ProBuilder & Prototype Documentation

Important Links:

- Check for latest documentation at: www.procore3d.com/docs/probuilder
- Tutorial Videos + Full Info: www.procore3d.com/probuilder

Access source files, beta builds, and online download links:
Once you have Registered (by forwarding your purchase invoice to contact@procore3d.com), you may:

- Create an account at the ProCore3D User Toolbox website for online access to your files, including ProBuilder Source Files.
- Join the Beta Testing Group, to help us test early builds of ProBuilder!

Thanks for purchasing ProBuilder, your support allows us to keep updating and developing all the ProCore tools!

Table of Contents

Helpful Links and Info

Website: The central hub for all ProCore tools, assets, and info.

Contact ProCore:
- Email: contact@procore3d.com
- Facebook: www.facebook.com/probuilder3d
- Twitter: www.twitter.com/probuilder3d

Support and Troubleshooting: Please report any bugs or issues directly to the official support Forum! The Forum is also a great place to discuss, critique, and gain inspiration from an active, ever-expanding community.

Newsletter: Subscribe to receive info on ProCore tools via email, usually about once or twice a month. No spam here!

Video Tutorials: Take a short break to watch the video tutorials before using ProBuilder or Prototype- you'll be an expert in no time!

What is ProBuilder?

> Video Overview: http://www.youtube.com/watch?v=Nomx1LNk7r8

ProBuilder is an editor extension that enables you to seamlessly build, edit, and texture custom geometry, directly in the Unity editor, with an extremely fluid and intuitive workflow. It's a mixture of old-school "BSP-style construction", and full-featured 3D modeling and UV Unwrapping toolsets.

Also included are helper tools for:

- Vertex and Face coloring
- Custom Collision construction
- Trigger Zones
- Efficient Occlusion setup
- Material Palettes and per-face application
- Batching and Optimization
- Exporting to OBJ
- ...and much more!

Prototype is the core of ProBuilder, stripped for speed and simplicity. Using Prototype, you can quickly build great looking early-stage structures, props, walls, bunkers, vehicles, virtually anything at all. Test and tweak instantly, then replace with final models once your artists catch up- if they can! Prototype also includes ProBuilder's ability to quickly colorize faces without adding a single draw call, so you can designate team areas, or just get creative with colorful dev textures.

> **IMPORTANT:** This documentation encompasses ALL features, actions, and tools available in ProBuilder- only some are included with Prototype. If you are using/considering Prototype, please view the full ProBuilder vs Prototype Comparision.

Installing and Upgrading

WARNING: The upgrade process is NOT reversible, and if an error occurs, you will almost certainly lose all your work. Make a backup of your entire project!

Depending on the version of ProBuilder you currently have installed, the process differs. If you're using any version greater than 2.4, follow the `Standard Upgrade` guide. If you're using below 2.4, or if you are using the Source version and wish to switch to the DLL version (or vice-versa), follow the `Upgrade Kit` guide.

Standard Upgrade

Upgrading the DLL version in Unity 5

> Video tutorial: Youtube

- Import the new ProBuilder unity package. Make sure all items are toggled in the Importing Package window.
- After import, close the ProBuilder About Window with this version's changelog.
- There are now errors in the Console. This is expected.
- Navigate to the `ProCore > ProBuilder > Classes` folder.
- Right-Click (Context-Click Mac) the `ProBuilderCore-Unity5` file and select `Show In Explorer`.
- In the File Explorer (or Finder, on Mac), delete the `ProBuilderCore-Unity5` and `ProBuilderMeshOps-Unity5`
- Next (still in the File Explorer) rename `ProBuilderCore-Unity6` and `ProBuilderMeshOps-Unity6` to `ProBuilderCore-Unity5` and `ProBuilderMeshOps-Unity5`. If visible meta files are enabled, don't worry about changing their file names. Unity will take care of that for you.
- Staying in the File Explorer, navigate one folder up and into the `Editor` folder.
- Follow the same procedure with the `ProBuilderEditor-Unity5` files. Delete `ProBuilderEditor-Unity5` then rename `ProBuilderEditor-Unity6` to `ProBuilderEditor-Unity5`.
- Open Unity again. The project will recompile.
- Depending on what version of ProBuilder you are upgrading from, you may see some errors in the Console from deprecated scripts. Just click the error to find the file, then delete it (making sure that it is in the ProBuilder folder, don't delete any of your own scripts!).
    - Common deprecated files to delete:

    - `ProBuilder > Editor > MenuItems > File > pb_SaveLoad`
    - `ProBuilder > Editor > MenuItems > Tools > pb_VertexPainter`
    - `ProBuilder > Editor > MenuItems > Tools > pb_MaterialSelectionTool`
    - `ProCore > Shared` (entire folder is outdated)
- Done!

Upgrading the Source version

- Before importing the new package, delete the `ProCore > ProBuilder` folder (you can also delete the `ProCore > Shared` folder if it exists).
- Import the new ProBuilder package.
- Done!

Upgrade Kit ProBuilder Update

Follow these steps if you are upgrading a ProBuilder project from a version less than 2.4 (Tools / ProBuilder / About to check your current version). If you are switching from the Source version of ProBuilder to the DLL version this guide also applies.

Youtube Tutorial

Upgrade Kit Download

- **Back up your project**
- Import the ProBuilderUpgradeKit package before importing the new version of ProBuilder (downloadable in the User Toolbox, or bundled in the ProBuilder package).
- Run `Tools > ProBuilder > Upgrade > Batch Prepare Scenes for Upgrade`.
- Delete the ProBuilder folder, and optionally the ProCore > Shared folder (if you delete this, make sure to also update ProGrids).
- Import the new ProBuilder package.
- Run `Tools > ProBuilder > Upgrade > Batch Re-attach ProBuilder Scripts`.
- Delete ProBuilderUpgradeKit folder.

Fundamentals of Using ProBuilder

> Video Tutorial: http://www.youtube.com/watch?v=TyIp-UzEm84

With ProBuilder, you can build, edit, unwrap, and texture geometry, right inside the Unity editor, similar to 3D modeling in tools like 3DS Max, Maya, or Blender. Obviously, that's a lot of potential complication, but we won't let that happen! To keep your Unity workflow smooth and complication-free, ProBuilder uses simple, quick-to-swap, Edit Modes.

There are only 2 Edit Modes, **Object** and **Element:**

- **Object** mode is just what it sounds- standard Unity control of objects. Nothing different here, really.
- **Element** mode is where you can edit the mesh, unwrap UVs, assign textures per-face, and much, much more! In **Element** mode, you have 3 sub-modes:
    - Vertices
    - Edges
    - Faces

While using ProBuilder, you will always be in one of these two Edit Modes (**Object** or **Element**). The currently active mode is displayed by the "Mode Indicator" at the top of the Unity SceneView. This "Mode Indicator" can be clicked to swap between modes, or (much better!) you can use keyboard shortcuts.

Editing Geometry, or "3D Modeling", is simple and exactly as you would expect: enter **Element** mode, then proceed to edit by Vertex, Edge, or Face, using standard Unity controls (ie, Move, Rotate, and Scale). Nothing new to learn! Then, use the GUI Panel to perform more complex actions like Flipping, Bridging, Connecting, Welding, etc. See the Interface and Geometry sections for full details!

> Tip: Select a Face, then try holding `Shift` while Moving, Rotating, or even Scaling. Instant extrusion!

Applying Materials and UV Editing, or "Texturing", has been completely rewritten for ProBuilder v2.3. You now have both **Auto-UV** and **Manual UV** unwrapping options for both fast and fine-grained control. Simply open the "UV Editor Window", then enter **Element** mode and edit the UVs by vertex, edge or face. Changes are reflected immediately in the Unity SceneView- zero guesswork. Similar to **Geometry Editing**, the UV Actions

Panel provides access to complex actions like Sew, Collapse, Project Faces, and so forth. See the Interface Overview and Texturing and UVs sections for full details on the completely new, and much improved, Texturing/Material system.

Interface Overview

> Video Tutorial: http://www.youtube.com/watch?v=U7HEG0iKlzU

Opening the GUI Panel

In order to create or edit with ProBuilder, you will need the GUI Panel open. This is done by selecting from the top menu bar in Unity:

`Tools > ProBuilder > Open Probuilder Window`

This will open the ProBuilder window. By default the window is opened as a dockable panel, but may be changed to a floating window by context-clicking (Control-Click on Mac, Right-Click on Windows) and selecting one of the floating options.

Using the ProBuilder GUI Panel

ProBuilder's editor window dynamically changes it's display based on the current state of the Editor. For example, when editing a mesh in **Face** selection mode, editing tools specific to face operations (extrude, subdivide, etc) are shown. Switching to **Edge** selection mode will display edge-specific functions, like **Bridge** or **Connect Edges**.

Panel Area (1) - Element Modes (Vertex, Edge, Face)

At the very top of the GUI Panel are the 3 always available Element mode buttons: `Vertex`, `Edge`, and `Face`.

Click the `Element` you would like to edit and ProBuilder will instantly move into that mode, allowing you to edit the object.

- `G` on your keyboard to toggle in/out of Element mode.
- `H` swaps between `Vertex`, `Edge`, and `Face`.
- `Escape` exits to Object mode.

Once in an Element mode, you can click again on its button to exit that mode and return to Unity default Object mode.

> **Example:** Select an object, then click on the **Vertex** button- the object will now show it's vertices, which you can edit. Then, click on the **Edge** button, to show and edit by edge. Finished editing? Click again on the **Edge** button, since you are still in that mode, to toggle out of editing and back to **Object** mode.

Panel Area (2) - Tools

The **Tools** section is also always available in the main GUI Panel. These buttons will open separate, floating panels with the following uses:

- Shape
  - Opens the **New Shape** panel, so you can create new ProBuilder objects from the various templates available, including Pipe, Arch, Dome, Door, and others. See the Creating and Editing Geometry section for details.
- Material
  - Opens the **Material Palette** for quick access to setting materials per-face on ProBuilder Objects. See the Texturing and UVs section for details.
- UV Editor
  - Opens the powerful new **UV Editor** window! This is where you control all UV settings, both Auto and Manual. There is a lot to cover here, so be sure to view the Texturing and UVs section.
- Vertex Colors
  - Opens the **Vertex Color Palette** for applying vertex colors with ProBuilder. See the Vertex Colors section for details, this is a fun and handy tool!
- Smoothing
  - Opens the **Smoothing Groups** panel that allows you to set custom smooth and hard edges on your geometry. You guessed it- see the Smoothing Groups section for details.

Panel Area (3) - Geometry Actions

The 3rd section of the main GUI Panel is the truly dynamic area- here you can always see all available Geometry Actions, based on your current

Edit Mode and selection. See the Creating and Editing Geometry section for details.

Panel Area (4) - Entity Actions

The bottom area of the main GUI Panel is reserved for Entity Actions. This area is only available when in `Object` mode. These are used to convert ProBuilder Objects into special Entity Types, and toggle on/off the visibility of each. See the Entity Types section for details.

Creating & Editing Geometry (3D Modeling)

> Video Tutorial: http://www.youtube.com/watch?v=c8GbEfi51Cc

New to 3D Modeling? *This documentation can't be a full guide to 3D modeling in general, so we highly recommend searching online for good "Introduction to 3D Modeling" courses- any will do for learning the basic techniques, guidelines, best practices, etc.*

Creating Geometry

ProBuilder is similar to most major 3D modeling tools, in that you start with basic geometric shape, then build upon that geometry to create your own, personal, Works of Wonder (certainly, nothing less!).

Creating Your First ProBuilder Object

The simplest and most often used shape, is a 1m³ meter cube. You can instantly spawn this cube into your Scene by pressing `"Ctrl-K"`.

Creating Objects with the Shape Panel

ProBuilder also offers a (growing!) variety of more advanced shapes to choose from, all with unique generation options. Give them all a try, as they can save you a lot of time and trouble! You customize and spawn these shapes through the **Shape Panel**.

- This panel can be opened at any time from the main ProBuilder GUI Panel (**"Shape"** button in the **Tools** section), or by pressing `"Ctrl-Shift-K"` on the keyboard.
- You can create new ProBuilder Objects in both **Object** and **Element** modes! There is no need to switch between modes when creating new, or duplicating existing, ProBuilder Objects.

Upon opening the **Shape Panel**, you will see the **Shape Preview**, a blue-textured ProBuilder Object, appear in the Scene. You can move, rotate, and scale the **Shape Preview** just like any other object, before committing it. However, it is only a preview, and will disappear when the **Shape Panel** is closed.

Shape Panel GUI

- **Show Preview:** Checkbox to toggle on/off display of the Shape Preview
- **Center Preview:** Click to center the Shape Preview in front of you, in the the Scene
- **Shape Selector:** Choose a shape from the drop-down list
- **Customization Area:** Here, each shape will display it's customizable options
- **Build Shape:** Click to "commit" the shape and spawn it into the Scene

Available Shapes

- Cube
- Stair
- Prism
- Cylinder
- Plane
- Door
- Pipe
- Cone
- Sprite
- Arch
- Custom

Modes & Elements

As mentioned in the Fundamentals and Interface Overview sections, ProBuilder uses a "Mode" system to keep your Unity workflow clean and speedy. Let's go over those modes again, it a bit more detail.

Object and **Element** are the two major modes. These are designed so you can quickly swap between each, seamlessly working on both ProBuilder and non-ProBuilder parts of your game.

Object mode is essentially standard Unity workflow, where ProBuilder Objects act like normal static meshes. There are some special actions available though, which we will look at later.

> How to Use: Click on the "Object" button in the Mode Indicator to exit to Object mode. Or, hit `Escape` on the keyboard.

An "Element" refers to a Vertex, Edge, or Face. 3DS Max users, think "Sub-Object."

Element mode is the real power of ProBuilder- in this mode, you can see and edit the Vertices, Edges, and Faces of ProBuilder objects, similar to 3D Modeling in tools like 3DS Max, Maya, Blender, etc.

> How to Use: Click on any of the Element Mode buttons at the top of the GUI to instantly enter that Element Mode (Vertex, Edge, or Face). Or, hit `G` on the keyboard. Once in an Element Mode, you can also hit `H` on the keyboard to swap between Element modes.

Vertex and Edge visuals will only show on the ProBuilder Object(s) currently selected. If you are not seeing a change in you scene when switching to Element mode, try selecting a ProBuilder object.

- `Vertex`
  - Gives you even fine control, right down to the individual vertices. Selected ProBuilder objects will show their vertices as blue dots, and selected vertices will be shown with green.
- `Edge`
  - ProBuilder will highlight the nearest edge to your mouse with a red color, while all selectable edges will be rendered blue. The current selection is shown in green.
  - Editing via edges provides access to some of the more advanced geometry editing features, like Insert Edge Loop and Bridge Edges.
- `Face`
  - Allows you to select and manipulate the faces of ProBuilder Objects. Selected faces are shown with a light-blue highlight.

> *Did you know?* You can customize the colors of all element graphics in the Preferences panel.

Selecting and Manipulating Elements

Selecting and manipulating Elements in ProBuilder works just like anything else in Unity- nothing new to learn here! You can:

- Click to select just one.
- Drag to select many.
- Hold Shift when click or drag-selecting to add or remove elements from the selection.

ProBuilder also add two special selection methods for Elements:

- In Edge or Vertex Mode, click on a face to select all the Edges/Verts on that face
- Double-Click on an objects face to select all Elements (of the current mode) on that object (in Edge mode double-clicking selects an edge loop).

Geometry Actions

In the following paragraphs, we will cover each of the Geometry Actions available in ProBuilder, moving top-to-bottom on main GUI Panel.

Geometry Actions: All Modes

The following actions are available in **all** Modes:

- **Flip Normals**
  - In **Object** Mode, this will flip *all* faces on the selected ProBuilder object(s).
  - In **Element** Mode, this button will flip only the selected faces.
    - Very useful for turning solid shapes into hollow ones!
- **Subdivide**

- In **Object** Mode, this will subdivide (4x) ALL faces on the selected ProBuilder object(s).
- In **Element** Mode, this button will subdivide only the selected faces.
  - When in `Face` or `Edge` mode, this splits faces by connecting the centers of all edges to a new vertex in the center of the face. In `Vertex` mode, subdivsion is done by connecting all vertices to a new vertex in the center of the face ("Poke Face").
  - Works well to quickly add more poly detail, especially for animation and vertex coloring

- **Set Pivot**
  - In **Object** mode, this will center the pivot of the selected object(s).
  - In **Element** mode, this will move the object's pivot to the center of of the selected Elements.
  - Great for setting an object to rotate or scale from an exact vertex point!

Geometry Actions: Object Mode Only

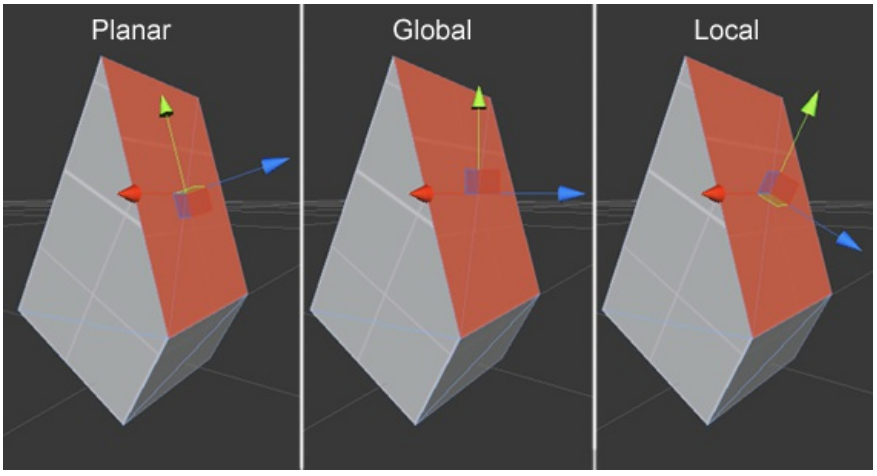
The following actions are only available in **Object** mode:

- **Merge**
  - Click this button to merge all selected ProBuilder objects into one single ProBuilder Object, with the option to save or delete the originals.
  - If you choose to save the originals, they will simply be deactivated in the scene- their names will appear greyed-out in the hierarchy list.
  - Merging objects is a great way to make your game run more efficiently, since it combines meshes and therefore lowers draw calls- very important for mobile games!
- **Mirror**
  - Click this button to open the Mirror Tool. From there select which axes to mirror on, and click “Mirror” to duplicate and mirror the selected ProBuilder object.

Geometry Actions: All Element Modes

The following actions are only available in **Element** mode, but can be used with **all** Elements:

- **Handle Coordinates**: This drop-down list controls the coordinate space currently being used for editing geometry.
  - `Planar`: movement in the direction the selected face’s normal.
  - `Global`: Movement in the “World” coordinates (always the same).
  - `Local`: Movement relative to the objects transform (model-space).



> Not making sense? This can be a confusing subject the first time you encounter it. Stick with “Global”, and give each of the others a try from time to time- they will make better sense with practice, than I could ever explain. You will soon find these are incredibly handy for complex construction. Hit the “P” key on your keyboard to swap between Coordinate Space modes.

- **Grow**
  - Clicking **Grow** will "spread" the selection outwards, taking all elements adjacent to the currently selected Element and adding them to the selection.
- **Grow with Angle**
  - Click the `+` button to toggle open the options for **Grow**
  - Use the checkbox to toggle On/Off **Grow By Angle**
  - Type in the desired Grow Angle (degrees)
  - When active, the **Grow** action will only spread the selection to adjacent elements whose normal direction is less than than the amount

entered (degrees)

- **Shrink**
  - Performs the exact opposite of **Grow**, by removing the outermost elements in the selection.
- **Invert**
  - Selects the inverse of the current selection. Eg, all unselected elements will become selected, the current selection will be unselected.
- **Extrude**
  - Click to extrude the currently selected faces (regardless of Element mode). You can then Move, Rotate, or Scale the newly extruded Faces, as desired.

> ProTip: It is often much easier to simply hold `Shift` while using the Move, Rotate, or Scale tool- this will automaticaly extrude the selected Face(s)!

- **Extrude by Amount**
  - Click the "+" button to toggle open the options for **Extrude**
  - Use the checkbox to toggle On/Off **Extrude By Exact Amount**
  - Type in the desired Extrude Amount (meters)
  - When active, the **Extrude** action will instantly extrude the selected face(s) by the entered amount (meters)
- **Delete**
  - Deletes the selected face(s) (regardless of **Element** mode!)
  - You can also use the `Backspace` key

> ProTip: **Don't** accidentally press `Delete`, that will delete the entire object.

- **Detach**
  - This will break free all selected face(s) (regardless of **Element** mode), so that they can be moved separately.
  - When you click **Detach**, you will be given two options:
    - Detach to New Object: The detached faces will be removed from the current object, and create a new object.
    - Detach to Submesh: The detached faces will be broken from the current object, but remain part of the mesh.

Edit Mode: Vertex Only

The following actions are only available in the **Vertex Element Mode:**

- **Connect**
  - This will create edges connecting all selected vertices (where possible).
- **Weld**
  - Select 2 or more vertices that are in the same position, and click **Weld** to make them one single vertex.
- **Weld by Distance**
  - Click the `+` button to toggle open the options for **Weld**
  - Use the checkbox to toggle On/Off **Weld By Distance**
  - Type in the desired Weld Distance (meters)
  - When active, the **Weld** action will affect not only vertices in the exact same location, but also all those within the specified distance (meters).
- **Collapse**
  - This will find the center position between all selected vertices and collapse them to a single vertex at that position. This is done **regardless of distance.**
- **Split**
  - This will cause all selected vertices to split apart, creating a unique vertex for each edge that connected to the original vertex.

Edit Mode: Edge Only

- **Loop**
  - Loops selection from the current edge selection.
- **Ring**
  - Rings selection from the current edge selection.
- **Bridge**
  - Select 2 open edges, then click **Bridge** to create a new face which spans the area between the 2 edges.
    - Useful for filling holes in geometry.
- **Connect**
  - Connects all selected edges with new edges spanning from the center of each selected edge to its neighboring edges.

Edit Mode: Face Only

- **Merge Faces**
  - Select any number of adjacent faces, then click "Merge Faces" to reduce them to a single, unified, polygon

Tips for Better Building

Here, we'll go over some basic tips, tricks, and advice for modeling with ProBuilder 2.0:

- **Use ProGrids!** With ProBuilder, you will most often be constructing hard-surface models, with many parts that need to align exactly, match sizes, and so forth. ProGrids will save you hours of time and sanity by snapping your objects and elements to the grid. Your resulting creation will look and function better as well.
- **Stay "On The Grid".** Now that you are using ProGrids, stay on that grid! Making sure all your vertices are on an exact grid point will make your ProBuilder objects much, much simpler to align, edit, and modify.
- **Start Big.** The first version you build won't always be wrong, but it won't ever be right either. Start with with large, simple, boxy construction- I typically start at a grid level of 1/2 meter (.5) If you are building a level or world, test out the flow, fit, and scale. Try some lighting and atmosphere tests, really get a feel for what you are constructing. Then whittle down to smaller and smaller grid levels, adding more detail with each level, just like LODs.
- **Use Simple Angles.** When creating angles, try to stick with exactly 1x1, 1x2, and 1x3, etc. For example, "1 unit up, 1 unit over". This will keep your design clean, and help match up complex geometry.
- **Textures Come Last.** Graybox (build geometry with the default material) your level completely before you even think about adding real textures! Use the Colorizing tool to differentiate your level/world/item as needed, but save the real texturing for the very last. Only once the geometry is 95% finished and final, you should begin adding real textures. This saves time spent re-texturing parts of the level that you have to rebuild when an issue arises.
- **Delete Unseen Faces.** Fewer triangles to render, and your lightmaps will take *much* less time to bake!
- **Use Static Flags (Unity Pro).** ProBuilder defaults to mostly Static flags with one exception: `Occluder Static`. If you are using `Occlusion Culling` in Unity Pro, make sure you mark objects that should occlude visibility with `Occluder Static`. See the "Entity Types" section for more details on what static flags are set for different types.

Texturing and UVs

Applying Materials

You can apply materials to your ProBuilder Objects (or individual faces!) via several methods- simple "drag-n-drop", the Material Palette, or QuickPaint method. Try them each, and find which works best for you!

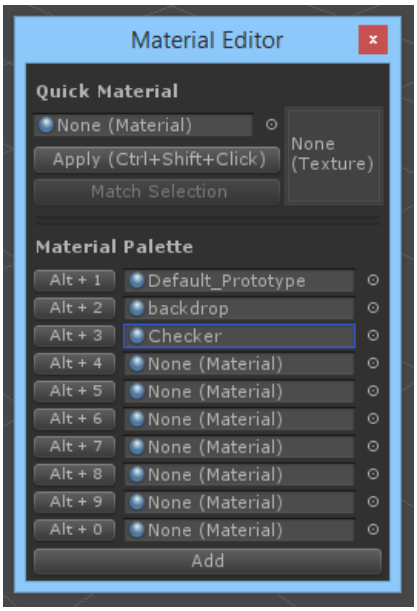
> Video Tutorial: http://www.youtube.com/watch?v=m085rEQmVP8

Drag-n-Drop

For this method, simply drag a material onto any ProBuilder object, just like a normal Unity GameObject. However, the result will differ by Edit Mode:

- **Object** mode: Will apply the material to the entire ProBuilder object.
- **Element** mode: Will apply the material only to the selected face selection.

Material Palette



The Material Palette, new in v2.3, allows you to setup an easy-access palette of often used materials, and apply them instantly via a GUI button, or keyboard shortcuts (Alt + 0-9). You can also add and delete custom material slots should you need more than 10. Similar to using "drag-n-drop", applying a material via the Material Palette will have different results depending on Edit Mode:

- **Object** mode: Will apply the material to the entire ProBuilder object.
- **Element** mode: Will apply the material only to the selected face.

QuickPaint

"QuickPaint" is a method used via the GUI at the very top of the Material Palette window. Choose a material for the QuickPaint feature, then just use `Control - Shift - Left Click` to instantly paint that material to any face you click on.

- This method will **always** paint to a single face only, regardless of Edit Mode or selection.

UV Editor Window Introduction

Check out the Video Tutorial

ProBuilder 2.3 nearly entirely overhauls the previous UV system. Don't worry, UVs can still be automatically generated (and are by default). The familiar controls and handles are all still here.

The most obvious change is that UVs are now edited in a new window which shows you exactly where your UVs are in 2D space. You can position, rotate, and scale your UVs in this window, or you can lock the `Texture Handle` and manipulate UVs in the SceneView.

Auto and Manual Modes

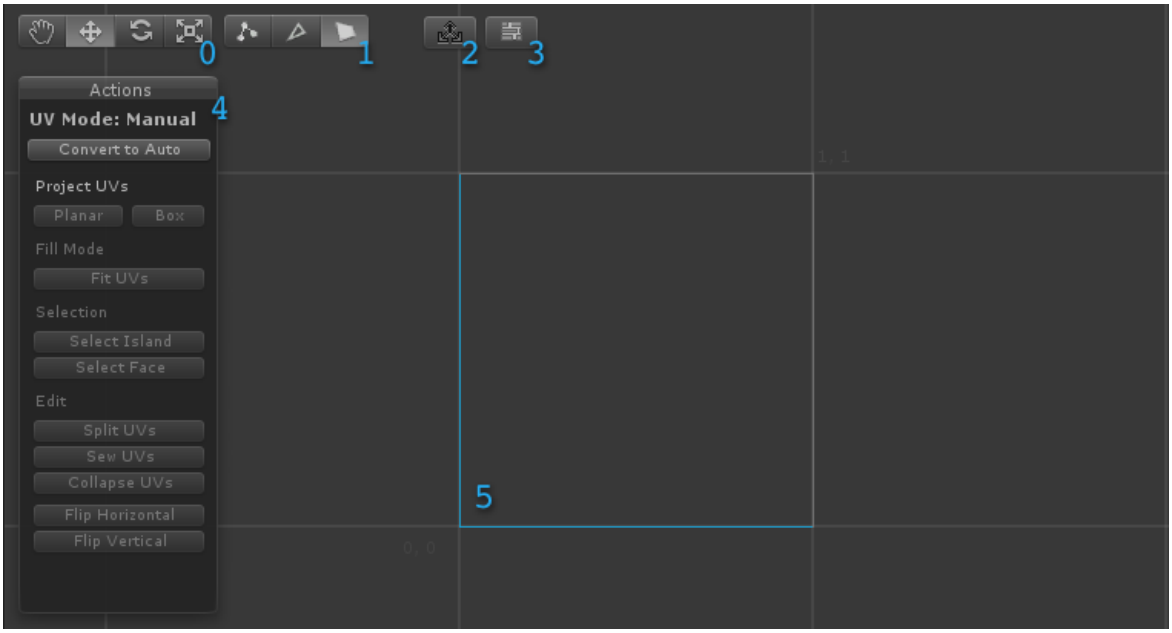
Faces are by default unwrapped using `Auto Mode`, which means that you control a set of parameters that are used to project UV coordinates for you. If you've used ProBuilder prior to 2.3, this will feel very familiar. `Manual Mode` on the other hand behaves more like traditional 3D modeling apps - you have precise control over how UVs are projected, and once you've set them they will not move.

Faces that are in `Manual Mode` will be highlighted in orange, while `Auto Mode` UVs will be highlighted blue.

> `Auto Mode` UVs are only applicable to face selections. If you want to modify UVs per-edge or per-vertex, `Manual Mode` must be used. ProBuilder will automatically handle switching from `Auto` to `Manual` mode for you if you modify a non-face element while editing an `Auto` face.
>
> You may switch between `Manual` and `Auto` at any time, but be aware that when swapping from `Manual` to `Auto` you may lose some features of your work (since `Auto` mode cannot manipulate vertices independent of their faces).

The UV Editor Window

The UV Editor window contains two guide lines, on the `X` and `Y` axis ranging from `0,0` to `1,1`. These lines serve to provide a point of origin.



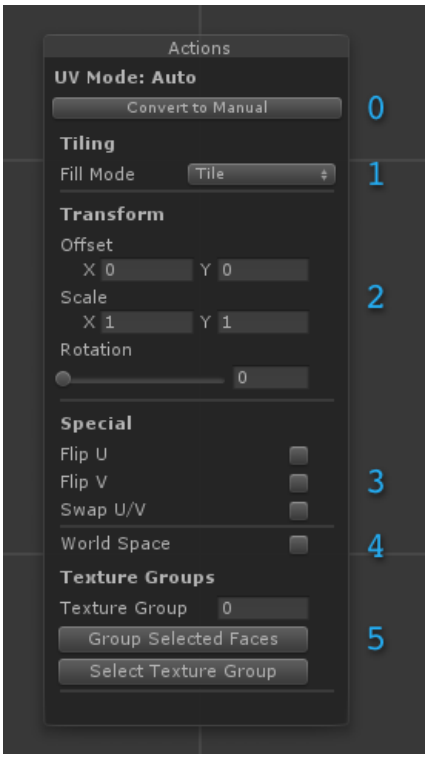
	Name	Description
0	Tool selection	Sets the current tool - `{Pan, Move, Rotate, Scale}`
1	Element mode	Changes the element selection mode - `{Vertex, Edge, Face}`
2	Texture Lock	Sets the `SceneView` tools to be used for UV modifications. This takes the place of `Texture Mode`.
3	Show Material Preview	When toggled, a preview of the first selected face's material texture will be shown. Note that this features requires the material's shader to contain a `_mainTexture` property.
4	Actions Window	This window will update based on your selection. It displays the relevant tools and actions for each mode per-selected face.
5	Canvas	The blue guides represent coordinates `(0,0) -> (1,1)`. Your UVs may be placed anywhere on this canvas.

Action Window

There are two interfaces that can be displayed in the `Action Window`: `Manual Mode` and `Auto Mode`. Both modes provide similar functionality, with important differences in how they are executed.

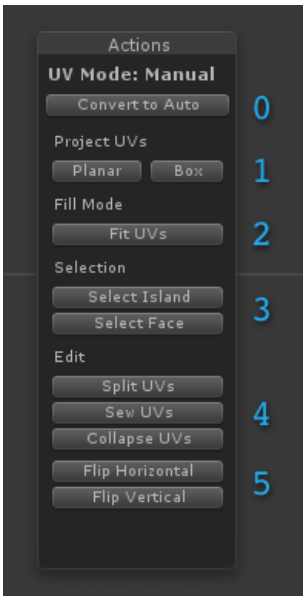
> Note that if you modify a single vertex, edge, or any non-face element while in `Auto Mode`, the face containing those elements will automatically be converted to `Manual` for you.

Auto Mode Interface



	Description
0	Convert the current face selection to `Manual Mode` UVs. This will clear all current `Auto Mode` settings for this face, but you will not lose UV positions.
1	`Fill Mode` determines how UVs behave once they're projected. `Tile` is usually the correct behavior, but in some cases you may wish to fit your UVs into `(0,0)-(1,1)` space. `Fit` uniformly scales UVs to size, where `Stretch` simply expands the selection on all sides to fill space.
2	`Offset, Rotation, and Scale` are applied after UVs are projected. You may use the UV `Handle` tool or these fields to set values.
3	`Special` toggles enable very specific changes to how UVs are calculated. Specifically, they allow you to flip coordinates on the `X` and `Y` axis (using `Flip {U, V}`) or invert them (`Swap U/V`).
4	`World Space` tells ProBuilder to skip the normalization step following a projection event - UVs will be left where-ever the initial projection places them.
5	`Texture Groups` provide high level access to the projection process. Setting faces to share a texture group will guarantee that those faces will be projected as a single plane, sharing the same parameters. This is most often useful for faces that have a similar orientation, and share an edge.

Manual Mode Interface



	Description
0	Convert the current face selection to `Auto Mode` UVs.
1	`Project UVs` provides methods of projecting vertices to UV space. This is the first step in unwrapping a model. See below for an explanation of both.
2	`Fill Mode` provides actions for setting UVs to certain spaces. Currently `Fit UVs` is the only option, which automatically (and uniformly) scales all selected UVs to fit in `(0,0)-(1,1)` coordinate space.
3	`Selection` provides actions for expanding the current element selection. A UV `Island` is any set of faces or elements connected by the `Sew` or `AutoStitch` functions.
4	`Edit` allows you to connect / disconnect UV elements. `Sew` is similar to a geometry `Weld`.
5	`Flip {Horizontal, Vertical}` flips UVs across the `X` or `Y` axis.

Projection

- `Planar` - This projects UVs by treating all faces as a single plane, then mapping their vertices to 2d space.
- `Box` - Project UVs from the best matching `normal` on a surrounding box. This is great for quickly unwrapping an object with generally acceptable defaults.

Additional Features

Autostitch

`Autostitch` is an action that will perfectly align 2 faces at their shared edge. To perform an `Autostitch`, simply select a face (one face only), then `Control+Click` a neighboring face.

On success, the `SceneView` will display a notification and the current selection will be set to the clicked face. You may continue `Control + Clicking`-ing neighboring faces.

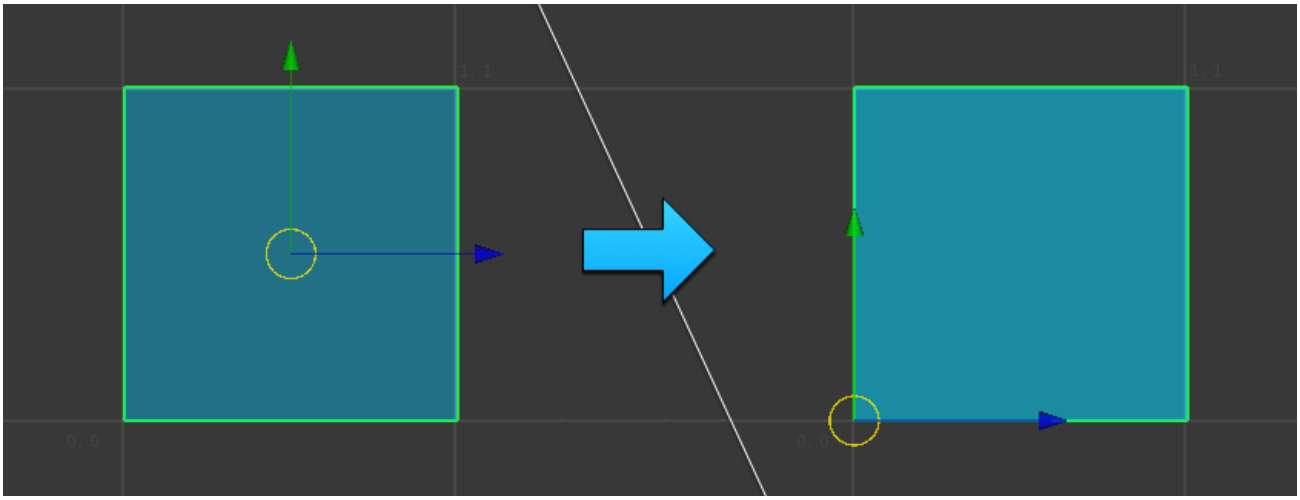
> The UV Editor window must be open to perform an `Autostitch` action.
>
> To successfully `Autostitch` two faces, they must share an `Edge`.

Set UV Pivot

When using the UV Editor's `Handles`, it may be useful to set a different pivot point than the center of the selection. To do this, simply `Right Click` and drag the `Move Handle` to the desired pivot. Once you have placed the pivot, you may switch freely between `Move`, `Rotate`,

and `Scale` tools without losing your pivot.

> **Mac Users** - Use `Alt + Drag` instead of `Right Click + Drag` to set custom pivot points.



To reset your handle pivot back to the center of a selection simply click a new element (or the current selection).

UV Snapping

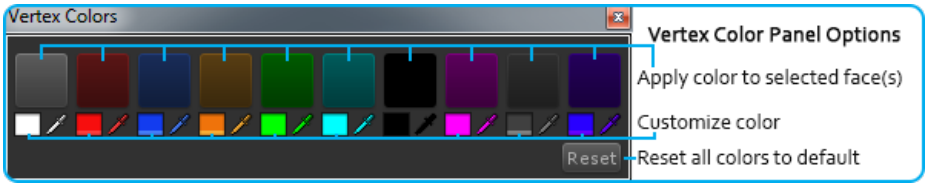
When dragging UVs, you may notice that your selection snaps to the nearest vertex. This makes aligning faces very quick, but can be undesirable in some situations. To disable proximity snapping, simply hold the `Shift` key while dragging.

Vertex Colors ("Colorizing")

> Video Tutorial: http://www.youtube.com/watch?v=m085rEQmVP8

"Colorizing" allows you to color individual faces when using a **material that supports vertex colors**. With this method, you can quickly add color and variation throughout your map, without changing materials or adding drawcalls.

The Vertex Color Panel



- You can open the Vertex Color Panel from the main GUI panel with the button, or choose “Tools > [name of package] > Vertex Colors > Vertex Color Interface” from the top menu.
- Customizing Vertex Colors
  - Each of the 10 color choices are customizable by clicking on the smaller “color picker” button below the larger “Apply Color” button. Your customizations will be remembered between Unity sessions. Click the “Reset” button to revert to default colors.
- Applying Vertex Colors
  - Enter Geometry Editing Mode (`G` on your keyboard), then select any number of faces.
  - Apply the vertex color via to the faces by either of 2 methods:
  - Open the Vertex Color Panel, then click the desired color button

> **ProTip:** Keep one of the colors at simple white, so you can quickly revert faces to standard vertex color.

Entity Types

All ProBuilder objects have an "Entity Type". These are basically categories, like “Melee, Ranged, Explosive, etc”- they set certain properties in the object, and how it acts in your game.

Since all ProBuilder objects have a type, and you generally don’t need to see all types at once, you can use the Entity Types buttons to toggle the visibility on or off for each “group” of types. This becomes extremely useful as your scenes become more and more detailed/complex.

- **Mover** is the same as a Detail object, except it is non-static, for use as moving platforms, doors, elevators, etc. It can be occluded, but will not occlude other objects. This is set as default, since too many occluders will actually hurt performance much more than too few. Set any ProBuilder object(s) to “Mover” type by selecting them, and hitting the “M” key on your keyboard.
- **Detail** is the standard, default ProBuilder Object type. A mesh with a texture and a collider, nothing more. It can be occluded, but will not occlude other objects. This is set as default, since too many occluders will actually hurt performance much more than too few. Set any ProBuilder object(s) to “Detail” type by selecting them, and hitting the “D” key on your keyboard.
- **Collision** objects are invisible in-game, but still have full collision. These are very handy for smoothing stairways into ramps, adding player clip to round out sharp corners, force fields, and many other semi-advanced uses. They will show in the editor as bright-green and semi transparent. Naturally, they do not occlude or block light. However, you should always disable them via the Entity Types controls before lightmapping, or their color will affect nearby areas. Set any ProBuilder object(s) to “Collision” type by selecting them, and hitting the “C” key on your keyboard.
- **Triggers** are a special type of ProBuilder object, designed specifically to aid in the creation of Zones, Volumes, and (of course) Triggers. They are invisible in game, but have a collision component set to “trigger”. This makes them great for things like triggering elevators, doors, or cutscenes (as the player enters or exits the Trigger zone), designating “Kill Zones” or FX Volumes, and so forth. Set any ProBuilder object(s) to “Trigger” type by selecting them, and hitting the “T” key on your keyboard.

Optimization

Deleting Faces is generally done once your mesh is complete, or near complete. Any face that will never be seen or "used" in the game should be deleted. Otherwise, it would add to the total polygon count, take up lightmap texture space, and potentially add drawcalls.

- **Note:** If you delete a face, but need it back later, use the `Bridge` function!

Occlusion (Unity Pro only) is extremely important for good optimization. Wherever you have large, visibility-blocking ProBuilder objects, mark them `Static` in the top right corner of the Inspector window. This will let them take advantage of Unity’s Occlusion system, by becoming Occluders.

- Occlusion can be tricky at first, but will yield serious performance benefits, so don’t overlook it. Experiment with this one, and read up on Unitys occlusion system for the best results. Unity Occlusion Culling Overview
- **Merging** allows you to collapse multiple ProBuilder objects into one single object, while still being able to edit it like any other ProBuilder object. This is mainly useful for reducing draw calls, and welding vertices. See **Merging** in the Interface Overview section for details on using this function.

Custom Collision should be used wherever possible, as it can significantly reduce in-game overhead and pre-game loading times. Essentially, anywhere that you can reduce a complex collider, or a group of colliders, down to a single, simple collider, you should use Custom Collision.

- A good example of this is a stairway. If you left its collision as the default (Concave MeshCollider), each and every step is part of the collision. Instead, disable the stairways collision component, then create a ProBuilder object that matches the stairways slope. Set this object to the `Collision` Entity Type by pressing `C` on your keyboard, and give the stairway a test run. Not only will your game run better, but you can now move smoothly up and down the stairway, without those annoying bumping and collision-snagging actions.

Lightmap Size

An important part of improving a games performance is ensuring that your draw calls are managed in an efficient manner. This means making sure that Unity can dynamically (or statically, if you're using Unity Pro) batch mesh objects where appropriate. Unfortunately, there are lots of things that break batching. Scaling at the transform level, for example, is one of those (`Freeze Transforms` can help there). Another trickier one is lightmap index.

- Lets say you have 10 objects, you lightmap your scene, and end up with 2 lightmaps at 1024x1024 each. All objects should batch down to one, but you get 2 draw calls- why? Because you have more than one lightmap, and therefore, more than one material.

- One solution is bigger lightmaps. You can control the size of generated lightmaps by using this handy script: http://forum.unity3d.com/threads/56435-light-map-max-at-1k-solved
- Each time after building your maps at larger than 1K size, you will also need to reset the lightmap texture's import settings to "Max: 4K", as well.

This is a largely subjective optimization, as increasing the lightmap texture size may also have a performance impact (especially on mobile) equal to or greater than the cost of an extra draw call to load additional lightmap textures.

Lightmapping

ProBuilder automatically generates perfectly sized, normalized, UV2 channels for each and every ProBuilder object. However, there are a few items to keep in mind when lightmapping:

- Delete Invisible Faces: Don't waste valuable lightmap texture space on faces that aren't seen.

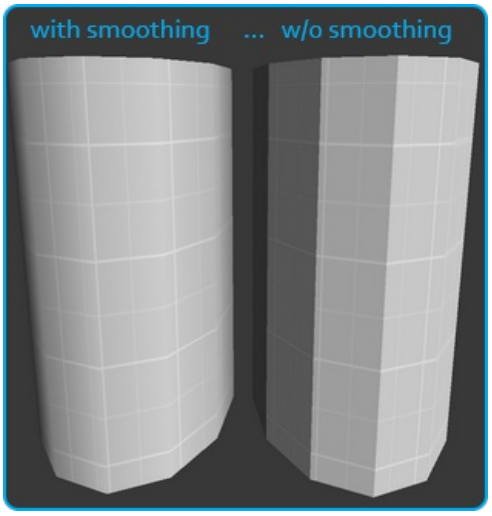
Lightmap Generation Settings

You can customize how ProBuilder generates lightmap UVs, both per-object and globally. To do so, choose `Tools > ProBuilder > Editor > Lightmap Settings Window` from the Unity menu bar.

Default values are preset for all objects, and should generally be appropriate. However, if you are seeing artifacts or strange effects on your lightmaps for an object you may try adjusting these parameters.

Smoothing Groups

Smoothing groups average the vertex normals with neighboring planes. This allows lighting to behave in a more realistic manner when dealing with edges that are intended to be smooth.



- **Opening the Smoothing Menu** To open the smoothing menu, first open the Texture Window go to

`Tools > (ProBuilder / Prototype) >Texture Window`.

In the texture window, click the button titled "Smoothing."

- **Using Smoothing Groups**
- ProBuilder decides which edges should be smoothed by checking for neighboring faces that are in the same group. It also checks for `Hard` groups, which as you might guess, hardens edges of neighboring faces.

> As an example, selecting all side faces on a cylinder and setting them to the same smoothing group will result in smooth sides, while keeping the top and bottom edges hard. In some cases it may be desirable to have adjoining faces smoothed with certain neighbors, but not others. In these cases, you may use multiple groups in order to achieve the desired result. ProBuilder provides 24 smooth groups (all functionally the same, but only same number faces will smooth edges) and 18 hard groups.

Customizing ProBuilder

- To open the Customization Panel, click on “Edit > Preferences”, in the Unity top menu, which will open the Editor Preferences window. Choose the “ProBuilder” (or “Prototype”) tab, and you will be presented with all customizable options.
- Press “Use Defaults” if you would like to return to the standard configuration.

Special Menu Items

A list of Special Menu Items only available from the top menu `Tools > ProBuilder > ...`, and their uses:

- **About:** Provides info on the currently installed version of ProBuilder
- **Documentation:** Opens the latest Documentation online
- **Editor:** Specialized ProBuilder editor tools and functions
  - **Lightmap Settings Window:** Advanced lightmap/UV2 generation parameters and controls for ProBuilder Objects
- **Selection:** Selection modifiers that help to remove otherwise repetitive, tedious actions
  - **Select Faces with Material:** Select all faces on the currently active ProBuilder Object, which have the same material applied as the currently selected face.
  - **Select Faces with Vertex Color:** Selects all faces on the currently active ProBuilder Object, which hae the same Vertex Color as the currently selected face.
- **Geometry:** Specialized functions for editing Geometry, not used often enough to be part of the Panel GUI
  - **Conform Normals:** Sets all face normals to the same relative direction, in case you suspect a "leak".
  - **Triangulate Object:** Reduces all polygons to their base triangles.
  - **Freeze Transforms:** Sets the selected objects position to world coordinates `{0,0,0}` without changing any vertex positions.
- **Actions:** ProBuilder is built to be extremely extensible. User built functions and assorted utilities for working with ProBuilder are stored in the `Actions` folder
  - **ProBuilderize Selection:** Converts any selected Model to a ProBuilder editable mesh, triangulated.
  - **ProBuilderize Selection (Preserve Faces):** Converts the selected model to a ProBuilder editable mesh, and attempts to keep faces (does not create explicit triangles).
  - **Generate UV2 - Selection:** If you have toggled off the automatic generation of UV2 channels in Preferences, you can use this item to build UV2 (lightmap) channels for the current selection.
  - **Generate UV2 - Scene:** This generates UV2 (lightmap) channels for all ProBuilder objects in the scene. This is only useful if you have toggled off automatic UV2 generation in the Preferences panel.
  - **Export Selected to OBJ:** Exports the selected ProBuilder objects as an OBJ file.
  - **Make Asset:** Creates a `.asset` and prefab in project from the current selection. This strips the ProBuilder scripts from your object, but retains the mesh and other component data.
  - **Strip all ProBuilder Objects in Scene:** Remove all ProBuilder scripts from all objects in this scene, leaving just the models.
  - **Strip all ProBuilder Objects in Selection:** Remove all ProBuilder scripts from selected objects, leaving just the model.
- **Repair:** This menu contains a set of tools to help fix broken ProBuilder scenes and objects. Most users will not need these, but in some cases they may be necessary
  - **Remove Degenerate Triangles:** This deletes triangles on a mesh that are either taking up no space, or are duplicates.
  - **Clean Up Leaked Meshes:** If you see console logs saying anything about leaking meshes, run this command to clean up the leaks.
  - **Force Refresh Scene:** Sometimes necessary after an upgrade. Will regenerate mesh geometry and refresh the scene view.
  - **Invert UV Scale (Scene):** UV scale will be inverted (faces with an area of 2m² becomes .5m²). This is useful for users upgrading from a pre-2.3 project.
  - **Invert UV Scale (Selected Objects):** UV scale is inverted for selected objects.
  - **Invert UV Scale (Selected Faces):** UV scale is inverted for selected faces.
  - **Repair Missing Script References:** If ProBuilder script references are lost, this will attempt to reconnect the proper components.
- **Experimental:** These are tools or functions that aren't quite ready for public use, but are included for users to try out early, and report issues/feedback. WARNING: Use with caution, unwanted results may occur!
  - **Vertex Painter Tool:** Allows brush-style painting of colors and textures (via vertex colors)
  - **Boolean (CSG) Tool:** Union, Intersection, and Subtraction methods currently implemented
  - **Save ProBuilder Object:** Save selection to a `.pbo` binary file using the `pb_SerializableObject` type. This object will be fully editable when imported.
  - **Load ProBuilder Object:** Imports a `.pbo` file to a new prefab in the project. This object will be fully editable.

Hints & Tips

- Double clicking a face in Geometry mode selects all faces on that object.
- `Ctrl-Shift-I` (thats 'eye') inverts the face selection.
- Select a face and hit `Ctrl-J`. Your object's pivot is now the center of that face. This also works for vertices.
- `Alt-G` adds all adjacent faces to the selection.
- You can drag select faces as well as vertices and edges.
- You may delete faces by hitting the 'Backspace' key.
- You can assign your own colors to the vertex coloring hotkeys by opening the 'Vertex Color Interface' in "Tools > ProBuilder > Vertex Colors > Vertex Color Interface"
- Don't want a dockable window? Toggle "Open in Dockable Window" to false in the Preferences panel.
- Like to live dangerously? Disable Edge Extrude from Perimeters Only and Bridge Perimeter Edges Only to enable extrusion and bridging from any edge, any time.
    - **Note:** This can easily lead to bizarre geometry - but hey, you can handle the power, right?

Keyboard Shortcuts

ProBuilder 2 can be almost entirely keyboard-driven, which keeps the GUI clean, and workflow very fast. Even better, nearly every keyboard shortcut, and many other settings, can be customized! Just open "Edit > Preferences > ProBuilder" . Below is a "cheat sheet" of all default keyboard shortcuts.

Shortcut	Description
`Ctrl - K`	New Cube
`Ctrl - Shift - K`	New Shape
`G`	Enter Geometry Edit Mode
`H`	Toggle Between Face, Edge, and Vertex Manipulation
`P`	Toggle Handle Coordinate Alignment
`Escape`	Exit Texture or Geometry Mode
`M`	Set selected objects to Mover Entity Type
`B`	Set selected objects to Detail Entity Type
`T`	Set selected objects to Trigger Entity Type
`C`	Set selected objects to Collision Entity Type
`Ctrl-Shift-Left Click`	With Material Palette open, paint Quick Material slot to clicked face
`Ctrl-E`	Extrude selected face(s) with translation
`Ctrl-J`	Set pivot to center of selection (vertex, face, or object)
`Ctrl-Shift-I`	Invert selection
`Alt-(0-9)`	Paint selected face(s) to color preset (Vertex Colors Menu)
`Shift (Drag/Rotate/Scale)`	Hold shift while scaling, rotating, or moving to extrude selected faces.
`Backspace`	Delete selected face(s)
`Alt + C`	Collapse selected vertices

`Alt + V`	Weld selected vertices
`Alt + X`	Split selected vertices
`Alt + B`	Bridge selected edges
`Alt + R`	Select Edge Ring
`Alt + L`	Select Edge Loop
`Shift + Alt + G`	Shrink Selection
`Shift + G`	Grow Selection
`Alt + N`	Flip Face Normals
`Alt + U`	Insert Edge Loop
`Alt + E`	Connect selected vertices or edges

Feature Index and Comparison

We will endeavor to list each and every feature, action, and option available for ProBuilder in the section below. If we missed something, please let us know!

IMPORTANT: ProBuilder vs Prototype Comparison

- Items marked with "***(ProBuilder Only)***" are only included with ProBuilder, and are NOT available in Prototype.

Panel GUI Items

These are features and actions available from the main ProBuilder GUI Panel

Edit Mode: Object

- Edit Mode: Vertex
- Edit Mode: Edge
- Edit Mode: Face
- Shapes
- Material Palette ***(ProBuilder Only)***
- UV Editor ***(ProBuilder Only)***
- Vertex Color Palette
- Smoothing ***(ProBuilder Only)***
- Merge ***(ProBuilder Only)***
- Mirror ***(ProBuilder Only)***
- Flip Normals ***(ProBuilder Only)***
- Subdivide ***(ProBuilder Only)***
- Set Pivot
- Entity Type: Detail
- Entity Type: Mover
- Entity Type: Collider
- Entity Type: Trigger

Edit Mode: All Element Modes

- Handle Coordinates (World, Local, Planar)
- Grow Selection
- Grow Selection By Angle
- Shrink Selection
- Invert Selection

- Set Pivot
- Extrude
- Extrude by Amount
- Flip Normals ***(ProBuilder Only)***
- Delete Selected Face(s) ***(ProBuilder Only)***
- Detach Selected Face(s) ***(ProBuilder Only)***
- Subdivide Face(s) ***(ProBuilder Only)***

Edit Mode: Vertex Only

- Connect Selected Vertices ***(ProBuilder Only)***
- Weld Selected Vertices ***(ProBuilder Only)***
- Weld Selected Vertices by Distance ***(ProBuilder Only)***
- Collapse Selected Vertices ***(ProBuilder Only)***
- Split Selected Vertices/Vertex ***(ProBuilder Only)***

Edit Mode: Edge Only

- Select Edge Loop ***(ProBuilder Only)***
- Select Edge Ring ***(ProBuilder Only)***
- Bridge Selected Edges ***(ProBuilder Only)***
- Connect Selected Edges ***(ProBuilder Only)***

Edit Mode: Face Only

- Merge Face(s) ***(ProBuilder Only)***

Menu-Only Items

These are features and actions only available via the Unity Menu Bar

Tools > ProBuilder > Editor

- Lightmap Settings Window ***(ProBuilder Only)***

Tools > ProBuilder > Selection

- Select Faces with Material ***(ProBuilder Only)***
- Select Faces with Vertex Color

Tools > ProBuilder > Geometry

- Conform Normals ***(ProBuilder Only)***
- Triangulate Objecct ***(ProBuilder Only)***
- Freeze Transform ***(ProBuilder Only)***

Tools > ProBuilder > Actions

- Export Selected to OBJ ***(ProBuilder Only)***
- ProBuilderize Selection ***(ProBuilder Only)***
- ProBuilderize Selection (Preserve Faces) ***(ProBuilder Only)***
- Generate UV2 - Selection ***(ProBuilder Only)***
- Generate UV2 - Scene ***(ProBuilder Only)***
- Strip all ProBuilder Objects in Scene ***(ProBuilder Only)***
- Strip all ProBuilder Objects in Selecction ***(ProBuilder Only)***

Tools > ProBuilder > Repair

- Remove Degenerate Triangles ***(ProBuilder Only)***
- Clean Up Leaked Meshes
- Force Refresh Scene
- Invert UV Scale (Selected Objects)
- Invert UV Scale (Selected Faces)

- Repair Missing Script References

Tools > ProBuilder > Expirimental

- Vertex Painter Tool ***(ProBuilder Only)***
- Boolean (CSG) Tool ***(ProBuilder Only)***
- Load ProBuilder Object ***(ProBuilder Only)***
- Save ProBuilder Object ***(ProBuilder Only)***