter window will change to show that this can be used to paint on.
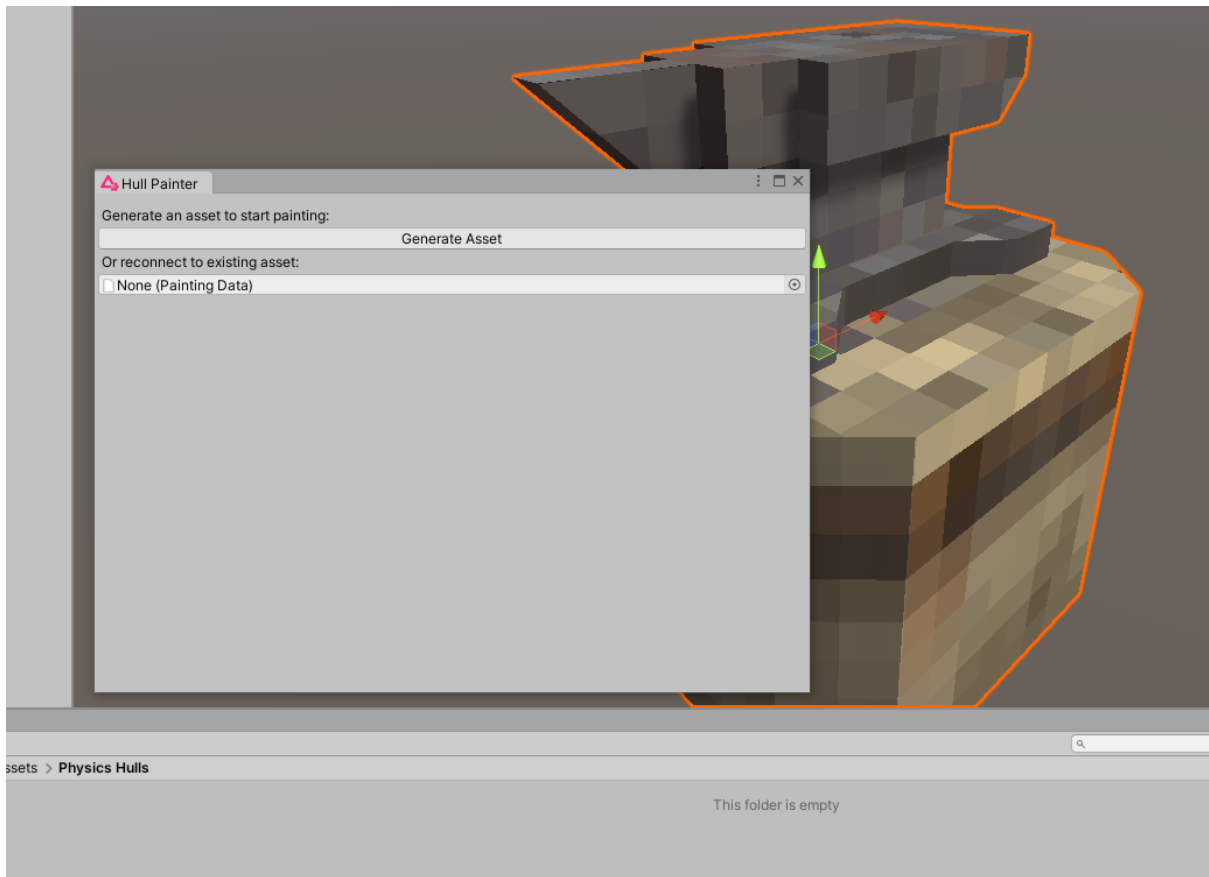
Hull Painter window with valid selection

Now click `Generate Asset` to set this object up for painting. This will do three things:

- Assets for painting and hull data will be created in your project in `Assets/Physics Hulls`. These store the data about the painted surfaces and also the generated collision meshes.
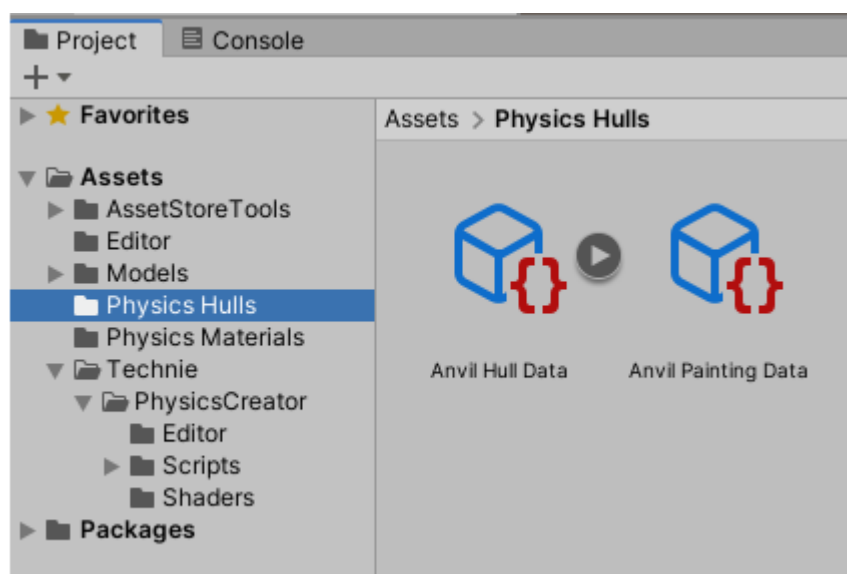
- A `HullPainter` component will be added to the object. This is what connects the assets to this particular object so you can paint on it.
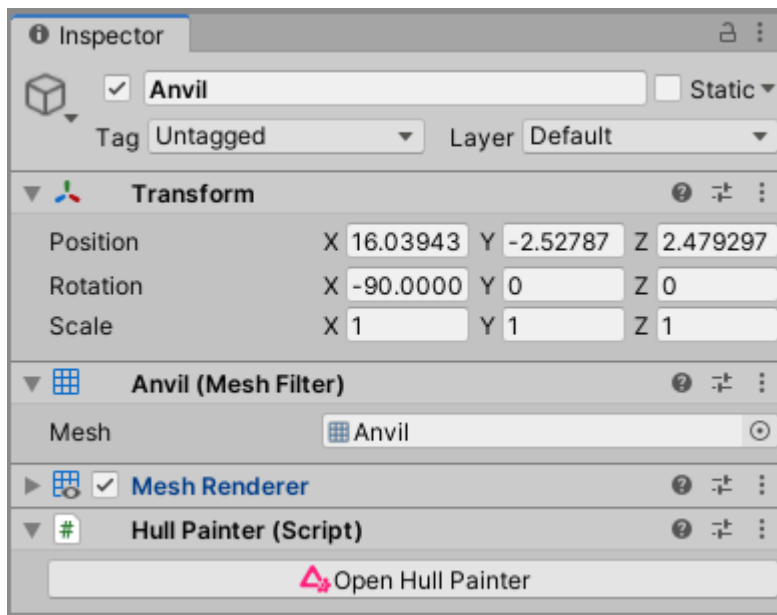
After the assets are generated the window will show you have a single hull ready for painting.
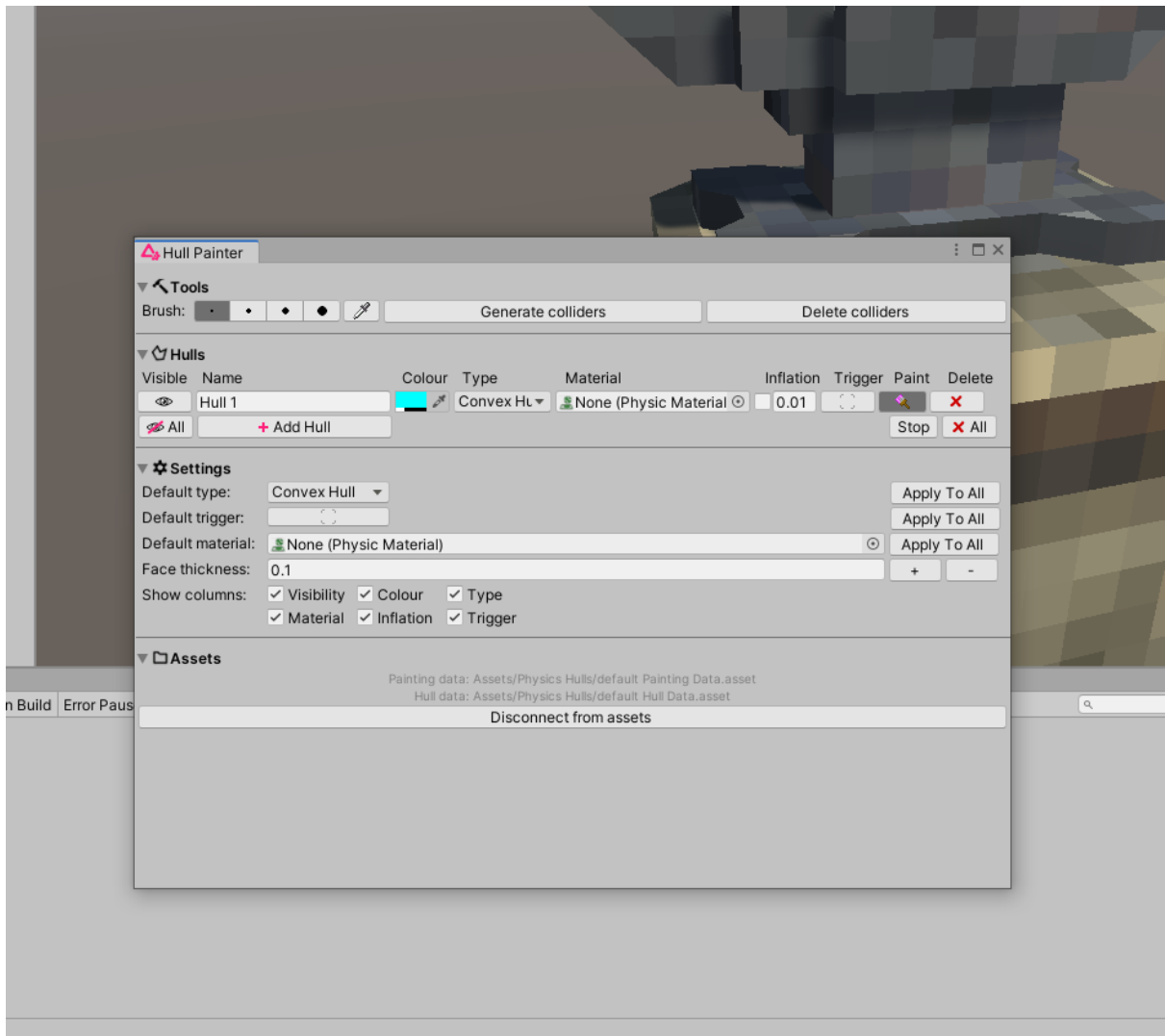
Click and drag on the surface of the object to paint faces to include in the collider. To remove faces click or drag on a face that is already marked. You can also set the name, colour and type of the hull in the window.
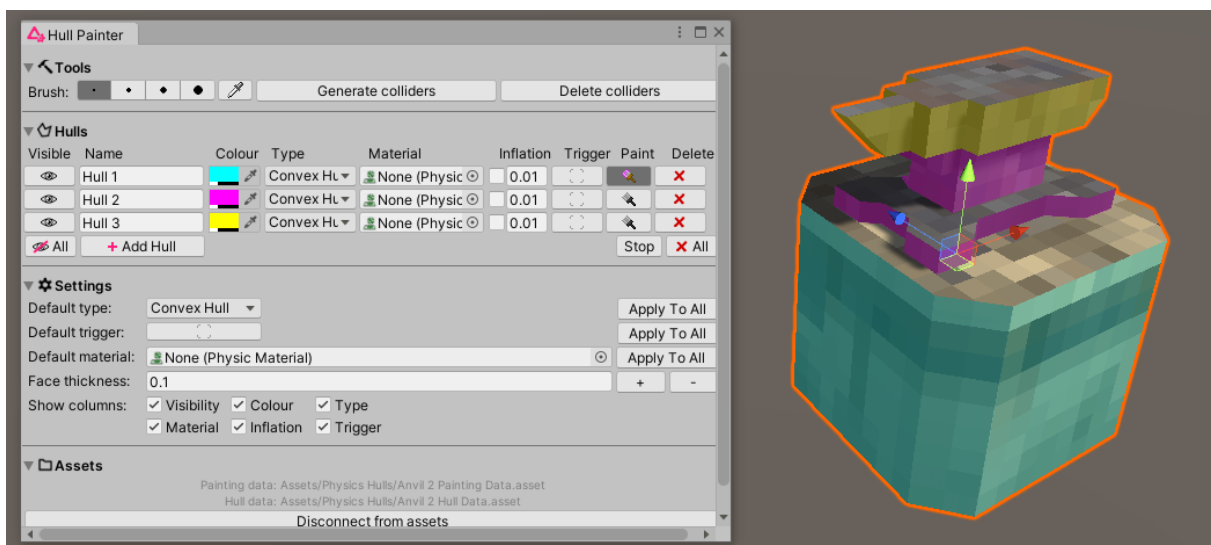
Three hulls painted on one object

More hulls can be added by clicking `Add Hull`, if you have multiple hulls on an object then choose which to edit by pressing the `Paint` button.

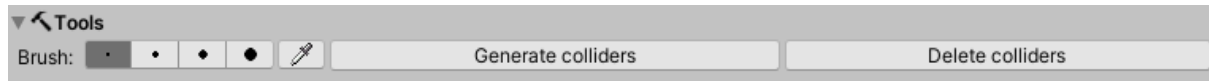Once you're happy with your painting, hit `Generate Colliders` and colliders will be created on the object.

Hull Types

When creating hulls, you have a few types available:

BOX - generates BoxColliders. Very efficient but axis-aligned (unrotated) by default. If you need rotated boxes tick the *As Child* option and choose an appropriate *Box Fit* method.

SPHERE - generates the smallest possible SphereCollider that encloses the hull. Very efficient, use this when you need a smoothly curved surface.

FACE - takes the selected faces, and gives them a thickness (from the 'face thickness' setting). Useful for flat surfaces such as floors, walls, ceilings, etc.

CONVEX HULL - creates a convex hull around the selected faces. Highest accuracy and still fast and allows for rigidbodies. Use for the most awkward objects or where highest quality is needed.

CAPSULE - Halfway between a box and a sphere, this is very efficient and great for long, thin volumes (like table legs) where you want smooth surfaces. Like BOX this is axis-aligned by default so use the *As Child* option for a tighter fit on angled volumes.

AUTO - Automatically creates convex hulls for the selection. The whole mesh is converted into hulls, and then trimmed down to only the volume defined by the painted sections. Use when you want results fast but don't mind about small inaccuracies. You can use the 'paint all' button (next to the Generate button) to quickly apply AUTO to the whole mesh.

UI
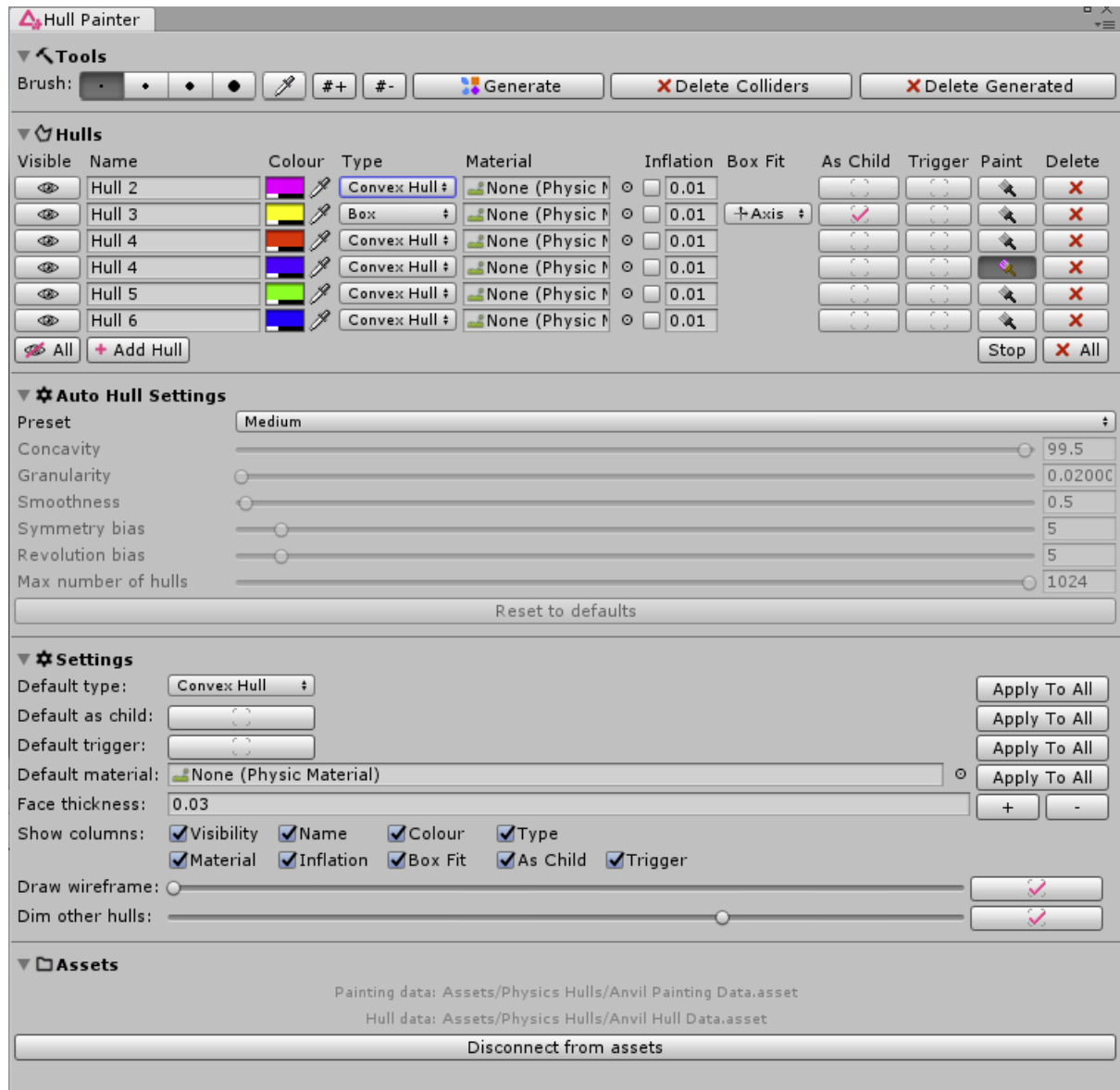
Tools UI

Brush size - choose a brush size to paint faces for specific hulls.

**Pipette** - used for selecting a hull from the scene view. Select this then click on a hull in the scene view to select it for painting.

Generate - regenerates the collider components for this hull

Delete Colliders - deletes all generated colliders, leaves child objects and their components for later recreation

Delete Generated - deletes all generated objects - colliders, and child objects and child colliders

Hulls UI
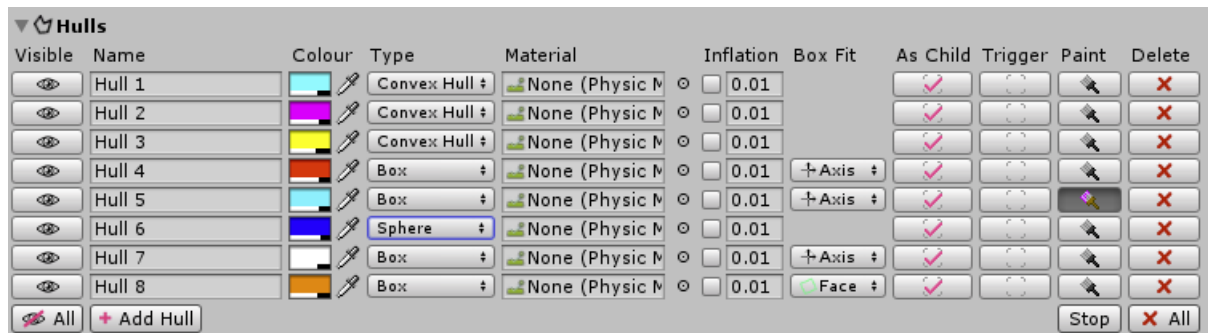
Visibility - toggle whether this hull is shown in the scene view or not

Name - enter a name here so you can easily keep track of different hulls

Colour - choose the colour this hull will use in the scene view

Type - choose the type of collider this hull will generate

Material - drag in a physics material and it will be assigned to the generated collider

Inflation - tick the box to enable hull inflation, and specify an amount to inflate by

Box Fit - what algorithm is used to fit Box hulls to the data.

> *Axis* is aligned to the object's axis and unrotated
> *Tight* creates the smallest possible box around the painted faces
> *Face* matches the boxes faces to the painted faces
> Note that *Tight* and *Face* are only possible when *As Child* is ticked.

Trigger - tick this box to make the generated collider a trigger

As Child - tick this box to create this collider as a child object

Paint - this selects which hull is the active hull for painting

Delete - click to delete this hull

And on the bottom row:

Visibility All - Toggles visibility of all hulls at once

Add Hull - Adds a new hull

Stop - Stops painting and deselects active hull

Delete All - Deletes all the hull authoring and painting data you have created on this object

Auto Hull Settings UI
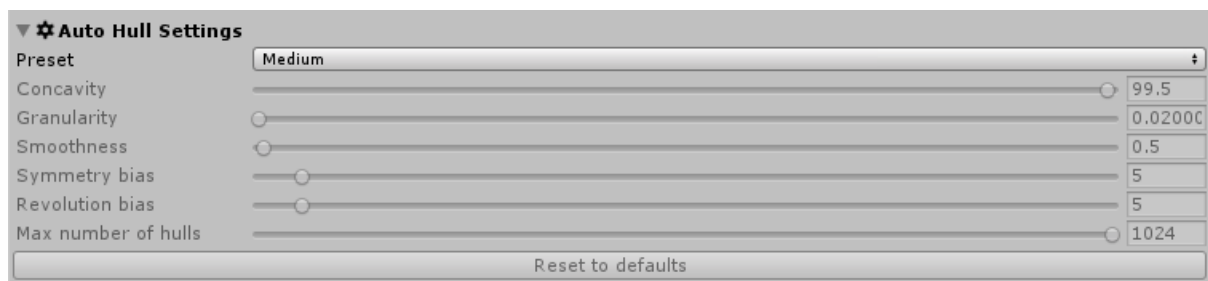
These settings are used when the AUTO hull type is chosen. These control how the model is broken down into separate hulls and affect the accuracy and time required when pressing 'Generate'.

Preset - choose from one of the quality presets, or choose 'custom' to adjust the individual settings manually

Concavity - Controls how sensitive to concave regions the output is. A low value will ignore smaller bumps and groves. A higher value will follow the surface more accurately but generate more hulls.

Granularity - Affects the internal resolution of the calculations. Too low and fine details like corners and grooves will not be captured. Too high and the algorithm can take a very long time so start low and only increase it when needed.

Smoothness - Affects how smooth the output hulls will be. High values create very accurate hulls with many faces. Low values create blockier hulls which will be quicker at runtime.

**Symmetry bias** - Affects how the model is cut into individual pieces around symmetry planes. **Revolution bias** - Affects how the model is cut into pieces around revolution axies.

Max number of hulls - Control the maximum number of hulls each AUTO hull can produce. Note this controls a target and the exact number of output hulls may be slightly different.

Reset to defaults - resets the settings for 'custom' back to their default values.

Auto hull settings are stored as part of the painting data, so when you return to the object and press 'generate' the same settings will be applied as last time.

Settings UI
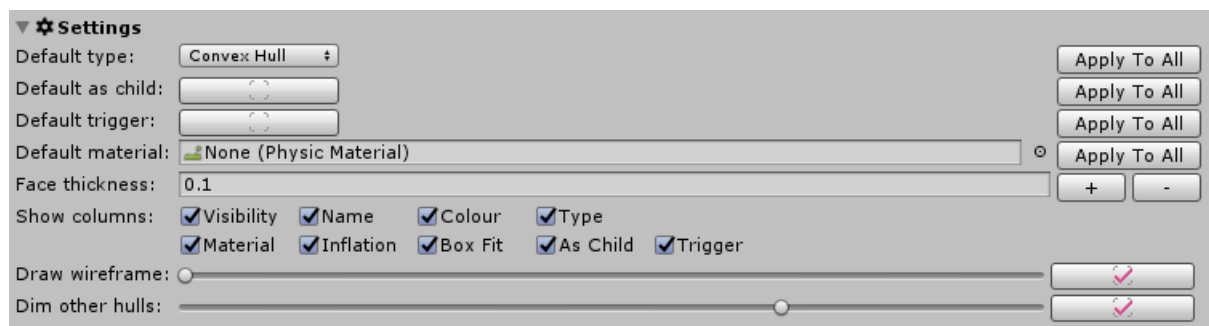
Default type - this type will be set to any newly created hull (from Add Hull)

Default trigger - should new hulls be marked as a trigger by default?

Default material - drag a physics material to use this as the default for new hulls

Face thickness - when generating face colliders, this sets how 'deep' the faces are

Show columns - toggle the columns in the Hulls section to slim down the UI

Draw wireframe - toggle drawing the wireframe for the current painting mesh. The slider controls the brightness of the wireframe lines.

Dim other hulls - when ticked this keeps the hull you're painting bright and darkens the other hulls so it's easier to see which is which. The slider controls how much to dim the other hulls by.

Apply to All - will apply this setting to all the Hulls you have already created.

Assets UI
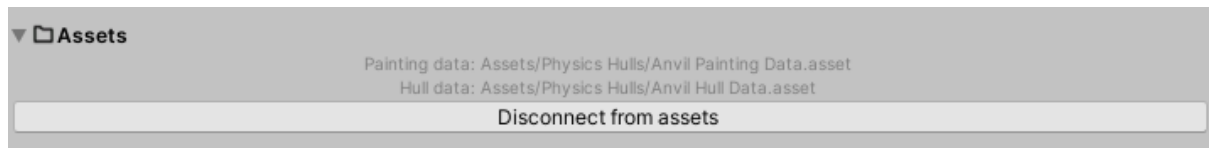
Displays the assets linked to this hull. See 'Disconnecting from Editor Data' section.

Hull Inflation

Hull inflation can be turned on by ticking the 'Inflate' check box in the row for the hull. This will expand the hull outwards in all directions by the entered amount. This is particularly useful for convex hulls, as inflating it will reduce the amount of faces needed and therefor increase the performance for only a small loss in accuracy. If you have highly smooth geometry then you should definitely enable this.

For sphere and box hull types, this will simply expand their size by the entered amount. This can be useful if you want your collision to be larger than the object (eg. to make it easier to shoot/hit an enemy).

For face hull types then the inflation amount will be how far backwards the face is projected to give it it's thickness. In these cases you may want the thickness to be somewhat larger than the default to prevent physics objects 'leap frogging' very thin face hulls if they're moving very quickly.

Due to change in the Unity physics engine in 2019.3, hull inflation is currently disabled in this version.

Disconnecting From Editor Data

Physics Creator has been deliberately written to have zero CPU overhead when your game is actually running. The HullPainter component itself does no work, and only uses a tiny amount of memory for the painting data. Colliders are all created at editor-time and not game startup. So while building your game you can leave the `HullPainter` component on your objects for when you want to further edit your hulls.

If you want zero CPU and memory overhead (such as when you ship your game) you can remove the `HullPainter` component. This means that the painting data asset will no longer be loaded, but all colliders will still work as before.

When choosing this option you will also get the option to delete the child components or leave them. The child components are just markers for each hull, and aren't used otherwise. Leaving them means that if you reconnect the data later on it'll know what hull the colliders were generated from so it's easier to carry on where you left off. Deleting them removes all Technie components so you have a completely clean object.

Reconnecting Editor Data

If you disconnect an object from the painting data you can later reconnect it by dragging the painting data asset into the hull painter window. This will let you paint the hulls again.

Install Location

Collider creator will auto-detect it's install location, so once you've added it to your project you can move it to any folder in your Assets folder. If for some reason the auto-detect fails and no icons are shown then you can set the default install path in the HullPainterWindow.cs file.

Generate Colliders From Selection

`Window > Technie Collider Creator > Generate Colliders From Selection`

A useful starting point when you're authoring physics for a level. Clones the current selection and wraps colliders around any object with a MeshRenderer on it. Use this to quickly fill in physics before hand adjusting the trickier areas.

Span Physics

`Window > Techie Collider Creator > Span From Selection`

Tool for guided creation of colliders, especially for level geometry. Select several objects (such as the corners of a wall) and this will try and wrap the tightest possible box collider around them. Very useful for rapidly authoring collision data for walls, floors, ceilings, etc.

Keyboard Shortcuts

Most common actions can also be done with keyboard shortcuts. To view or rebind the shortcuts, open the shortcuts manager from the menus in `Edit > Shortcuts...`

Rebind keyboard shortcuts here

By default all shortcuts use SHIFT to avoid conflicts with other commands, but they can be mapped to different keys here.

As this requires the shortcut manager, this feature is only available if you are using Unity 2019 or later.

Hull Data Folder

By default hull and painting data will be stored in `Assets/Physics Hulls`. This will be created automatically if it does not exist, along with a marker file to identify it.

If you want your data to be stored elsewhere, then simply rename or move this folder - just make sure you move the marker file (`PhysicsCreatorHullFolder.asset`) as well. New data will be created wherever you have moved the marker file to.

Tips

Remember that you do not need to paint all the triangles! The hulls will be made as small as possible around those that are painted. Often you only need to paint a few surfaces to get the shape you want, so experiment.
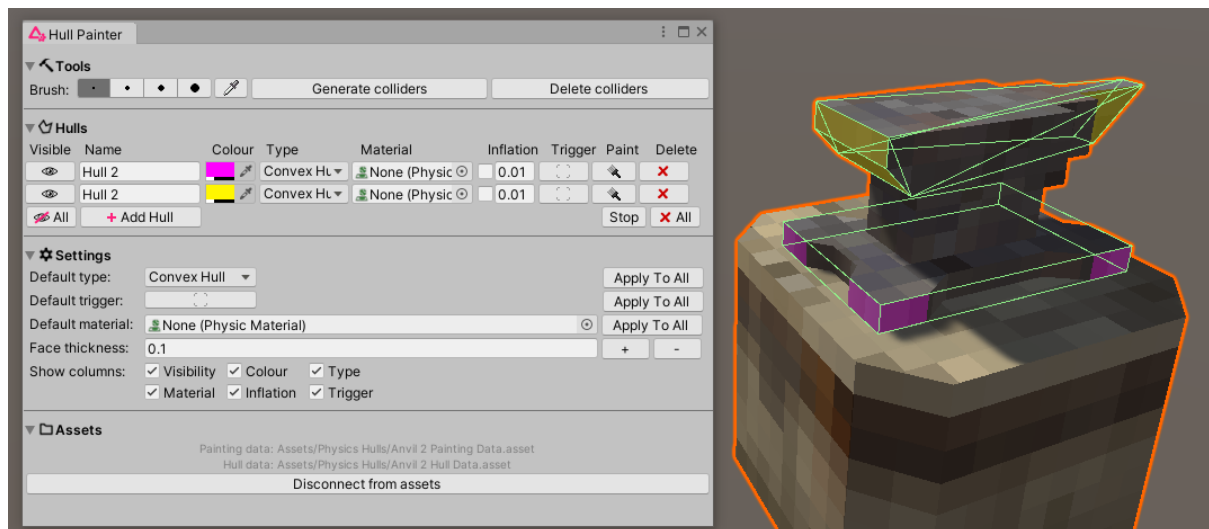
These hulls only have a few faces painted but still produce a suitable collider

If your model is small or contains small, difficult to select triangles then scale the whole model up while hull painting by scaling the transform. Your mouse / camera movement will be more precise. Then just return to normal scale at the end and generate the colliders again.

When you start painting you will add faces if you start your drag over an unpainted face, and subtract if you start over an already painted face. If you need to explicitly add or subtract then hold SHIFT (for add) or CONTROL (for subtract) when clicking.

While Box hulls are technically the most efficient, they are often much less accurate. I start by making everything as Convex Hulls and only change them to boxes if the difference is minimal. I have yet to see a real-world difference in performance in an actual game.

Since colliders are generated to always fully enclose painted faces, you do not have to paint every face. Often you only need to paint the faces at the far extremes of the shape you want. This can be quicker to edit in some situations.

The `Generate Colliders` button will update existing colliders after the first usage, so use it often.

If you edit a generated collider manually then the painter will decide you have taken ownership of it and will no longer update it. Delete the collider and press `Generate Colliders` to return ownership.

When using AUTO hulls, start with the preset settings first and see if they're suitable, if not then start changing the values with the Custom preset. In general:
- If auto hulls aren't lining up with the edges of your model, increase the Granularity slowly
- If the hulls appear in the wrong places or the topography is wrong, adjust the symmetry and revolution biases
- If the hulls are too chunky, raise the Smoothness
- If you're trying to optimise the output hulls to be more efficient, lower the Smoothness, Concavity or Max Number Of Hulls.

Known Issues

If you're trying to paint but instead are seeing the selection rectangle then you need to enable gizmos (press the `Gizmos` button at the top right of the Scene view). This is fixed for 2019.1 onwards.

If you have this error in the console after importing the project:

```
Instance of HullPainterEditor couldn't be created. The script class needs
to derive from ScriptableObject and be placed in the Assets/Editor folder.
```

Then close and restart the editor and it will fix itself. This is a known bug in Unity 2017 LTS (but fixed in 2018 onwards).

If you receive a DllNotFoundException: libvhacd in the console, then you are probably missing the VS 2019 Redistributables on your computer. The installer can be found on the Microsoft website at https://visualstudio.microsoft.com/downloads/
Or download them directly from here: https://aka.ms/vs/16/release/VC_redist.x64.exe

Caveats

Since painting data is stored using triangle indices for efficiency, painting data will be lost if the original mesh changes. You will need to repaint your hulls for the new mesh.

Problems? Feature Requests? Bugs?

Send an email to `technie@triangularpixels.com` for support and feature suggestions.

Please include your Unity version, and OS in any support emails. If reporting a bug then if you include a (small!) reproduction project with instructions on how to reproduce your bug

then we'll be able to fix things *much* quicker. Please also remember to include meta files as these contain import settings for meshes that are often important. Thanks!

Licenses

Collider Creator uses the V-HACD library by Khaled Mamou, licensed under the BSD 3 license. See the 'Third Party Notices.txt' in the Plugins folder for more details.