“Prototype” and “ProBuilder” Documentation

Last Updated 12-8-2013, build v1406

Note: If you would like to receive updates, beta access, and info via email also, you can “register”:
To register, just send an email with your invoice number to “contact@procore3d.com”. This is not at all required, but allows me to send you updates instantly. I also send out a newsletter once a month or so, with info on new features, bug fixes, tools, etc. . I will never use/sell/etc your email for anything other than ProCore info, I hate spam too!

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[1] Helpful Links and Info

- **VIDEO TUTORIALS:** Please, take a short break to watch the video tutorials before using ProBuilder and Prototype. Make a sandwich*, relax and watch the tutorials, and you’ll be an expert in no time! Visit www.procore3d.com to find all our tutorials!
    - **Heavy recommends Sandvich*
- Email us directly at: contact@procore3d.com
- Website: www.procore3d.com is the central hub for all ProCore tools, assets, and info.
- Social: The best way to stay knowledgeable on updates, new features and tools, etc
    - www.facebook.com/probuiler3d
    - www.twitter.com/probuilder3d
- Newsletter: Subscribe here at “http://eepurl.com/waKUX” to recieve info on ProCore tools via email, usually about once or twice a month. No spam here!
- Official Unity Forums thread: Leave testimonials, share your experiences with ProBuilder 2.0, showcase your art, and just say “Hi!” to the Unity community. Please do, since it

really helps us spread the word and make ProCore even better!

- SixBySeven Forum: Ever-expanding and resource-rich, with a very helpful and active community. Whatever you need take a look for it here, and if you can't find it, start a thread to ask! Especially if you have an error, bug, or issue that needs fixing, it's best to post it on the forums.
- **NEW** Beta Testing Group: available to all registered users!

[2] Overview

ProBuilder is a custom editor extension for the Unity 3D game engine, one that brings some very exciting and powerful new features to the engine. With ProBuilder, you can finally build, edit, and texture custom geometry with an extremely fluid, intuitive, and fast workflow. You can even manipulate UV direction, tiling, offset, rotation, and more.

Using ProBuilder, you can also quickly setup very efficient collision and occlusion, and trigger volumes for events, switches, and zones.

Prototype is the core of our 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.

*Whatever your project, **Prototype** or **ProBuilder** can accelerate its development, ease your stress, and ultimately allow you to ship a better finished project. Give it a try, you'll wonder how you ever worked without it*!

[3] Installing and Upgrading

Import the Unity Package. The Install Window should appear automatically. If it does not, navigate to "*Tools > [name of package] > Upgrade / Install".*

Select your install type. Release is the standard installation type - it provides the core and Editor utilities as libraries, meaning they do not need to be recompiled along with your existing project. Alternatively, you may choose to install the source version (ProBuilder only), providing complete access to all scripts, etc. If you choose to install source, please note that you will need to remove any previous ProBuilder installs prior to running the installation process.

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!**

[4] Interface Overview

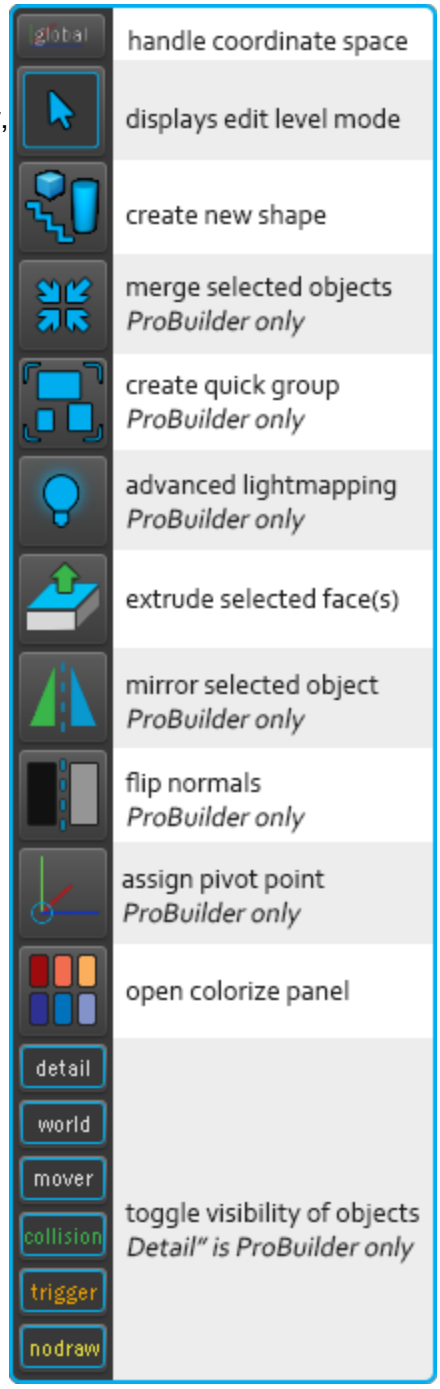
[4-a] Opening the GUI Panel

In order to begin creating with Prototype or ProBuilder, you'll need the GUI Panel open. This is done by selecting, from the top menu bar in Unity "*Tools* > *[name of package]* > *Open Probuilder Window*"

This will open the GUI Panel, which you can leave floating, or dock. We recommend docking in a vertical position with minimal horizontal size, to use the least amount of space.

[4-b] Using the GUI Panel

The Prototype interface is built to use up very little space on your screen, but still have all the functionality you will need for 98% of construction:



Coordinate Space: This button controls and displays the coordinate space currently being used for editing geometry.

a. 

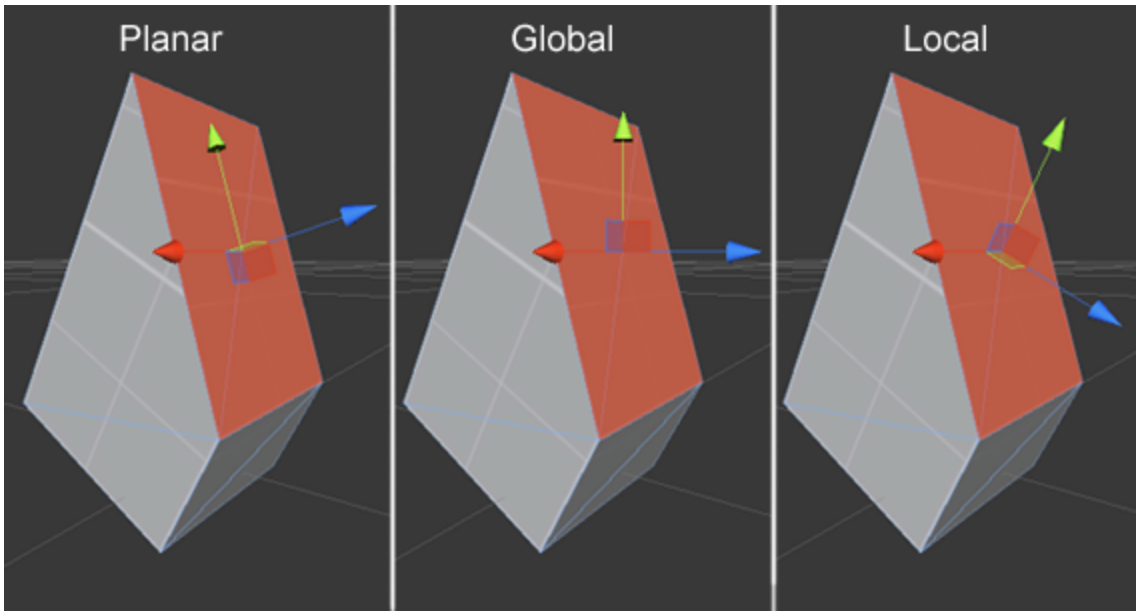
Planar: movement in the direction the selected face's normal

b. 

Global: Movement in the "Global" or "World" XYZ directions

c. 

Local: Movement relative to the object's transform orientation



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.*

Editing Mode: When working with Prototype, you are always in one of three modes: **Object** Editing, **Geometry** Editing, or **Texture** Editing.


Object Editing Mode is the default, standard mode- this is essentially "nothing special" mode- you can select, move, rotate, delete, etc, just like you normally would. To exit any other mode, and return to Object Editing mode, simply press the "Escape" key on your keyboard.

Geometry Editing Modes allows you to edit the actual geometry of any ProBuilder object, either by Face or Vertex. Hit the "G" key on your keyboard to enter Geometry Editing mode. You will instantly enter either Face Geometry Editing, or Vertex Geometry

Editing, depending on which you have set as default in the ProBuilder Editor Preferences. To toggle between Vertex, Face, and Edge Geometry Editing, hit the “H” key on your keyboard.

 **Face Geometry Editing** allows you to select and manipulate the faces of ProBuilder Objects. Once in this mode, simply left-click to select a face, (use the standard shift-left-click to select multiple), and manipulate them with with the standard unity movement handles.

 **Vertex Geometry Editing** gives you even finer control, right down to the individual vertices. Since showing all the vertices in a complex scene could very likely crash Unity, you must select any ProBuilder Objects whose vertices you intend to edit. Their vertices will immediately show up as blue dots, and can then be selected (their color will change to green) and manipulated. You can drag-select vertices, and use the “Shift” key to add to the selection, just like any other item in Unity. ProTip- click on a face to instantly select all of it’s connected vertices!

 **Edge Geometry Editing** coming soon!

 **Texture Editing** mode opens the Texture and UV Tools panel, giving you access to the powerful uv and texturing toolset of ProBuilder. Just like Face Geometry Editing, left-click to select a single face, and use the standard shift-left-click to select additional faces. Then use the Texture and UV Tools panel to apply textures, set UV tiling, rotation, and offset, and more. *Hit the “J” key on your keyboard to enter Texture Editing mode.*

See the “Geometry Editing” and “Texture and UV Editing” sections for more details.

 **Create New Shape:** Click this button to open the “Create New Shape” panel, which allows you to instantly construct user-configurable special Shapes.

To create a shape, select a type (Cube, Stairs, Plane, etc) from the drop down list. The Create New Shape panel will change it’s contents to match the selected type, displaying different options for each. **New in 2.1.4** is the ability to live preview geometry. To enable this, simply toggle the “Preview Object” checkbox. You may move, rotate, and scale this

preview object while adjusting settings.

 **Merge Objects:** 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.

Note: Merging an object will also weld vertices that are open and in the same position.

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! However, be aware that if there are multiple materials on the resulting object, each material will still incur a separate draw call- this is just the way Unity works.

 **Create ProBuilder Group:** This button will parent all selected ProBuilder objects to a new, empty game object. The result is a “group” that can be moved or rotated as one single object, a handy technique to use as your scenes grow more and more complex.

 **Lightmap Generation Settings:** Select a ProBuilder object and click this button to open up the UV2 generation parameters for this object. Default values are preset for all objects, and should generally be appropriate. However, if you are seeing artifacting or strange effects on your lightmaps for an object, you may try adjusting these parameters.

 **Extrude:** Click this button (or press “Ctrl-Shift-E” on your keyboard) to extrude all selected faces an automatic .25meters in the direction of their face normals. You can also use “Ctrl-E” to extrude a zero distance. ProTip: a much faster method is to hold “Shift”, then move, rotate, or scale faces- this will instantly extrude as you manipulate the face(s).

 **Mirror:** Click this button to open the Mirror Tool. From there, select which axis to mirror on, and click “Mirror” to mirror the selected ProBuilder object.

 **Flip Normals:** In Geometry Editing Mode, this button will flip the front/back properties of all selected faces. In Object Editing Mode, it will flip ALL faces on the

selected ProBuilder object(s).

 **Set Pivot:** Click this button (or hit “Ctrl-J” on your keyboard) to force a ProBuilder object’s pivot to an exact location. In Geometry Editing Mode, you can select any number of faces or vertices, and clicking the Set Pivot button will place the pivot at the center of those faces/vertices. In Object Editing Mode, clicking Set Pivot will set the pivot of the selected ProBuilder object to the center of that object.

 **Open Vertex Color Panel:** Clicking this button will open the Vertex Color Panel. See the “Vertex Coloring” section for more information.

VisGroups: ProBuilder 2.0 identifies 5 unique Entity Types for ProBuilder objects: Detail, World, Mover, Collision, and Trigger, plus a special sixth category, “NoDraw”. Click any of the six VisGroup buttons to toggle their respective Entity Type’s visibility on and off- this is an incredibly handy visual aid, in both simple and complex scenes. See the “VisGroups and Entity Types” section for more information, you should be using these!

[4-c] Keyboard Shortcuts

ProBuilder 2.0 is almost entirely keyboard-driven, which keeps the GUI clean, and workflow very fast. **Every single keyboard shortcut, and many other settings, can be customized!** Just open *Editor* > *Preferences* > *ProBuilder* . Below is a “cheat sheet” of all default keyboard shortcuts. *(On a separate page for easy printing)*

Default Keyboard Shortcuts (*Editor > Preferences > ProBuilder/Prototype)*
Items marked in **bold** are only available in ProBuilder

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
T	**Open Texture Edit Mode**
N	**Set Selected face(s) to NoDraw**
Escape	Exit Texture or Geometry Mode
M	Set selected objects to Mover Entity Type
B	Set selected objects to Detail Entity Type
O	**Set selected objects to World Entity Type**
T	Set selected objects to Trigger Entity Type
C	Set selected objects to Collision Entity Type
Ctrl-Shift-Left Click	**In Texture mode, paint selected material to clicked face**
Alt-F	Extrude selected face(s)
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)
W	Move Tool
E	Rotate Tool
R	Scale Tool
Shift + (W / E / R)	Hold shift while scaling, rotating, or moving a face to automatically extrude those faces.
Backspace	**Delete selected face(s)**

[5] Building and Editing Geometry (Modeling)

In the previous section, we went over the technical details of how to construct and edit geometry with ProBuilder. Before you jump right in though, you should definitely watch the ProBuilder “Intro to Modeling” tutorial- it’s fairly quick but extremely informative. Here, we’ll go over some basic tips, tricks, and advice for modeling with ProBuilder 2.0:

Use ProGrids! If you are not using ProGrids yet, please do! 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, and 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. So, 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 unity up, 1 unit over”. This will keep your design clean, and help match up complex geometry.

Textures Come Last. Greybox that level completely, before you even think about adding real textures! Use the included dev materials (grey, orange, red, blue) 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, should you begin adding real textures, else you risk wasting many hours of work when that geometry you painted has to change...

Use NoDraw or Delete Faces. NoDraw might seem a little strange at first, but use the shortcuts provided plus the “Auto NoDraw” action, and you will be a pro in no time. The performance savings will be huge, and your lightmaps will take MUCH less time to bake!

Alternatively, you can simply delete faces (“backspace” key) that will not be need to block light. See the NoDraw section for more details.

Assign “World” Geometry. Only ProBuilder objects that are given the “World” entity type will occlude other objects. This isn’t the default type, so you have to assign it

manually. See the VisGroups section for more details.

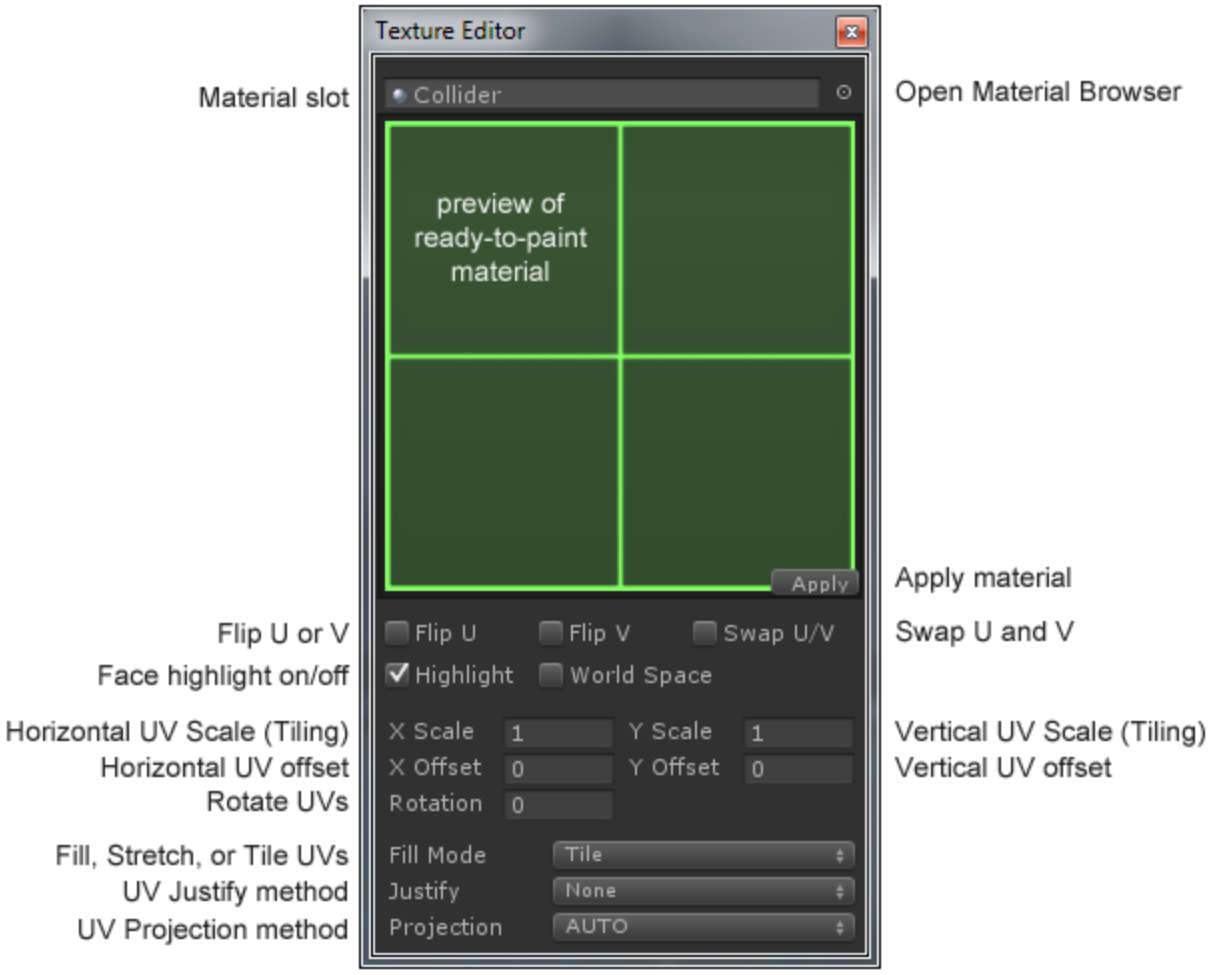
[6] Textures and UVs *(ProBuilder Only)*

[7-a] The Texture and UV Tool Panel

ProBuilder's Texture and UV Tool panel is one of it's most powerful and useful features. It is automatically opened when you enter Texture Edit mode, by hitting "J" on your keyboard.

Firstly, it facilitates extremely fast, simple, "painting" of materials onto your ProBuilder objects, and even allows painting a different material on each and every face, should you need to.

Secondly, It allows you to change how a material is displayed on individual faces of your ProBuilder objects, without editing the material itself. This means you can create infinite variations, with still just a single draw call.



Material Slot: Drag ‘n drop the material you intend to use, into this slot...

Open Material Browser: ...or, click the small circle-with-a-dot to open the standard Unity Material Browser, and choose your material there.

Preview of Ready-To-Paint Material: This area shows a flat preview of your selected material. I will size itself according to the panel size.

Apply Material: Applies the material to all selected faces.

Flip U or V: Use these toggles to flip, or “mirror” the selected face’s UV coordinates.

Swap U and V: Use this toggle to completely swap the selected face’s UV coordinates.

Face Highlight on/off: When on, all selected faces will be highlighted. You can change the color and opacity of this highlight in the Editor Preferences panel, see the “Customization” section for more details.

Horizontal/Vertical Scale: This number controls scale, or “tiling”, of the selected face’s UVs.

Horizontal/Vertical Offset: This number controls offset, or “position”, of the selected face’s UVs. You can use the Movement handles to move your texture around very intuitively and easily!

Rotation: This number controls the rotation, in degrees, of the selected face’s UVs.

[7-b] Applying Materials (“Texturing”)

First, a note on definition and methodology: somewhere along the way in game engine development, the difference between “Texture” and “Material” became a source of much confusion and misinterpretation. In the case of ProBuilder, just know this- nothing special at all is happening with materials or textures. You apply materials to your ProBuilder objects just like any other object, and those materials will act/display just the same, as well.

That aside, there are several ways to apply materials in ProBuilder. All of the following methods assume you are already in Texture Edit mode, and have a material set in the Material Slot of the Texture and UV Tools panel:

Apply To Entire Object(s): To apply one material to an entire object, or several objects, first select the full object(s) by either drag-selecting a box, or selecting via the Hierarchy.

You may also double-click a face on the object to select all faces. Click the “Apply Material” button to instantly paint all faces of the selected object(s) with the chosen material.

Apply to Selected Face(s): Select one or more faces, then click the “Apply Material” button to instantly paint all selected faces with the chosen material.

Quick Paint: This one is very handy! While holding ctrl and shift on the keyboard, any face you left-click on will be instantly be painted with the chosen material.

[7-c] Editing UVs

Being able to edit the individual UVs of each face on a ProBuilder Object, allows for virtually infinite variation and re-use of textures. This is great for both performance and making your scene look great!

For example, use the **Flip and Swap U/V** toggles to quickly make three different faces look different, despite using the same material. These are also handy if your texture needs to have a specific direction (arrows, grids, text, etc).

Use **Offset** to move textures around, displaying only certain parts of the texture per-face, or in an exact location. You can even use the movement handles for quick, intuitive control of placement.

Scale, or “tiling”, is extremely handy for controlling the perceived size of an item, fitting textures to geometry, and lessening obviously tiling patterns.

The **Fill Mode** options allow you control over the basic method of UV mapping that is applied to the selected face(s):

a. Tile: Default behavior, this simply tiles the the UVs uniformly. Useful in 95% of cases, ie wooden floors, plaster walls, ground, etc
b. Normalize: This will fill the face completely, without any tiling, but keep the UVs square, so no stretching or squashing occurs. This generally means the texture will be cropped on one of it’s sides.
c. Stretch: The same as Normalize, however this mode will stretch or squash the UVs so that the entire texture is shown on the face.

U**V Justify** can anchor the texture to any of the 4 sides of a face, or to the center. Very useful in situations where you need the texture placement to stay put while you edit geometry.
Projection gives you advanced control over exactly how the texture is “projected” onto the surface. 99% of the time you will want to just leave this on Auto, however the option is

available just for those special, niche situations where nothing else will work, and such control is needed.

[7] Vertex Coloring

Vertex Coloring allows you to color individual faces when using a material that supports Vertex Color. 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

1. Enter Geometry Editing Mode ("G" on your keyboard), then select any number of faces.
2. Apply the vertex color via to the faces by either of 2 methods:
    a. Open the Vertex Color Panel, then click the desired color button
    b. Hold "ALT" on your keyboard and hit the number which matches your color selection. For example, "red" in the above image would be "ALT-2", and "green" would be "ALT-5".

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

[8] VisGroups and Entity Types

All ProBuilder objects have an Entity Type, or simply "type". These are basically

categories, like “Melee, Ranged, Explosive, etc”- they set certain properties in the object, and how it acts in your game.

VisGroups are simply a very handy side effect of these Entity Types. Since all ProBuilder objects have a type, and you generally don’t need to see all types at once, you can use the VisGroups panel 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.

World type objects (ProBuilder only) are same as Detail, except they ***do** occlude other objects*. If you have large, simple objects, ones that you know will block larger portions of your level from view, they should probably be set as “World” type. Set any ProBuilder object(s) to “World” type by selecting them, and hitting the “O” key on your keyboard.

See also - http://docs.unity3d.com/Documentation/Manual/OcclusionCulling.html

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 VisGroups panel 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.

NoDraw (ProBuilder Only) is actually not an Entity Type, but does have a VisGroup dedicated to it. “NoDraw” refers to any ProBuilder Object’s face that has the NoDraw

material applied to it. Toggling on/off the NoDraw VisGroup will show/hide all faces (not the entire object) that have NoDraw applied. Set any selected faces to “NoDraw” with the “N” key on your keyboard.

[9] Optimization

ProBuilder 2.0 is very efficient on it’s own- in fact it is 6x more efficient than ProBuilder 1.x without any work on your part, due to using a single mesh per object now. On top of that, we expanded the already existing optimization methods, and added a few new ones- all of which are simple to implement, and will seriously aid your project.

NoDraw is a common method of optimization. Any face that needs to block light, but will never be seen in-game, should always be set as “NoDraw”. These faces will be deleted at runtime, which makes a substantial dent in the number of vertices being rendered. Most importantly, NoDraw faces are not lightmapped, which saves you quite a bit of texture space, and saves you time when baking lightmaps.

Setting a face as NoDraw is quick and simple- simply apply the “NoDraw” material to it. However, you **must** do this via the Texture and UV Tools panel, not by simply drag-and-dropping the material onto the object.

While in Texture Edit mode, you can also select any number of faces, and hit “N” on the keyboard to apply the NoDraw material, without changing your chosen material.

Occlusion is your second best method of optimization. Wherever you have large, visibility blocking ProBuilder objects, assign them the “World” Entity Type. This will let them take advantage of Unity’s Occlusion system, by becoming Occluders.

However, Occlusion’s benefits are very much situational. Too much Occlusion can be worse than too little- the game needs to calculate what can and can’t be seen, and if you have a very complex Occlusion setup, it can easily crush your framerate. On the other hand, if you have a room with lots of high-poly objects inside, even a complex Occluder might be worthwhile. Further, if you use purely static Occlusion data, then you can use quite a few more Occluders without hurting performance, and vice versa if using a more dynamic Occlusion method.

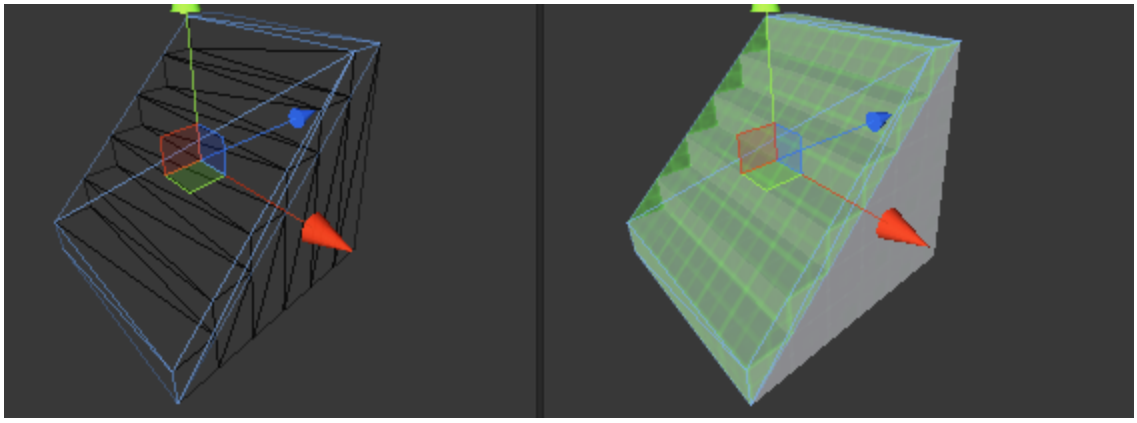
Occlusion can be tricky at first, but will yield serious performance benefits, so don’t overlook it. Experiment with this one, and read up on Unity’s Occlusion system for the best results.

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 it’s collision default, each and every step is part of the collision, and it would also be non-convex. Instead, disable the stairway’s 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 that happen far too often in sub-par games. Here is an image for better illustration:



Lightmap Size is a special fix that involves using a separate script, so we left it for last. Essentially, all the visual optimizations in ProBuilder are geared toward reducing draw calls- this is mostly done by getting objects to “batch” in the renderer. In an ideal game, every single mesh that uses the same material will batch down to one single draw call. You could have thousands of items, and only one draw call- as long as they all batch properly.

Unfortunately, there are lots of things that break batching- scaling, as mentioned is one of those. 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, technically more than one material. This can get really ugly in a real-world situation, where you have multiple

materials, and once you lightmap, your objects are spread throughout the lightmaps, allowing only a few or none to actually batch.

So, the solution is bigger lightmaps. And you can control that via this very handy script: http://forum.unity3d.com/threads/56435-light-map-max-at-1k-solved

All credit for this “Optimization”, and many thanks, goes to the forum users in the above linked post. We hope to implement our own version of this laterI, but for now just use the above script to set your lightmap size to larger than 1k (1024).

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.

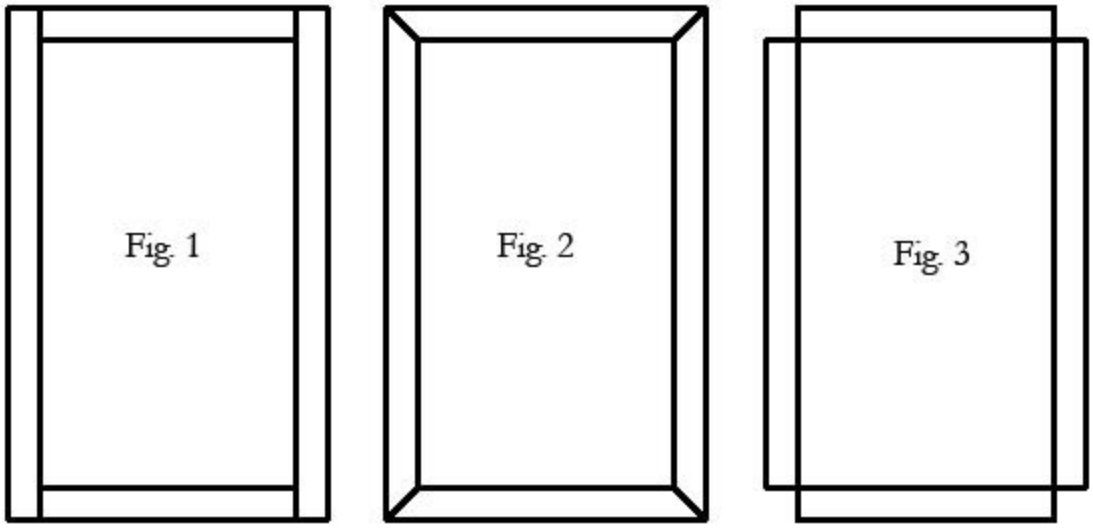
[10] Lightmapping

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

Lightmap Size: As mentioned above, make sure you use the largest lightmap size possible. For mobile devices and web/flash, I wouldn’t go over 2K (2048x2048), but otherwise 4096 should be perfectly fine, if you need it.

Use NoDraw and Delete Invisible Faces: Without this, your lightmaps will be about 2-3 times the size they should be- very bad for baking time and game performance.

Miter Corners: This is a throw-back to the days of Hammer, Radient, etc, but still very much applies, even with non-ProBuilder meshes. Take a look at this illustration:

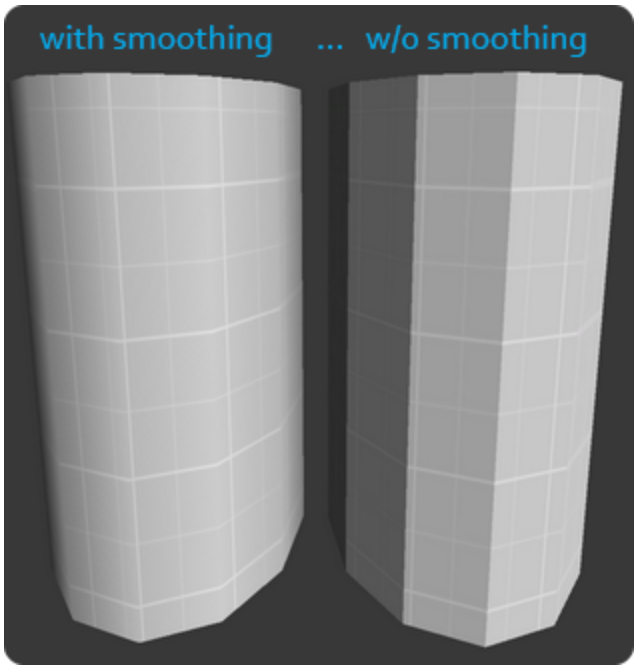


(Illustration credit to "camydoger" on www.tf2maps.net)

Figure 1 will allow light and/or shadows to "leak" and "bleed" under the edges, causing visual seems, artifacts, and wasted lightmap texture space.
Figure 2 is the OCD mapper's method, and honestly the best- the mitered corners make sure zero light/shadows can leak or bleed, and no space is wasted.
Figure 3 is technically just as good as Figure 2, but not as clean on the corners.

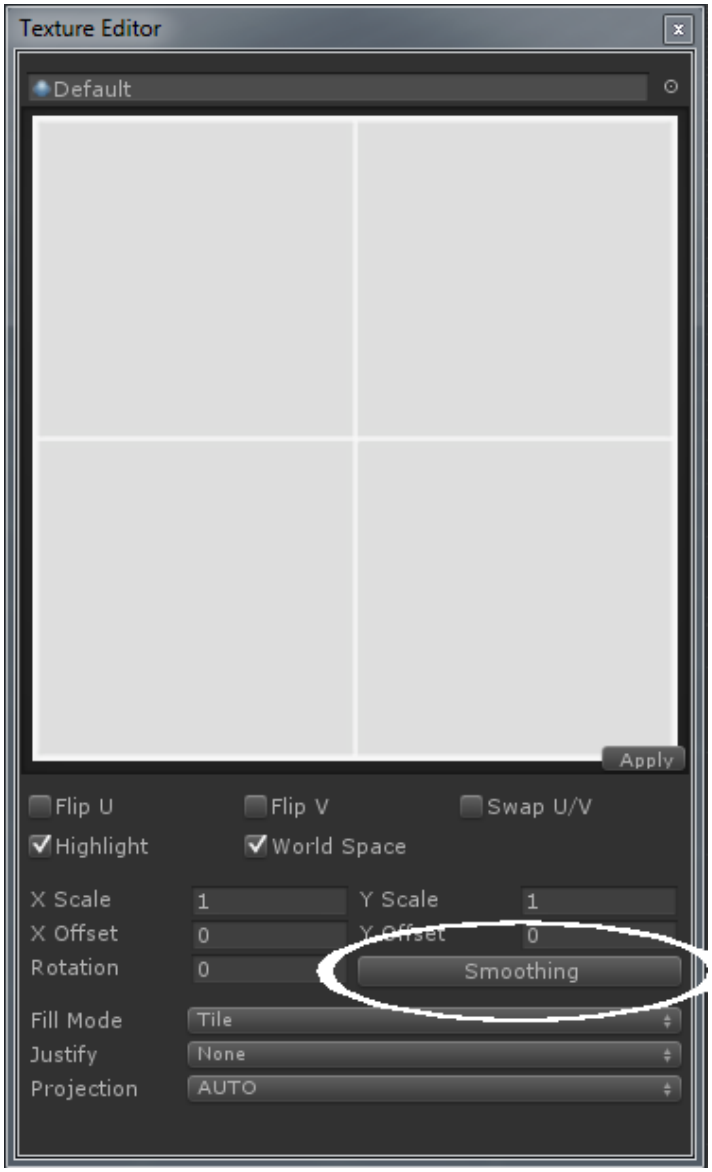
[11] Smoothing Groups

New in ProBuilder 2.1.3 is the ability to assign faces to 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. The example below shows 2 identical cylinders with the same polygon count and a single directional light. Note the rounder appearance and soft shading the left cylinder has relative to the right.



Opening the Smoothing Menu

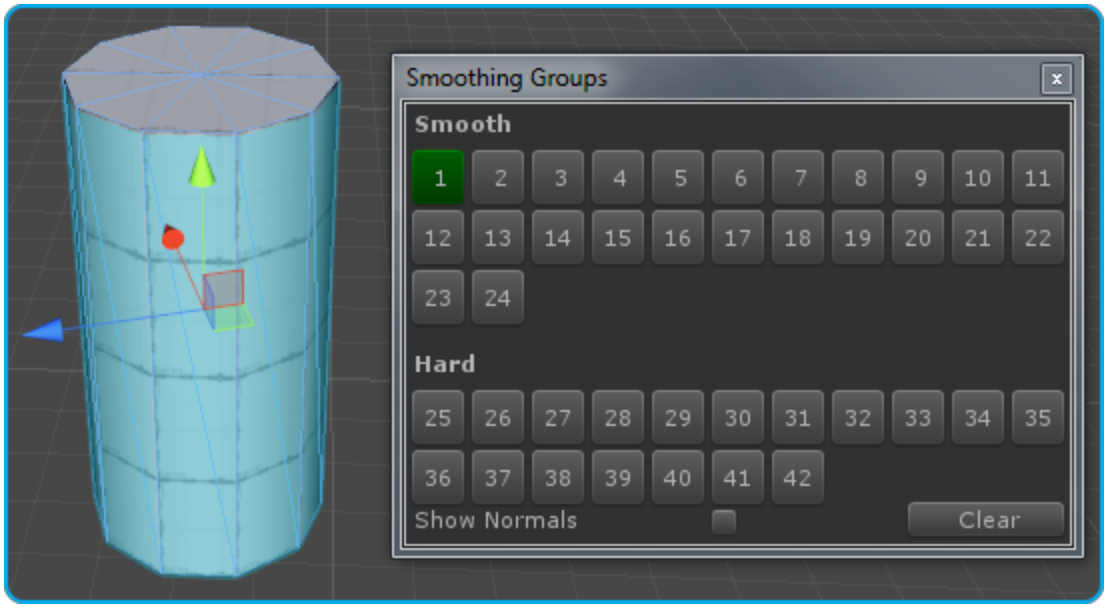
To open the smoothing menu, first open the Texture Window, either by pressing the 'J' key, or navigating to "*Tools* > *[name of package]* >*Texture Window"*. In the texture window, click the button titled "Smoothing."



Using Smoothing Groups

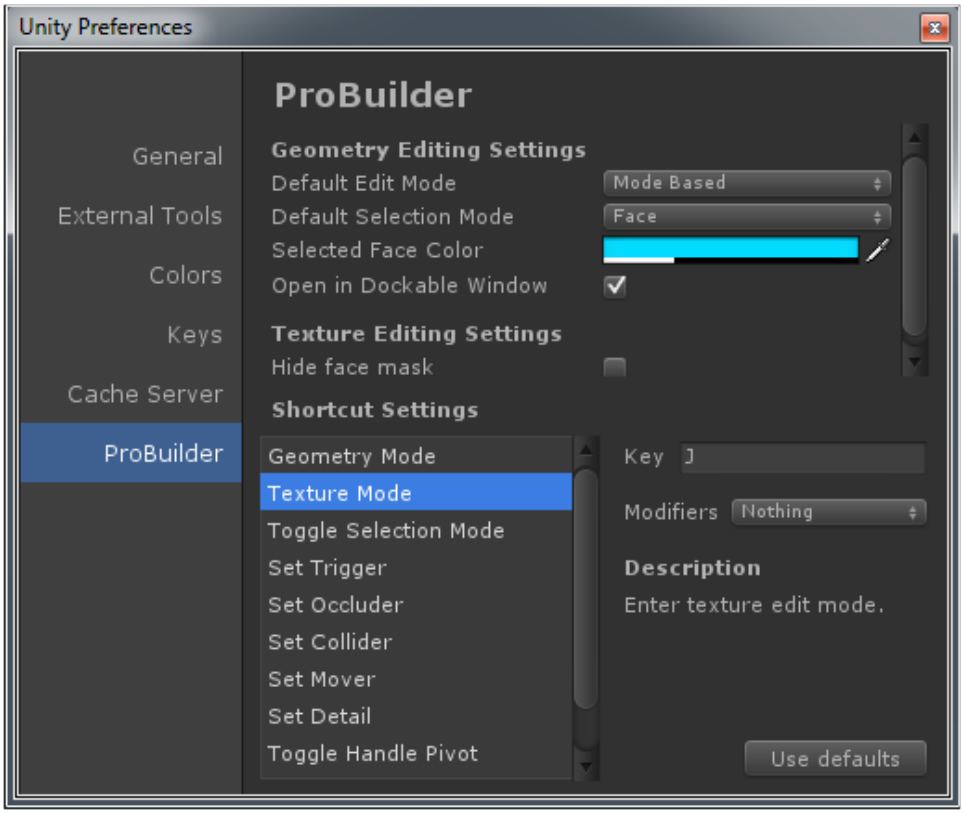
ProBuilder decides which edges should be smoothed by checking for neighboring faces that are in the same group. It also checks for 'Hard' groups, which as you might guess, hardens edges of neighboring faces.

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.



[12] Customizing ProBuilder and Prototype

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 the following options:



Edit as much as you like, and simply press “Use Defaults” if you would like to return to the standard configuration. We really hope everyone enjoys and uses this new feature, it should be very useful for those who want a specific keyboard layout, visuals, and workflow.

[13] Menu Items

- Geometry - *contains actions and tools related to manipulating geometry*
    - **Set Pivot:** Sets the pivot of the selected object to the center of the current selection (face, vertex, or object)
    - **Mirror Tool:** Duplicates the selected objects by mirroring in the selected direction.
    - **Extrude Face:** Extrudes the selected face(s) along the vertex normals.
    - **Detach Face:** Removes the selected face(s) from the object, allowing it to be moved separately from the main object.
    - **Flip Face / Object Normals:** Reverses the vertex normals on each selected face or object. Used to reverse culling for objects.
- Actions - *ProBuilder is built to be extremely extensible. User built functions and assorted utilities for working with ProBuilder are stored in the `Actions` folder*

    - **Export Selected to OBJ:** (Experimental) Exports selected objects to OBJ model format.
    - **Auto NoDraw Tool:** (Experimental) A tool for automatically selecting hidden faces and applying NoDraw to them.
    - **ProBuilderize Selection:** Converts any selected Model to a ProBuilder editable mesh.
    - **Strip ProBuilder Objects:** Remove all ProBuilder scripts from selected objects, leaving just the model. If no objects are selected, ALL objects in the current scene will be affected.
- 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*
    - **Rebuild Shared Indices Cache:** If you're seeing a lot of NullRef errors in GenerateSubmeshes, try running this Repair.
    - **Force Refresh Objects:** Sometimes necessary after an upgrade.
    - **Clean Up Leaked Meshes:** If you see console logs saying anything about leaking meshes, run this command to clean up the leaks.
    - **Fix GameObject Flags:** If you are having trouble with ProBuilder objects disappearing when building, try running this command.
- Vertex Colors - *If the shader your material is using supports vertex colors, this menu provides an interface to setting those colors*
- Editor - *These tools control how the editor acts in the Scene View. These are all available as shortcuts in addition to menu items*

[14] 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.
- You can drag select faces as well as vertices.
- 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 > [name of package] > Vertex Colors > Vertex Color Interface"
- Don't want a dockable window? Toggle "Open in Dockable Window" to false in the Preferences panel.