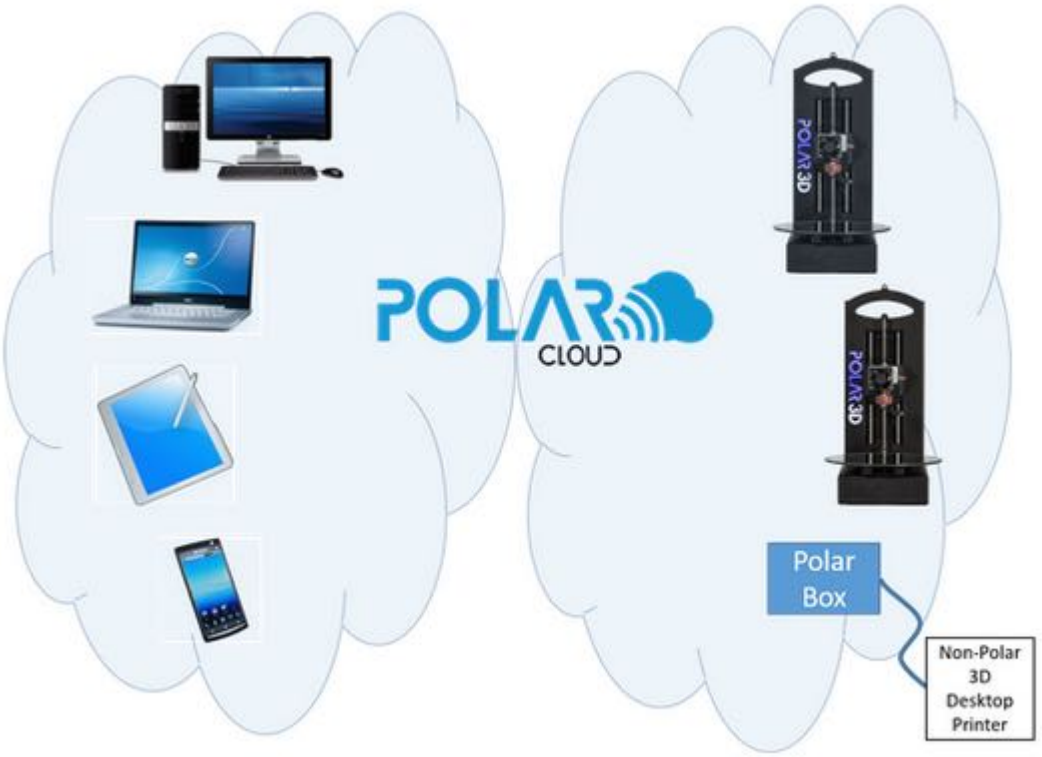

Polar 3D Implementation Guide

Maximizing the Polar 3D Environment

Kristin Hubner

April, 2017

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Chapter 1

Get connected to the Polar Cloud

When you open up your printer shipping box, you will see contents such as shown in Figure 1.1: the printer frame (with print head mounted), a spool of (blue) PLA filament, a power adapter and cord, a can of Aqua Net hair spray, a build plate, and a sample object test-printed on this printer at the factory (namely, a yellow boat).

There are two ways to setup your Polar3D printer to connect through a local network to the Polar Cloud:

1. Wireless (WiFi): see Section 1.1.
2. Ethernet cable: see Section 1.2

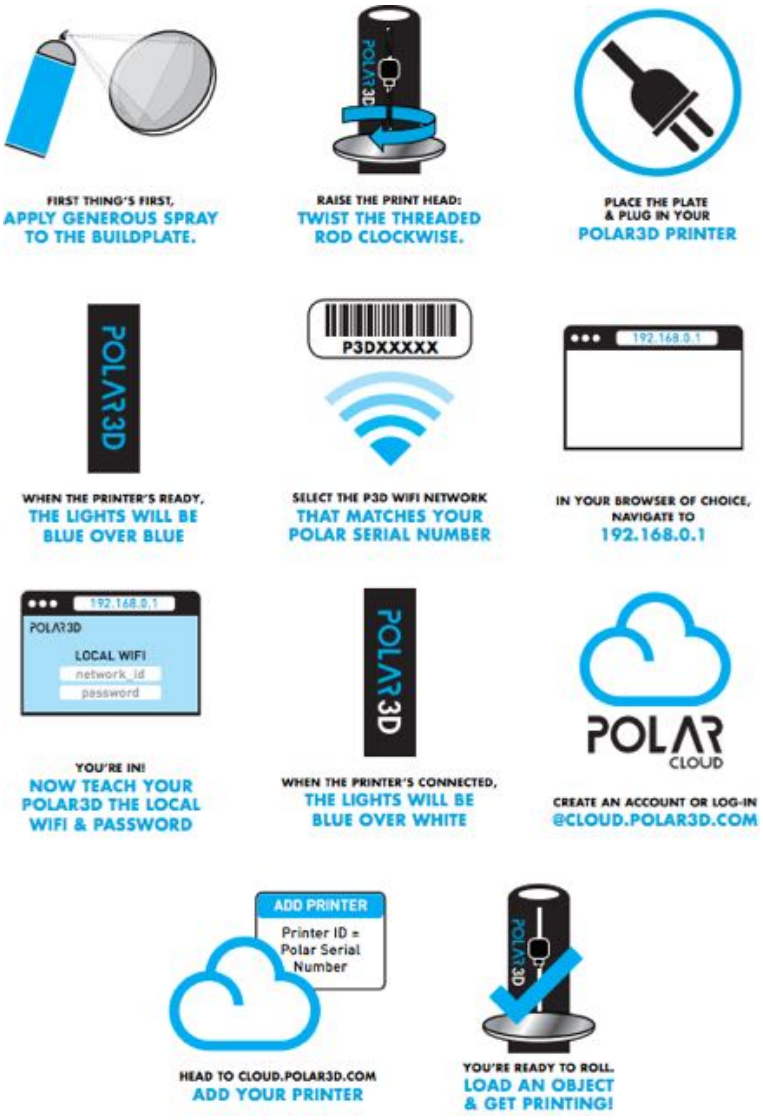
Setting up your Polar3D printer as a network printer connected to the Polar Cloud is strongly recommended, as it permits full access to the power of the Polar Cloud interface and features. However, for times when you don't have an Internet connection (or even access to a local network), the Polar3D

printer can instead be controlled directly from your device for printing: see Appendix C.

Figure 1.1: Printer in shipping box

1.1 Connecting the printer to the Polar Cloud via WiFi

Overview of getting your printer connected to the Polar Cloud via WiFi:



Details on getting your printer connected to the Polar Cloud

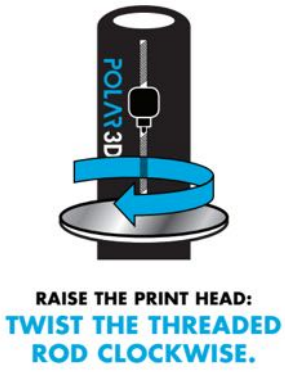
via WiFi:

1. Unpack the build plate; it is a mirrored glass disk, that will arrive detached from the printer, shipped in its own slot in the foam padding material.

Apply a generous quantity of Aqua Net Extra Hold hair spray (included in the shipping box with your Polar3D printer) to the build plate of your new printer. You should apply a smooth and heavy coat, so that the surface looks milky; for a video demonstration, see:

https:/www.instagram.com/p/BJBaWwrjCwF/

This will put a slightly sticky, but water soluble, layer on the build plate, giving better adhesion when objects are printing.



2. The printer arrives in its shipping box with the print head completely lowered, and the build plate (which is made of mirrored glass) not installed on the printer build plate shuttle. You will need to raise the print head in order to have room to place the build plate on the printer build plate shuttle.

Twist the threaded Z rod clockwise to raise the print head. Raising the print head one to two inches will give you room to install the build plate.

After you have unwrapped the build plate and prepared its surface by applying a coat of hair spray (see above), and raised the print head to make room for installing the build

plate, you are ready to install the build plate on the printer build plate shuttle.

The bottom center of the build plate has a gear affixed. Place the build plate so that the center of the gear seats over the bearing on the build plate shuttle, and the gear teeth engage with the geared axle of the printer build plate shuttle.

Hint: pull the build plate shuttle out towards the front of the printer to give yourself more access. Tip the build plate slightly and engage the gear on its bottom with the drive gear on the shuttle; then push the build plate down onto the shuttle so that it seats onto the center bearing of the shuttle.

3. Insert the power cord into the adapter, and the adapter plug into your Polar3D printer. Note: Do not force the adapter plug; it will *not* be flush with the printer.

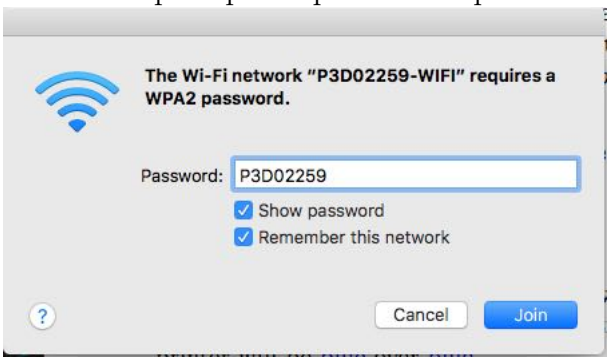
Plug in to a power outlet.

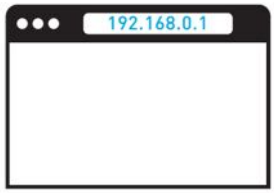
4. When the printer has finished powering up, the POLAR3D LED lights along the side of the printer will be entirely blue.

5. From your device (computer, tablet, or phone), select its WiFi network controls. From the list of WiFi networks your device displays, select the network named after your printer's serial number, as found on the back of the printer (see Figure 1.2); for example, "`P3D02259-WIFI`". You will be prompted for a password: that password is the 8-character serial number consisting of `P3D` and five digits, in this example "`P3D02259`"; (Figure 1.3 shows an example of entering this password on a Mac computer).

Figure 1.2: Back of printer: serial number and spool holder arm

Figure 1.3: Mac prompt for printer hotspot WiFi password



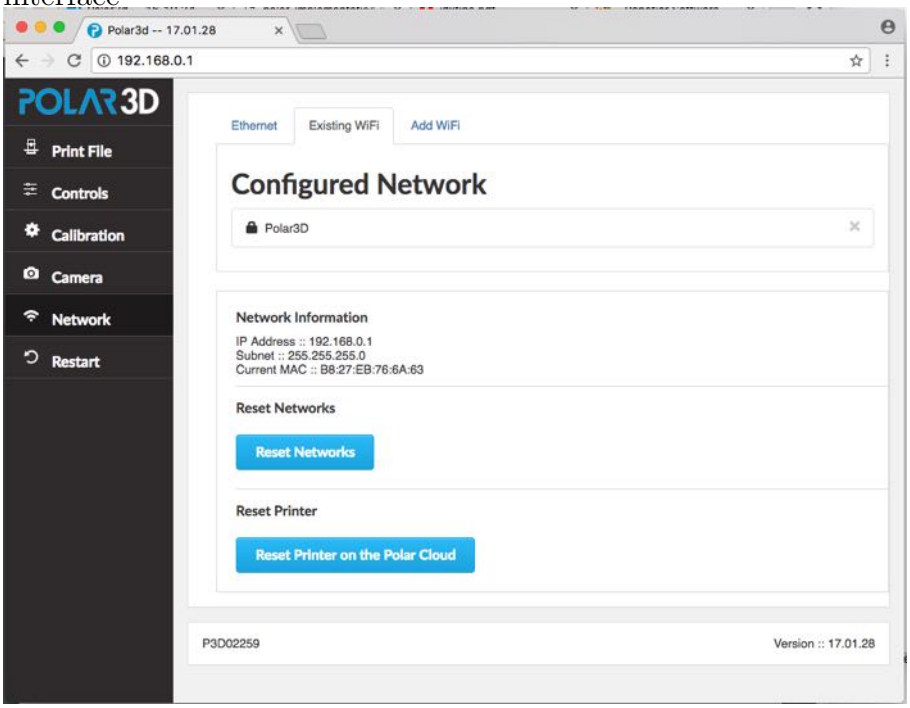


IN YOUR BROWSER OF CHOICE, NAVIGATE TO
192.168.0.1

6. In your browser (Chrome, Internet Explorer, Safari, Firefox, *etc.*), enter `192.168.0.1` into the navigation bar. You are now connected to the printer and should see the printer's web interface, as in Figure 1.4.

At this stage, in the printer web interface, note that there is no blue highlighted network shown under `Configured Network`, meaning that the printer is *not* (yet) connected to any local WiFi and through that to the Internet, but rather is in HotSpot mode. (Aside: The `Polar3D` WiFi listed, which your printer is not on, is the Polar 3D corporate WiFi.) Once you connect to your site's local WiFi network, then instead under `Configured Network` you will see your local WiFi highlighted in blue (seen later in Figure 1.7).

Figure 1.4: Use the printer's WiFi hotspot to connect to the printer's web interface



7. Click the "`Add WiFi`" tab and choose the WiFi network to which you would like to connect the printer; see Figure 1.5. You will need to tell your printer the name of the local WiFi network you wish to use, and (likely also) its password; see Figure 1.6. (At some sites, local networking may require some additional configuration work here: if you know that your site uses static IP addresses or requires configuration assistance by the network administrator to allow your printer's MAC address onto the local network or allow your printer access to outgoing HTTP ports, this is the time to perform such steps: see Section 1.3. Also, please note that captive portal network

access is *not* supported.)

Once you have configured the printer to know about your local WiFi network, go back to the "`Existing WiFi`" screen; as shown in Figure 1.7, your local network should now be listed, highlighted in blue, under `Configured Network`.

Figure 1.5: Select local WiFi network

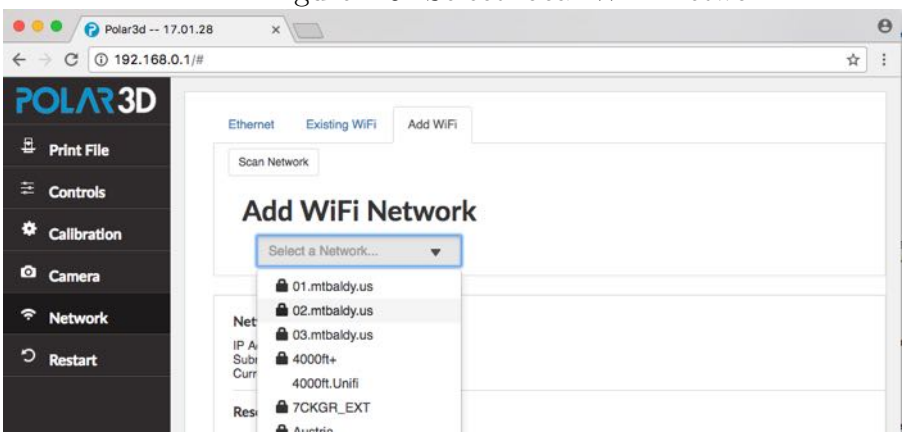


Figure 1.6: Enter local WiFi password

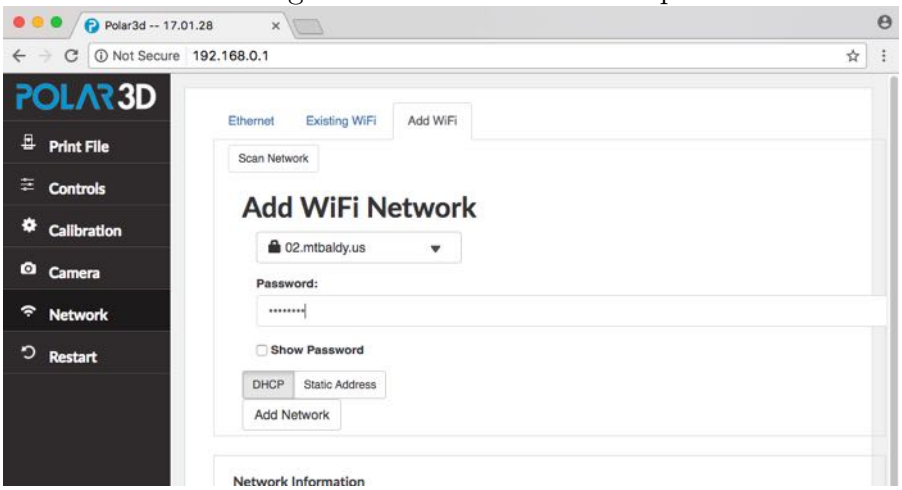


Figure 1.7: Local Wifi configured as network

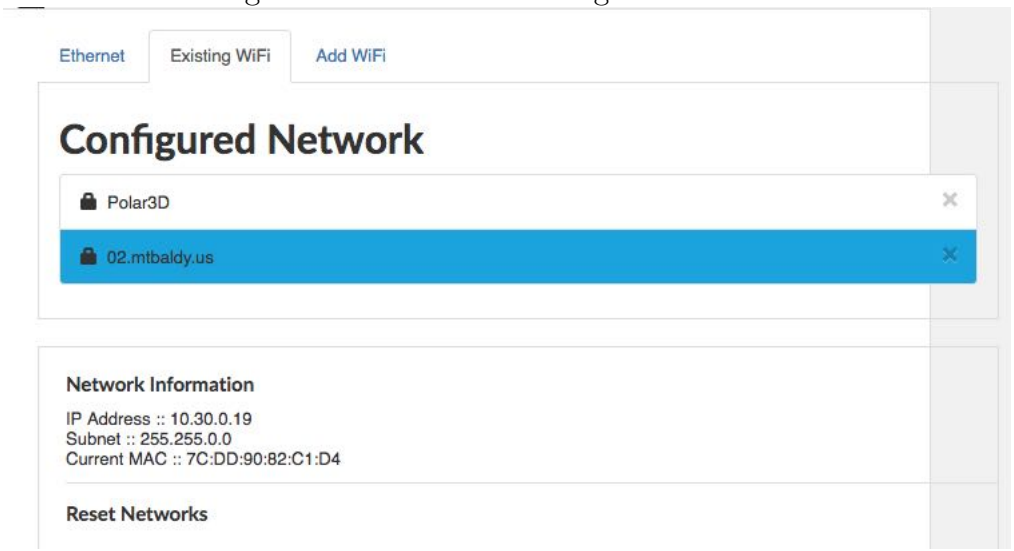
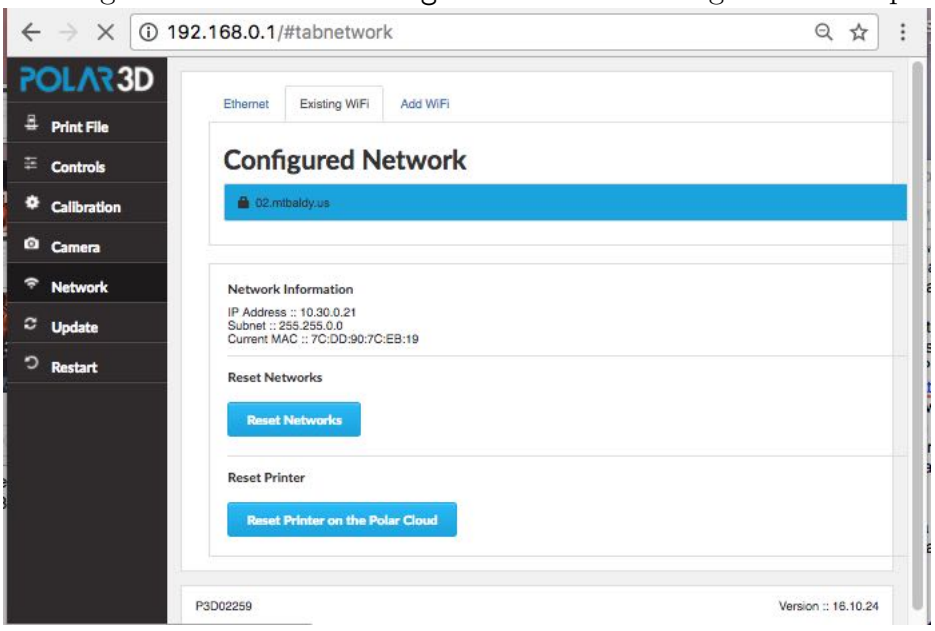


Figure 1.8: Printer `Configured Network` configuration completed

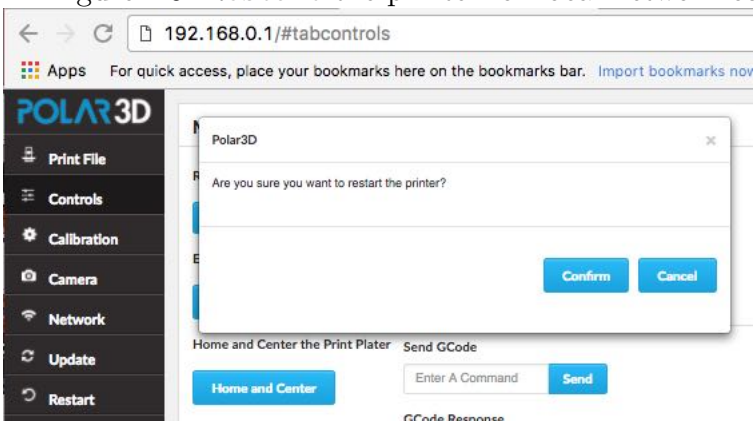


While not strictly necessary, we recommend that you *remove*

the "Polar3D" WiFi network from the Configured Network list by clicking on the X mark right of it; see Figure 1.7. (Removing the "Polar3D" network will prevent your printer from attempting to connect to that network after power cycles; you want your printer to attempt to connect first to *your* local network when it powers on.) After removing Polar3D WiFi network, your Configured Network screen should look similar to Figure 1.8.

You have now configured your 3D printer with a network profile for your local network. But incorrect values, such as for the local network password (see Figure 1.6), won't be detected until your printer attempts to actually connect...

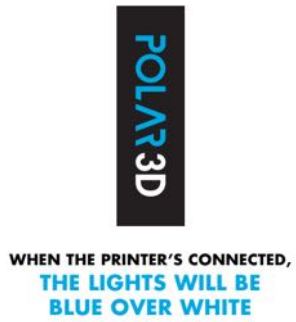
Figure 1.9: Restart the printer for local network connection attempt



Once your printer is configured to know how to connect to the local network (and if necessary, the local network has been configured by your network administrator to permit your printer to connect), click the "Restart" tab on the left navigation pane, and then click the "Confirm" button, see Figure 1.9, to have your printer attempt to connect to the local network, and

through it to the Polar Cloud; upon success, the LED lights on the side of the printer will go through a progression of colors ending as blue over white: POLAR3D.

If the connection attempt does not succeed, check that you properly entered the local WiFi password (see Figure 1.6), and attempt connection again. If the connection attempt still does not succeed, then at your site local networking may require some additional configuration work, such as configuring static IP address information rather than use of DHCP, and possibly assistance from your local IT administrator to permit your 3D printer onto the local network and permit it access to outgoing HTTP ports: see Section 1.3.



8. Once the printer is connected through your local network to the Polar Cloud, its POLAR3D LED lights will be blue over white.

You may now close the browser window that had been used to connect to the printer's local web interface (the browser window connected to `192.168.0.1`, opened in step 6).

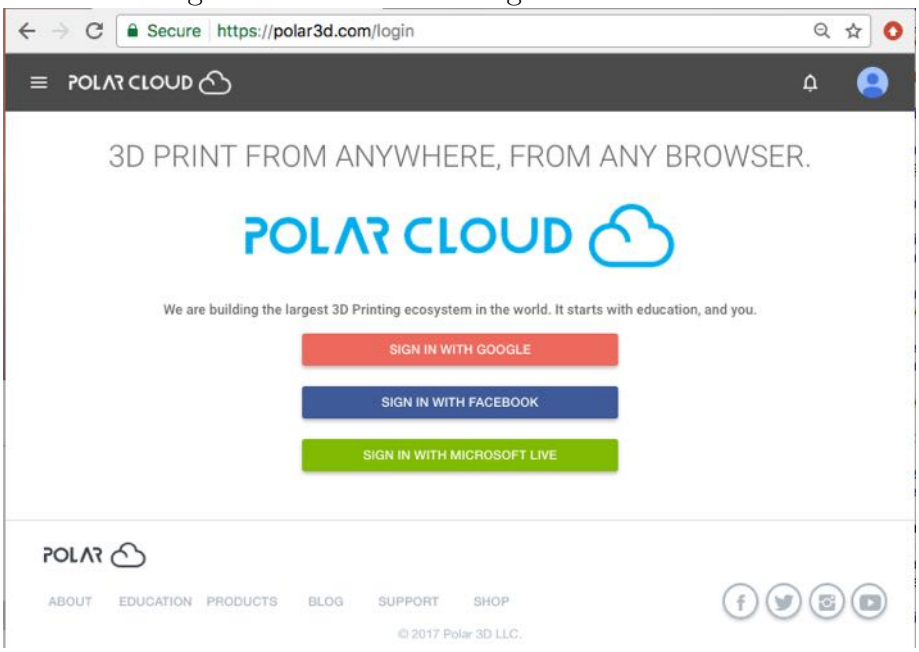
9. Creating a Polar Cloud account is a first step in establishing your Polar 3D environment, as the Polar Cloud is the central hub and command center of the environment.

For Polar Cloud, you will need a Google account, a Facebook account, or a Microsoft Live account. If you do not already have any such account, you will need to make one. (For instance, a Google account

is very easy to create: go to www.gmail.com.) The Polar 3D support article Linking Your Current Email Address to a Google, Microsoft, or Facebook Account has additional details.

Go to polar3d.com on your device (computer, tablet, or phone); see Figure 1.10.

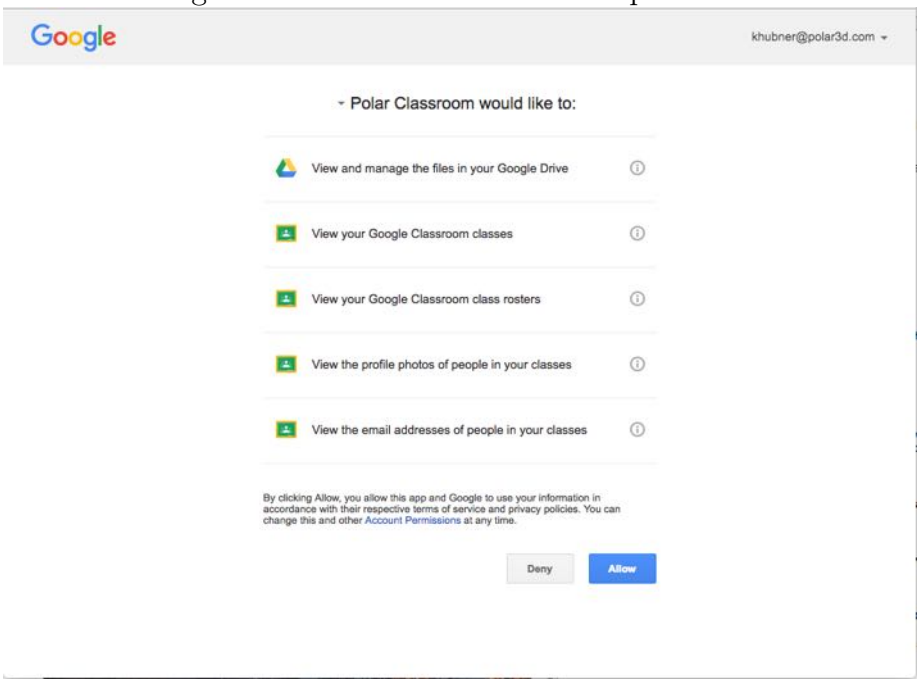
Figure 1.10: First time login to Polar Cloud



Click on the account that you're going to use for Polar Cloud access (Google, Facebook, or Microsoft Live). That will create your Polar Cloud account.

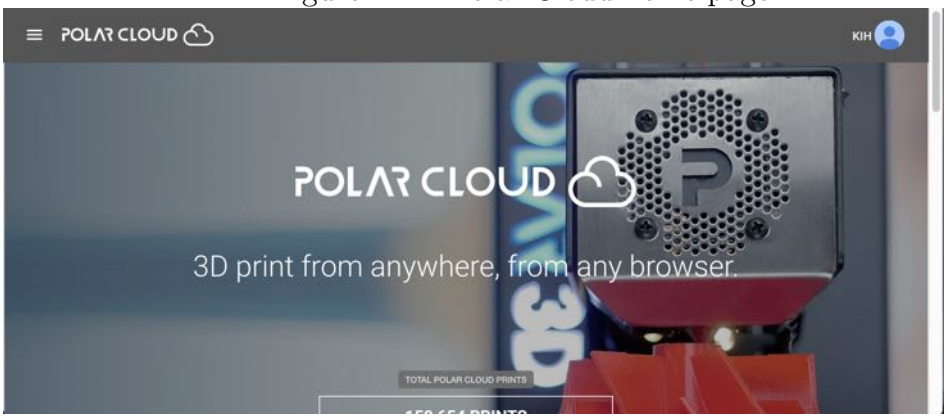
If this is your first time signing into the Polar Cloud, you will next see a screen asking for permission to access Polar Cloud sharing and classroom features:

Figure 1.11: First time classroom permissions screen



Once you're signed in, your home page should appear, looking similar to Figure 1.12.

Figure 1.12: Polar Cloud home page



10. Now, with the printer turned on and connected to the Polar Cloud, and with you logged in to your Polar Cloud account:

(i) From the Polar Cloud main menu, expand the menu lines at the upper left, click the "`PRINTERS`" tab, as shown in Figure 1.13, and then click the "`ADD`" ("`+`") button (towards the upper right), shown in Figure 1.14.

scale=0.35 was good in pdf

Figure 1.13: Polar Cloud expand top menu and click `PRINTERS`

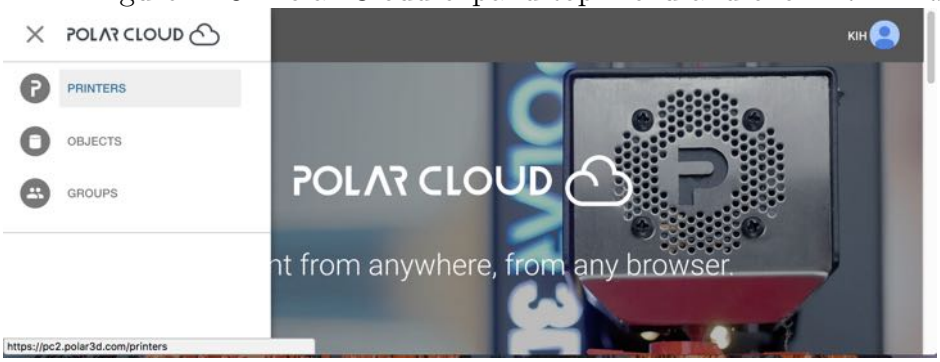
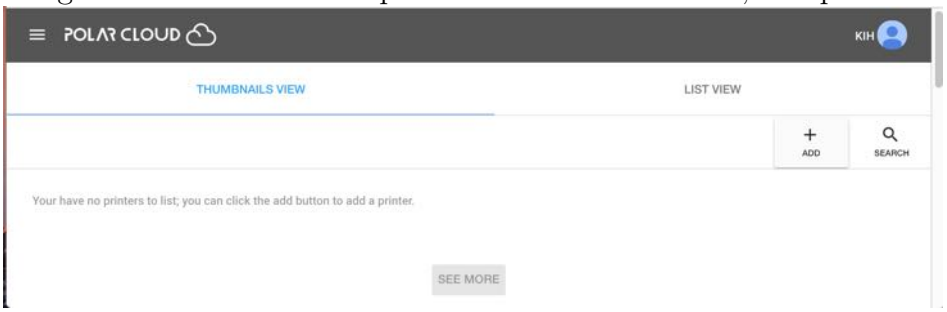


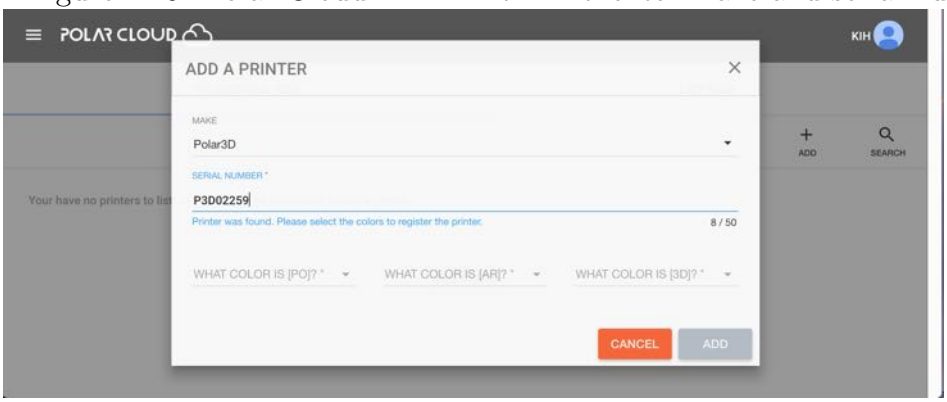
Figure 1.14: Polar Cloud printers `THUMBNAILS VIEW`, `ADD` printer button



(ii) On the `ADD A PRINTER` screen shown in Figure 1.15, at "`Printer Make`", select `Polar3D` if this is a Polar3D printer. If

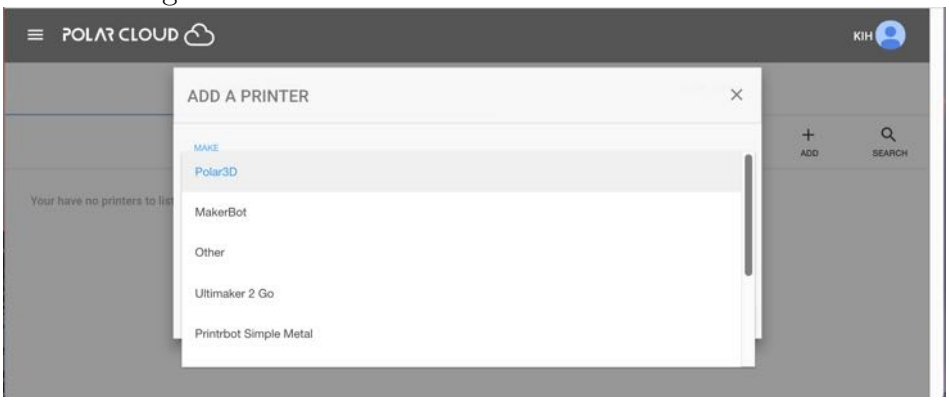
this is a Polar3D printer, also enter the printer's serial number (the same "P3D" and five digits that you entered in step 5), as shown in Figure 1.15.

Figure 1.15: Polar Cloud ADD A PRINTER: enter make and serial number



The Polar Cloud is printer-independent, being designed to operate with other desktop 3D printers as well as Polar3D printers; so if this is not a Polar3D menu, there is a drop down menu under "Make" for entering alternate types of printer makes, as shown in Figure 1.16.

Figure 1.16: Polar Cloud ADD A PRINTER make submenu



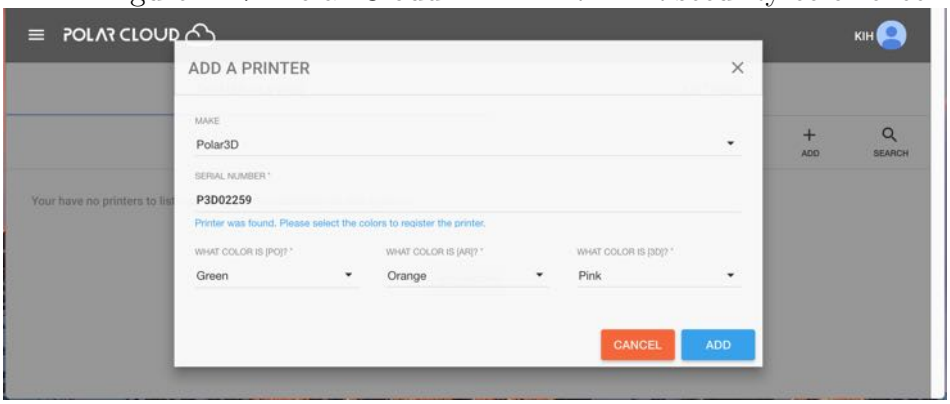
(Note that later, using the Polar Cloud printer management interface, you will also be able to change the printer's name and enter a longer text description and location for the printer, should you wish: perhaps describing the printer's location, its primary intended purpose, the class for whose use it is intended, *etc.*; see Section 4.5.3.)

(iii) If the Polar Cloud located the printer with the serial number you entered, a message will appear, see Figure 1.17, saying

> Printer was found. Please select the colors to register the printer.

(If you do not see this message nor see the screen shown in Figure 1.17, return to step (ii) and make sure that the printer is plugged in and connected to the Internet with POLAR3D LED lights blue over white; then check that you correctly input the printer's serial number.)

Figure 1.17: Polar Cloud `ADD A PRINTER` security color check



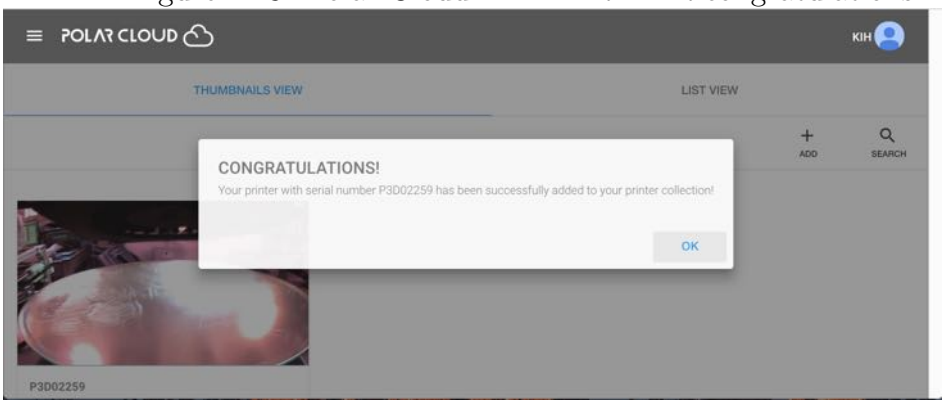
The color of the LED lights spelling out "`POLAR3D`" along the side of the printer will now form a security check: at each of the three drop down menus, enter the color that your printer's

lights are showing for the corresponding letters, for "PO", "AR", and for "3D", as in the example PORAR3D shown in Figure 1.17, and click "ADD".

Note that you have a limited amount of time (several minutes) to enter these colors; if you do not enter the colors properly, you will be "locked out" of adding the printer for a short time.

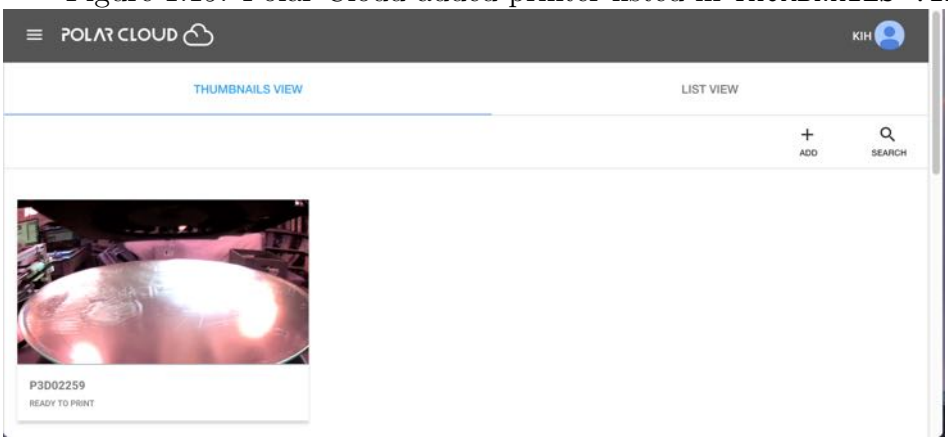
If you entered the colors successfully, you will get a confirmation that your printer was successfully added, as shown in Figure 1.18.

Figure 1.18: Polar Cloud ADD A PRINTER congratulations



Click "OK" to dismiss this confirmation and move to the printer listing screen (THUMBNAILS VIEW), as shown in Figure 1.19.

Figure 1.19: Polar Cloud added printer listed in `THUMBNAILS VIEW`



11. The printer is now connected and ready to print! See Chapter 2 for an example of performing a first print through the Polar Cloud!

1.2 Connecting the printer to the Polar Cloud via Ethernet cable

Connecting the printer to your network via an Ethernet cable is similar in functionality, from a Polar Cloud perspective, as a wireless connection. The only difference is in the portability of the printer, as with an Ethernet cable connection, the printer will be physically connected to the network.

Perform steps 1 through 4 from Section 1.1.

But instead of steps 5 through 8 from Section 1.1, simply plug in the Ethernet cable to both the printer, and to an Ethernet jack for your local network. If the POLAR3D LED lights on the printer become blue over white, it indicates that your printer has successfully connected to the Polar Cloud!

However, if the printer could not successfully connect to the Polar Cloud, see Section 1.3: you may need to enter a static IP address for your printer, or ask your IT or network administrator to open up local network access to your printer.

Once the LED lights on the printer show as POLAR3D (blue over white), then perform steps 9 and 10 from Section 1.1; that is, log in to your Polar Cloud account, and add the printer to your Polar Cloud account.

1.3 Network issues and solutions

Note that captive portal network access is not supported.

If your site does not use DHCP and instead assigns static IP addresses to network devices (such as your 3D printer), you will need to configure your 3D printer to know its static IP information; see Section 1.3.1.

If your site uses advanced networking requiring authentication of a MAC address, then your IT or network administrator will need to add your 3D printer's MAC address to the list of hardware on the network in order for your printer to successfully connect to the local network; see Section 1.3.2.

In order for your 3D printer to successfully connect to the Polar Cloud, outgoing HTTP ports 80 and 443 must be open to your printer. If your local network does not allow the printer to access those outgoing ports, then the printer's attempts to connect to the Polar Cloud will not fully succeed. In this case, you will need your IT or network administrator to allow your printer to access those outgoing ports; see Section 1.3.3.

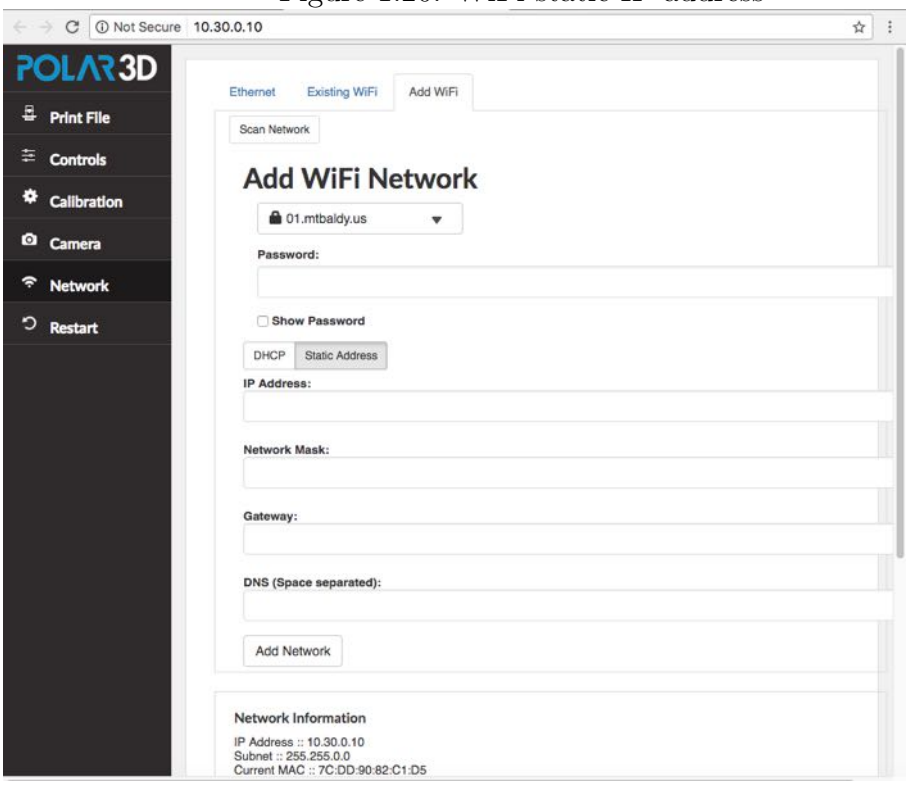
For a general overview of network connectivity diagnosis and solutions, see Section 1.3.4.

1.3.1 Static IP address for printer

Many networks automatically assign IP addresses (via DHCP) to network devices such as your 3D printer, but if your local network does not have a DHCP server, then you will need to manually configure your printer with a static IP address. If your local network requires a static IP address, then after connecting to `192.168.0.1` (and if necessary clicking the "`NETWORK`" tab to get to a screen such as Figure 1.4), either click on "`Add WiFi`" and then select a WiFi network name from the drop down menu (if you are configuring a WiFi connection), or click on "`Ethernet`" (if you are configuring an Ethernet connection).

Instead of leaving the "`DHCP`" button highlighted, click the "`Static Address`" button. This will bring up a display such as shown in Figure 1.20 (WiFi) or Figure 1.21 (Ethernet).

Figure 1.20: WiFi static IP address

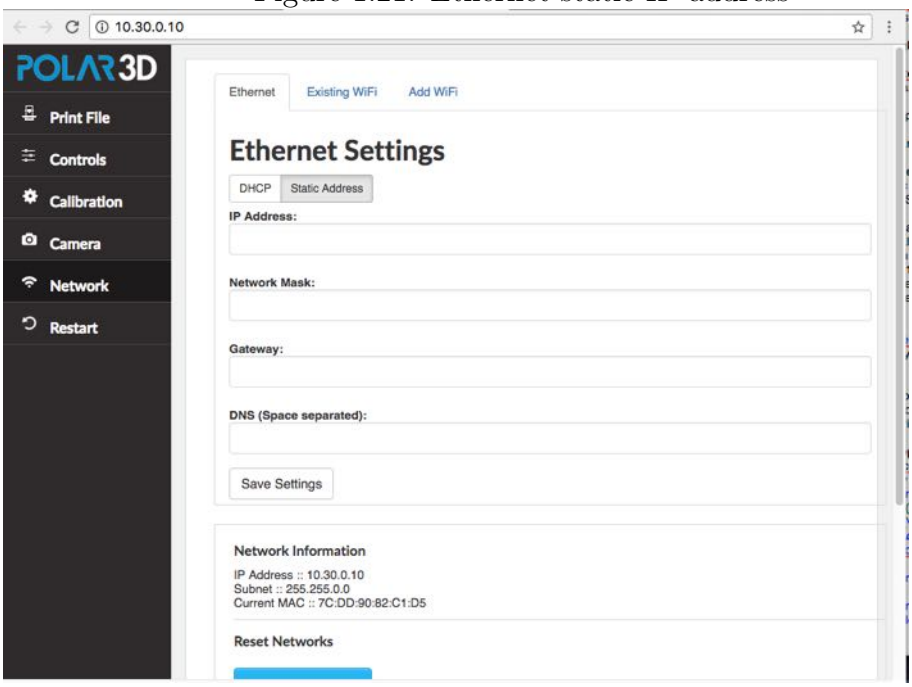


Enter specific values for:

1. IP Address
2. Network Mask
3. Gateway
4. DNS servers (space separated if your site has more than one)

If you are used to adding network devices to your network, you're probably familiar with the sorts of values to enter. Otherwise, ask your IT or network administrator for details on what values to enter.

Figure 1.21: Ethernet static IP address



Once you have finished entering appropriate values for your site, click the "`Add Network`" button (WiFi – see Figure 1.20) or "`Save Settings`" button (Ethernet – see Figure 1.21).

Then click the "`RESTART`" tab on the left navigation pane to have the printer attempt to use your newly configured local network information to connect to your local network, and then through it to the Polar Cloud.

1.3.2 MAC address for the printer

Some advanced networks require different types of authentication. In this case, your IT or network administrator will need to

add your 3D printer's MAC address to the list of hardware on the network – similarly to how they would add a laser printer.

Make a note of the MAC address of your printer, as your network administrator will likely need it! The MAC address is printed on the backside of the "`GETTING STARTED`" sheet shipped with your Polar3D printer. The MAC address may also be found displayed by the printer local web interface: after connecting to `192.168.0.1`, look under the header "`Network Information`" for the value in the "`Current MAC`" field; see for instance Figure 1.8. (Indeed, the printer local web interface shows the MAC address in multiple places; see also for example Figure 1.20 or Figure 1.21.)

Note that if you have left your Polar3D printer configured to potentially use multiple WiFi networks, then the MAC address displayed may differ in its final digit from the value printed on the "`GETTING STARTED`" sheet.

1.3.3 Open HTTP ports

Outgoing HTTP ports 80 and 443 must be open to the printer. If your local network does not allow the printer to access those outgoing ports, then the printer's attempts to connect to the Polar Cloud will not fully succeed.

In terms of LED lights, the symptom you will see when the rest of configuration was successful but now the printer can't access the outgoing HTTP ports is that the LED lights will be blue over yellow: POLAR3D.

Make a note of your printer's IP address (if you are using a

static IP address) and its MAC address and contact your IT or network administrator to ask them to open up access for your printer.

1.3.4 Solving network connectivity problems

If your printer's LED lights are not showing as POLAR3D (blue over white), then the printer is not connected to the Polar Cloud.

If the LED lights cycled:

1. POLAR3D → POLAR3D → POLAR3D (the LED lights cycled from entirely blue, to blue over red, before returning to entirely blue): the printer searched for the specified local network, but could not successfully connect.
   (a) For WiFi connection, first go back to the network profile configuration (step 7 in Section 1.1; see in particular Figure 1.6), and check that you entered the local network password correctly!
   (b) If using a static IP address, check that all those networking parameters were correctly entered; see Section 1.3.1.
   (c) On an advanced network, check with your network administrator that he or she has used your printer's MAC address to permit it access; see Section 1.3.2.
2. POLAR3D → POLAR3D → POLAR3D (the LED lights cycled from entirely blue, to blue over red, before ending as blue over yellow): the printer successfully connected to

your local network, but has not been able to connect over the Internet to the Polar Cloud.

(a) Confirm with your network administrator that the printer is being allowed access to outgoing HTTP ports 80 and 443; if your local network normally blocks access to those ports, the network administrator will need to open up access for the printer.

(b) Check whether your site is having general Internet connectivity problems – the printer can't connect to the Polar Cloud unless your Internet connection is operating!

Chapter 2

Start printing

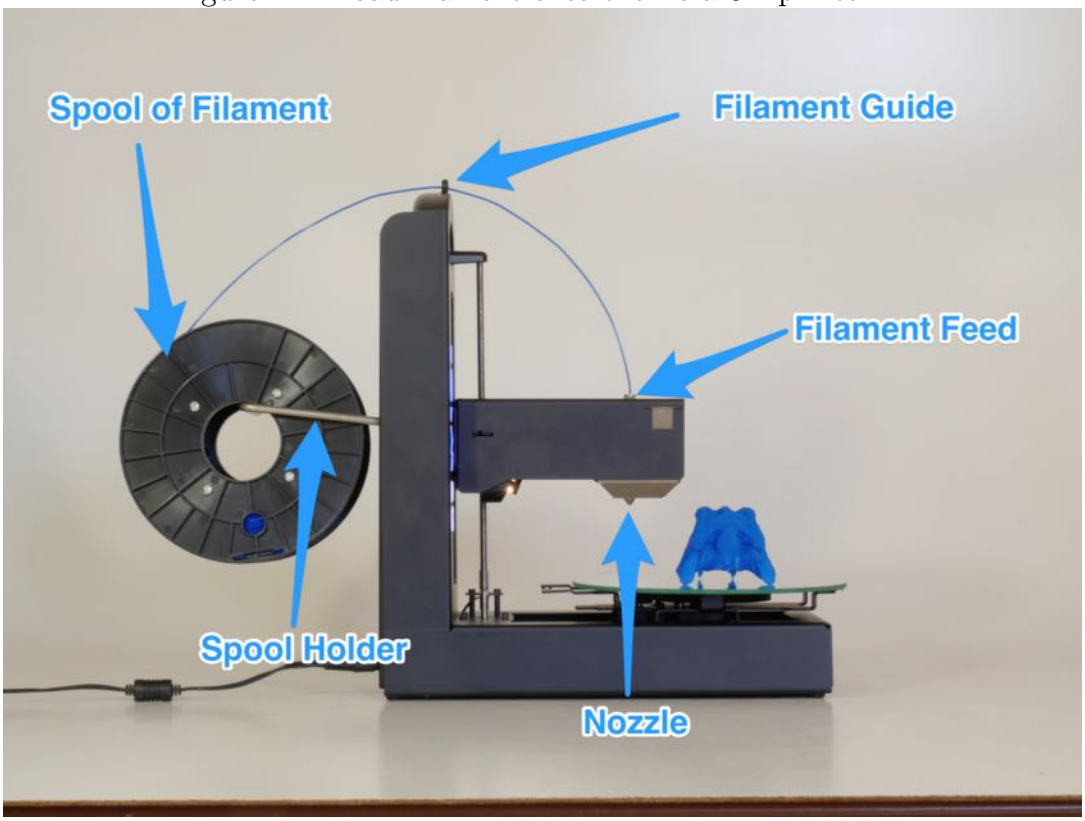
Once you have your printer connected to the Polar Cloud (see Chapter 1), you can start your first print through the Polar Cloud![1]

For your first print, you'll want to load filament (Section 2.1), get an object (Section 2.2), and then start a print job (Section 2.3); you can monitor the printing of your object through the Polar Cloud, including via real-time video (Section 2.4) of the printer as it prints your object.

[1] If you want to print without connecting through the Internet to the Polar Cloud, see Appendix C which explains how to get started printing when directly connected to the printer.

2.1 Load filament

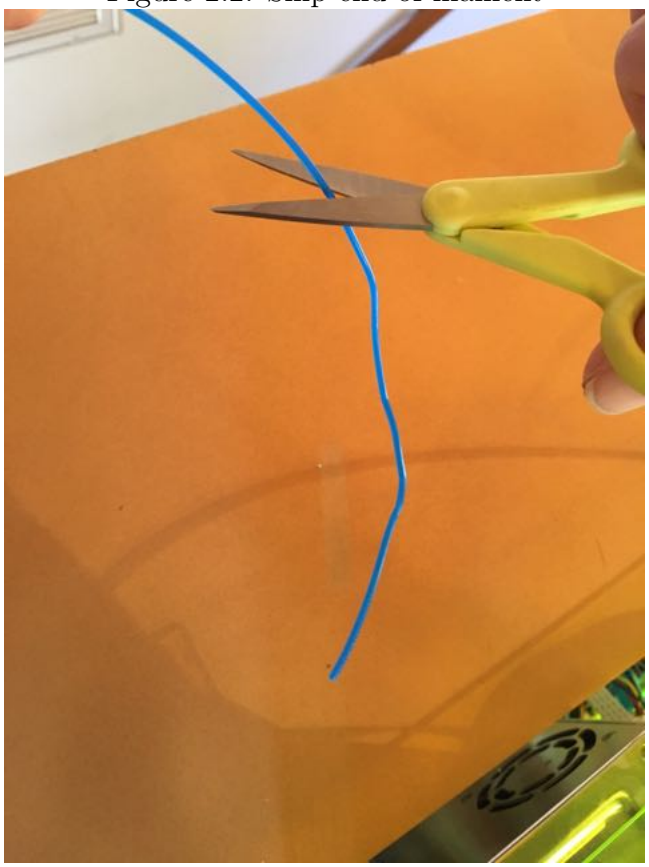
Figure 2.1: Load filament onto the Polar3D printer



1. Swing out the spool holder arm from the back (see Figure 1.2) of the Polar3D printer.
2. Unwrap the spool of filament and place it onto the spool holder; see Figure 2.1.
3. Find the end of the string of filament.
4. Snip off the end of the filament – perhaps an inch or two – with a pair of scissors or wire clippers to get a good, clean

end to feed into the printer (*especially* if the end is kinked, or melted, or blobby); see Figure 2.2.

Figure 2.2: Snip end of filament



5. Feed the filament through the filament guide (the hole at the top of the Polar3D printer); see Figure 2.1.

6. Stick the end of the filament into the filament feed hole at the top of the print head. The "feel" of this takes a bit of getting used to: when sticking the filament into the feed, you must push past some initial resistance: you must push the filament in far enough to engage with the filament drive

gear inside the print head, and then down past that into the throat of the extruder. The Polar 3D support site has a clip of this process:

Polar 3D support document "Loading and Unloading Filament"

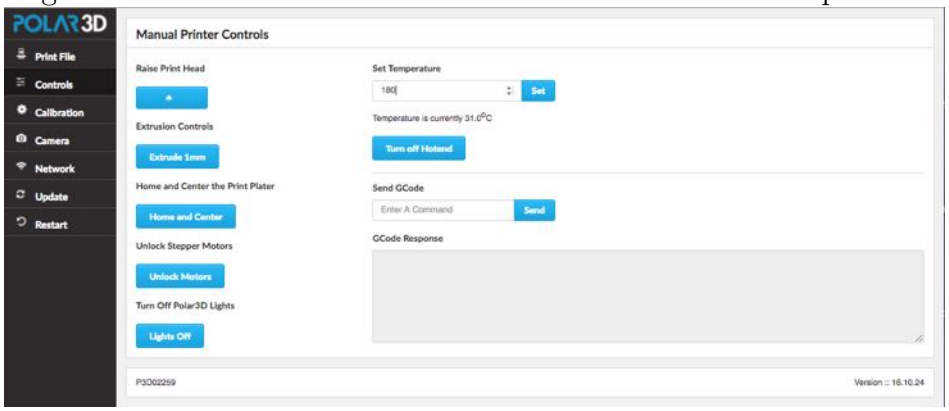
7. Check that the filament is properly inserted and engaged with the filament drive gear as follows:

   (a) From your device (phone, tablet, computer), connect to the printer's local IP address to access the printer's local web interface. (If your local network permits access from the Internet back to your printer's local IP address, you may instead conveniently access the printer local web interface and perform such settings while within the Polar Cloud. From the Polar Cloud main menu, expand the left-hand menu and click on "`PRINTERS`", then click on the image of the printer you are loading with filament; this will take you to the printer's dashboard screen; see Figure 4.56. At that screen, click on the "`LOCAL UI`" tab (gear icon) at the upper right, to navigate to the printer's local web interface.)

   At the printer local web interface, see Figure 5.7, click on the "`Controls`" tab from the vertical menu on the right. At the "`Manual Printer Controls`" screen, enter a temperature of 180°C and click the "`SET`" button; see Figure 2.3.

   (b) Once the extruder has warmed up, which you can see on the `Manual Printer Controls` screen just underneath

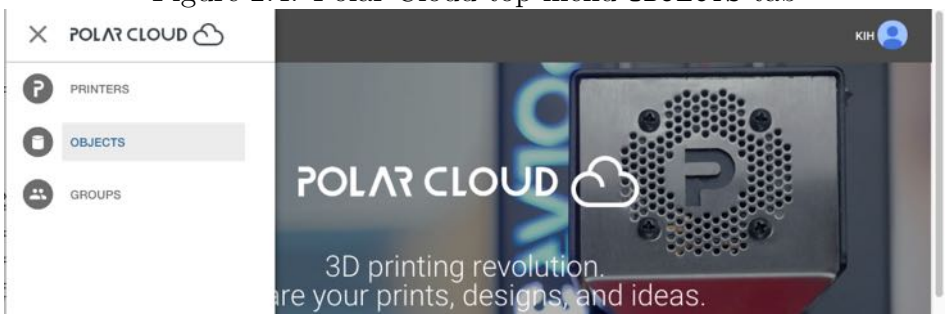
Figure 2.3: `Manual Printer Controls` screen: set the temperature



where you set the desired temperature, on that same screen click the "`Extrude 1mm`" button several times, to extrude a few millimeters of filament.

(c) Note that if the printer already had a bit of filament in the extruder – and the Polar3D printers get a test print performed at the factory so even a brand-new printer may have a bit of filament in the extruder – you may see molten plastic leaking out as the printer heats up, even before you tell it to extrude filament. But you want to see the printer feeding in and extruding *your* filament – the filament you just loaded. Seeing a string of your filament get extruded as now molten plastic confirms that your filament is properly loaded, and you're ready to print!

Figure 2.4: Polar Cloud top menu `OBJECTS` tab



2.2 An object to print

To print using the Polar Cloud, you need an object (one or more `.stl` files) in the Polar Cloud; you may:

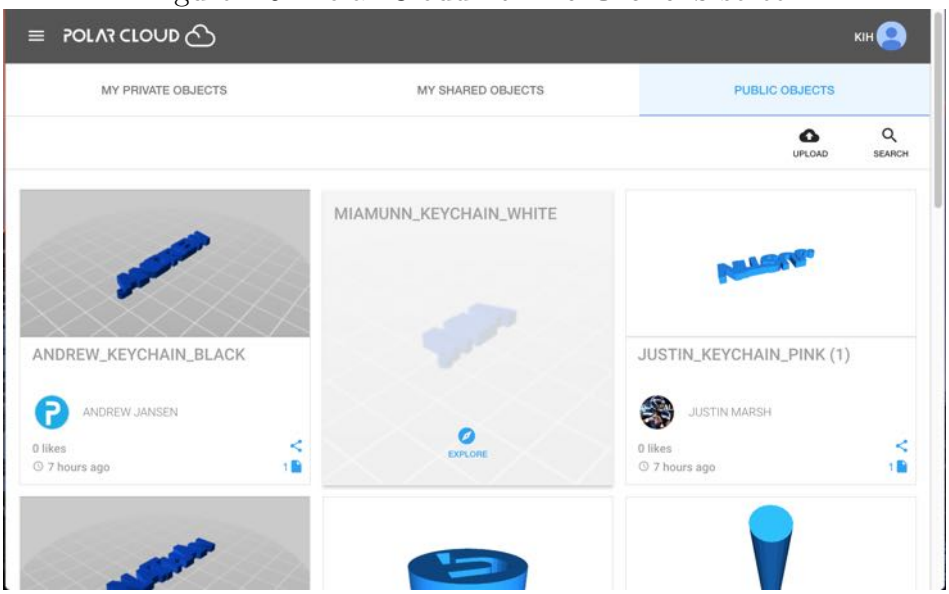
1. Search for and find in the Polar Cloud an object shared by someone else,
2. Upload an existing object (from outside the Polar Cloud) into the Polar Cloud,
3. Create a new object yourself, using CAD software,
4. Print any object already in your Polar Cloud collection (though if you're a new Polar Cloud member, you probably won't have any such objects yet).

A quick way to get started is to find an object in the Polar Cloud, as will be demonstrated in Section 2.2.1.

2.2.1 Find an object in the Polar Cloud

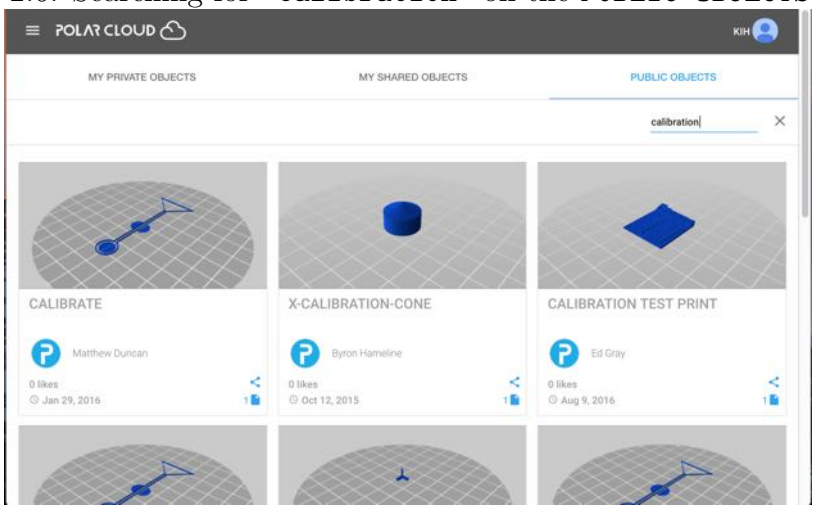
From the Polar Cloud main screen, expand the top left menu and click on "`OBJECTS`"; see Figure 2.4. Then click on "`PUBLIC OBJECTS`"; this will bring up a screen such as shown in Figure 2.5. Scrolling to the bottom of the screen and clicking "`SEE MORE`" will load additional objects. You may click on an object to select it.

Figure 2.5: Polar Cloud `PUBLIC OBJECTS` screen



Note that you may also search these objects by clicking on "`SEARCH`". For instance, if you don't see any object that particularly appeals to you as your first print, you might try searching for "`calibration`" (to find objects intended for checking calibration) and try one of those objects as your first print; see Figure 2.6.

Figure 2.6: Searching for "`calibration`" on the `PUBLIC OBJECTS` screen



Let's scroll down and find William Steel's original calibration key, as shown in Figure 2.7.

Figure 2.7: `PUBLIC OBJECTS` listing of William Steele's `CALIBRATIONKEY`

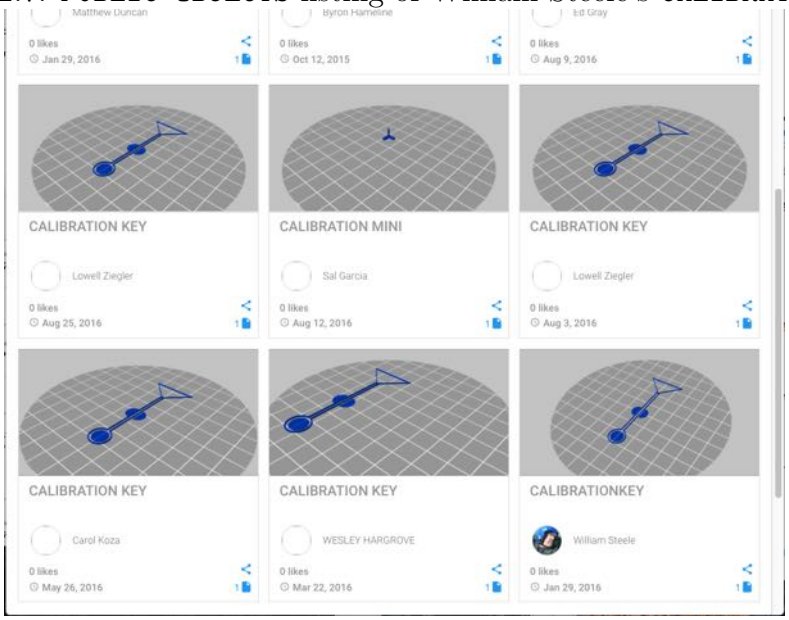
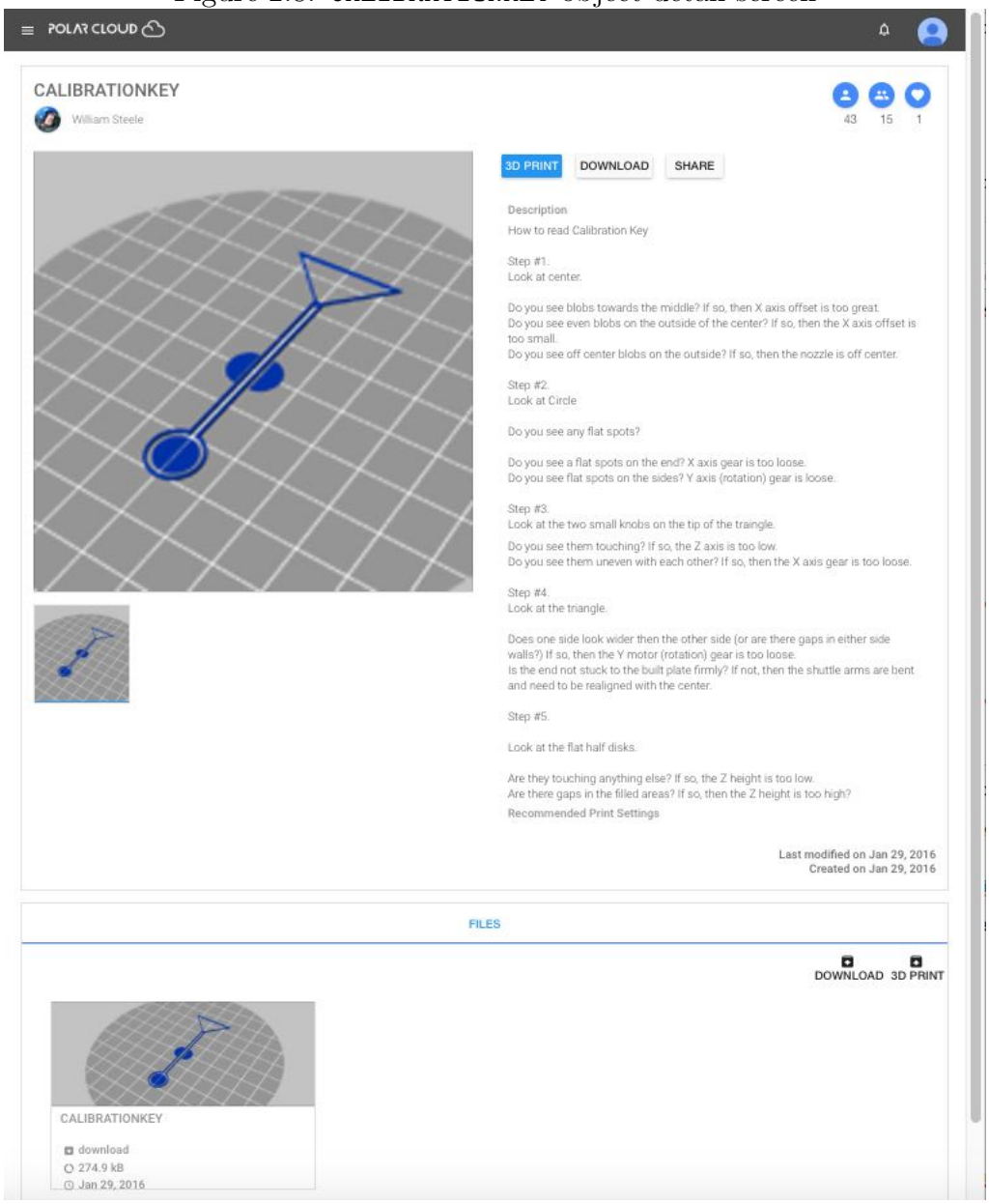
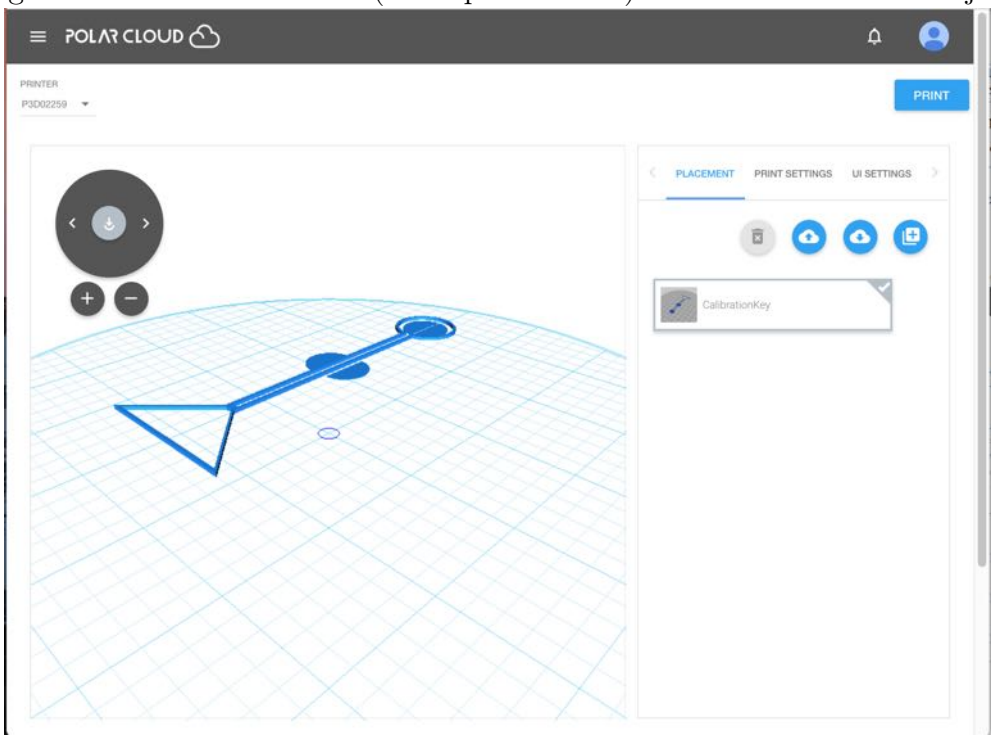


Figure 2.8: `CALIBRATIONKEY` object detail screen



Clicking on that object's icon image takes you to the object's detail screen, as shown in Figure 2.8. (Note that for especially

Figure 2.9: `3D PRINT` screen (build plate screen) for `CALIBRATIONKEY` object



complex objects, objects with multiple or large `.stl` files, the process of loading the object's image to the screen may take a minute or so; you will see a blue swirling loading icon towards the bottom right of the screen.)

Then clicking on the "`3D PRINT`" button will take you to the build plate screen, as shown in Figure 2.9.

At the "`3D PRINT`" screen, also referred to as the build plate screen, you may optionally make *numerous* adjustments to the object; see Section 2.2.2.

Once you are content with the planned object, click the "`PRINT`" button (at screen's upper right) to submit the print job to the printer; this will automatically take you (after possibly a minute

or so with a blue swirling loading icon towards the lower right of the screen) to the printer dashboard screen; see Figure 2.14.

2.2.2 Experiment with adjusting object placement and print settings

Once you choose an object to print and click the "3D PRINT" button on the object's display screen (see Figure 2.8), you will be at a screen such as shown in Figure 2.9, where you have the opportunity to adjust your object, and adjust printer settings, if you wish.

There are *many* ways to adjust your object, as well as adjust printer settings, before printing. (The variety of possible adjustments are discussed in detail in Section 4.6.1.) For now, you may merely want to experiment with, and check, the following:

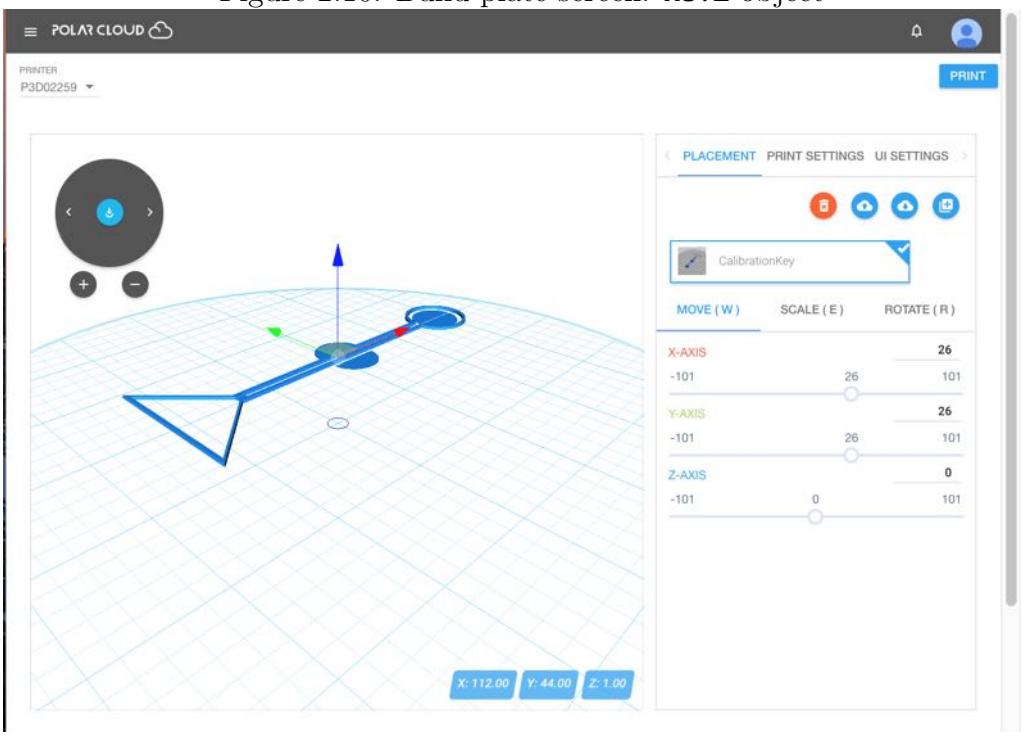
1. Move the position of the object on the build plate.
2. Change the size of the object, making it bigger or smaller.
3. Rotate your view of the object.
4. Check that your extruder temperature is set sensibly for the filament that you are using; for the PLA filament supplied by Polar 3D, the proper temperature is 185°C.

2.2.2.1 Experiment with moving the object on the build plate

At the object build plate screen, see Figure 2.9, check that "PLACEMENT" is highlighted (in blue), meaning that placement is the active mode; if necessary, click on "PLACEMENT" to select it.

Click on the object image on the build plate screen, or click on the object name on the right underneath "PLACEMENT. Clicking either place will bring up a set of colored axes (red X-axis, green Y-axis, blue Z-axis) superimposed on the object image, and three tabs will appear in the right window under "PLACEMENT": "MOVE (W)", "SCALE (E)", and "ROTATE (R)". Check that "MOVE" is highlighted (in blue), meaning that it is selected; clicking on "MOVE", or typing W, will select it; see Figure 2.10.

Figure 2.10: Build plate screen: MOVE object



To move the object's desired placement on the build plate, you may do whichever is most convenient:

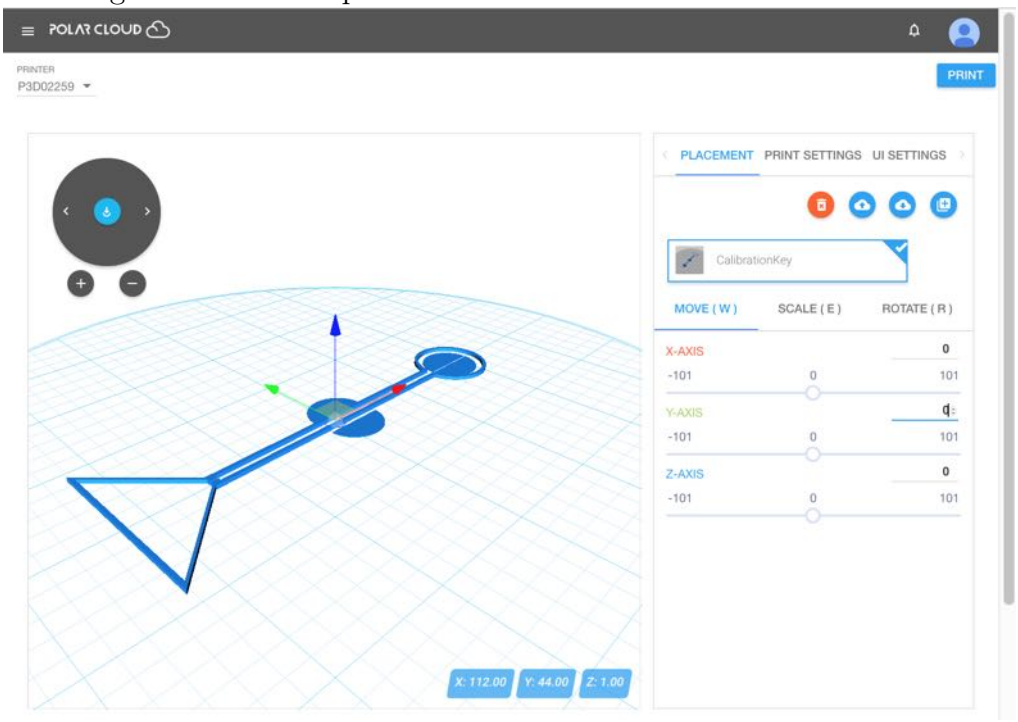
1. Click on the axis arrow in the left-hand, object view win-

dow, and then drag the object to a desired position.

2. Move the slider position on desired axes in the right-hand window.

3. Enter a numeric value for how much to move along the desired axis in the right-hand window; such a numeric value can be entered at the far right of the right hand window level with the axis name.

Figure 2.11: Build plate screen: `MOVE` to center `CALIBRATIONKEY`



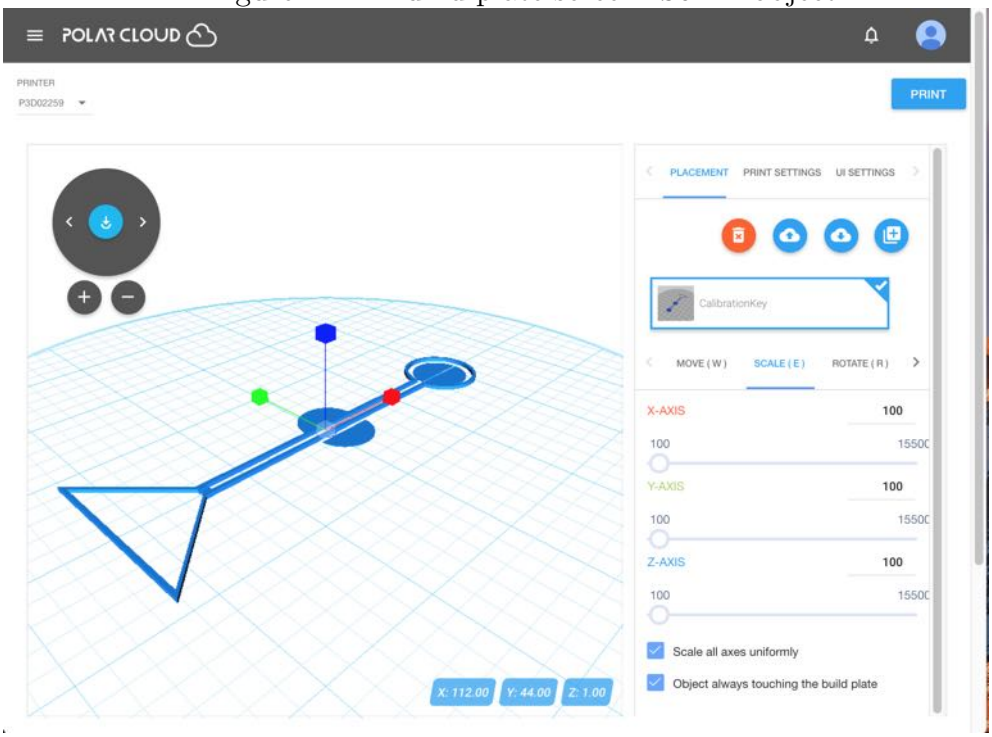
While in general objects are best printed *offset* from the center of the build plate (thereby avoiding blemishes from any suboptimal calibration at the build plate center – see Section 8.1.1), the `CALIBRATIONKEY` object, as it intended to test and *display* any calibration issues, is best printed with its center at the cen-

ter of the build plate. Figure 2.11 shows the CALIBRATIONKEY moved to be centered on the build plate.

2.2.2.2 Experiment with changing the size of the object

At the object build plate screen, see Figure 2.9, check that "PLACEMENT" is highlighted (in blue), meaning that placement is the active mode; if necessary, click on "PLACEMENT" to select it.

Figure 2.12: Builld plate screen: SCALE object



Click on the screen where the object image is shown on the build plate. This will bring up a set of colored axes (red X-axis, green Y-axis, blue Z-axis) superimposed on the object

image, and three tabs will appear in the right window under "PLACEMENT": "MOVE (W)", "SCALE (E)", and "ROTATE (R)". Click on "SCALE" (or type "E") to select it (when selected, it will show as blue); see Figure 2.12.

You may choose to scale the object's overall size uniformly along all axes, or scale the object differently along different axes: see the "Scale of axes uniformly" checkbox below the "SCALE" tab. To adjust the object's size, you may either move the slider position on an axis in the right-hand window, or you may click on an axis in the left-hand, object view window, and then drag to change the size along that axis as desired.

2.2.2.3 Experiment with rotating your view of the object

At the object build plate screen, see Figure 2.9, the dial towards the upper left of the left-hand (object on build plate) screen in effect "rotates the build plate" – it rotates your view of the object. The two small buttons underneath the dial allow you to zoom in and zoom out on your view of the object and build plate.

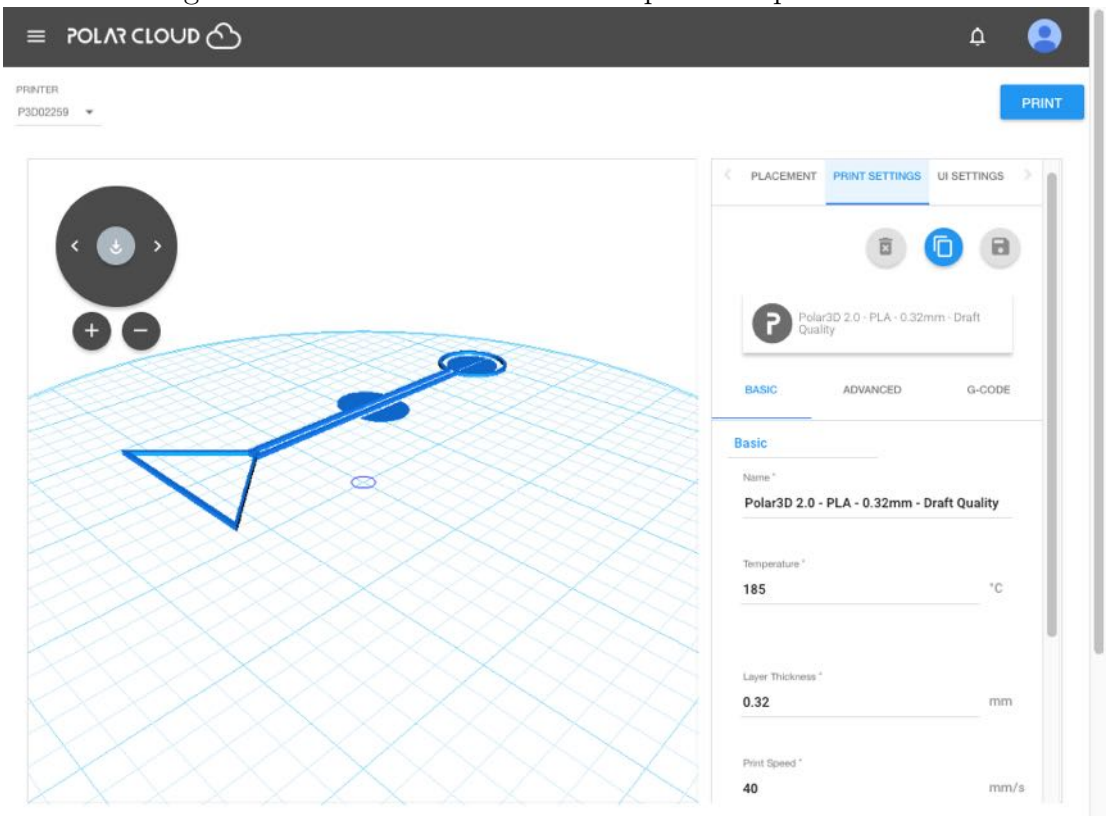
(Note that this rotation of your *view* of the build plate and the object on it is distinct from rotating the object's *placement* on the build plate – that operation, rotating the placement of the object while keeping the build plate stationary, is instead controlled via the "ROTATE (R)" tab under "PLACEMENT".)

Try clicking on the left arrow and right arrow on the dial to rotate the build plate (and the object on it), and try clicking on the left button below the dial (to zoom in) and the right button below the dial (to zoom out).

2.2.2.4 Check temperature

At the object build plate screen, see Figure 2.9, clicking "`PRINT SETTINGS`" in the right-hand window will bring up three tabs: "`BASIC`", "`ADVANCED`", and "`G-CODE`". The temperature which the printer is set to use for printing is displayed under the "`BASIC`" display, as shown in Figure 2.13.

Figure 2.13: Polar Cloud check the print temperature



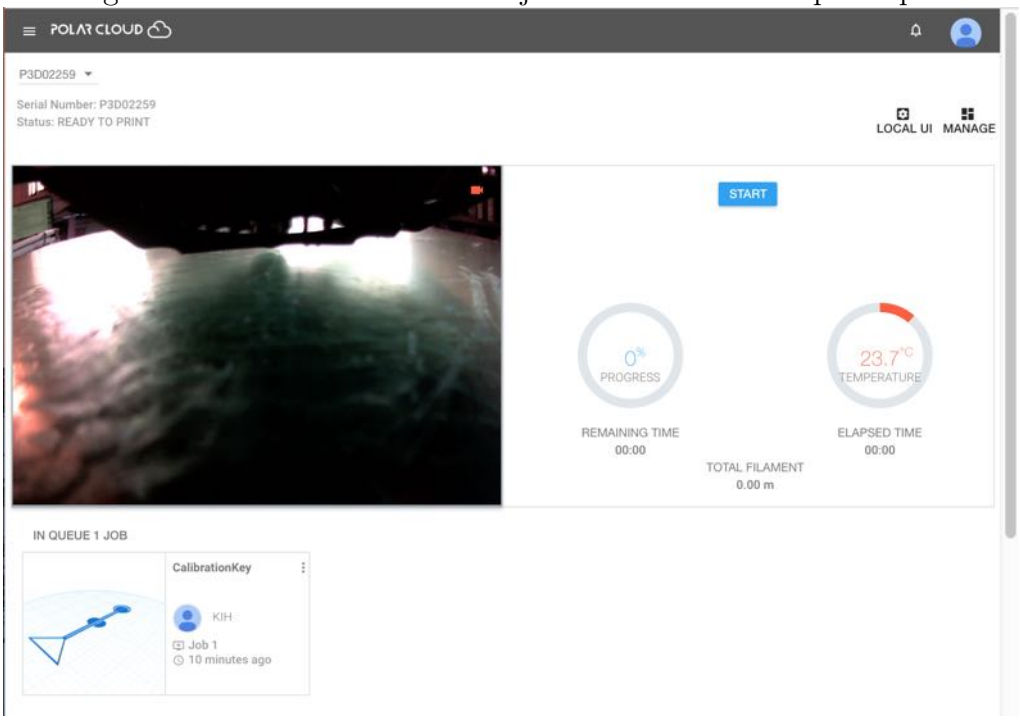
The proper temperature for the PLA filament provided by Polar 3D is 185°C. (If you are using a different type of filament, see the filament manufacturer's recommendation for what temperature to use for it.)

2.3 Start the print job

Are you ready to submit your object for printing? (Note that if you don't like any adjustments you tried making in Section 2.2.2, you may go back to the list of objects, and simply select the object again to have it back in its original location, size, *etc.*: that is, return to Section 2.2.1 and repeat the initial steps of selecting an object.)

Once you are ready to submit a print job – that is, once you have completed any adjustments you wished to make at the build plate ("`3D PRINT`") screen overviewed in Section 2.2.2 (and discussed in detail in Section 4.6.1) – then clicking the "`PRINT`" button towards the upper right of the "`3D PRINT`" screen will submit your job to your selected printer. (Note that, especially with complicated object models, the loading of the `.stl` file to the printer may take some time – it is normal for this stage to take a minute or two: a blue swirling loading icon will appear towards the lower right of the screen.) Once the submission has completed, you will be shown a printer dashboard screen such as Figure 2.14.

Figure 2.14: Printer dashboard: job submitted to the print queue



Click the "`START`" button (towards the upper right of the printer dashboard screen) to begin the print.

2.4 Monitor the printing

Having submitted your job and clicked "`START`" (see Section 2.3), the Polar Cloud printer dashboard screen (see Figure 2.14) will begin updating, showing you a camera view of the printer (on the left) and status data on the progress of the printer (on the right).

Note that after you have clicked "`START`", the status line underneath the printer name (towards the top left of the printer

dashboard screen) will cycle (fairly rapidly) through: `WAITING FOR RESPONSE`, `PREPARING PRINT`, and then `PRINTING`.

At 175°C, the printer will home (*i.e.*, move the build plate and print head into proper position for the beginning of the print). Then the printer will continue to heat up to 185°C (the proper temperature for extruding Polar 3D PLA filament). At 185°C, the printer will begin extruding melted filament and your print is in progress!

Once the object has finished printing, the status line under the printer name (towards the top left of the screen) will cycle through: `COMPLETING PRINT JOB`, `FINISHING PRINTING`, and then `READY TO PRINT` (when it is ready for a new job).

Chapter 3

Understanding the Polar 3D 2.0 Environment

Welcome to Polar 3D 2.0! If you have used Polar 3D 1.0, you will find use of Polar 3D 2.0 enhanced but familar! Older documentation on Polar 3D 1.0 can be found at:

Polar 3D Support Documents

The Polar 3D environment is not just about high quality, reliable, cost effective 3D printers, but also provides a collaborative and flexible inventor space that supports management of printing from anywhere in the world. The Polar 3D environment includes many features supporting and enhancing classroom use, and Polar 3D offers the innovative, NGSS-aligned STEAMtrax curriculum to aid in bringing the excitement and learning opportunities of 3D printing directly into the classroom.

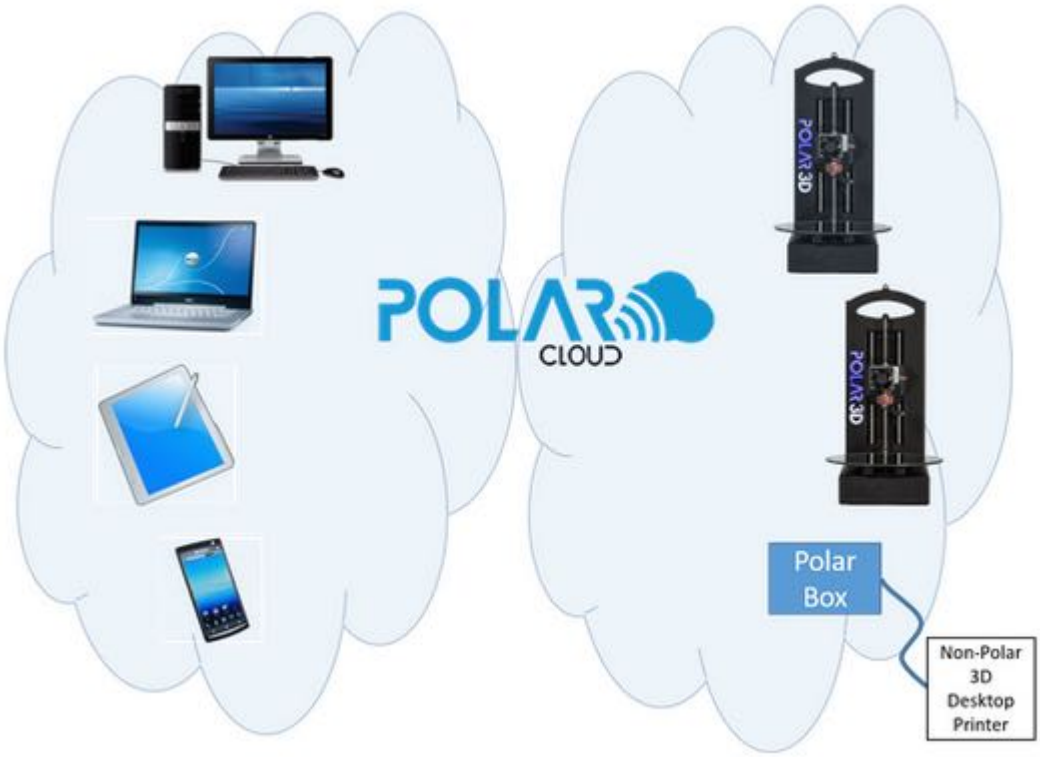
Polar Cloud – The Polar Cloud is the central hub of the Polar 3D environment. It is a free, web-based platform for collaboration, design, class assignments, and lab management. Polar Cloud groups allow teachers to group students by subject, and

allows members to find groups with mutual interests. Within the Polar Cloud, members collect and share objects to print using in-site CAD software to alter and adjust their `.stl` files. The Polar Cloud also allows for remote printing: you can control your printer from the office next door, a lab in another country, or 30,000 feet in the air.

Polar3D Printer – The Polar3D printer is unique in ways which make it very desirable, not just novel. The narrow footprint, simplicity of the hardware, quality print results, and robust, web-based printing control software are all tops on its list of positives.

Polar Box – (under development) This brings the remote printer management capabilities of the Polar 3D environment to any desktop 3D printer.

STEAMtrax – Curriculum is another component of maximizing the educational benefit from classroom 3D printers, or a 3D printer lab. The STEAMtrax curriculum provides modules that are easy to align to NGSS or state standards, so whether you're a teacher new to 3D printing, or a long-time "maker", STEAMtrax can aid you in incorporating 3D printing into your classroom for a rich and exciting learning experience for your students.



3.1 The process of 3D design and printing

The process of designing and printing an object includes many possible stages.

1. Identify and define the objective: Identify a need, define a problem, and generate and develop ideas for a solution. A personal goal, or group project, or engineering task may give rise to an objective. Or a curriculum such as STEAM-trax may present a student or group of students with a task;

see Chapter 7. Note that STEAMtrax materials include a breakdown of the engineering design process that goes into additional detail, in particular further breaking down the "define" and "develop" stages. Note also that educationally, promoting the practices of science and engineering – promoting the cognitive, social, and physical practices of scientific inquiry and modeling, and engineering design and construction – is a key component of the NGSS (Next Generation Science Standards).

2. Select an idea for something to build: Step 1 may have generated several potential solution ideas; choose an object or part to try creating.

3. Design 3D model: Generate a 3D model of the object using available CAD (Computer Aided Design) software such as OpenSCAD, BlocksCAD, or Tinkercad; (see Chapter 6 for additional CAD software options); use the CAD software to generate an industry-standard `.stl` file. Or find, shared in the Polar Cloud, an already created `.stl` file.

4. Print: Load the generated `.stl` file(s) onto a 3D printer for printing. See Section 4.6 for details of using the Polar Cloud to submit a print job. (Or when you don't have network access to the Internet, see Appendix C.)

5. Solve any printing problems: See Chapter 8 and Chapter 11.

6. Test: Try using the object; test and evaluate it.

7. Refine: As needed, revise, improve, or refine the design; then return to step 3 to generate an updated 3D model.

8. Present/communicate/share: Report back to your group or teacher, as appropriate. If you wish, you may share your model, photos of your object, and any comments in the Polar Cloud.

9. Extend and apply: Return to step 1 if your objective is a large enough task to require several components for its solution. Or, during the process above, you may have come up with additional ideas you would like to further explore!

Chapter 4

The Polar Cloud

The Polar Cloud is the central hub, or "command and control center", for the Polar 3D ecosystem.

As a Polar Cloud member, you may conveniently view a history of your printing activity and communicate with other Polar Cloud members; see Section 4.1.

The Polar Cloud provides a convenient and powerful platform for managing and storing 3D objects, and for collaborating with other Polar Cloud members. You may store 3D object files (as well as supplementary information such as photographs) in the Polar Cloud (Section 4.2), share objects with other Polar Cloud members (Section 4.2.2 and Section 4.2.3), and give and receive printing and usage tips and feedback on objects (Section 4.2.4 and Section 4.2.6).

Polar Cloud groups provide a way to collaborate, sharing printers and objects, amongst a student class, maker space club, or library members, *etc.*; see Section 4.4.

The Polar Cloud provides mechanisms for managing and shar-

ing 3D printers; see Section 4.5. Polar3D printers arrive Polar Cloud enabled. But the Polar Cloud is printer neutral – other 3D printers can become part of the Polar Cloud!

The Polar Cloud lets you submit, monitor, and manage your print jobs, regardless of your physical location; see Section 4.6. You can even watch real-time video of your print job in progress; see Section 4.6.5.

The Polar Cloud provides a platform for various forms of collaborating and sharing 3D model work with others, whether with particular Polar Cloud members, or through classroom or club Polar Cloud groups. In particular, you may share objects (such as `.stl` files), photos and printing tips about objects, give and receive feedback on objects, and share 3D printer use; see Section 4.9.

The Polar Cloud has access to CAD software for creating your own 3D models; see Section 4.3.

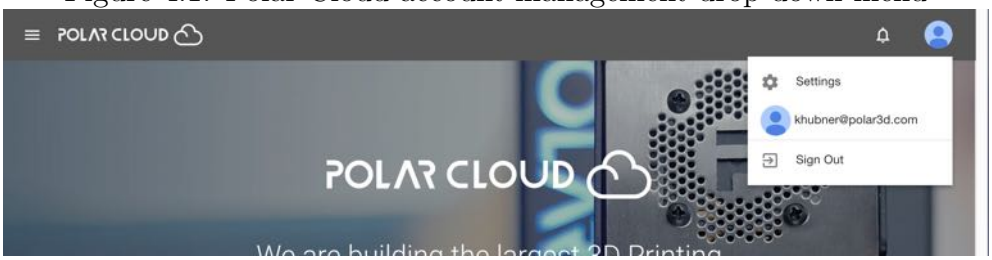
For an overview of navigating through the Polar Cloud user interface, see Section 4.10.

4.1 Polar Cloud account

To perform Polar Cloud account[1] tasks, click on your account name at the top right-hand side of the Polar Cloud bar at the top of Polar Cloud screens to access the drop down menu shown in Figure 4.1.

[1] If you do not yet have a Polar Cloud account, see Section 4.1.1 or Section 1.1, step 9.

Figure 4.1: Polar Cloud account management drop down menu



Via this menu, you may perform various account tasks, including:

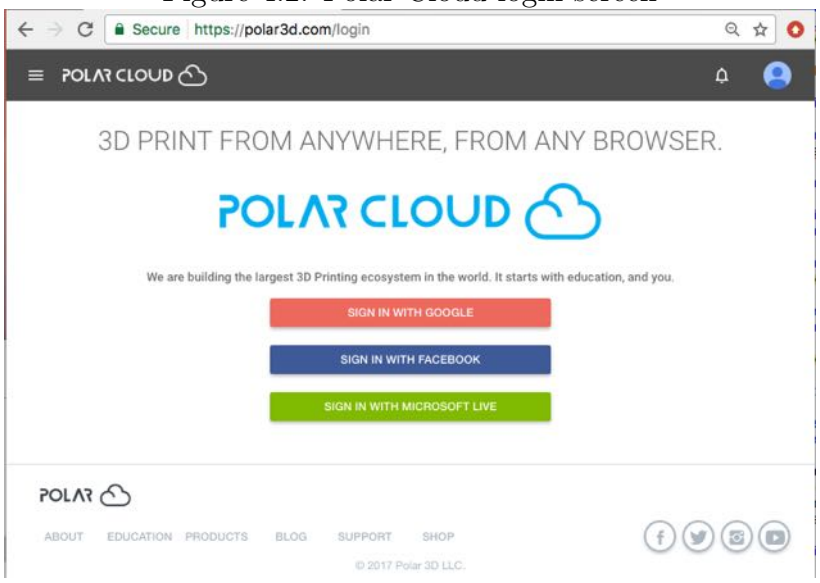
1. Change your account settings and customize your profile; see Section 4.1.2.
2. Track your account activity; see Section 4.1.3.
3. Log out; click the "`Sign Out`" tab.

4.1.1 Creating your Polar Cloud account

Creating a Polar Cloud account is a first step in establishing your Polar 3D environment, as the Polar Cloud is the central hub and command center of the environment. (Note that initial Polar Cloud account creation is also described in Section 1.1; see step 9.)

1. For Polar Cloud, you will need a Google account, a Facebook account, or a Microsoft Live account. If you do not already have any such account, you will need to make one. (For instance, a Google account is very easy to create: go to www.gmail.com.) The Polar 3D support article Linking Your Current Email Address to a Google, Microsoft, or Facebook Account has additional details.

Figure 4.2: Polar Cloud login screen



2. Got to polar3d.com on your device (computer, tablet, or phone) to get to the login screen shown in Figure 4.2.

   Click on the account that you're going to use for Polar Cloud access (Google, Facebook, or Microsoft Live): that will create your Polar Cloud account!

3. The first time you log in to the Polar Cloud (and possibly on occasion afterward, if the Polar Cloud has been updated with new sharing features), you may get asked whether you wish to permit the Polar Cloud to make use of certain sharing/access and classroom features; an example such screen is shown in Figure 4.3. (Permitting such access is recommended.) After you make your choice, you're done creating your account!

Once you're signed in, the Polar Cloud home page should appear, looking similar to that shown in Figure 4.4.

Figure 4.3: Polar Cloud account access screen

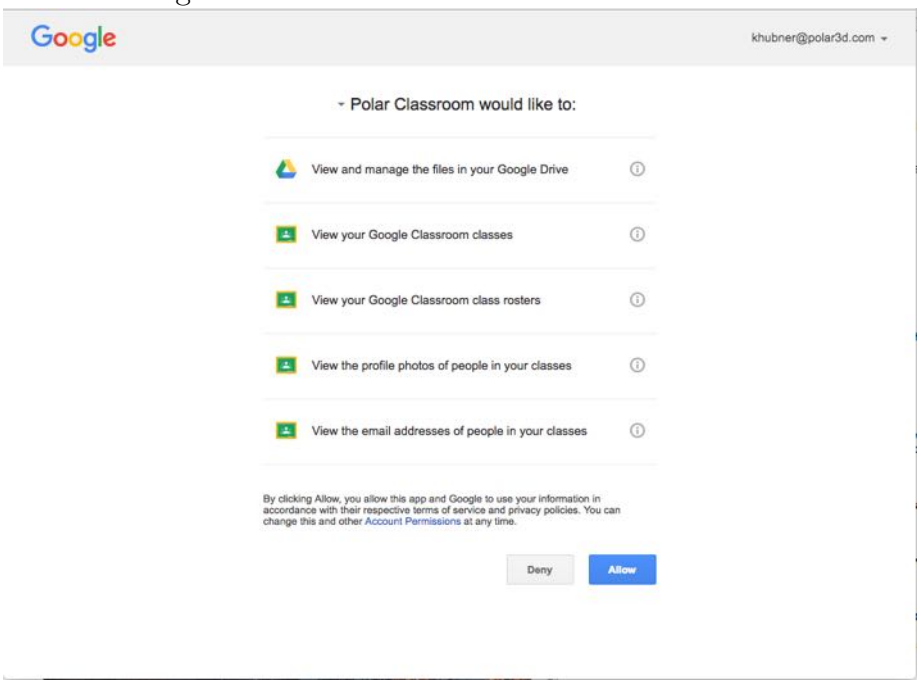


Figure 4.4: Polar Cloud home page

(Note that you can always return to this home page by clicking on the cloud icon towards the upper left of Polar Cloud screens.)

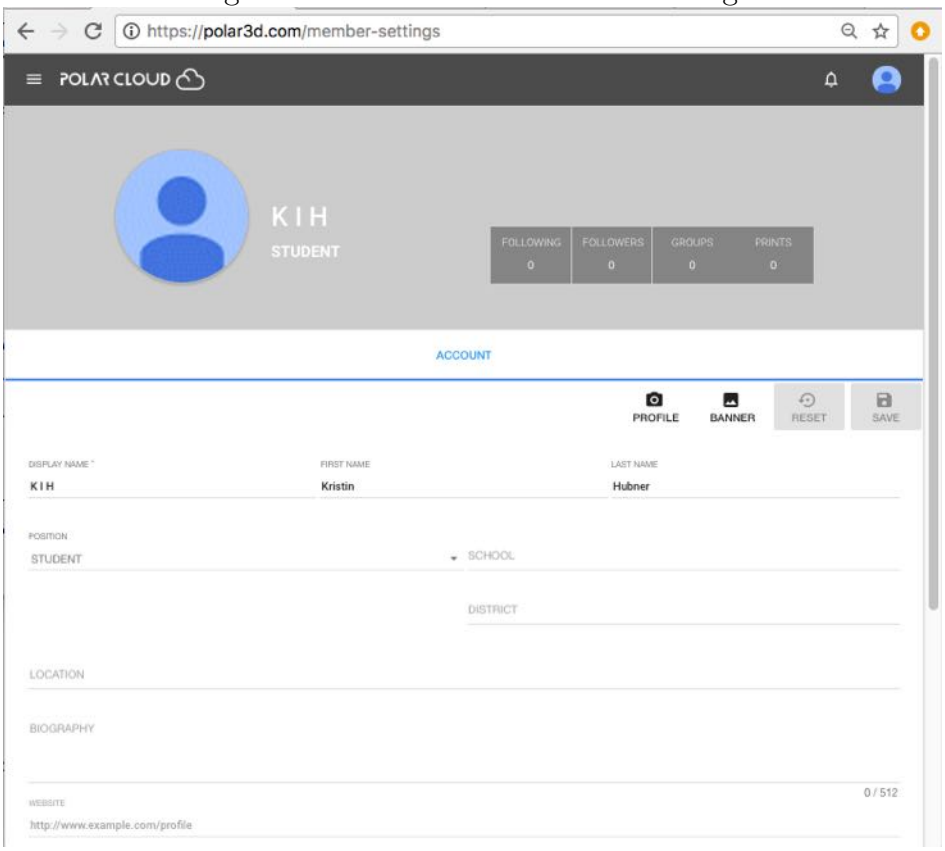
If you have a brand new Polar3D printer, go to Chapter 1 to get started on setting up your new printer.

If you are a new Polar Cloud member at a site that already has 3D printers ready to share, go to Section 4.5 to learn how to possibly use and share existing 3D printers in the Polar Cloud.

4.1.2 Polar Cloud account settings

To modify settings for your Polar Cloud account, at the account drop down menu (see Figure 4.1) click on "`Settings`" to get to a screen such as shown in Figure 4.5.

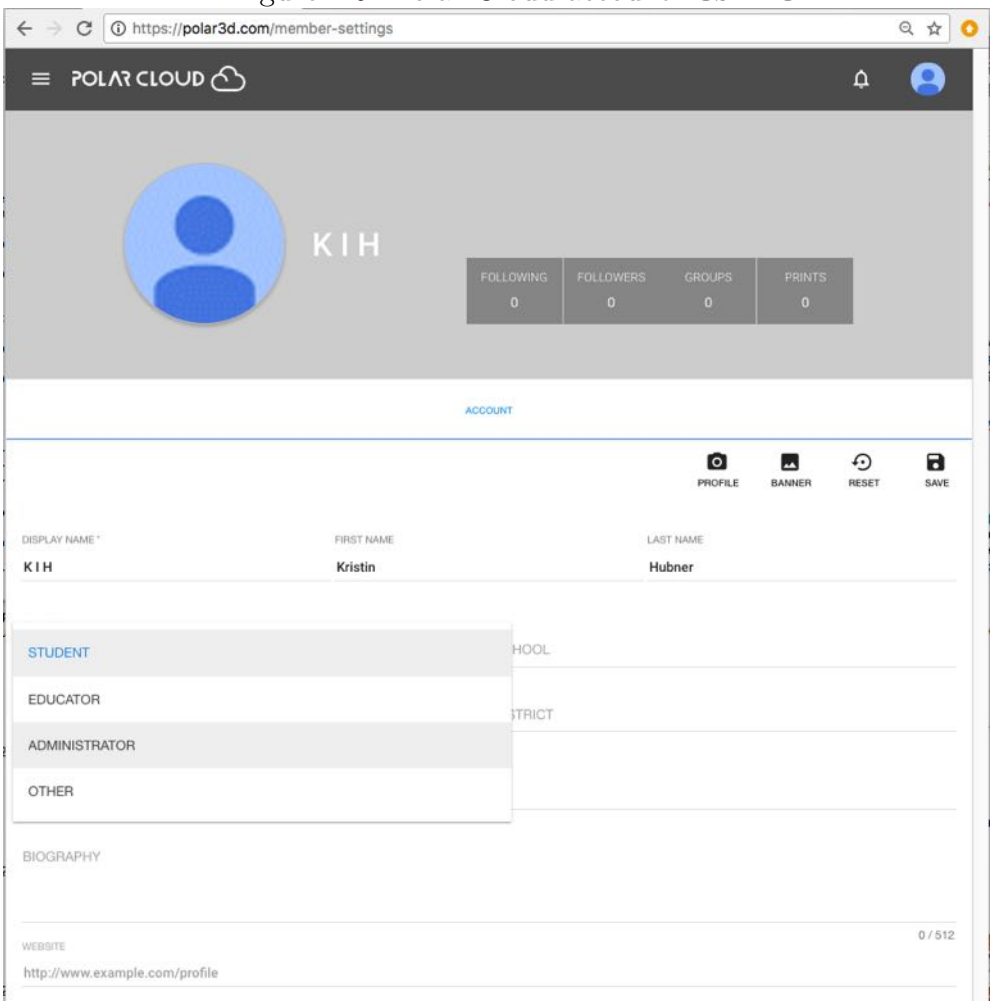
Figure 4.5: Polar Cloud account settings



Your display name is the name that will be displayed throughout the Polar Cloud on objects you post, when you are a member of a group, if another Polar Cloud member is `SEARCH`ing for you to share an object with you, *etc.* As such, put some thought into what you would like displayed: consider whether you wish to be easily identifiable when other members search or view objects you posted, or whether you prefer a more obscure or symbolic name. Teachers may also wish to advise students on "appropriate" choice of display name. To set or modify your display name, click on the field underneath "`DISPLAY NAME`".

While the default "`POSITION`" value for newly created Polar Cloud accounts is `STUDENT`, if you are a teacher or administrator (or IT support person or other non-student), you will probably wish to set the "`POSITION`" field to properly represent your status; see Figure 4.6.

Figure 4.6: Polar Cloud account `POSITION`



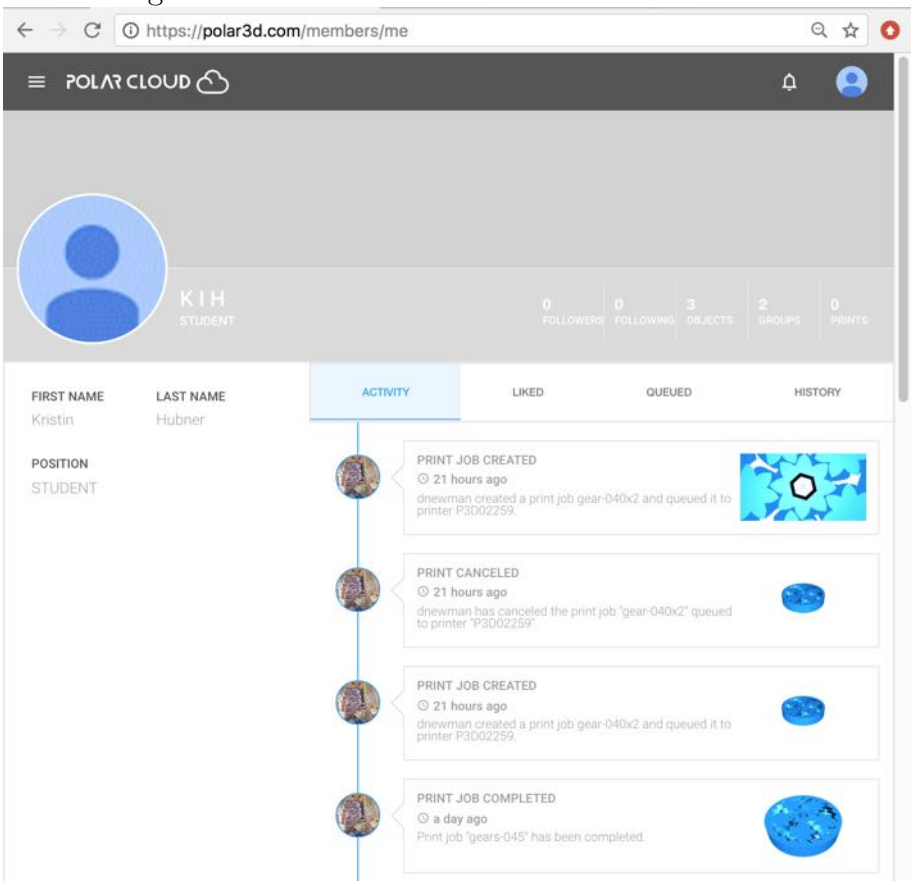
You may upload a profile picture of yourself, to be displayed in small fingernail size along with your account display name

when other Polar Cloud members search for you, or see you listed in a group, and displayed at full size when other Polar Cloud members view your member page. See the "`PROFILE`" tab.

You may upload a photo to use as the banner background for your Polar Cloud account screens, displayed when you are viewing your own account screens or when other Polar Cloud members view your member page. See the "`BANNER`" tab.

Make sure to click the "`SAVE`" tab (toward the upper right of the account screen) after making any changes to your account settings.

Figure 4.7: Polar Cloud account `ACTIVITY` screen



4.1.3 Polar Cloud account dashboard

From the Polar Cloud account drop down menu (see Figure 4.1), clicking on your Polar Cloud account email (the second item in the drop down list) will take you to your account dashboard screen, with the "`ACTIVITY`" tab highlighted, displaying your recent account activity; see Figure 4.7. Account activity may include operations such as adding a new printer, your own print jobs getting created and cancelled or completed, other users

of your printer(s) submitting jobs, you creating a new group, *etc.*

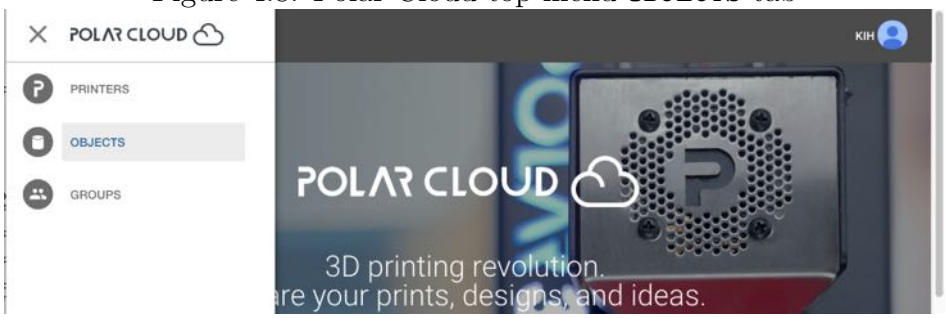
The tabs and screens available under your account dashboard (`members/me` page) are:

1. "`ACTIVITY` – all your account's activity, including other Polar Cloud member interactions (such as other members' jobs on your printers).
2. "`LIKED`" – list of objects you have liked.
3. "`QUEUED`" – list of your own currently queued print jobs.
4. "`HISTORY`" – list of all your own print jobs.

4.2 Objects in the Polar Cloud

Through the Polar Cloud, you may create your own objects, search for and find objects created by others, and print objects. You may share object files (*e.g.*, `.stl` files), descriptions and comments regarding object creation and use, recommendations for print settings to aid in successful printing, photos of printed objects, and videos of printing objects, with other Polar Cloud members. You may also download object files from the Polar Cloud, or upload into the Polar Cloud object files created outside the Polar Cloud.

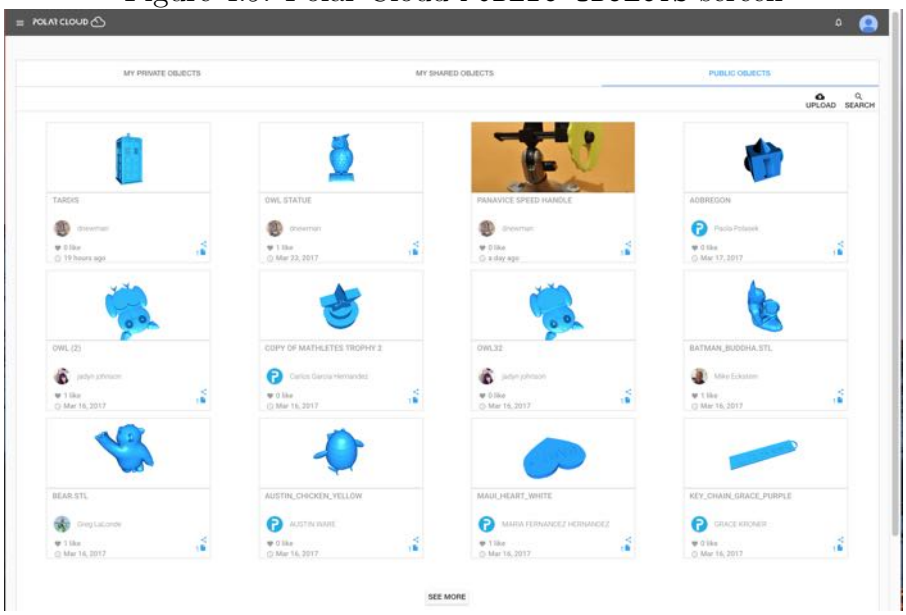
Figure 4.8: Polar Cloud top menu `OBJECTS` tab



One of the Polar Cloud top menu's main tabs is "`OBJECTS`"; see Figure 4.8. Clicking on the "`OBJECTS`" tab will take you to the `OBJECTS` screen, such as shown in Figure 4.9, with tabs for "`MY PRIVATE OBJECTS`", "`MY SHARED OBJECTS`", and "`PUBLIC OBJECTS`". You will go directly to (see highlighted) whichever of "`MY PRIVATE OBJECTS`", "`MY SHARED OBJECTS`", or "`PUBLIC OBJECTS`" you most recently viewed – with "`PUBLIC OBJECTS`" the default if this is your first login to the Polar Cloud.

Objects are listed in order from most recent to oldest.

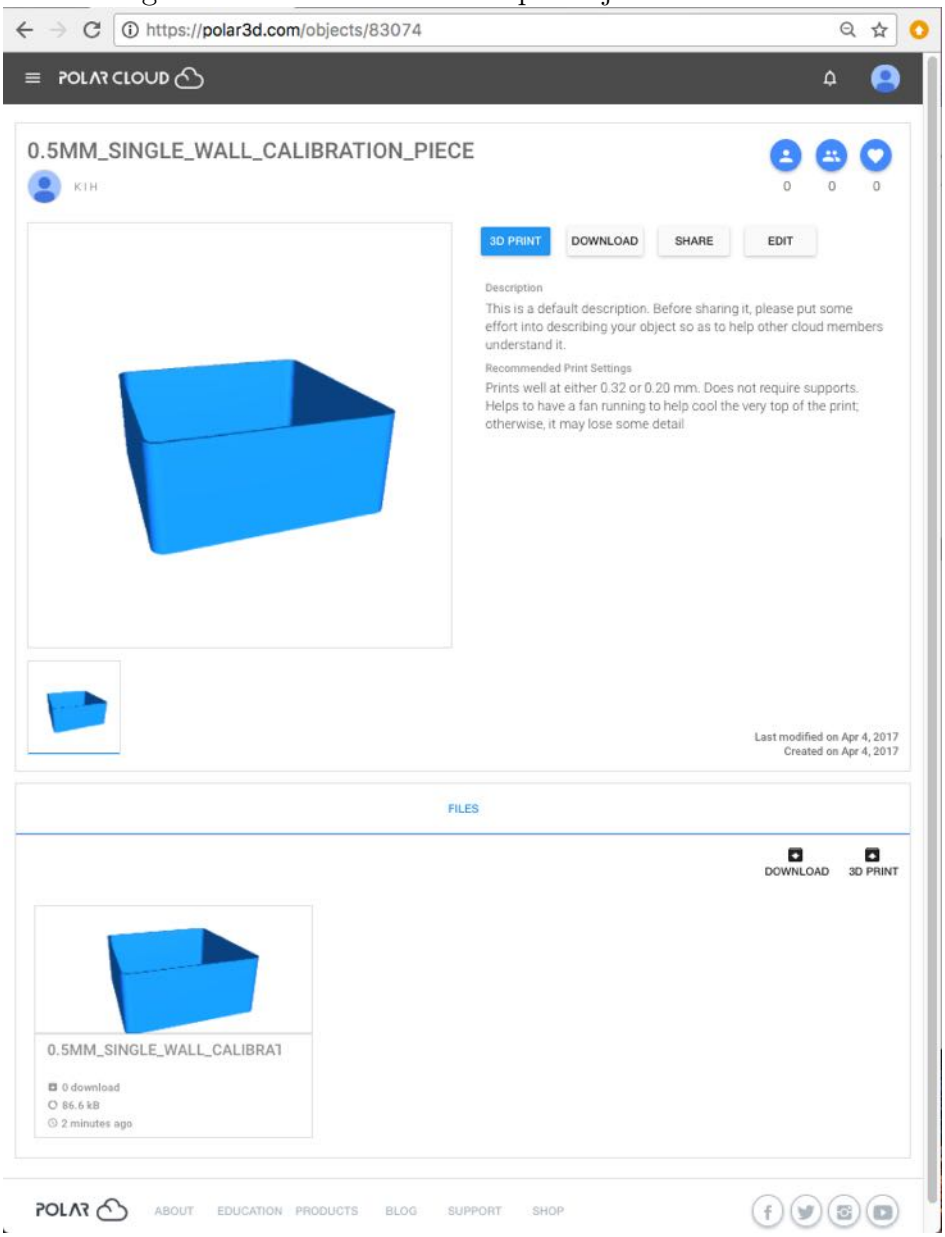
Figure 4.9: Polar Cloud PUBLIC OBJECTS screen



If you wish to "CREATE" an object, you may use CAD packages available within the Polar Cloud itself to design an object and generate its .stl file(s); see Section 4.3. Or if you already have some .stl file(s) describing an object available from elsewhere, you may upload the file(s) into the Polar Cloud using the "UPLOAD" tab.

To print or otherwise manage an object already in your set of objects (under "MY PRIVATE OBJECTS"), click on the icon for the object itself. That will take you to a screen such as shown in Figure 4.10 where you may: "3D PRINT", "DOWNLOAD", "SHARE", (or in the case of private objects, "EDIT" the text description of) your object.

Figure 4.10: Polar Cloud sample object detail screen



To print or otherwise access a shared (under "`MY SHARED OBJECTS`) or public object (under "`PUBLIC OBJECTS`"), click on

the icon for the object itself. For shared or public objects, you may: "3D PRINT", "DOWNLOAD", or "SHARE" the object; see Figure 4.24.

To print or otherwise access an object shared with you due to your membership in a group, navigate to the group, select "OBJECTS", and then click on the icon for the object itself; see Section 4.4.

From the object's detail screen, clicking "3D PRINT" will take you to the build plate screen where you may adjust placement and print settings, and when ready click "PRINT" to actually submit the print job; see Section 4.6 and in particular Section 4.6.1.

4.2.1 Uploading and downloading objects

You may upload objects into your Polar Cloud collection of objects. Such objects might be ones you yourself created using your choice of external CAD software (note that objects you create using CAD software while inside the Polar Cloud are already in your object collection in the Polar Cloud and do not need to be uploaded), or objects you found or purchased off the Internet. Any normal `.stl` file can be uploaded into the Polar Cloud.

Note that when you upload an object into the Polar Cloud, the object is always uploaded to your *private* collection of objects, (as shown under "MY PRIVATE OBJECTS"), regardless of what context you may be in when you perform the upload. If you wish, subsequently you may choose to share your uploaded object with particular Polar Cloud members, or groups, or make

the object publicly available in the Polar Cloud.

Figure 4.11: Polar Cloud `MY PRIVATE OBJECTS` screen

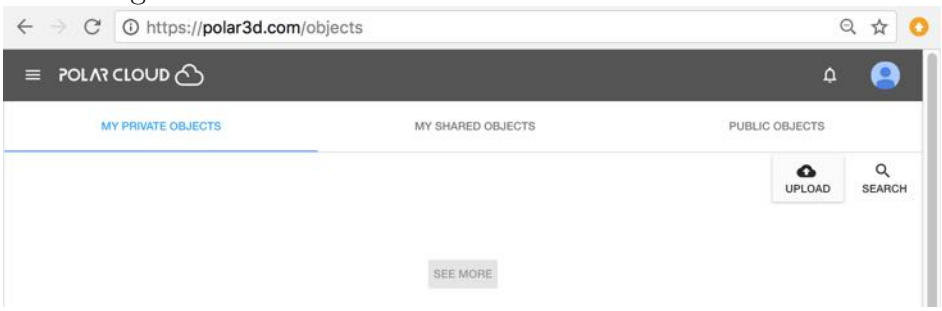
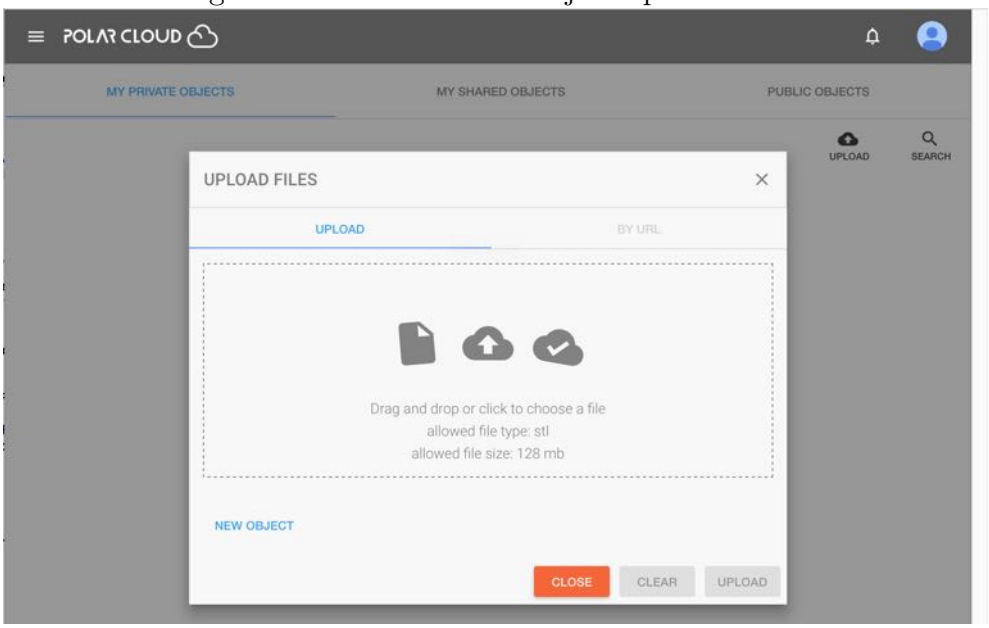


Figure 4.12: Polar Cloud object upload screen



To upload an existing object `.stl` file from your device into your private collection of objects in the Polar Cloud, at the Polar Cloud's top menu select "`OBJECTS`", as shown in Figure 4.8. This will take you to the Polar Cloud "`objects`" screen,

highlighting whichever of "MY PRIVATE OBJECTS", "MY SHARED OBJECTS", or "PUBLIC OBJECTS" you most recently viewed. (If this is your very first time in the Polar Cloud, clicking "OBJECTS" will take you to the Polar Cloud PUBLIC OBJECTS screen such as shown in Figure 4.9.)

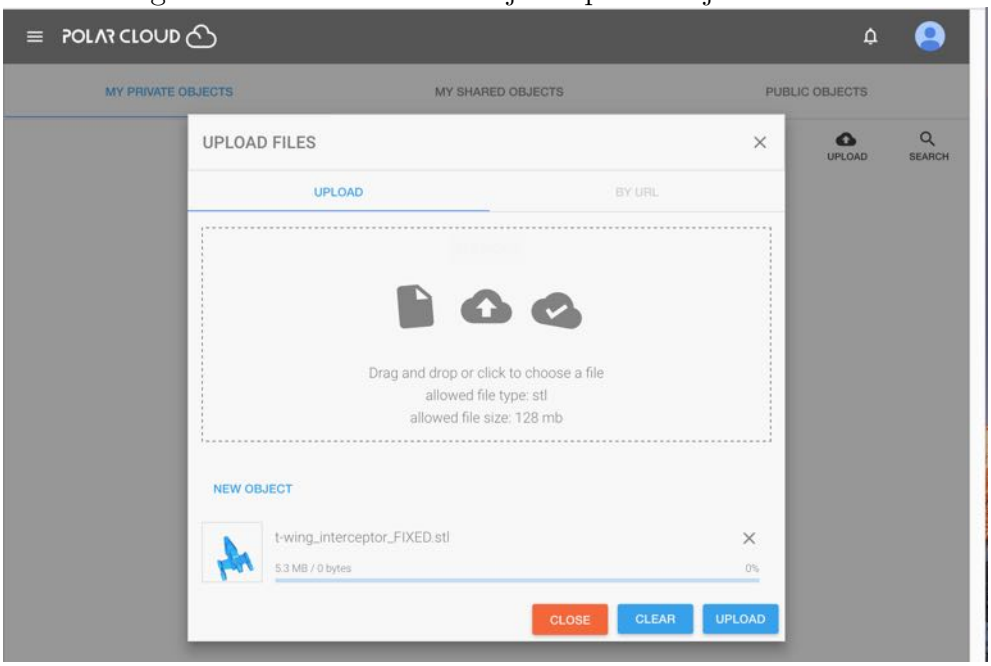
Though for your upload, it *does not matter* which list of objects you are viewing, if you wish, you may go to the MY PRIVATE OBJECTS screen: at the Polar Cloud's top menu select "OBJECTS", then click MY PRIVATE OBJECTS (towards the left of the screen). If you do not yet have any private objects, you will see a screen such as shown in Figure 4.11.

At the MY PRIVATE OBJECTS screen (or at the MY SHARED OBJECTS screen or the PUBLIC OBJECTS screen), click the "UPLOAD" button; see Figure 4.11. This will open up a window, as shown in Figure 4.12, where you may drag-and-drop a file, or click inside the window to search the files on your device.

Once you have specified the file(s) you wish to upload, see Figure 4.13, click the "UPLOAD" button. The progress of the upload will be displayed; see Figure 4.14.

Note that you do not need to pause your work while the upload occurs; clicking either the "CLOSE" button or the "X" mark at the upper right of the 'UPLOAD FILES" screen shown in Figure 4.14 will close that window, but your upload will continue, and you will continue to see the progress icon in the lower right of whatever Polar Cloud screen you are at. Clicking on the upload progress icon from a different Polar Cloud screen will re-open the "UPLOAD FILES" progress window, should you wish to return to it.

Figure 4.13: Polar Cloud object upload object selected



Once the file(s) have finished uploading, you will automatically be taken to the object's build plate screen (as if you'd selected the object and clicked "`3D PRINT`"), as illustrated in Figure 4.15.

Figure 4.14: Polar Cloud object upload progress

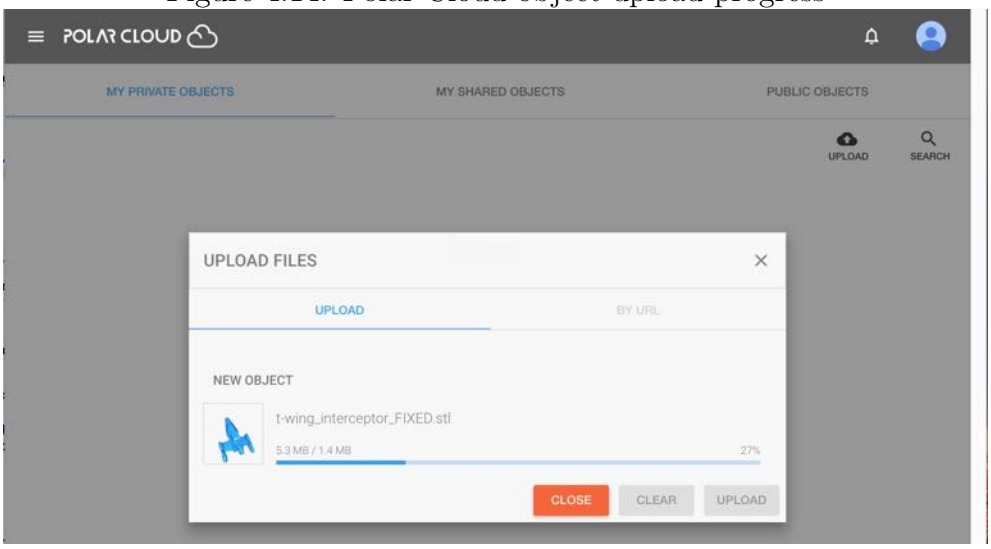
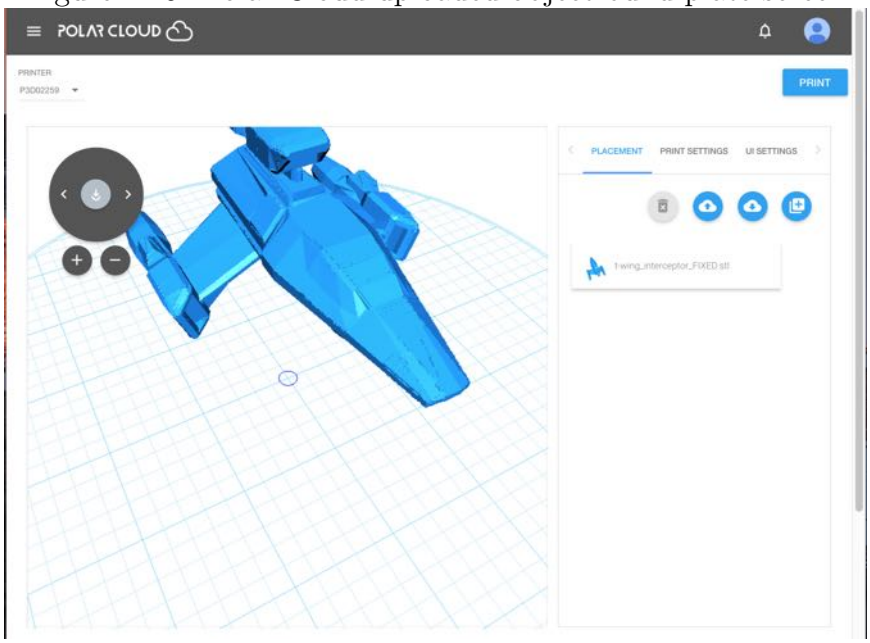


Figure 4.15: Polar Cloud uploaded object build plate screen



From the object's build plate screen, you may perform all the

normal modifications of the object or its print settings (discussed in detail in Section 4.6.1), and then click the "PRINT" button when you are ready to print the object.

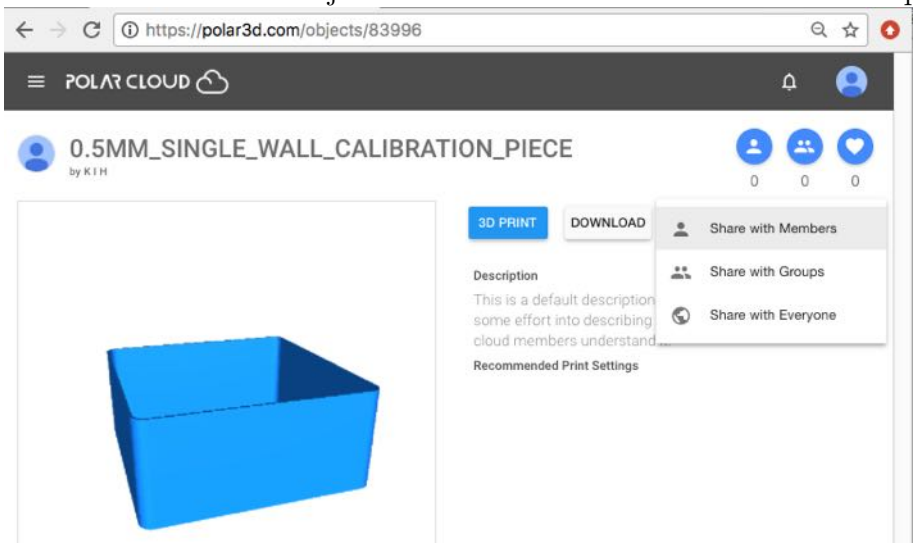
After uploading, the object is now in your collection of objects, and will be included in your listing at the MY PRIVATE OBJECTS screen, as shown in Figure 4.16.

Figure 4.16: Polar Cloud MY PRIVATE OBJECTS screen after upload

To download, from a Polar Cloud object detail screen, such as shown in Figure 4.10, you may click the "DOWNLOAD" button to save the object (.stl file(s)) to your device. (Note that you may download to your device any type of object in the Polar Cloud: private object, shared object, or public object.)

Downloading can also be performed on objects accessible to you from within a print queue using the print queue job edit menu, or from printer history, or from your account history.

Figure 4.17: Polar Cloud object `SHARE` button `Share with Members` option



4.2.2 Sharing objects

There are three types of sharing of objects: sharing an object only with specified members, making an object public (any Polar Cloud member may access it), or sharing an object with members of particular groups (only members in those groups may access it).

To share an object with specified members, from the object detail page click the "`SHARE`" button and select "`Share with Members`"; see Figure 4.17. This will bring up a "`SHARE WITH MEMBERS`" search screen, where you may search for and add the Polar Cloud members with whom you wish to share your object; see Figure 4.18. Note that the searching is by Polar Cloud account display name.

To make an object of yours public, so that all others in the Polar Cloud may copy and use it, from the object's screen, see

Figure 4.18: Polar Cloud object `SHARE WITH MEMBERS` screen

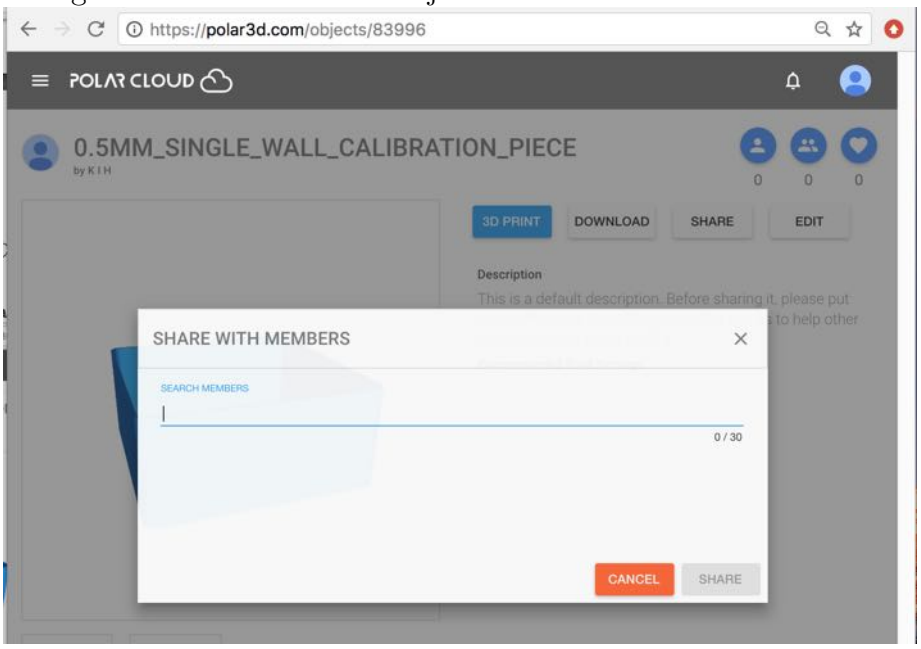
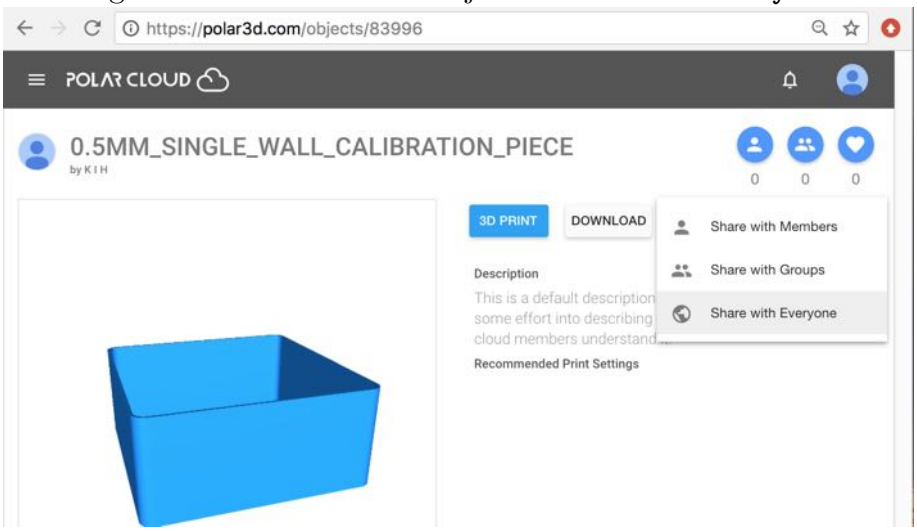


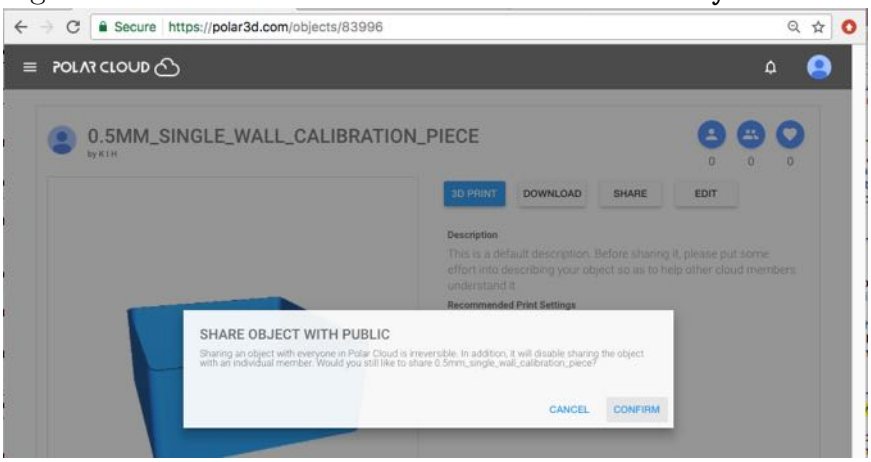
Figure 4.10, click the "`SHARE`" button, and then select "`Share with Everyone`"; see Figure 4.19.

Figure 4.19: Polar Cloud object `Share with Everyone`



Since making an object public is an irrevocable action, you will be asked to confirm this action; see Figure 4.20. Once an object is shared publicly, note that it cannot then be shared to specific Polar Cloud members nor re-shared to everyone (as either would serve little purpose – any Polar Cloud member can access any public object regardless); however, public objects *can* be shared with groups, for convenience in drawing group members' attention to an object.

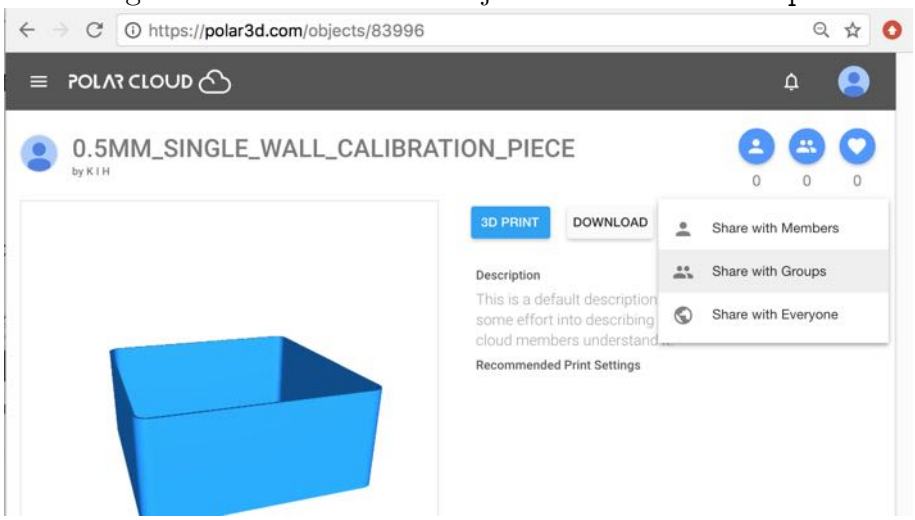
Figure 4.20: Polar Cloud confirm `Share with Everyone` action



Note that sharing an object with everyone in the Polar Cloud, that is, making it a public object, means that your Polar Cloud display name is associated publicly with that object. In particular, if a student member shares an object publicly, that student (and any biographical data they have included in their account biography) thereby becomes somewhat more publicly visible in the Polar Cloud. Teachers may wish to discuss this aspect of public posting of objects with their students.

To share an object with specific groups, there are two approaches. The first approach is to perform the sharing from the

Figure 4.21: Polar Cloud object `Share with Groups`



object detail page, analogous to the approaches discussed above for sharing an object with specific members or publicly. The second approach is to perform the sharing from the group's own "`OBJECTS`" screen. The approaches have an equivalent effect, and will be discussed respectively below.

To share an object with a group from the object detail page, click the "`SHARE`" button and then select "`Share with Groups`"; see Figure 4.21. This will bring up a "`SHARE WITH GROUPS`" screen, where you may select (or search) among the groups of which you are a member for groups with which you wish to share your object; see Figure 4.22. Once you have clicked the checkbox(es) of a group or groups with which to share the object, you must click the blue "`SHARE`" button (towards the bottom right of the "`SHARE WITH GROUPS`" screen) to share the object; see Figure 4.23.

To share an object of yours with a specific group from the group's own "`OBJECTS`" screen, navigate to that group, click

Figure 4.22: Polar Cloud `SHARE WITH GROUPS screen`

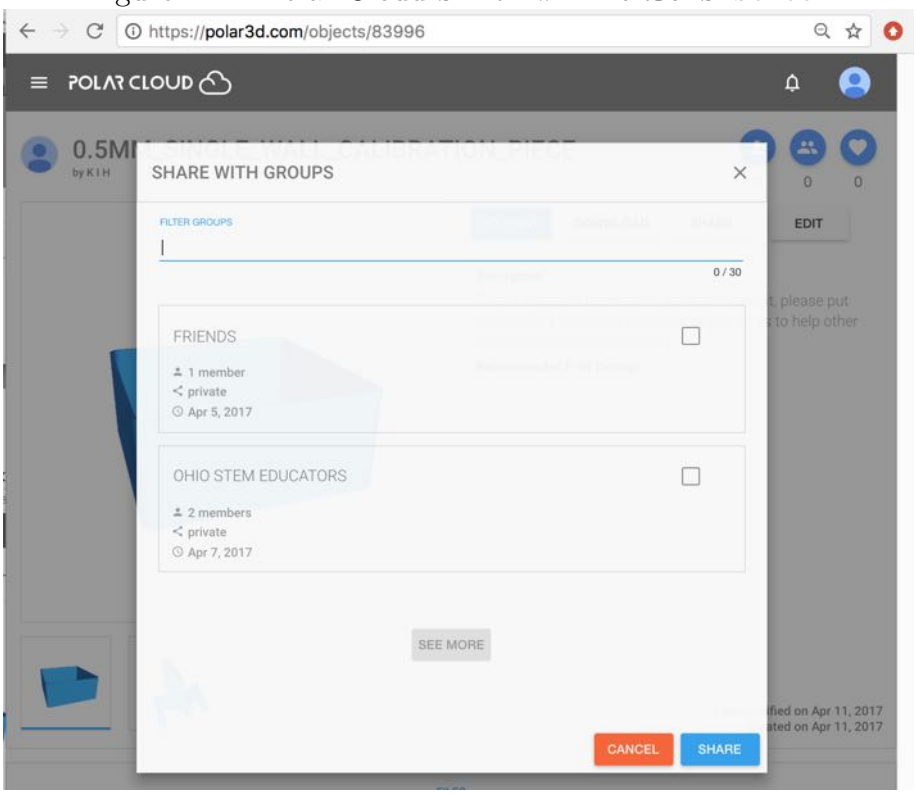
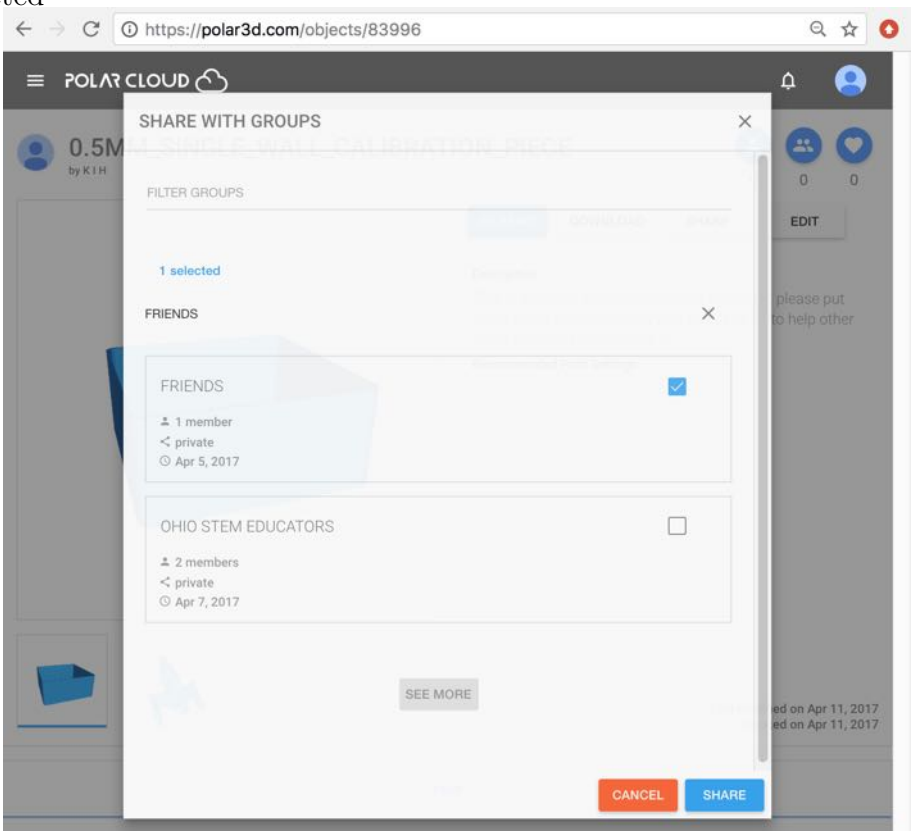


Figure 4.23: Polar Cloud `SHARE WITH GROUPS` screen with `FRIENDS` group selected



the "OBJECTS" tab for the group, and click "SHARE"; this will bring up a window in which you may search your own objects and select some to share. Select which objects by clicking the checkbox to the left of the desired object(s), and click "SHARE" in this object selection window. See Section 4.4.5 for an example of this process.

Note that you may "UNSHARE" objects that you have shared with specific other Polar Cloud members.

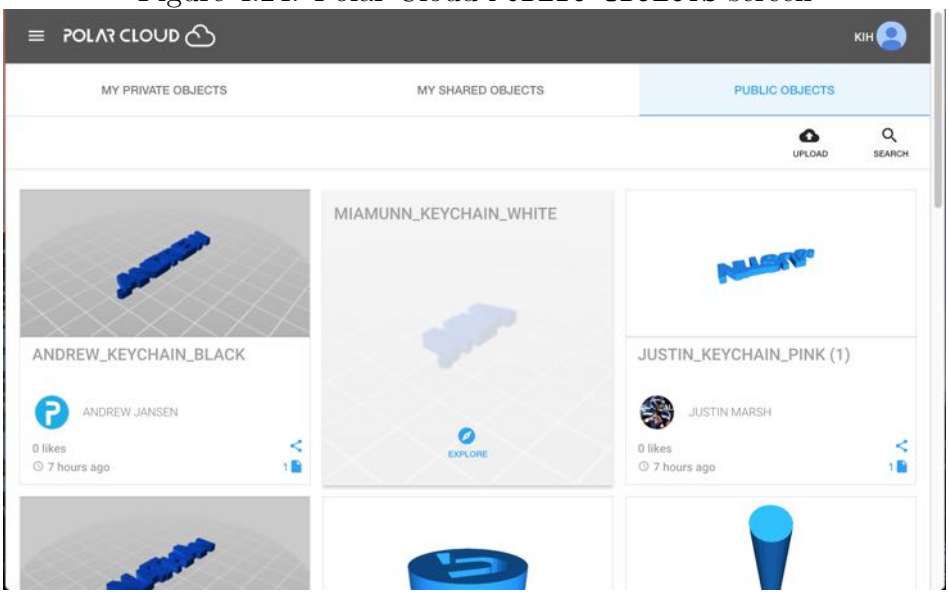
A group manager may "UNSHARE" from a group any object that any group member has shared with the group; however, to reduce the chance that a group member inadvertently "UNSHARE"s an object intended to be shared as part of a class assignment, ordinary group members can not "UNSHARE" any group objects, even ones they themselves shared with the group. (However, if a group member shared one of their own objects with a group, that member may "DELETE" the object, thereby effectively removing it from the group.)

You can neither "UNSHARE" nor "DELETE" any public object.

4.2.3 Searching for objects

To find objects that others have shared publicly in the Polar Cloud, from the "OBJECTS" screen shown in Figure 4.9, click the "PUBLIC OBJECTS" tab to go to a screen of publicly shared objects, shown in Figure 4.24, and click on the "SEARCH" button (or magnifying glass icon); then enter search terms for the sort of object you wish to find. Object name and description are compared when searching.

Figure 4.24: Polar Cloud `PUBLIC OBJECTS` screen



For instance, searching for "`box`" will result in a more specific list of objects, as shown in Figure 4.25.

To find objects shared within a group of which you are a member, select "`GROUPS`" from the Polar Cloud top menu (see Figure 4.32), click on a particular group to go to that group's menu (see for instance Figure 4.38), click on the "`OBJECTS`" tab to take you to a screen such as shown in Figure 4.26.

To find objects shared personally with you, select "`OBJECTS`" from the Polar Cloud top menu, click the "`MY SHARED OBJECTS`" tab to go to a screen of objects shared individually with you, and click the "`SEARCH`" button (or magnifying glass icon); then enter search terms for the sort of object you wish to find.

Figure 4.25: Polar Cloud search for a `box` object

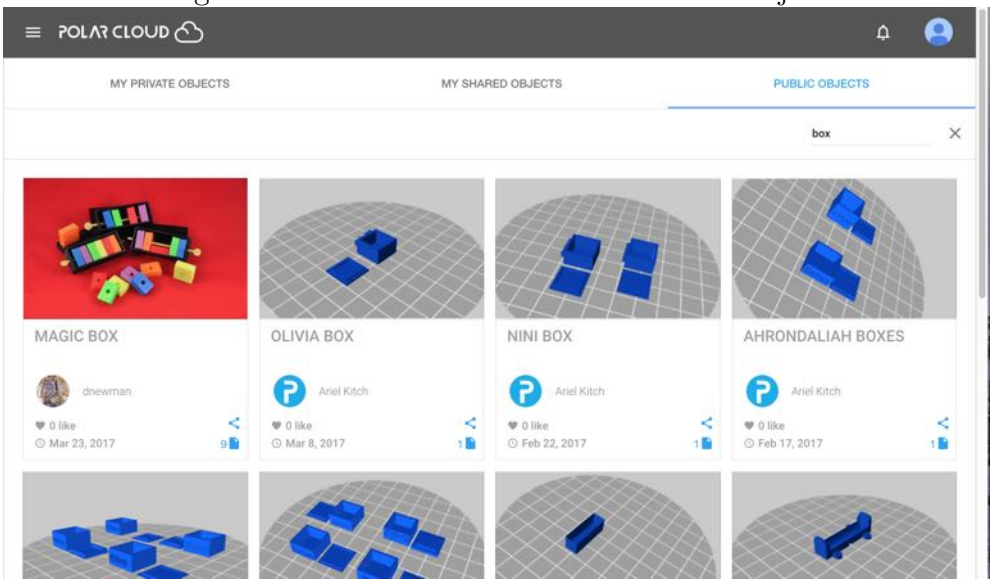
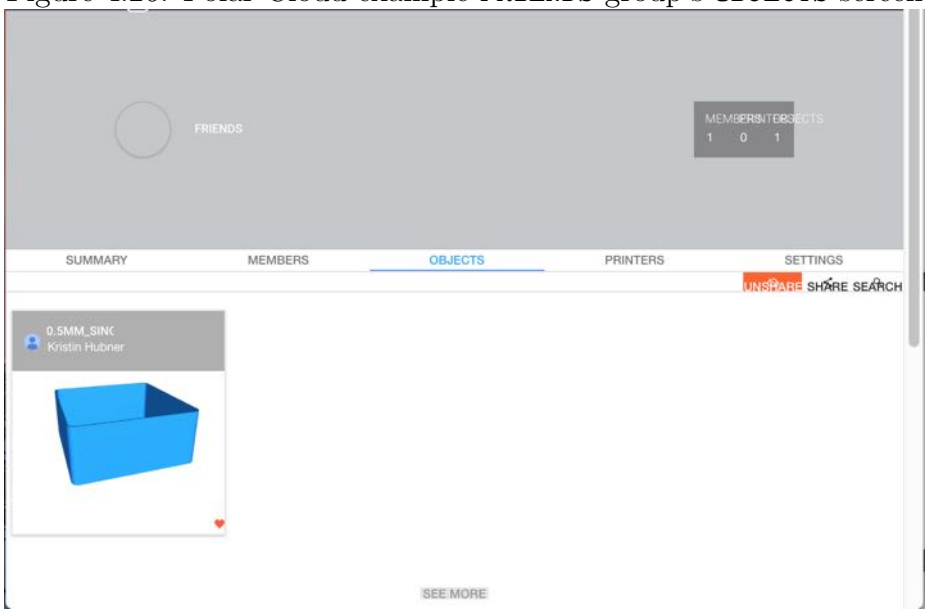


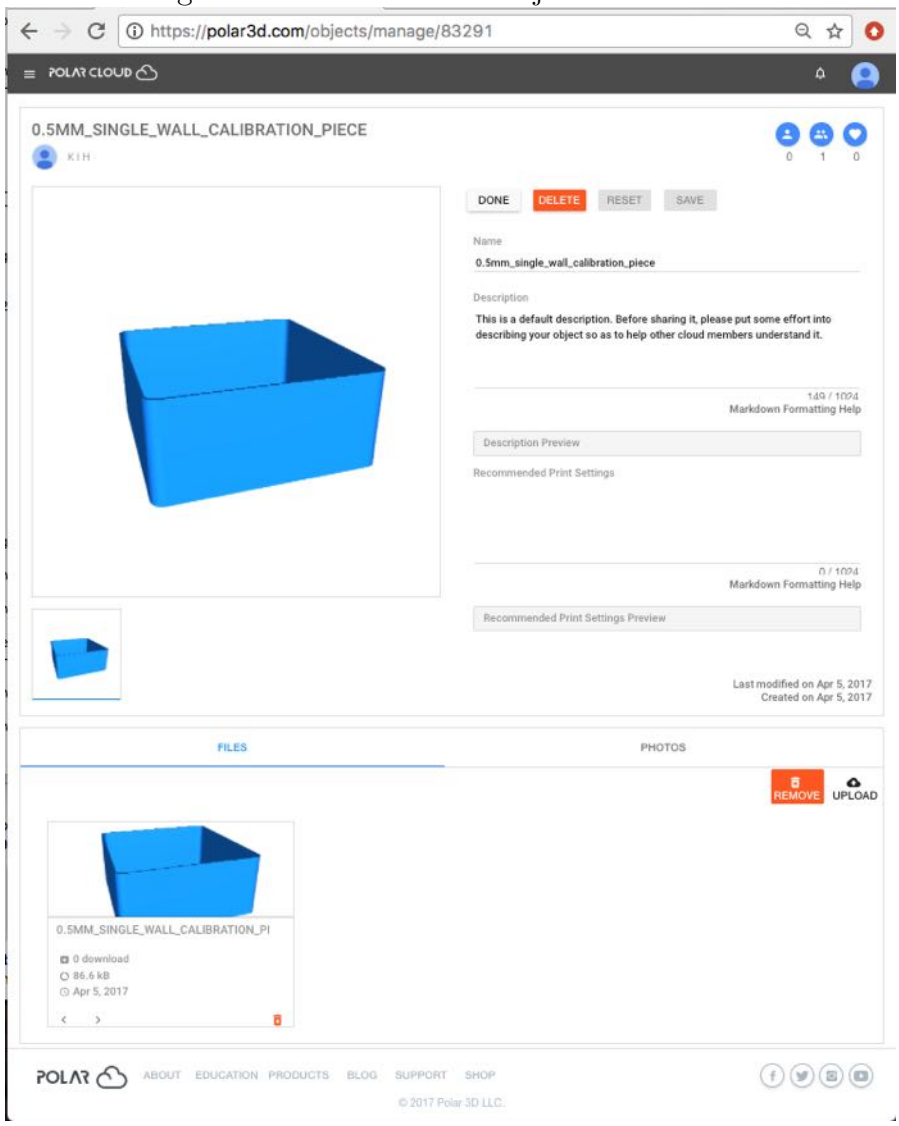
Figure 4.26: Polar Cloud example `FRIENDS` group's `OBJECTS` screen



4.2.4 Object description, print recommendations, photos

To add or change the description of an object, or add recommendations on printing it, click on the "EDIT" tab from the object detail page; see Figure 4.10. "EDIT" will take you to a screen such as shown in Figure 4.27, where you may enter or modify a description of the object, recommend print settings, upload additional `.stl` files or remove existing files, or upload (or remove) your own photos of a printed object.

Figure 4.27: Polar Cloud object `EDIT` screen



Once you are satisfied with your description or other details, click the "`SAVE`" button towards the top of the screen. (If you do not like your edits, you may click "`RESET`".) Then click "`DONE`" to finish editting and return to the object page.

4.2.5 Deleting an object

In general, there is little need to delete objects from the Polar Cloud, and you may wish to retain them in your Polar Cloud account for future reference. However, if you have an object whose `.stl` files are deeply flawed, or which was quite unsatisfactory in other ways, you may wish to remove it from your Polar Cloud account, so that you don't unintentionally refer to it and perhaps start printing it again in future.

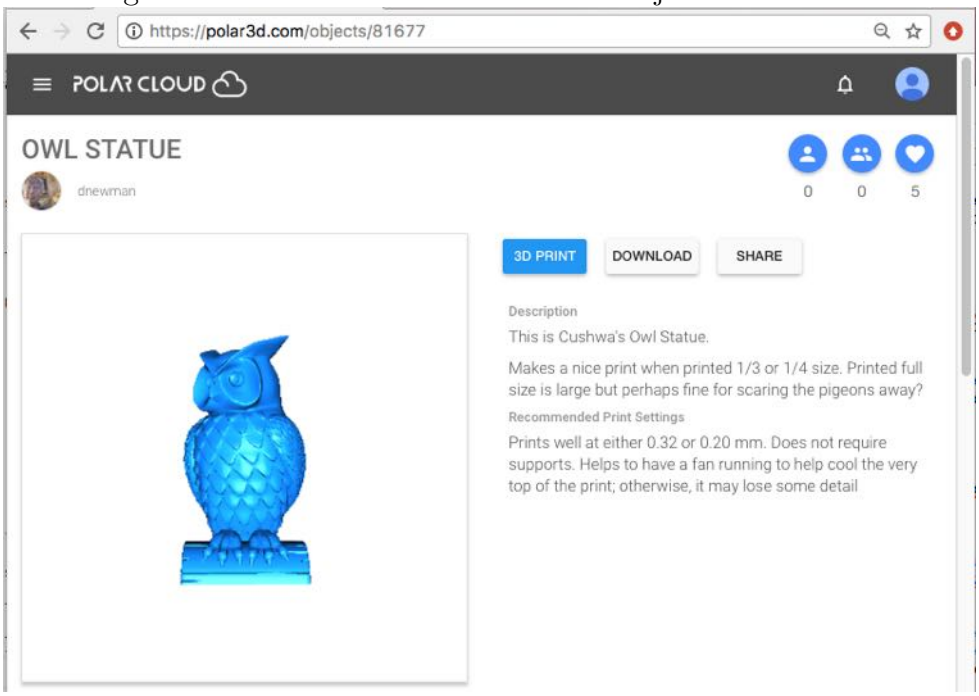
To delete one of your objects, whether entirely private, shared with some specific other Polar Cloud members, or shared with a group, select it (from where it is listed under "`MY PRIVATE OBJECTS`, or "`MY SHARED OBJECTS`, or a group's "`OBJECTS`") to get to the object's detail page, see Figure 4.10. Then click "`EDIT`" to get to the object's manage page; see Figure 4.27. Then click the red "`DELETE`" button towards the top.

Objects that have been shared publicly can not be deleted.

4.2.6 Object `LIKE`s

To `LIKE` an object, at the object's screen, see Figure 4.28, click on the heart icon towards the upper right. Note that the number of `LIKE`s an object has already received is tallied under the heart icon. You may not "`LIKE`" your own objects.

Figure 4.28: Polar Cloud `OWL STATUE` object detail screen

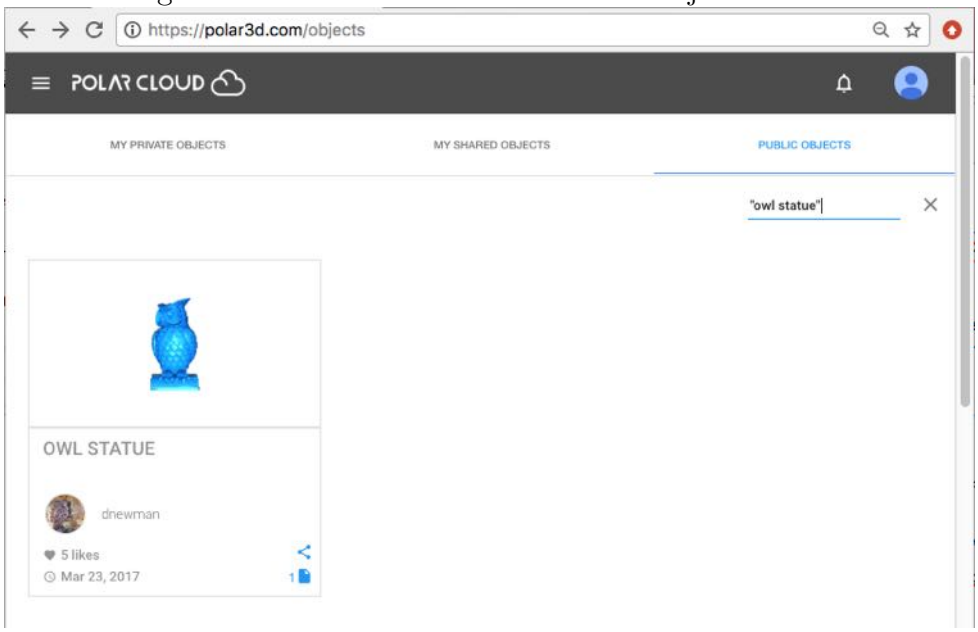


When an object is listed on the `OBJECTS` screen, the number of `LIKE`s an object has received is displayed towards the lower left; see Figure 4.29.

Once you personally have clicked to "`LIKE`" an object, the heart icon will then appear in red; see Figure 4.30.

Figure 4.30: Polar Cloud `LIKE` heart is red for personally liked object

Figure 4.29: Polar Cloud `OWL STATUS` object's `LIKES`

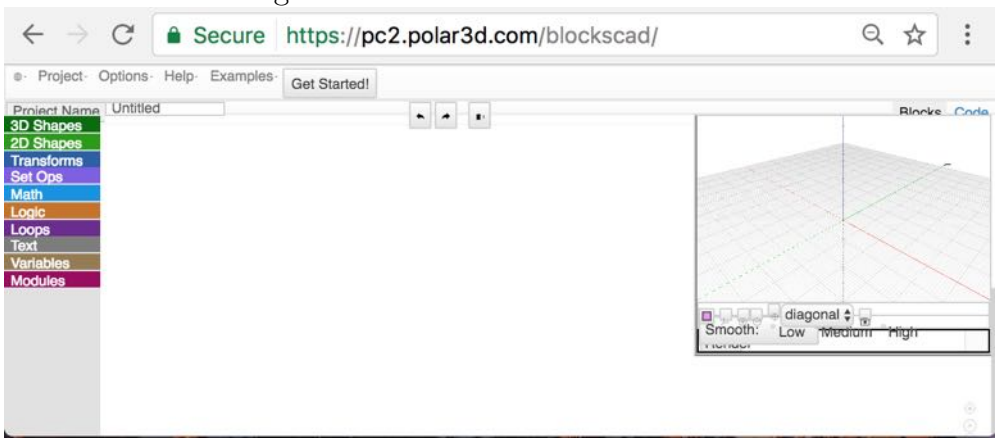


4.3 Creating objects using CAD software within the Polar Cloud

The Polar Cloud itself provides access to some convenient CAD software. Under the main Polar Cloud screen, go to "`OBJECTS`", then "`YOUR OBJECTS`", and then "`CREATE`".

(Note that if you prefer to use external CAD software and then import the `.stl` files you generate into the Polar Cloud, that is fully supported too. See Chapter 6 for a list of some suggested CAD packages, and see Section 4.2.1 for a discussion of uploading object files, once you create them.)

Figure 4.31: Polar Cloud BlocksCAD



4.4 Groups in the Polar Cloud

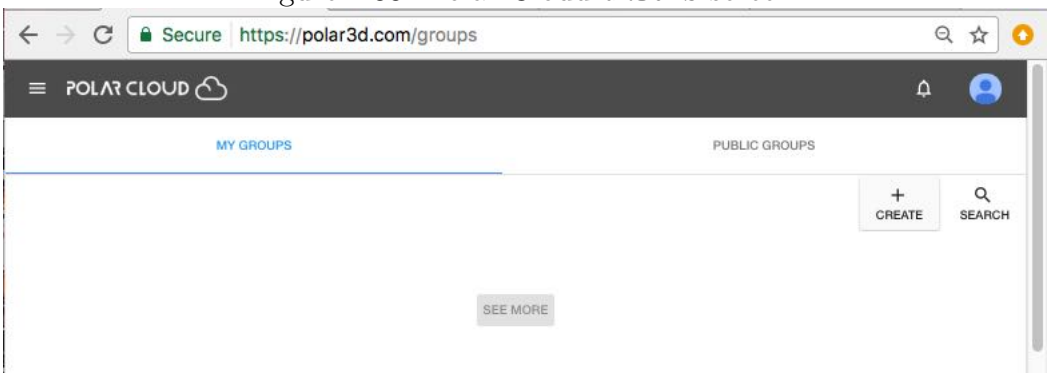
Polar Cloud groups provides a convenient means of sharing printer access, printer control, and objects with group members. Creating a group is typically the most convenient way to configure class, lab, school, library, or club access to a printer.

Figure 4.32: Polar Cloud top menu `GROUPS` tab

From the Polar Cloud main screen, expanding the left-hand menu lists "`GROUPS`" as one of the choices; see Figure 4.32.

Clicking "GROUPS" will take you to the GROUPS screen, with tabs to list either "MY GROUPS" or "PUBLIC GROUPS", as shown in Figure 4.33.

Figure 4.33: Polar Cloud GROUPS screen



Note that when you click "GROUPS", you will see highlighted whichever of "MY GROUPS" or "PUBLIC GROUPS" you most recently viewed.

4.4.1 Creating a group

To create your own group (whether that be a class group, a club group, or simply a group of like-minded makers), click the "CREATE" button shown in Figure 4.33, and fill in the fields describing the group on the group creation screen shown in Figure 4.34; click the "CREATE" tab (towards the lower right of the "CREATE A GROUP" pop-up screen) once you have filled in the fields.

Note that if you intend to set your group to allow it to be visible and searchable within the Polar Cloud, see Section 4.4.2, then including informative text in the "DESCRIPTION" and

"LOCATION" fields will aid other Polar Cloud members in searching for your group – so especially if you are planning to change this group from the default "PRIVATE" setting to instead make it "MODERATED" or "PUBLIC", consider adding informative text to these fields.

Figure 4.34: Polar Cloud group create screen

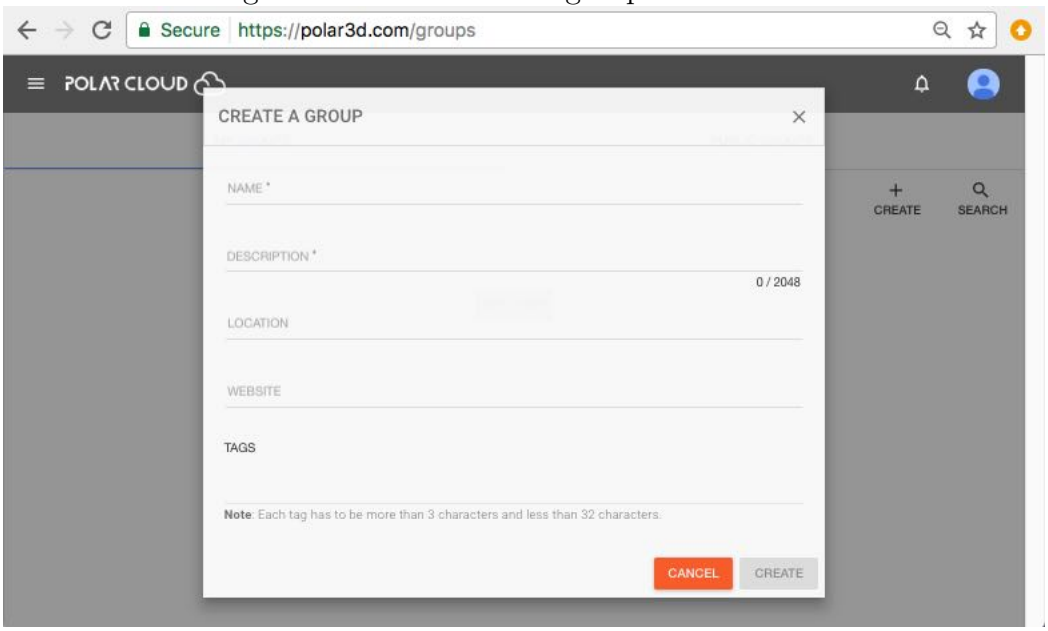
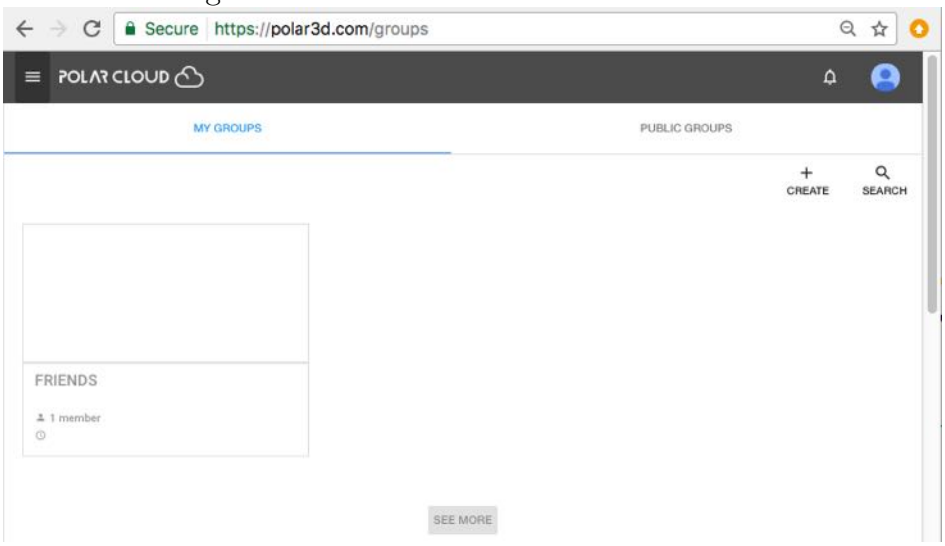


Figure 4.35: Polar Cloud `MY GROUPS` screen

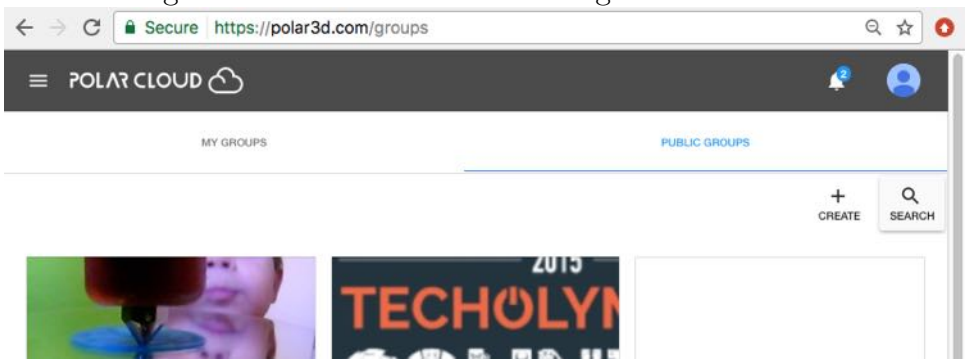


Once you have created a group, it will show up under the "`MY GROUPS`" list; for example, Figure 4.35 shows a group "`FRIENDS`".

4.4.2 Group settings

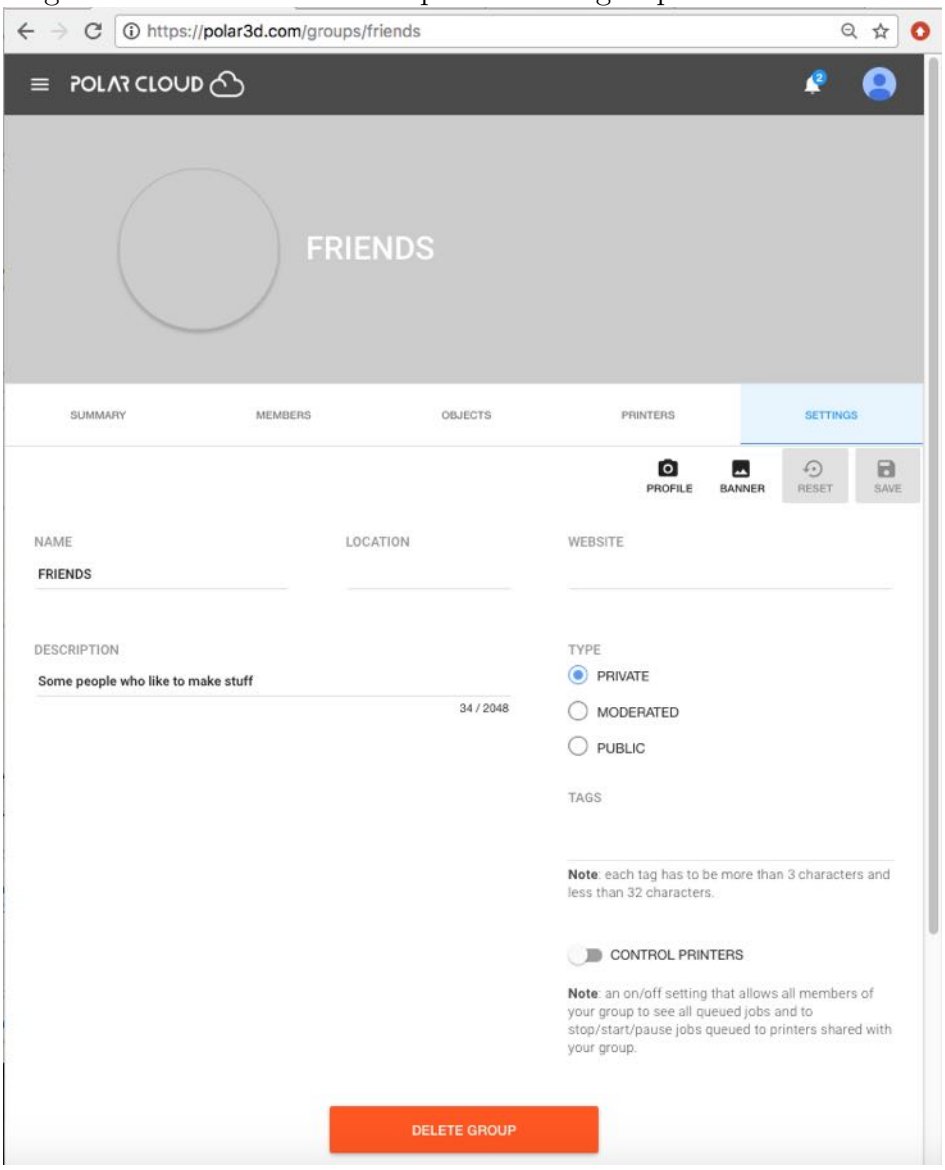
When you create a group, by default it is `PRIVATE`: only members of the group can see details about the group, or find it by searching via the "`SEARCH`" button at the Polar Cloud `GROUPS` screen; see Figure 4.36.

Figure 4.36: Polar Cloud searching `PUBLIC GROUPS`



Clicking on the `SETTINGS` tab at the group screen, see Figure 4.38, will take you to the group's `SETTINGS` screen; see Figure 4.37.

Figure 4.37: Polar Cloud sample `FRIENDS` group's `SETTINGS` screen



At the group's `SETTINGS` screen, click "`PUBLIC`" if you would like any Polar Cloud member to be able to join the group (with no approval required), view full group membership, and find the group by searching via the "`SEARCH`" button at the Polar Cloud

GROUPS screen. Click "MODERATED" if you would like requests to "JOIN" the group to require either knowledge of the group's join code or approval by you (the group owner), limit viewing of the full membership list of the group to the group's members (outsiders able to see only the group's manager(s)), and have the group's existence and name findable via "SEARCH.

For privacy reasons, typically school or class groups including student members should *not* be set "PUBLIC". However, if you wish the existence of your group to be visible while keeping the membership list private, you may set the group to be "MODERATED": with this setting, only your group's existence and your status as manager of the group will be visible within the Polar Cloud, and anyone wishing to join the group will either need the group's join code or have to make a request which will come to you.

Another group setting that may be of interest is the "CONTROL PRINTERS" switch. When you first create a group, by default group members do not have operation control of any group printers: that is, by default group members cannot see other members' jobs queued to such a printer nor start nor stop jobs on the printer. If you wish all group members to have limited operation control over group printers – see all queued jobs, and be able to start and stop jobs – then move this switch to the on position; see Figure 4.51.

Note that "CONTROL PRINTERS" access may be particularly suitable for classes or groups of experienced, reliable students (whereas printer manager access, in contrast, has further privileges, such as the ability to invite or delete Polar Cloud *member* access to the printer, and access the printer local web interface

from within the Polar Cloud, privileges which may not be appropriate to delegate to students). For classroom or lab printers, whether or not you wish to configure a printer so that class group members may control the printer themselves may depend on the age and maturity of your students. For younger students, you may wish to retain all printer control yourself, whereas it may be convenient to allow printer control to an entire class of experienced or older students. If you wish to permit printer control to only a few, selected students in a class, consider defining two groups of students, those with control access and those without, sharing use of the printer with both groups.

4.4.3 Inviting Polar Cloud members to join a group

To invite individually other Polar Cloud members to join your group, click on the specific group from your list of groups, see Figure 4.35. Selecting a specific group will take you to a display screen for that group, as shown in Figure 4.38; at this screen you may perform various group management operations.

To invite a fellow Polar Cloud member, or members, to join a group you have created, from the group's menu (such as shown in Figure 4.38), select "`MEMBERS`", to take you to a screen such as shown in Figure 4.39.

Figure 4.38: Polar Cloud example `FRIENDS` group `SUMMARY` screen

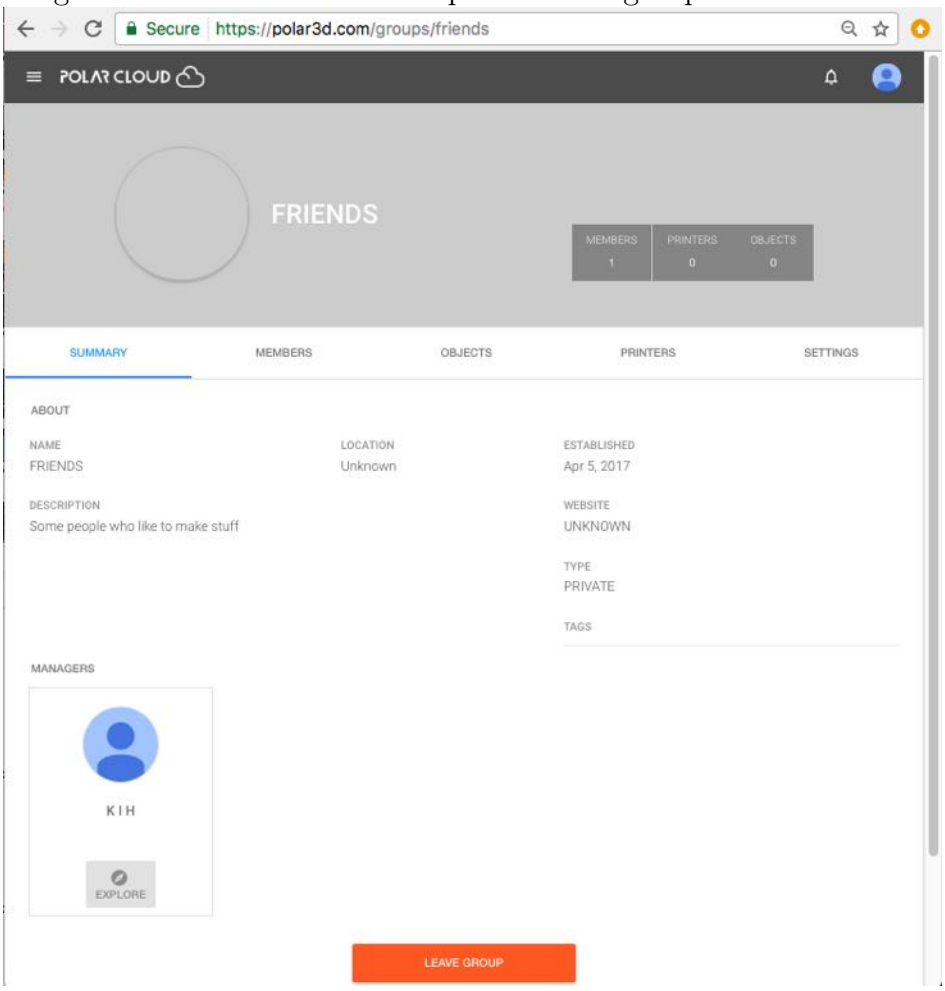
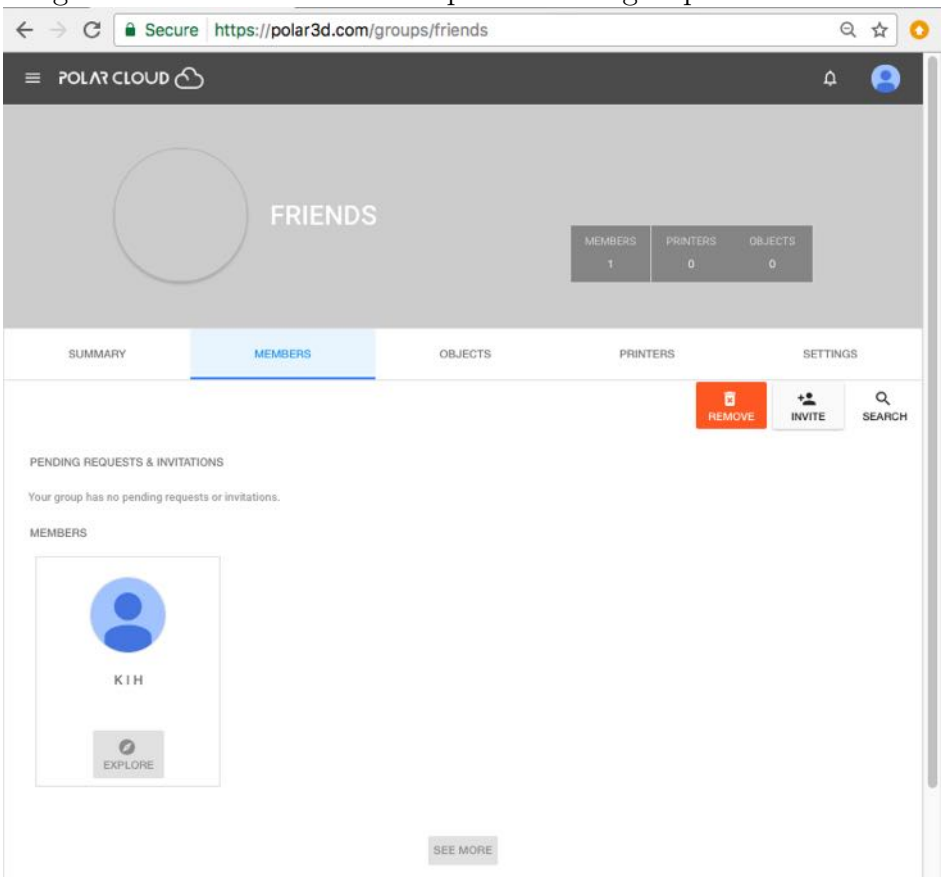


Figure 4.39: Polar Cloud example `FRIENDS` group `MEMBERS` screen



Then click on the "`INVITE`" button (towards the middle right of the group members screen, Figure 4.39). This will take you to an "`INVITE MEMBERS`" screen. Filling in the search field towards the top will show you only the Polar Cloud members who meet the search criteria – see Figure 4.40. Click on the checkbox to the left of the Polar Cloud member(s) who you wish to invite to join your group, as shown in Figure 4.41, and then click "`INVITE`" (towards the bottom right of the "`INVITE MEMBERS`" screen, Figure 4.41).

Figure 4.40: Polar Cloud group member invitation

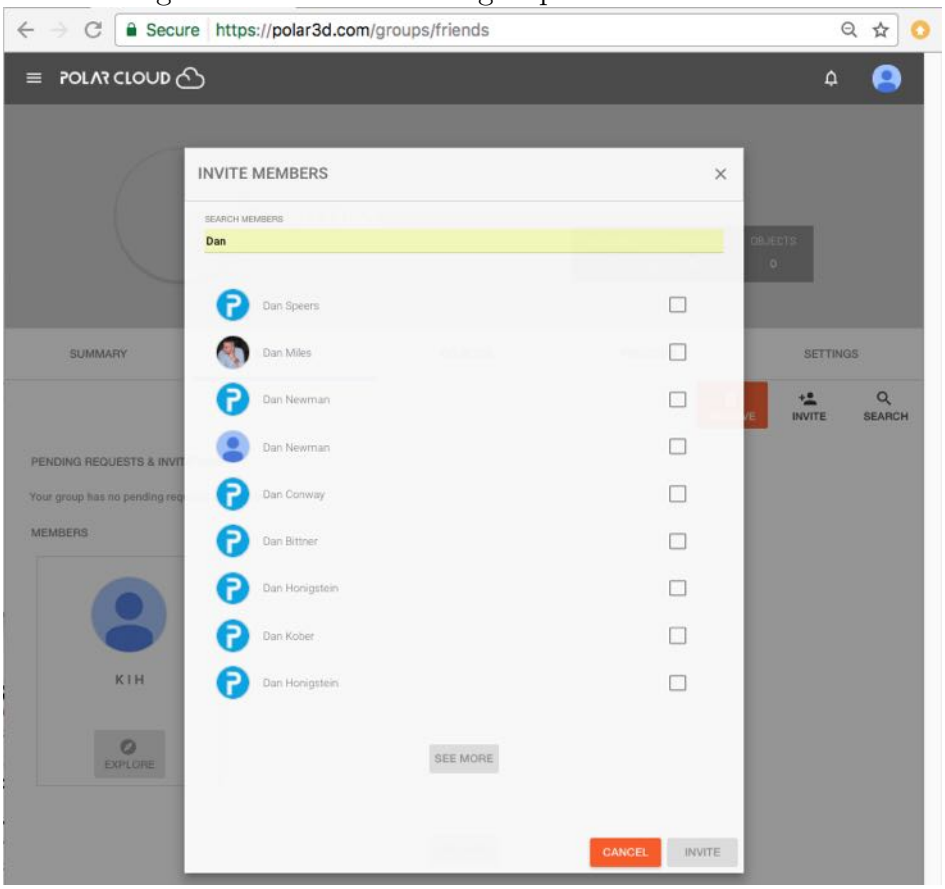
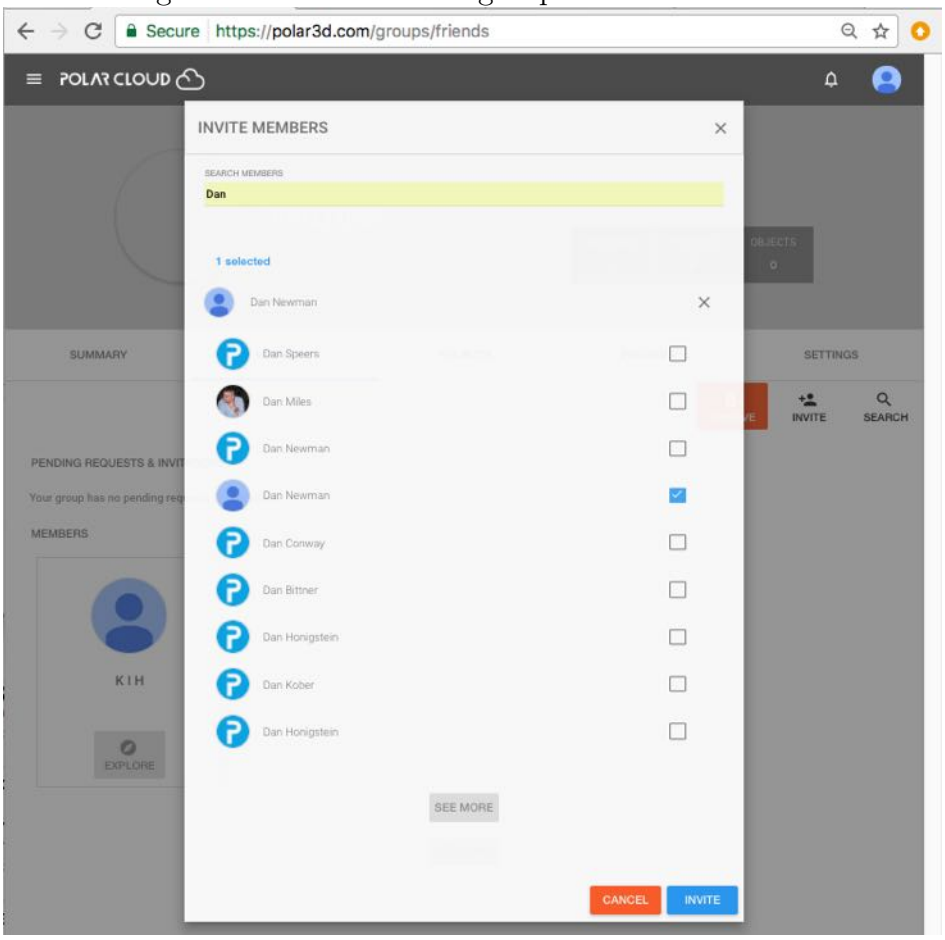
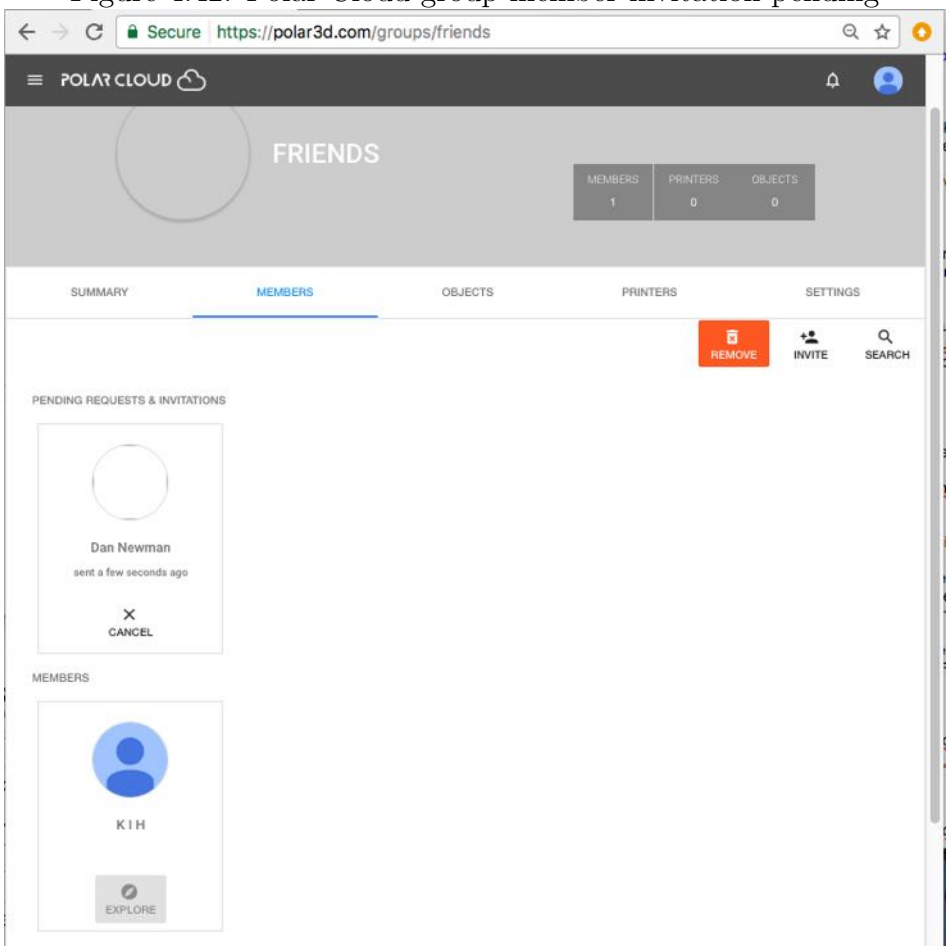


Figure 4.41: Polar Cloud group member invitation



The Polar Cloud member(s) you have invited will be sent an invitation notification to join your group. Such invited Polar Cloud members who have not yet accepted your invitation will show up as pending in your group's member list, as shown in Figure 4.42.

Figure 4.42: Polar Cloud group member invitation pending



Rather than individually inviting Polar Cloud members to join your group, you may set the group to have "`MODERATED`" type, and then inform certain Polar Cloud members of the group join code. Those other Polar Cloud members may then join your group using the group join code, without you having to individually select them in the Polar Cloud. For instance, a classroom teacher might inform all students in a class of the group join code for the class group, telling the students to go

use that group join code to join.

4.4.4 Requesting to join a group

A group's "TYPE", under the groups "SETTINGS" (see Section 4.4.2), controls how a group may be joined.

For a PUBLIC group, clicking the "JOIN" button will add you immediately to the group.

For a MODERATED group, a group join code is generated by the Polar Cloud, visible to the group owner on the group's "SUMMARY" screen. The group owner *may* choose to pass this code along to Polar Cloud members whom the group owner wishes to allow to join the group: for instance, for a class group, a teacher might pass out the group join code to all the students in the class.

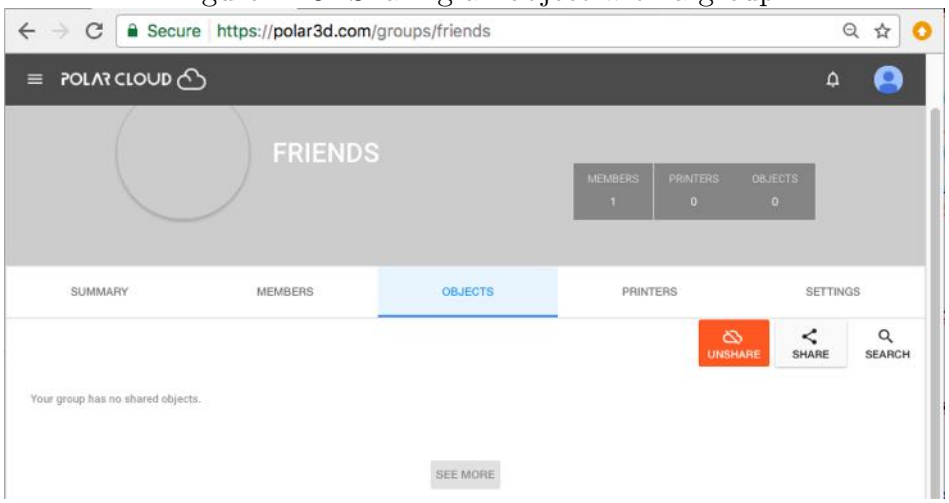
When a Polar Cloud member clicks the "JOIN" button for a "MODERATED" group, the member has the opportunity to enter the group join code. Entering the group join code will add the member to the group. If a Polar Cloud member does not know the group join code (or does not enter it correctly), then the Polar Cloud member's join request will result in a request notification to the group owner for the group owner to accept or decline.

4.4.5 Sharing objects within a group

The group manager or any members of the group may share within a group any objects to which they have access: such ac-

cessible objects includes public objects, and any objects shared with them by another Polar Cloud member ("`MY SHARED OBJECTS`"). There are two approaches: (1) navigate to the object's detail page, click "`SHARE`", and then "`Share with Groups`" and select the desired group(s) – see Section 4.2.2 for a discussion; or (2) navigate to the group's own "`OBJECTS`" page, click "`SHARE`", and then select the desired object(s), as discussed below. The effect is the same either way; selecting an object and then group(s) to share it with may be more convenient when you are sharing a single object with multiple groups, whereas from within a group selecting object(s) to share may be more convenient when you wish to share multiple objects to a single group.

Figure 4.43: Sharing an object with a group



To share an object using the group's own "`OBJECTS`" page, from the group's menu – see Figure 4.38 – click on "`OBJECTS`" to bring up a screen such as shown in Figure 4.43. Then click on "`SHARE`" (at center right) to bring up a list of objects which you may choose to share with the group as shown in Figure 4.44;

click the checkbox to the left of the object(s) you wish to select; then the click on "SHARE" (bottom right, Figure 4.45) once you have selected which objects to share.

Figure 4.44: List of objects to consider sharing with a group

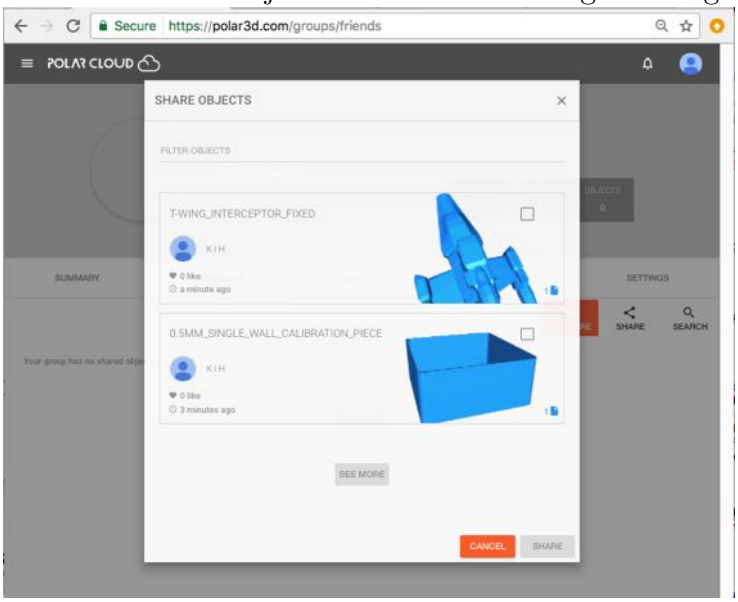
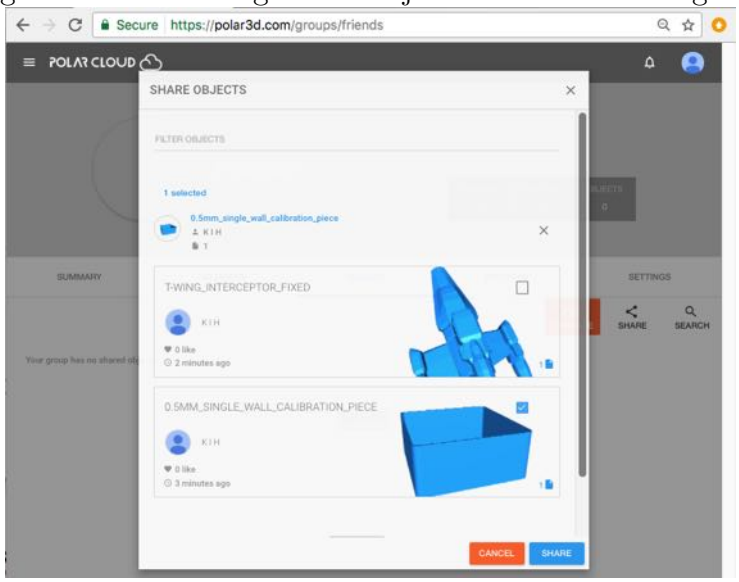
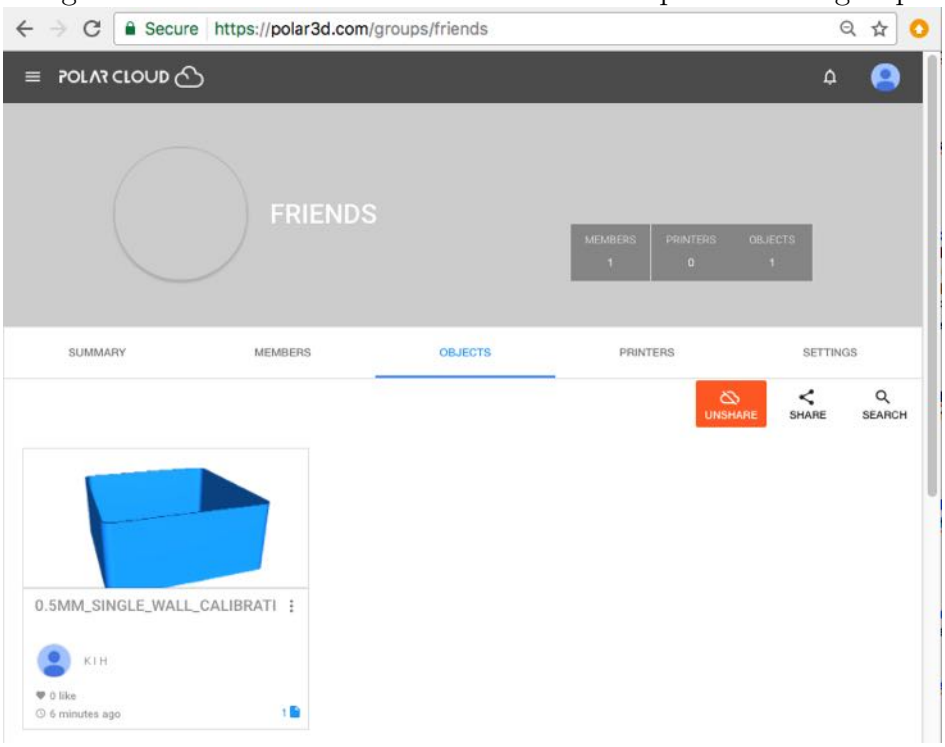


Figure 4.45: Selecting which objects to share with a group



The shared object will now appear under the group's "`OBJECTS`" display, as shown in Figure 4.46.

Figure 4.46: The shared `OBJECTS` in the example `FRIENDS` group



Note that if you wish to create a new object specifically for a group, or upload an object to a group, you will first need to create or upload that object to your own private collection of objects, and *then* share your object to the group.

4.4.6 Sharing printers within a group

A group member who manages a printer may share access to that printer across the group. From the group's menu – see Figure 4.38 – click on "`PRINTERS`" to bring up a screen such as shown in Figure 4.47. Then click on "`SHARE`" (at center right) to bring up a list of printers which you may choose to share with

the group (see Figure 4.48); click the checkbox to the left of the printer(s) you wish to share, and then click on "SHARE" (bottom right, Figure 4.49) when you have selected which printers to share.

Figure 4.47: Sharing a printer with a group

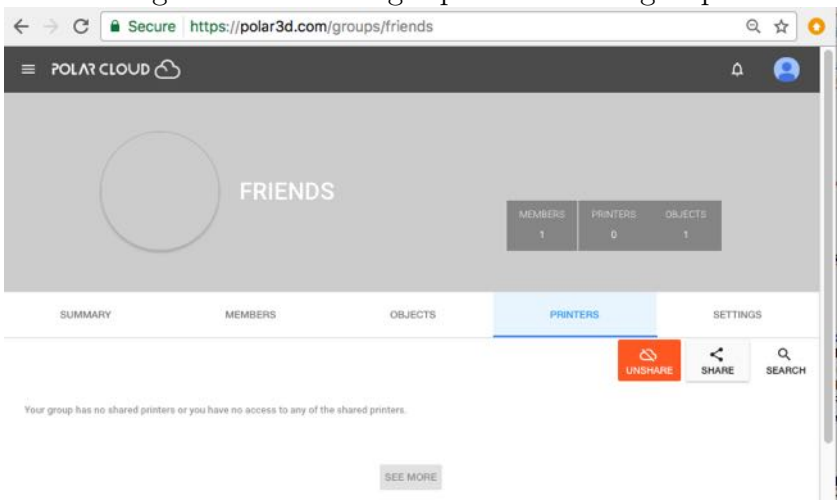


Figure 4.48: List of printers to consider sharing with a group

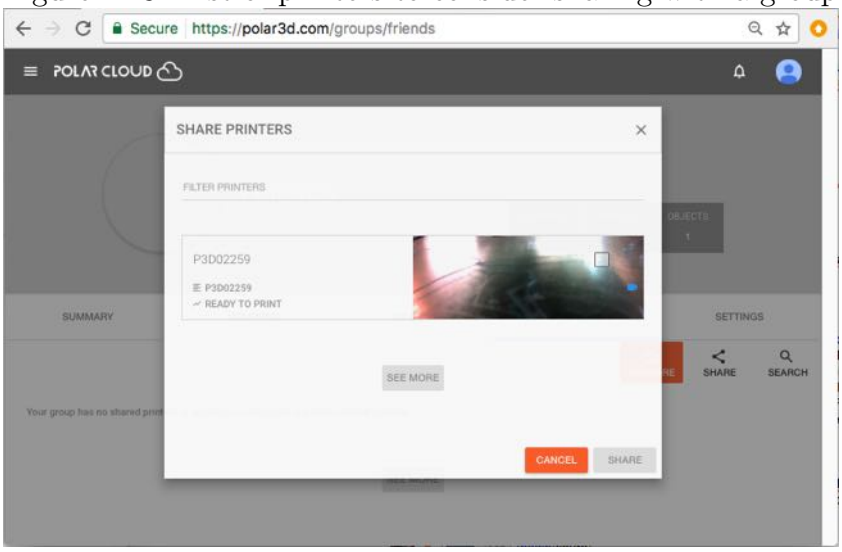
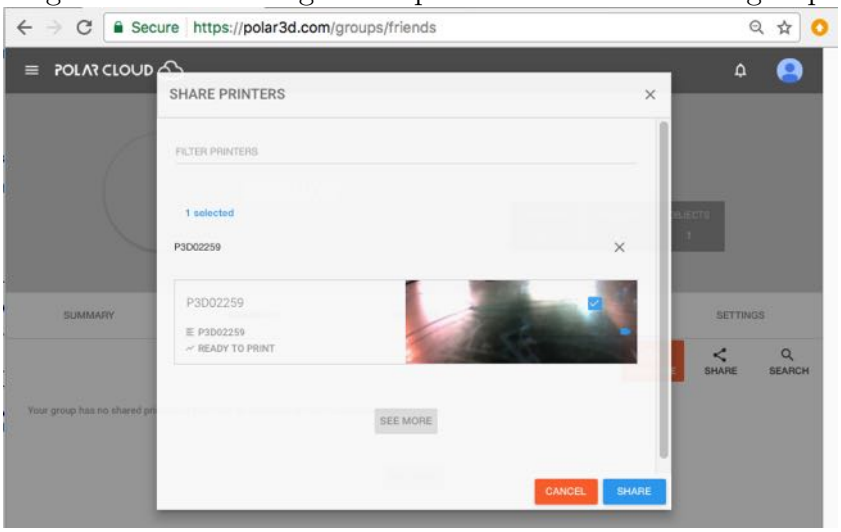


Figure 4.49: Selecting which printers to share with a group



Once you have shared printer(s), they will show up under the "PRINTERS" display for the group, as shown in Figure 4.50.

Figure 4.50: The FRIENDS group's shared printers

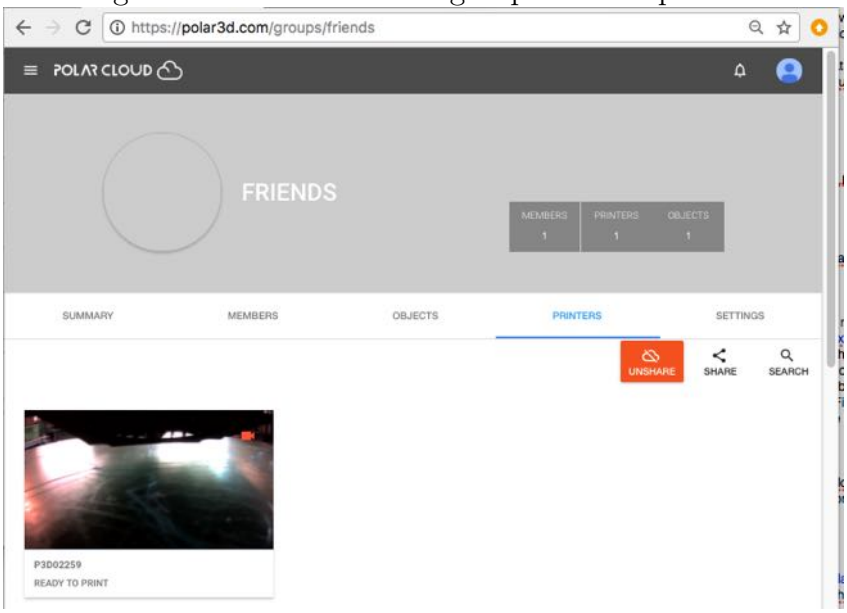
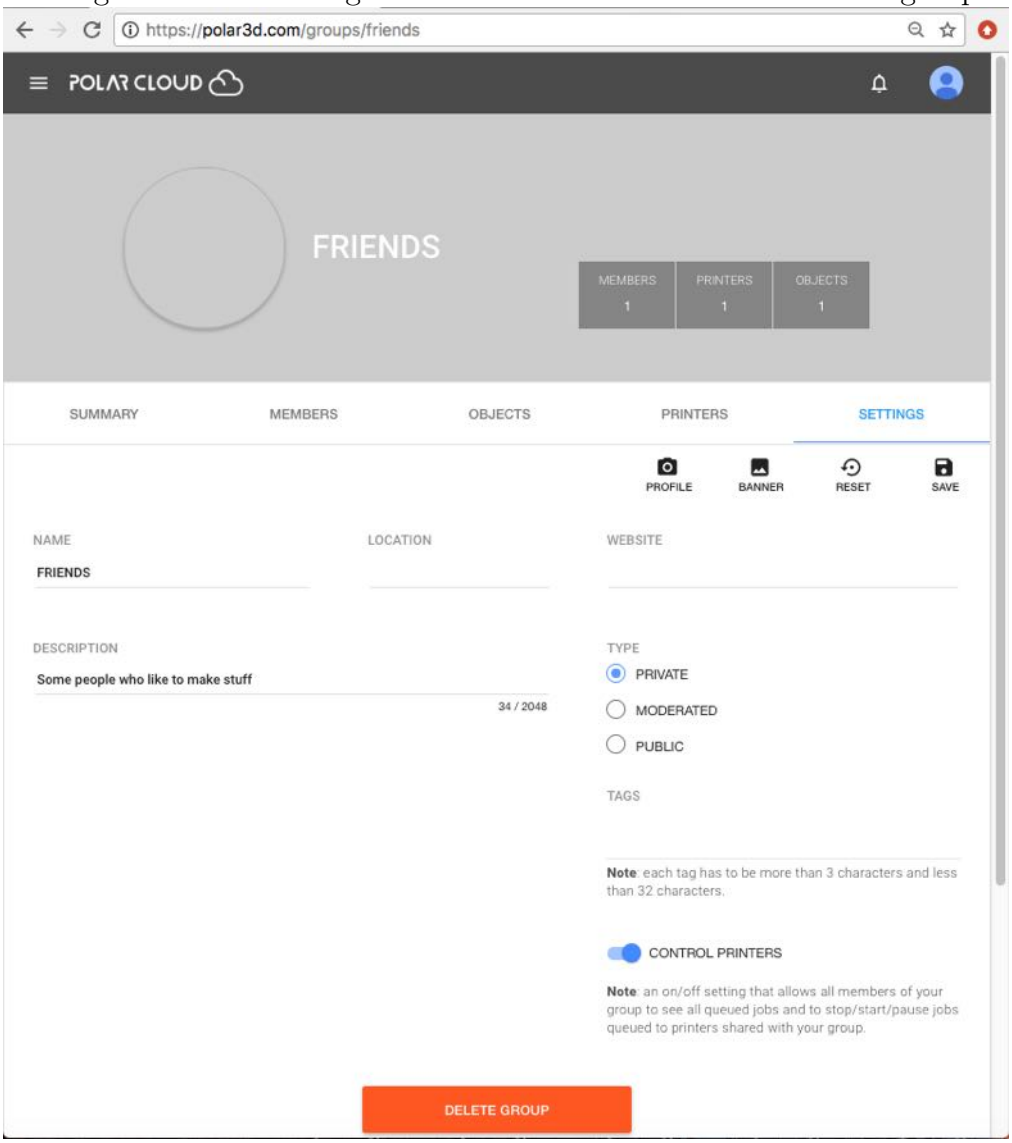


Figure 4.51: Allowing `CONTROL PRINTERS` access to `FRIENDS` group



By default, access to a printer shared with a group does *not* include printer operation control access: group members will have to wait for the printer owner or a manager to "`START`" or "`STOP`" the print jobs. To allow the members of a group to

control printer operation, see the "CONTROL PRINTERS" switch under the group's "SETTINGS" tab; Figure 4.51 shows allowing "CONTROL PRINTERS" access to members of the FRIENDS group.

4.4.7 Searching for a group

There may be existing groups within the Polar Cloud that you would like to join. To find a group of possible interest, you may scroll through or "SEARCH" under the "PUBLIC GROUPS" screen; Figure 4.52 shows an example.

As discussed in Section 4.4.2, you will only be able to see listed and find via searching those groups defined as "PUBLIC" (non-members can see full group details) or "MODERATED" (non-members can only see an overview and the group manager(s), but may not see a list of group members).

Clicking on a group will take you to the group's summary page. Typically, school or class groups will have been defined as "PRIVATE" (in which case you won't be able to see them at all – not even that such a group exists), or as at most "MODERATED" (in which case you can see the group's existence and a few details such as its manager(s), but not its list of members).

To request to join a group, click on the "JOIN" button (at the upper right of the group's summary screen); see Figure 4.53.

Figure 4.52: Polar Cloud `SEARCH` for `library` groups

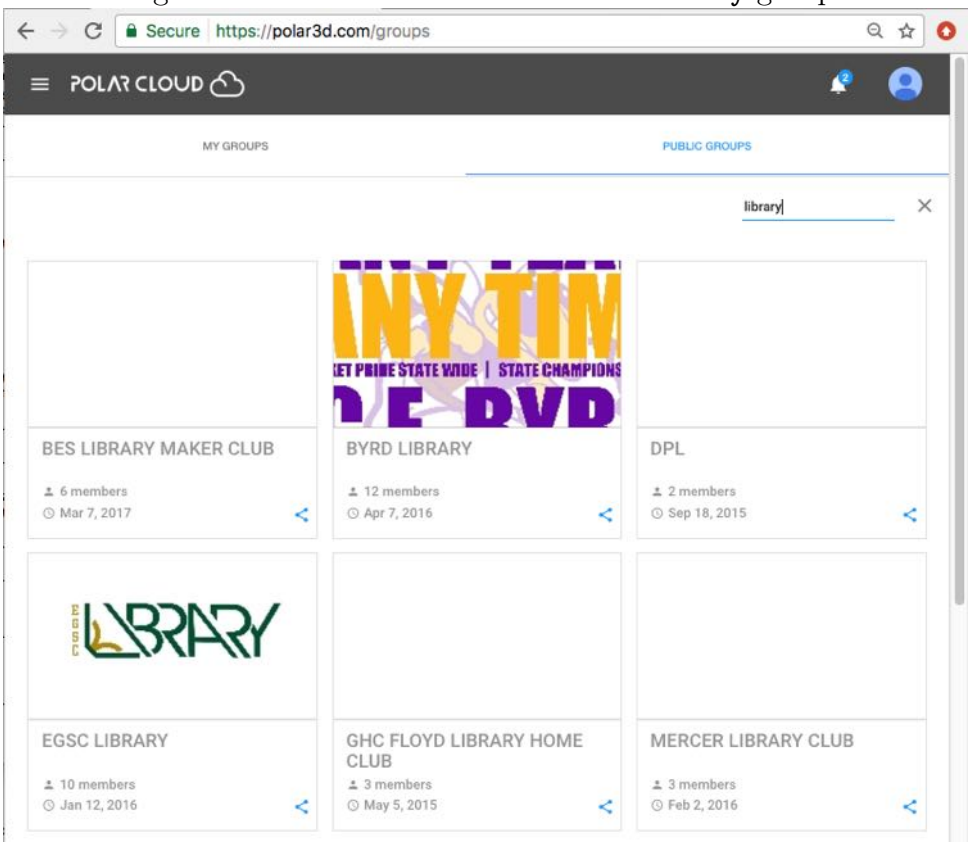
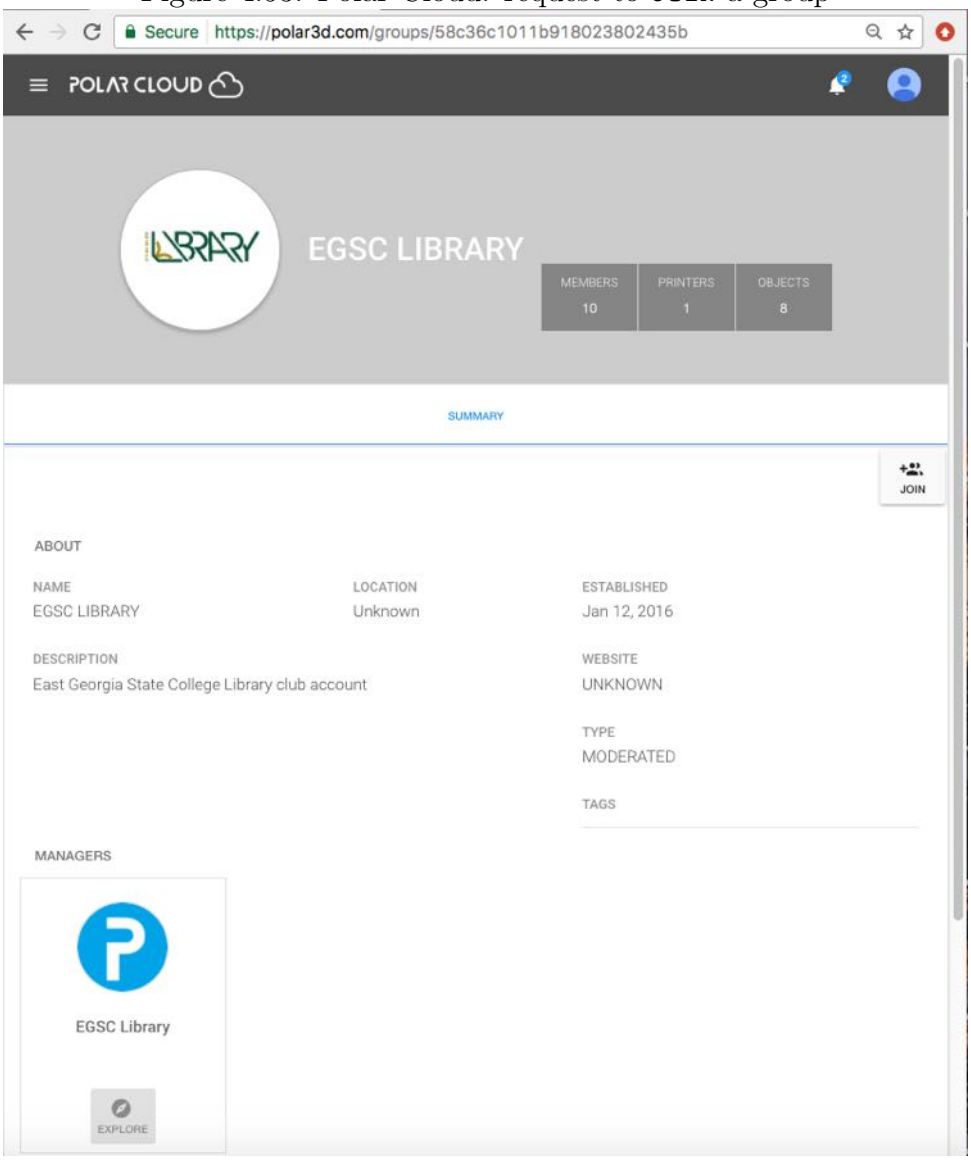


Figure 4.53: Polar Cloud: request to `JOIN` a group

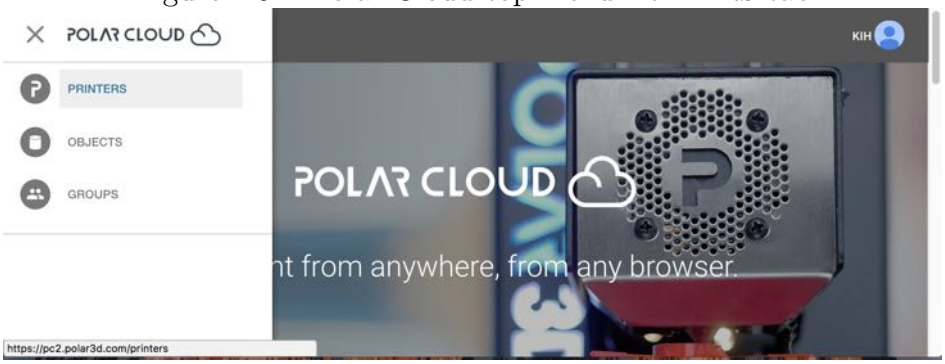


If it is a group configured for "`PUBLIC`" access, you will automatically be added to the group. If it is a group configured for "`MODERATED`" access and you know the group join code, you will be added to the group; without the group join code, the

group owner will receive a notification of your request to join the group, and it will then be up to the group owner whether or not to approve your join request.

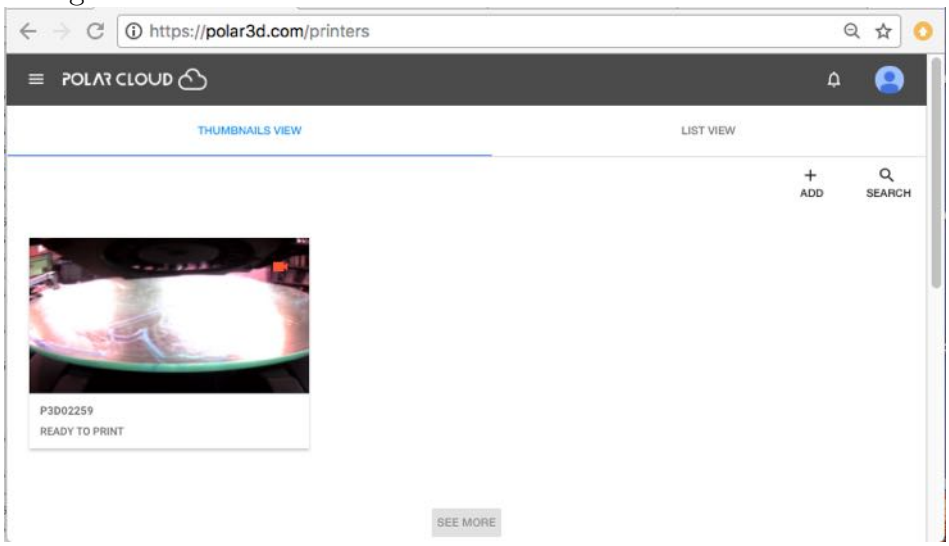
4.5 Managing and sharing printers

Figure 4.54: Polar Cloud top menu PRINTERS tab



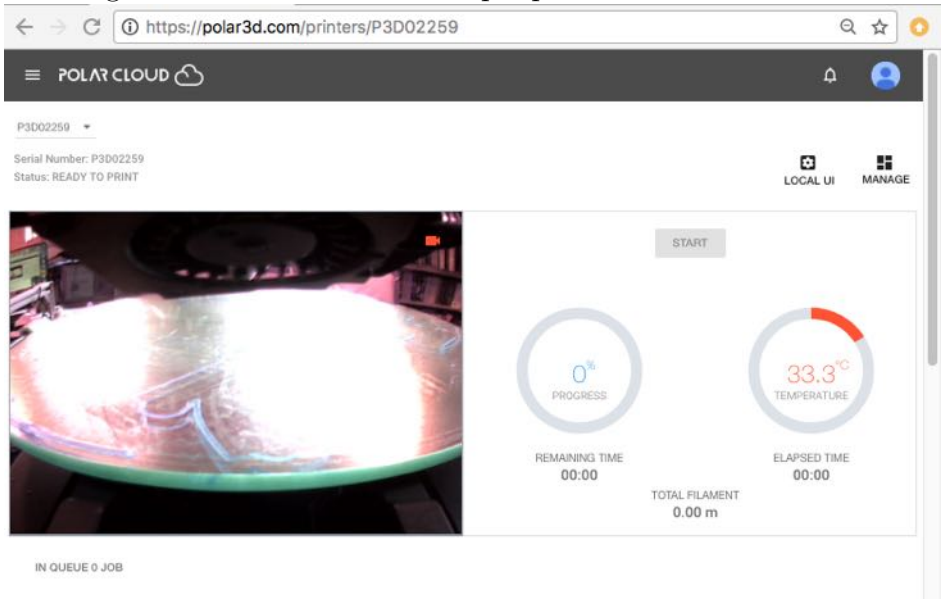
One of the Polar Cloud top menu's main sections is "PRINTERS"; see Figure 4.54. Under that tab, you will see a list of accessible printers (displayed either via icons or via text descriptions), a SEARCH button (magnifying glass), and an ADD button (+); Figure 4.55 shows an example of what the list of printers display might look like with only one printer accessible to you.

Figure 4.55: Polar Cloud `PRINTERS` screen in `THUMBNAILS VIEW`



Clicking on the image of a printer will take you to the printer dashboard screen, as illustrated in Figure 4.56.

Figure 4.56: Polar Cloud sample printer dashboard screen



4.5.1 Adding a printer to your Polar Cloud account

Typically, a printer is first connected to the Polar Cloud by the printer's owner when the printer is first acquired; see the detailed instructions in Chapter 1. And while Polar Cloud members might share management of a printer, that is typically achieved via the printer owner granting manager access to their printers; see Section 4.5.5. That is, printer management can be shared without altering printer ownership, and without altering the printer registration to a particular account in the Polar Cloud.

If you have acquired a previously used printer, especially if it is a printer previously used at your site, see the discussion of changing printer ownership in Section 4.5.2; for some circumstances (in particular, if either the network configuration is still the same or you wish to retain the printer's existing job history and job queues), it may be simpler and more satisfactory to re-assign printer ownership rather than going through the process of adding the printer to your account as a "new" printer (completely re-configuring the printer's network profile and re-registering the printer in the Polar Cloud).

Note that if you attempt to add a printer to your account while it is still registered in the Polar Cloud as having a different Polar Cloud member as its owner, the effect will be that you are added as a manager of the printer, not as the printer's owner, and the printer's existing job history and print queue will be unaffected. This is intentional behavior, as it allows for cases such as a substitute teacher managing the printer while the usual teacher is unavailable: the substitute teacher "adds" the printer and thereby becomes merely a new manager, rather than wiping

out the primary teacher's ownership.

If you wish to "wipe out" a prior printer owner's ownership and printer history and print queues (such as when you have acquired a printer from a different school district or other organization) so that you can register yourself as the owner of the printer in the Polar Cloud, first connect to the printer's local web interface and click the "`Reset Printer on the Polar Cloud`" tab. Then go through the steps to add a printer to your account, as if it were a brand new printer, as discussed in Chapter 1.

4.5.2 Changing printer ownership

Occasionally it may be necessary or useful to switch printer ownership, or to attach a printer originally connected by some other Polar Cloud member to your Polar Cloud account: for instance, if you are taking over or acquiring a previously used printer from another teacher.

If you are merely switching ownership at the same site, without changing connection details (network details), and without a desire to obsolete the existing printer queue and history of print jobs – as for instance, when a new teacher is assigned to take over an existing class and printer – the "`CHANGE OWNER`" button on the printer's `MEMBERS` screen under the printer manage screen, see Figure 4.57, allows the old manager to conveniently reassign printer ownership to another Polar Cloud member; see Figure 4.58. Note that in this case the print queue and printer history will remain unchanged: any pending print jobs can continue without interruption, and the printer history will retain its list of jobs performed.

Figure 4.57: Polar Cloud printer `CHANGE OWNER` button

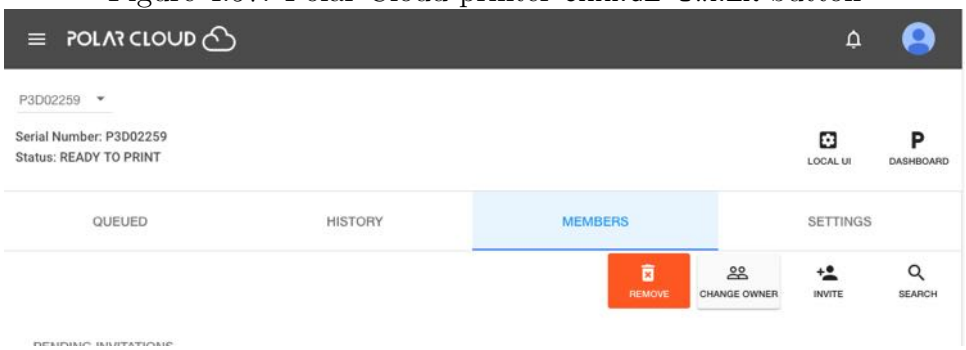
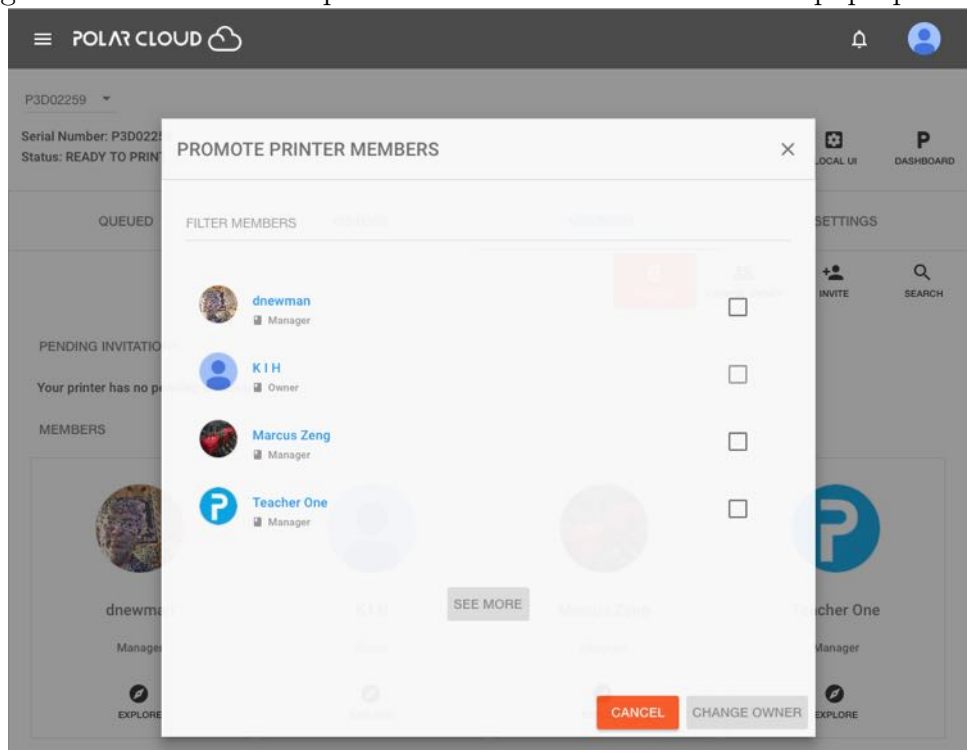


Figure 4.58: Polar Cloud printer `PROMOTE PRINTER MEMBERS` pop-up screen



However, when a printer previously registered in the Polar Cloud is moved to an entirely different site or organization, or is being drastically re-purposed, then the printer's new owner may

wish to re-register the printer and effectively "start afresh" with the printer. The process for starting afresh with a printer, attaching a previously used printer at a different site, is essentially that of attaching a new printer, already discussed in Chapter 1: adding a printer to your Polar Cloud account.

When a printer is moved to a new site, the prior owner *may* have chosen to delete their local network profile information from the printer via the `Reset Networks` button of the `Network` screen of the printer local web interface, and *may* have obsoleted their ownership of the printer in the Polar Cloud via that same screen's `Reset Printer on the Polar Cloud` button. Performing `Reset Printer on the Polar Cloud` in particular is recommended when changing ownership of a printer in high use as it means that any remaining print jobs queued to the printer remain visible to members, so that members can move such old jobs to another printer to which they have access – it is less disruptive to the printer's members. However, it is possible to "take over" a printer even without such steps, as when the former printer owner is no longer available to aid by performing such a "clean handover" step.

If the printer was previously connected via some other local network (as when you have acquired a printer formerly used at a different site), you will need to start at the steps for configuring local network use.

If, however, the printer was already in use in your 3D printer lab or classroom, so already properly configured to use your local network (and the prior owner didn't click `Reset Networks` thereby deleting the local network profile), and you merely need to take over as its owner, then you should start instead at step 10

(discussed in detail in Section 1.1 but which is identical whether connecting via WiFi or Ethernet cable), to add the printer to your Polar Cloud account. With the printer turned on (and its LED lights appearing as POLAR3D, *i.e.*, blue over white, then from the Polar Cloud main menu select "`PRINTERS`" and then on that screen click the "`ADD`" button ("`+`"); see Figure 4.55. Then continue on, entering the make and the serial number of the printer, and going through the colored light security check, *etc.*, as discussed in Chapter 1.

4.5.3 Printer settings: name, description, and location of printer

From the `THUMBNAILS` list of printers, hover over the printer of interest and click on its "`MANAGE`" tab, see Figure 4.59, to get to a view such as Figure 4.60.

Figure 4.59: Polar Cloud printer `MANAGE` tab

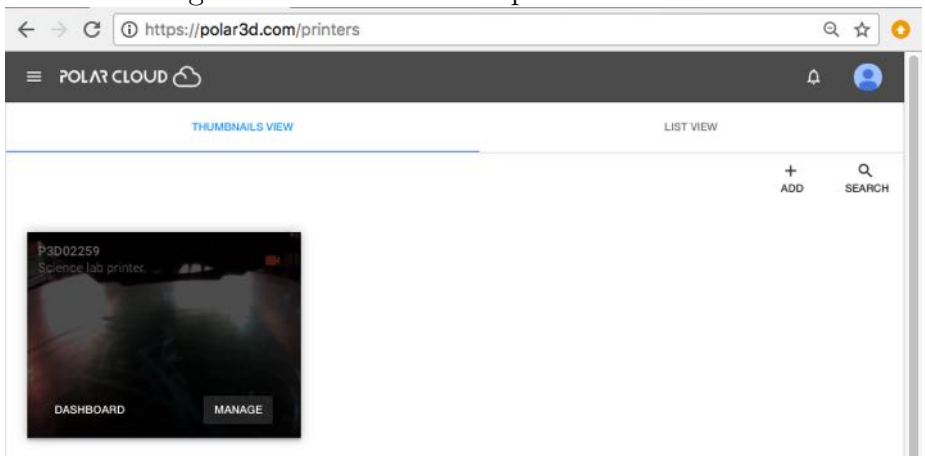
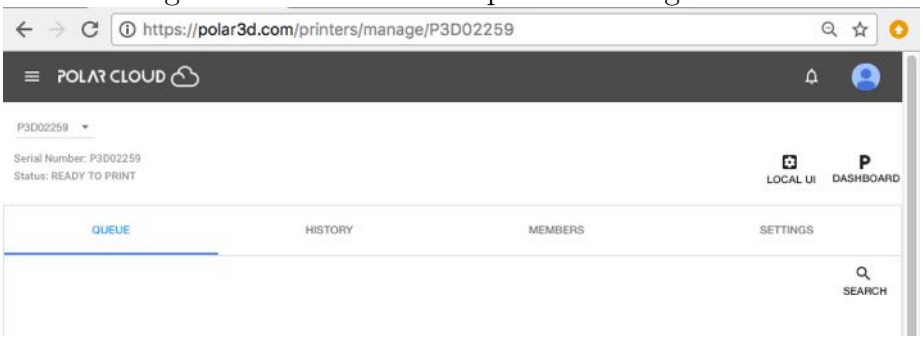


Figure 4.60: Polar Cloud printer manage screen



From the printer manage screen, Figure 4.60, click on "`SETTINGS`" to get to a screen such as shown in Figure 4.61. When your printer is first registered with the Polar Cloud, its `NAME` field is set to match its serial number. At the "`SETTINGS`" screen, you may change the printer name, as well as enter a text description of your printer and where it is located; see Figure 4.62.

Figure 4.61: Polar Cloud printer `SETTINGS` screen

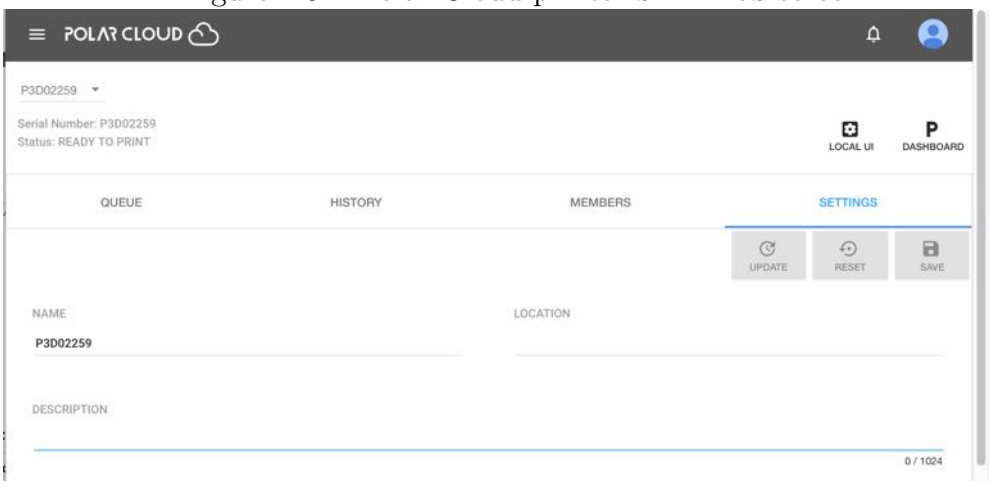
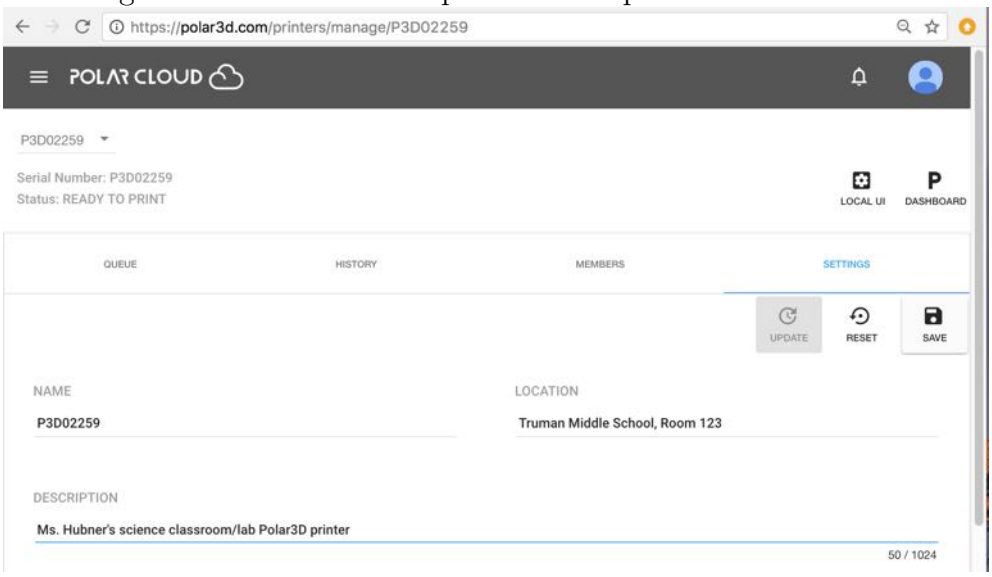


Figure 4.62: Polar Cloud printer description and location fields



The printer `NAME` will be the name displayed when listing printers, *e.g.*, displayed in the `THUMBNAILS VIEW` icon or in the drop-down printer list on the build plate screen. Thus many printer owners, if they change the `NAME` from its default serial-number value, find it useful to incorporate the serial-number into the printer name: *e.g.*, `Physics-lab-P3D02259`, or `Media-Center-P3D02265` or the like. Especially if your site owns multiple 3D printers accessible to many students or other Polar Cloud members, consider entering some information in the `DESCRIPTION` and `LOCATION` fields to aid in locating and identifying the purpose of *this* particular printer. In particular, note that when searching for a printer, see Section 4.5.4, the serial number, name, description, and location fields are all compared for a match.

Click the `SAVE` button when you have finished entering your desired information; see Figure 4.62.

4.5.4 Searching for a printer

Under either the "THUMBNAILS VIEW" or "LIST VIEW" of printers (see Figure 4.55 or Figure 4.110, respectively), the "SEARCH" tab allows searching for accessible-to-you printers, matching upon serial number, name, description, or location text (see Section 4.5.3), which may be useful if you have access to a large number of printers.

4.5.5 Allowing access to a printer

Access to a printer through the Polar Cloud is controlled by the printer's manager(s). Initially, the only manager of a printer is the printer's owner – the person who initially connected the printer to the Polar Cloud – but the printer owner (and *only* the printer owner) can authorize additional Polar Cloud members to become managers.[2]

A manager may add Polar Cloud members to a list of members allowed to use the printer, or may share a printer with a group.

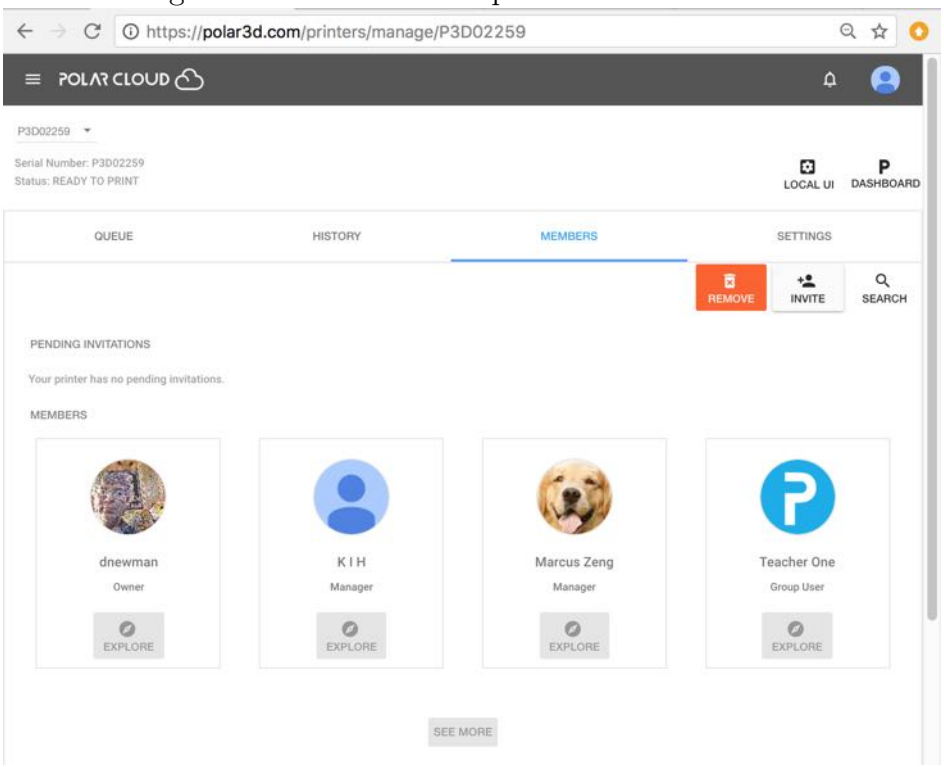
To authorize printer access for an additional Polar Cloud member or authorize an additional printer manager, select (click on) the specific printer from the list of printer(s) (see Figure 4.55), and then from the printer's dashboard screen (see Figure 4.56), click on the "MANAGE" tab (see Figure 4.59) to take you to the manage page for the printer, shown in Figure 4.60. (An alternate way to get to the selected printer's summary page:

[2]Note that Section 4.5.2 discusses how to change the printer owner, for cases where you want to reassign who is in charge of determining the printer's managers; in particular, the printer owner may reassign ownership to another user of the printer.

at the printer list view screen, see Figure 4.110, click the square button icon on the right-hand of the printer line in the list.)

On the selected printer's manage screen (see Figure 4.60), click on the "MEMBERS" tab to take you to the members screen for the printer, shown in Figure 4.63.

Figure 4.63: Polar Cloud printer MEMBERS screen



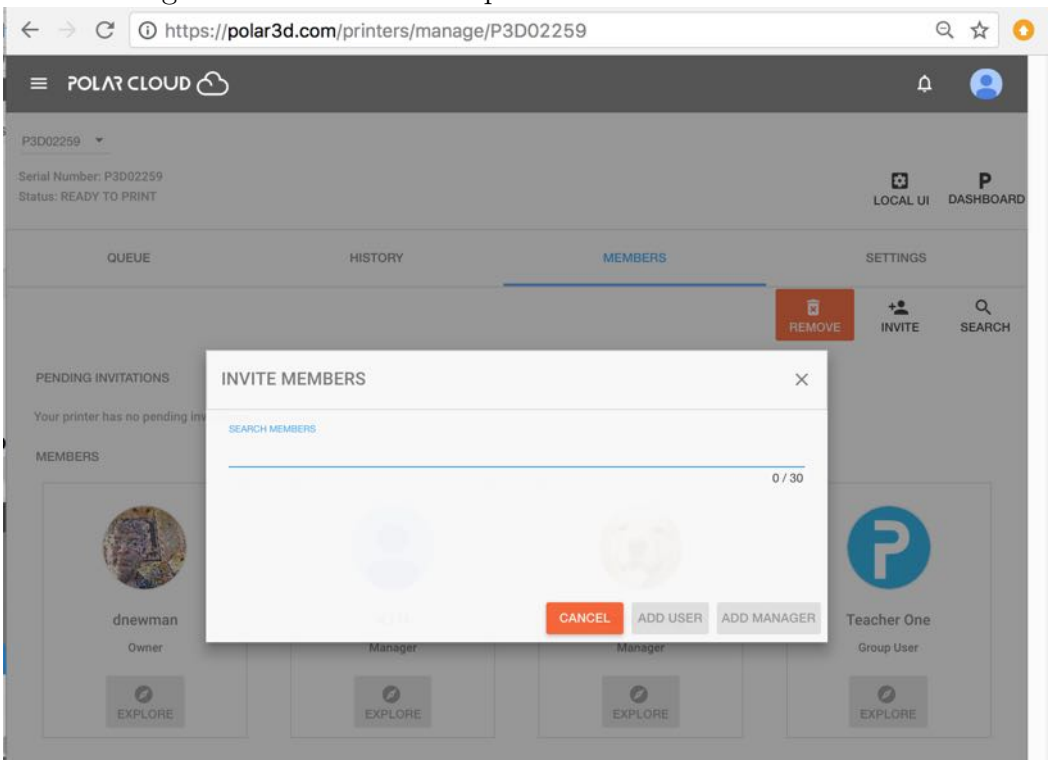
Then click on the "INVITE" button to bring up a screen, see Figure 4.64, at which the printer owner or a printer manager can invite another Polar Cloud member to access the printer ("ADD USER" button), or the printer owner can invite another another Polar Cloud member to become a manager for the printer ("ADD MANAGER" button). The invited member will receive a Polar

Cloud notification inviting him or her to access or manage the printer; the Polar Cloud member may `ACCEPT` or `DECLINE` that invitation.

The red "`REMOVE`" button, see Figure 4.64, allows you to remove members or managers from such access to the printer.

The "`SEARCH`" button may be used to search within those Polar Cloud members granted access to the printer; for printers with a large number of members allowed access, this may be more convenient than scrolling through the icons on the `MEMBERS` screen.

Figure 4.64: Polar Cloud printer `INVITE MEMBERS` screen



4.5.6 Managing the printer queue

From a printer `MANAGE` screen, see Figure 4.60, you can access the printer's current queue of pending jobs (as well as the history of what jobs it has performed, as will be discussed in Section 4.5.7). Clicking the "`QUEUE`" tab shows a screen of any currently pending jobs in the printer's queue; Figure 4.60 shows an empty queue. Figure 4.65, in contrast, shows a printer with two jobs queued. Note that the print queue is also displayed on the printer dashboard; see Figure 4.66 which shows the printer dashboard view of those same two queued jobs.

Figure 4.65: Polar Cloud printer queue with two jobs queued

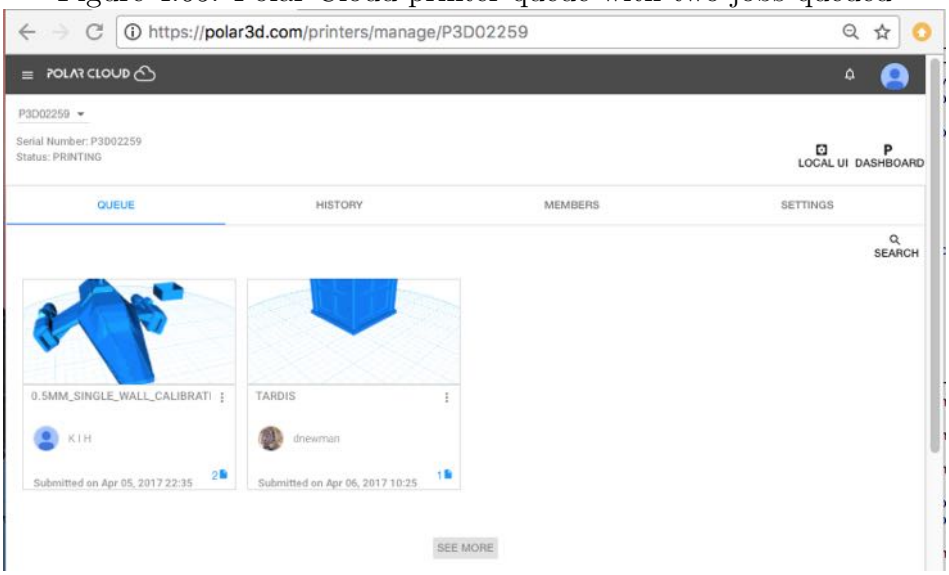
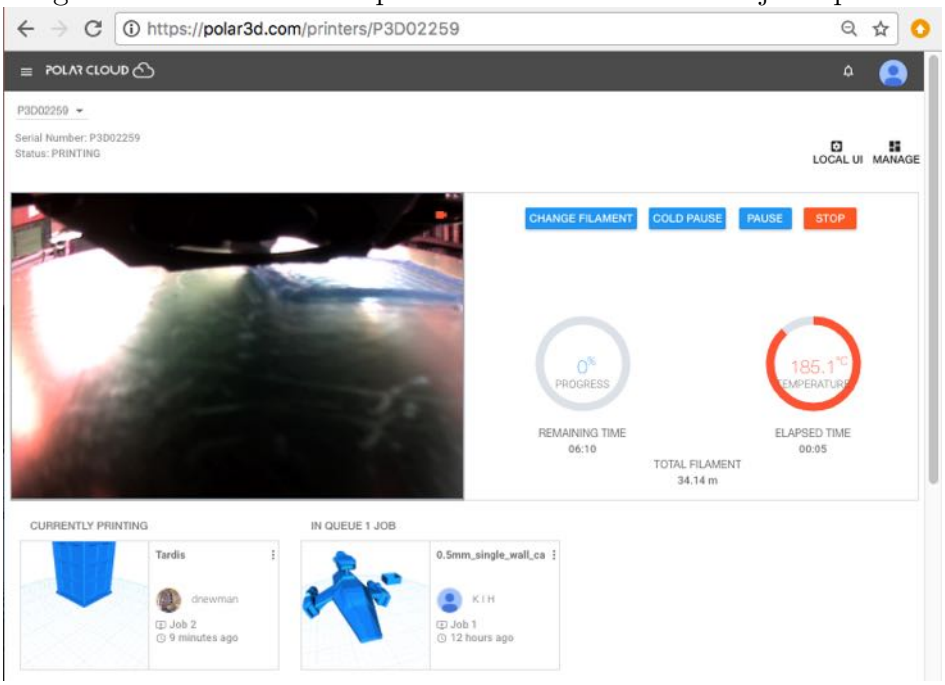


Figure 4.66: Polar Cloud printer dashboard with two jobs queued



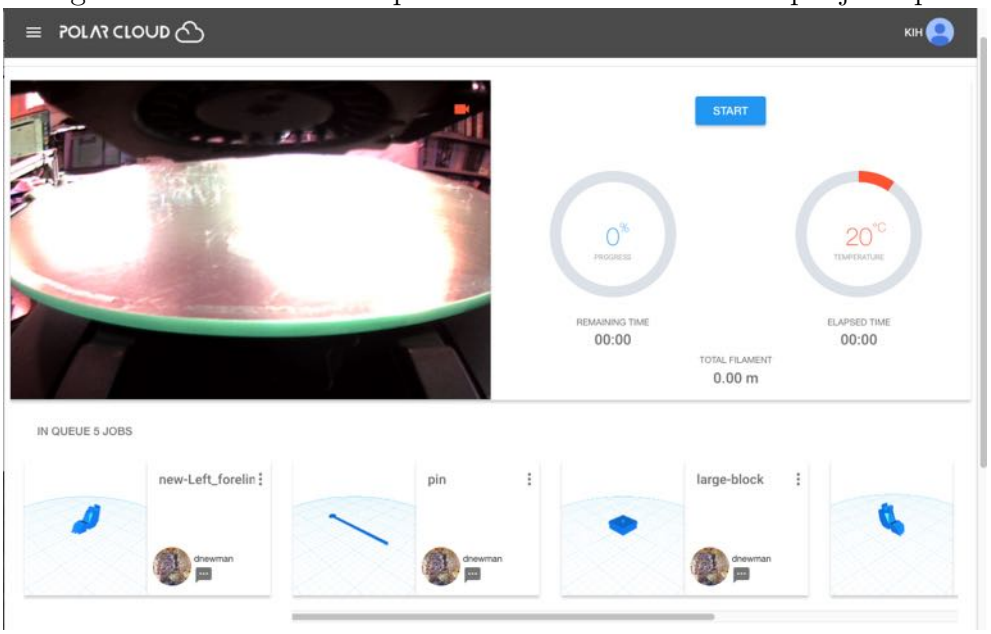
Since jobs are not started until the "START" button is clicked, note that the order in which jobs begin printing is not solely based on which job was submitted first. In the case of the print queue displayed in Figures 4.65 and 4.66, the job submitted later (the Tardis) has been started printing while the job submitted earlier remains waiting on the print queue.

As the owner or as a manager of a printer, (or if you are a member of a group granted CONTROL PRINTERS access to a shared printer) you have quite a bit of control over the jobs in the print queue. The owner or any manager (or any group member with control access) may:

1. Tell the printer to begin a job: click the "START" button.
2. "PAUSE" or "STOP" a currently printing job.

3. Modify a job in the queue, perhaps adding additional objects to the build plate.
4. Delete a job from the print queue.
5. Shuffle the order of jobs in the print queue, moving a job to the head of the queue (if currently elsewhere) or to the tail of the queue (if currently at the head of the queue).
6. Download the `.stl` files or configuration (print settings) for a job.

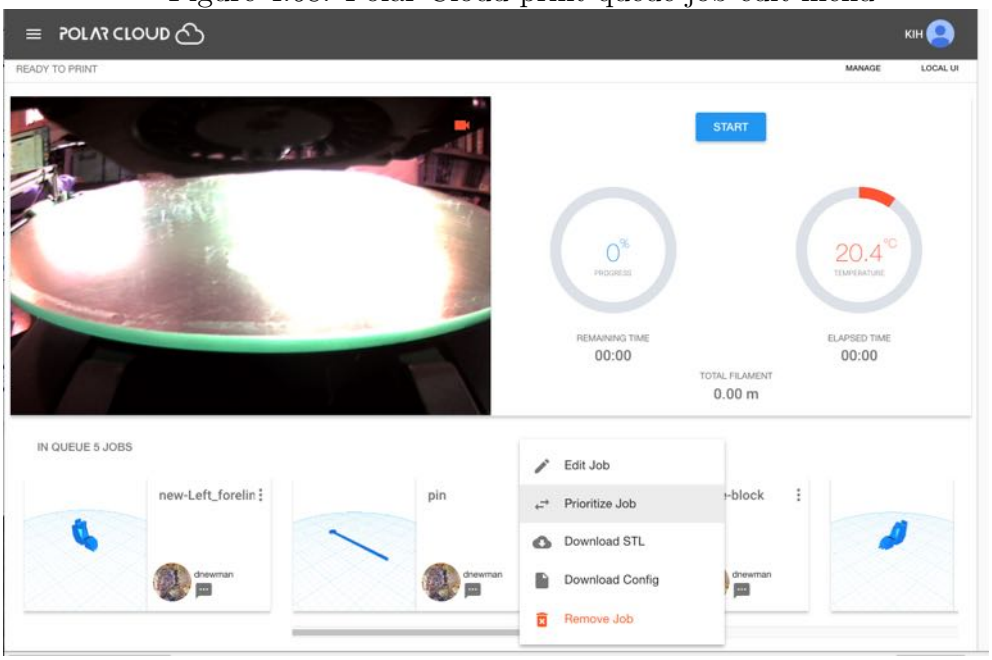
Figure 4.67: Polar Cloud printer dashboard with multiple jobs queued



When at a printer dashboard screen such as shown in Figure 4.67, clicking on the three dots towards the upper right of the icon for a job will bring up a menu for performing job modifications; see Figure 4.68.

The printer owner and any other printer managers (or any

Figure 4.68: Polar Cloud print queue job edit menu



group members with control access to a shared printer) can use the "START" control button on the printer dashboard to begin the actual execution of a queued job; once a job is printing, control buttons to "CHANGE FILAMENT", "COLD PAUSE", "PAUSE", and "STOP" become active for the owner and managers (and group members with control access); see Figure 4.86. The printer owner and managers (and group members with control access) also have the full range of job modification menu options shown in Figure 4.68 available for *all* pending jobs in the queue:

1. "Edit Job", which takes you back to the job's build plate screen, where you may perform any of the usual modifications, including:

   (a) Changing the PLACEMENT of the object: MOVE, SCALE, or ROTATE.

(b) Changing the PRINT SETTINGS for the object: BASIC, ADVANCED, or G-CODE.

(c) Changing the UI SETTINGS for build plate controls.

(d) Deleting an object from the build plate (which as there may be multiple objects on the build plate, submitted as single print job, is not necessarily the same thing as deleting the entire print job via the "Remove Job" tab discussed below).

(e) Uploading an object on the build plate to the Polar Cloud.

(f) Downloading an object from the build plate to your device.

(g) Merging (loading onto the build plate) the objects from other print jobs queued to the printer.

2. "Prioritize Job", which switches the order of queued jobs.

3. "Download STL", which downloads the object .stl file to your device.

4. "Download Config", which downloads the slicer settings (the job's "PRINT SETTINGS") to your device.

5. "Remove Job", which of course removes the entire job from the queue. (In the case of a job which includes multiple objects, if you only wish to remove particular object(s) from the print job rather than removing the entire job, see instead the "Edit Job" tab, discussed above.)

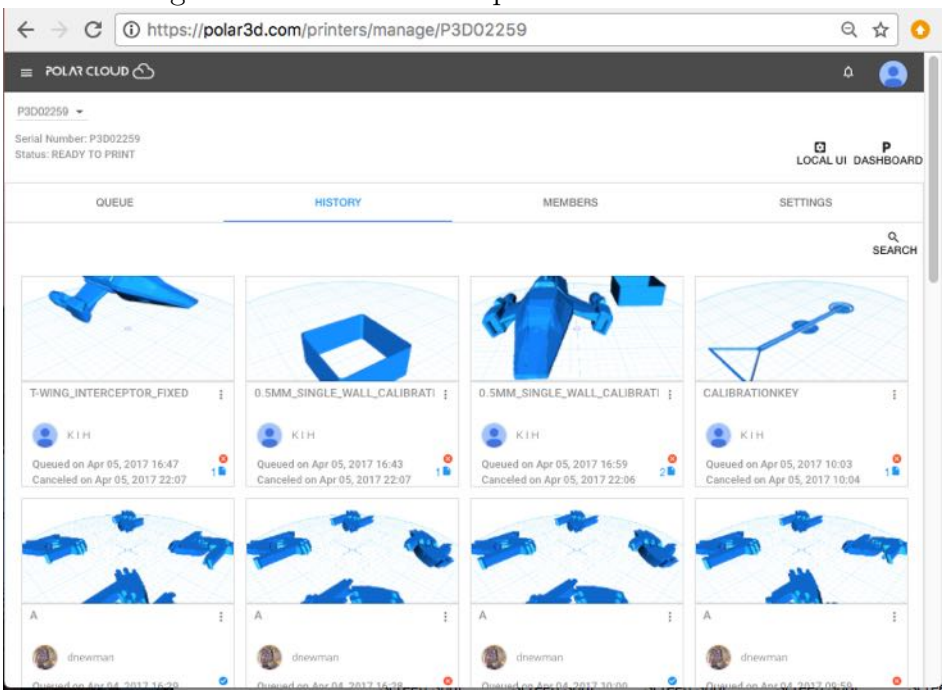
In contrast, the printer dashboard control buttons are not

active for general members, nor may general members modify print queue jobs other than their own.

4.5.7 Printer job history

From a printer `MANAGE` screen, see Figure 4.60, clicking the "`HISTORY`" tab shows the history of what print jobs the printer has performed; see Figure 4.69.

Figure 4.69: Polar Cloud printer `HISTORY` screen



Clicking on a particular object in the printer history will bring up a screen with information regarding that print job; see Figure 4.70. Besides "`DETAILS`" (the objects in that job, when it was queued and by whom, and when completed), other information about a print job includes a "`SNAPSHOT`" showing the completed

object(s) of the job – see Figure 4.71, and a "`TIME LAPSE`" video (sampled from still snapshots taken while the job was printing) showing the job running – see Figure 4.72.

Figure 4.70: Printer history of an object

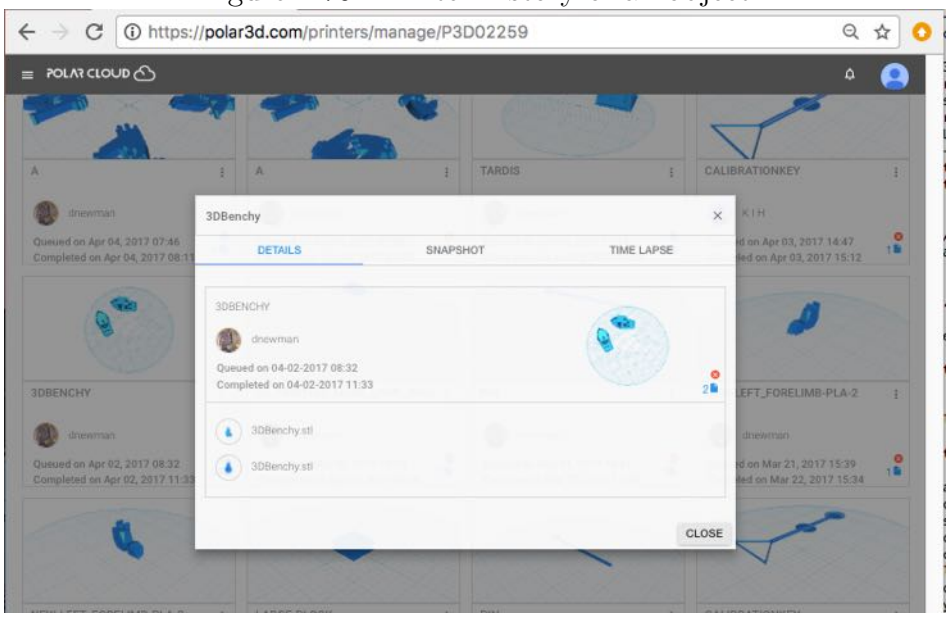


Figure 4.71: Printer history of an object: `SNAPSHOT`

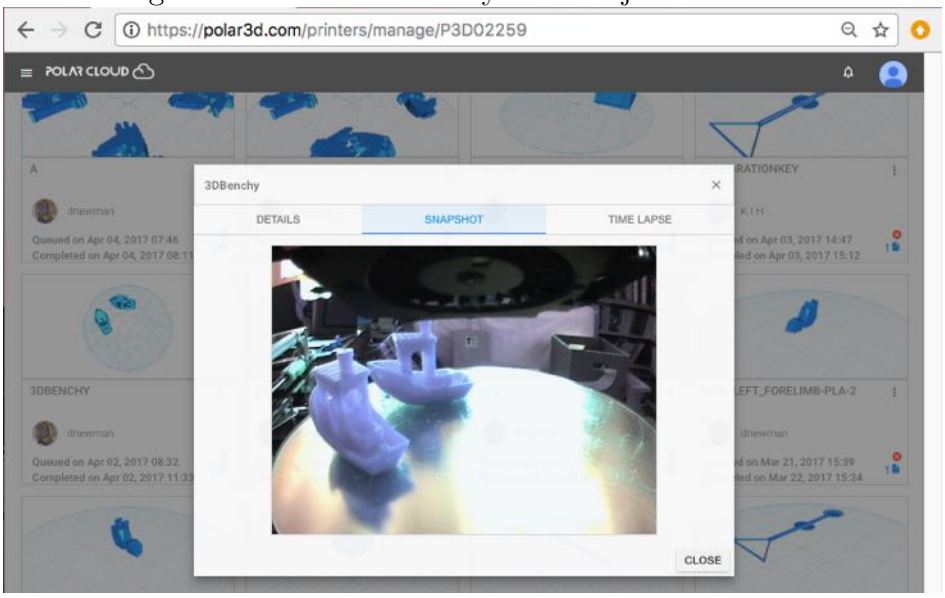
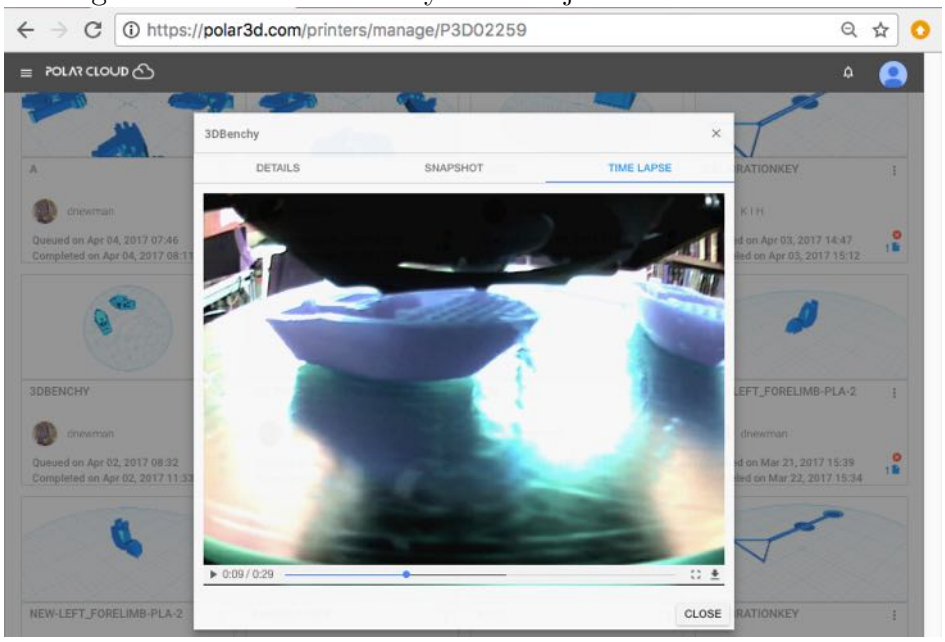


Figure 4.72: Printer history of an object: `TIME LAPSE` video



4.5.8 Updating the printer

Occasionally, an update to the printer firmware will be available. When an update is available, you will see an active `UPDATE` button appear on both the printer dashboard screen, see Figure 4.73, and the printer management screen, see Figure 4.74. Clicking the "`UPDATE`" button from either location will bring up a confirmation screen, see Figure 4.75; click the "`UPDATE PRINTER`" button to perform the update.

Figure 4.73: Polar Cloud printer dashboard `UPDATE` button

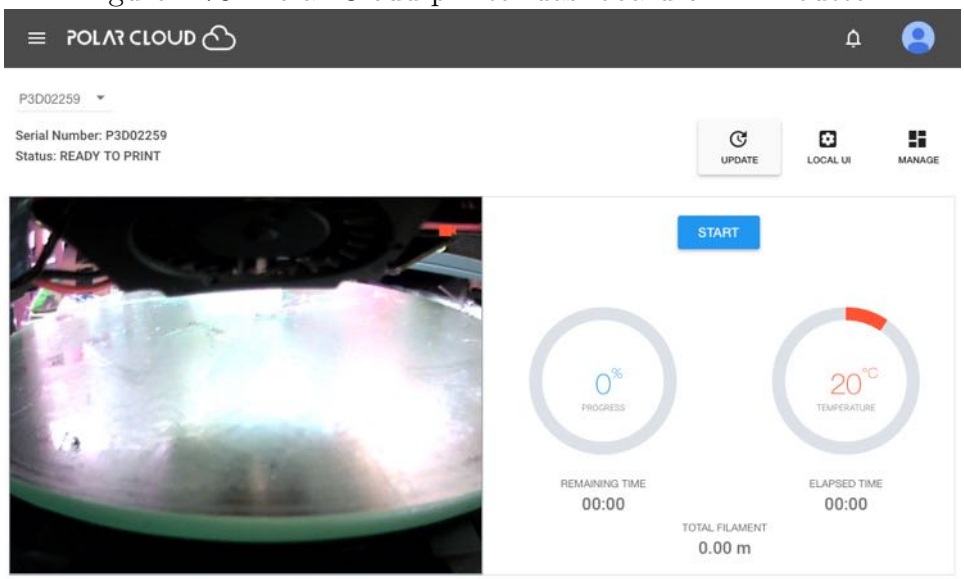


Figure 4.74: Polar Cloud printer management screen `UPDATE` button

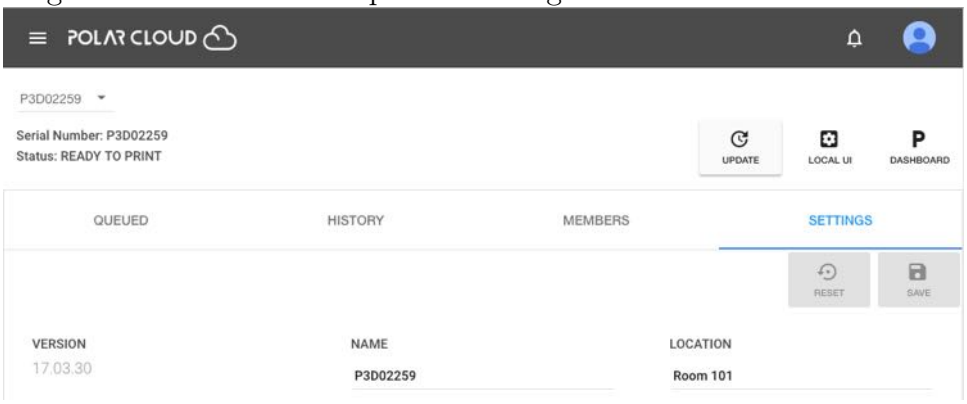
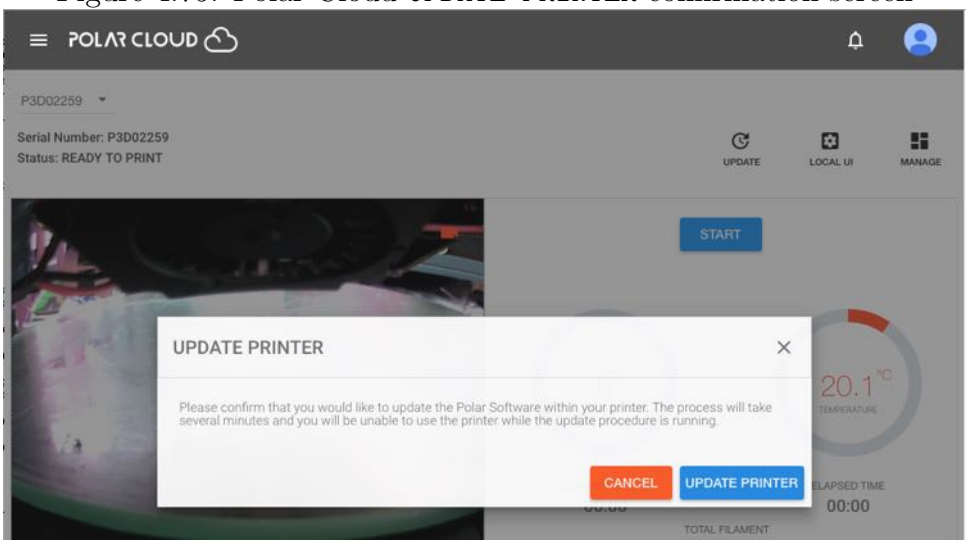
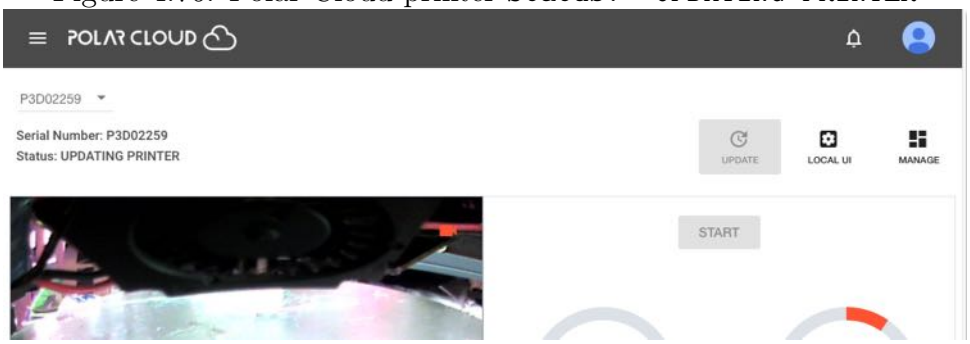


Figure 4.75: Polar Cloud `UPDATE PRINTER` confirmation screen



Note that when you click the "`UPDATE PRINTER`" button to begin the update, the printer's `Status:` will cycle through `WAITING FOR RESPONSE`, `UPDATING PRINTER` (see Figure 4.76 – this may take several minutes), and possibly `OFFLINE` (if the update requires the printer to restart), before getting back to `READY TO PRINT`.

Figure 4.76: Polar Cloud printer `Status: UPDATING PRINTER`



Note that when the printer is performing an update, the LED lights along the left-hand side of the printer will go through a color change: the LED lights towards the bottom (`3D`) will turn green, POLAR3D, and then the green color will gradually move up until all the lights are green, POLAR3D, indicating that the update is complete, before the lights return to their normal colors (blue over white, POLAR3D, for a printer connected to the Polar Cloud).

(Note that it is also possible to perform an update directly to the printer, without going through the Polar Cloud; see Chapter 9 for details.)

4.5.9 Printer local web interface accessed from the Polar Cloud

Clicking on the "`LOCAL UI`" tab (or gear icon towards the upper right) of a specific printer's screen (see Figure 4.56) will cause the Polar Cloud to attempt to open a connection itself to the printer's local web interface, using what the Polar Cloud believes to be the printer's IP address on your local network. Note

that only a printer owner or manager, or a member of a group configured to share operational control of the printer, may connect to the printer local web interface through the Polar Cloud. If your local network allows such access back from the Internet (which may or may not be the case), then you can access all of the printer's local web interface while still in the Polar Cloud. (However, if your local network does not allow such Internet access, then the Polar Cloud connection attempt to the printer's local web interface will not succeed; in that case, you will only be able to access the printer's local web interface by connecting directly to the printer while on your local network; see Chapter 5.)

However, note that once you have initially connected your printer to the Polar Cloud (as discussed in Chapter 1), there is seldom much subsequent need or interest in accessing the printer's local web interface; for printers managed through the Polar Cloud, use of the printer local web interface might occur only for occasional manual operations or for printer reconfiguration purposes. Sustained use of the printer's local web interface occurs primarily when instead controlling the printer directly from a device connected via local WiFi (as discussed in Section C.1).

See Chapter 5 for details on the features and use of the printer's local web interface.

4.6 Printing through the Polar Cloud

When you print through the Polar Cloud:

1. You may print your own objects, and other objects shared or objects shared in groups in the Polar Cloud.
2. Your print request is automatically placed in a print job queue, reducing the need for manual coordination with other users of shared printers.
3. You may remotely manage your queued print jobs, and (for a printer you own or manage or share in a group), you may remotely trigger the initiation of the print job, or pause or stop the printing.
4. You may remotely view the progress and status of your print job.
5. You may remotely view real-time video of your print as it occurs.
6. The printer history of jobs is updated.
7. Your own account activity and history of what you have printed is updated.

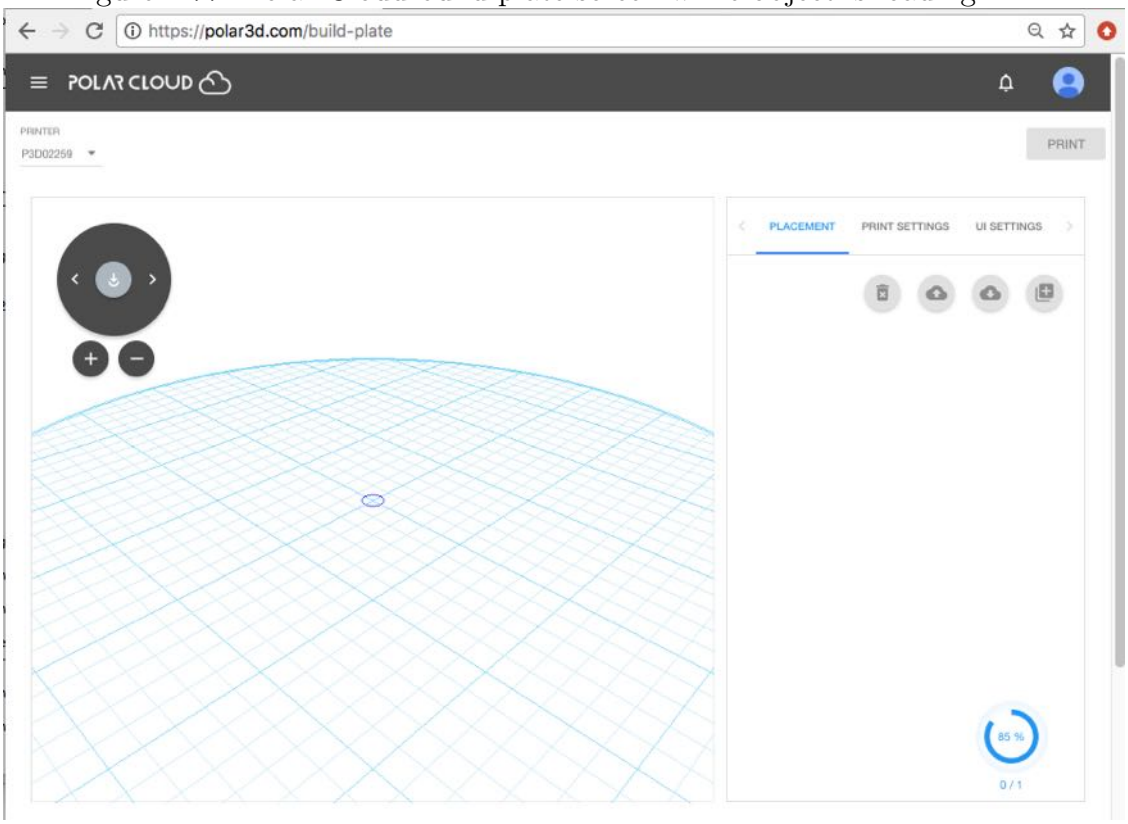
To print an object already in your Polar Cloud object collection (or a shared object or a public object in the Polar Cloud), from the Polar Cloud's main menu, select "`OBJECTS`" (see Figure 4.8), then "`MY PRIVATE OBJECTS`" (see Figure 4.9) – or you may select "`SHARED OBJECTS`" or "`PUBLIC OBJECTS`" – and then click on the specific object that you wish to print.

To print an object shared in a group of which you are a member, navigate to the group (see Section 4.4), and then select "`OBJECTS`" (see Figure 4.46), and then click on the specific object that you wish to print.

Selecting one of your own objects will take you to a screen

such as shown in Figure 4.10; selecting any type of shared object will take you to an analogous screen. From the object's display screen, click on "`3D PRINT`"; this will take you to the build plate screen, where as the object's `.stl` files are loading you may see a blue progress icon in the lower right corner, as shown in Figure 4.77; once the object is fully loaded, the build plate screen will become active, such as shown Figure 4.78.

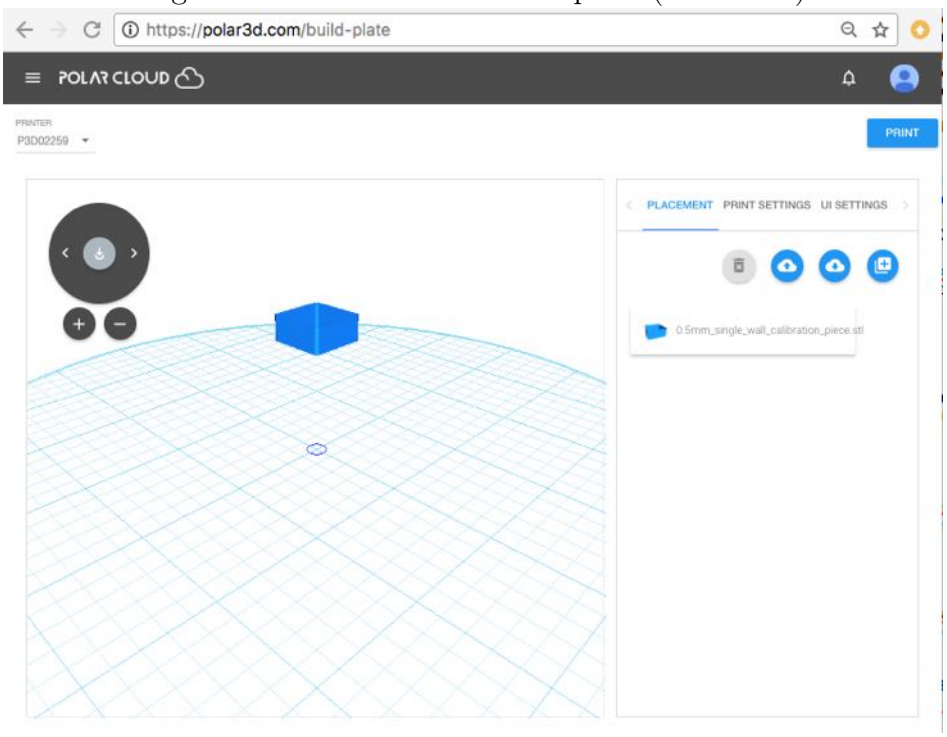
Figure 4.77: Polar Cloud build plate screen while object is loading



You may add objects to your Polar Cloud collection: uploading an object created elsewhere, or creating a new object through CAD software in the Polar Cloud, will both automati-

cally add the object to your collection – and when you upload or create an object, you will automatically be taken to the build plate screen, such as shown in Figure 4.78.

Figure 4.78: Polar Cloud build plate (`3D PRINT`) screen



4.6.1 The build plate screen (`3D PRINT`), and adjusting your print

There are a number of features of interest on the build plate `3D PRINT`) screen; see Figure 4.78.

1. Towards the upper left is the 3D printer currently selected; if multiple printers are accessible to you, you may select which one you want to print on via this drop-down menu.

2. Towards the upper right is the "PRINT" button; press that button when your object is ready, and you wish to submit it for printing. Note that when you press "PRINT", you will see a swirling loading icon towards the lower left of the screen as your job (with its underlying `.stl` files) is submitted to the printer , and then you will automatically go to the printer dashboard screen; see Section 4.6.5.

3. The object or objects are shown positioned on the build plate, towards the middle-left of the screen.

4. A dial for rotating your view of the object and build plate (and a central double-down-arrow for restoring the object to flat on the build plate), and "+" and "−" buttons for zooming the view in or out, is available on the left, above the view of the object itself.

5. On the right, underneath "PLACEMENT" , "PRINT SETTINGS", and "UI SETTINGS", is a list of one or more objects. Click on an object to activate the "PLACEMENT" and "PRINT SETTINGS" for that object.

   When there is only one object on the build plate, the "PLACEMENT" and "PRINT SETTINGS" apply to that object, and the object need not be explicitly selected (clicked on). However, when there is more than one object, clicking on the object in the list selects which object will have "PLACEMENT" and "PRINT SETTINGS" adjustments applied.

6. When "PLACEMENT" is highlighted, four buttons appear underneath it, above the list of objects.

Their functions are:

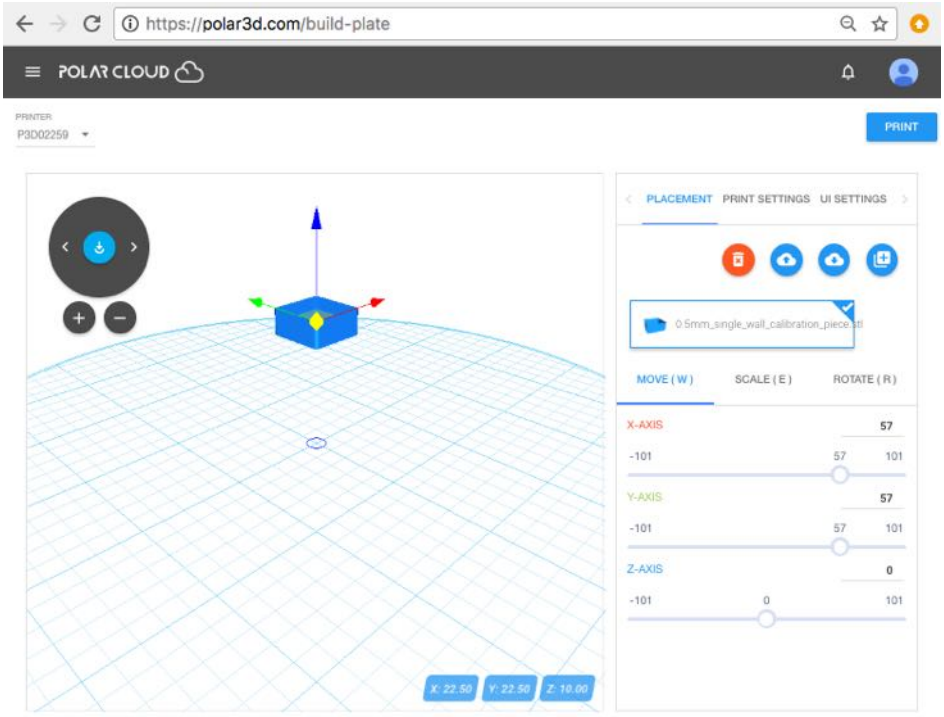
(a) `Delete Selected Object` – delete the selected object from the build plate. (The icon will only be colored red, meaning active, if one or more objects are actually selected from the list of objects.)

(b) `Upload Selected Objects to the Cloud` – upload the selected object(s) to your private collection of objects.

(c) `Load Objects from the Cloud` – load additional Polar Cloud objects to the build plate.

(d) `Load Objects from your Queue` – that is, add an object currently on the print queue to the build plate (that is, merge print queue jobs).

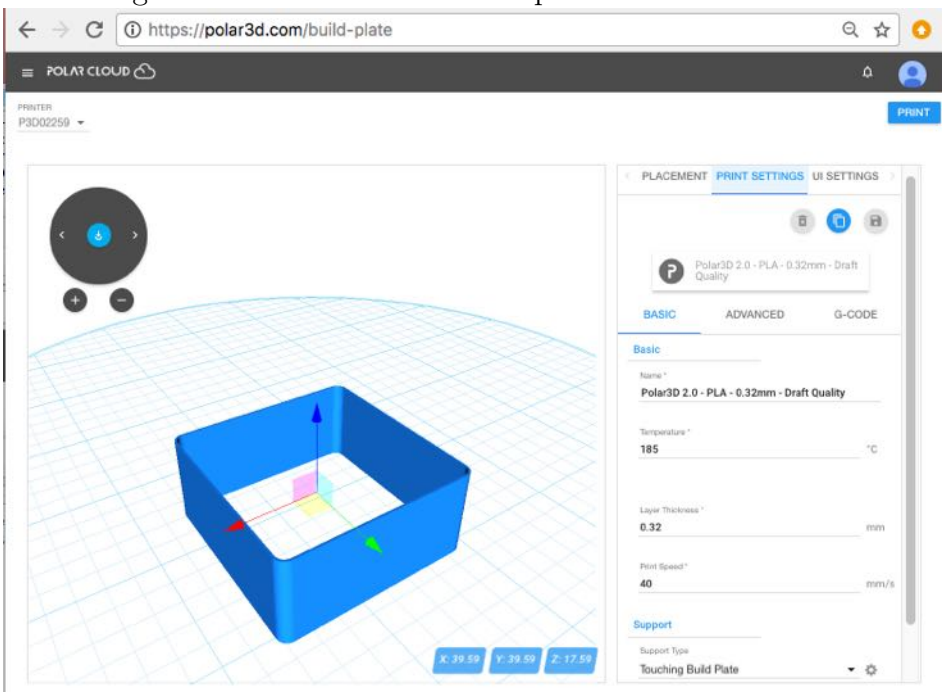
Figure 4.79: Polar Cloud build plate `MOVE` of object



index

7. Once an object has been selected by clicking on it (from the list on the right, underneath "PLACEMENT" and "PRINT SETTINGS"), the "PLACEMENT" tab becomes active. Three axes of movement will appear centered within the object on the build plate, and three choices of type of movement, "MOVE", "SCALE", or "ROTATE", along with three slider scales corresponding to the axes, will appear on the right, under "PLACEMENT" and the object list. You may move the object on the build plate, change its size, or rotate it about an axis, either by dragging and dropping on the image of the object, or via the slider scales, while "PLACEMENT" is selected. Figure 4.79 shows an example of the appearance of axes when "MOVE" has been selected.

Figure 4.80: Polar Cloud build plate PRINT SETTINGS



8. Once an object has been selected by clicking on it (in the list on the right, under "PLACEMENT" and "PRINT SETTINGS"), the "PRINT SETTINGS" tab also becomes active. Under "PRINT SETTINGS" are many settings, (corresponding to slicer settings) which may be used to adjust aspects of the print, such as the temperature, speed of printing, thickness of exterior walls on the object, whether to add a brim, raft, or skirt, *etc.*; see Figure 4.80.

   In particular, under "PRINT SETTINGS", there are three screens of settings:

   (a) The "BASIC" settings include extruder temperature (185°C is normal for the PLA filament provided by Polar 3D, but the temperature should always be adjusted for the type of filament you are actually using), and whether to add a brim, raft, or skirt when printing the object.

   (b) The "ADVANCED" settings include infill settings (density of the object's interior), filament diameter, retraction settings (raising the print head during non-printing moves), "Quality" settings (adjusting the thickness of the exterior of the object), "Speed" settings (*e.g.*, for fine-tuning the speed of printing the initial layer – which may be relevant for getting good adhesion, and a good initial flow of material), and some cooling settings.

   (c) The "G-CODE" settings allow you to modify the starting and ending Gcode (actual instructions to the printer).

9. The "UI SETTINGS" are several setting adjusting the operation of the build plate user interface; see Figure 4.81.