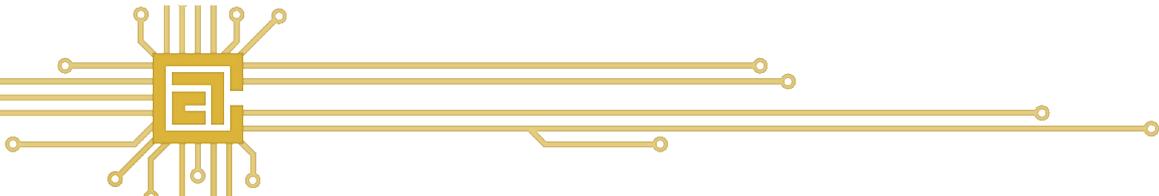


Raspberry Pi

Aryanto



What will we be doing today?

First Half:

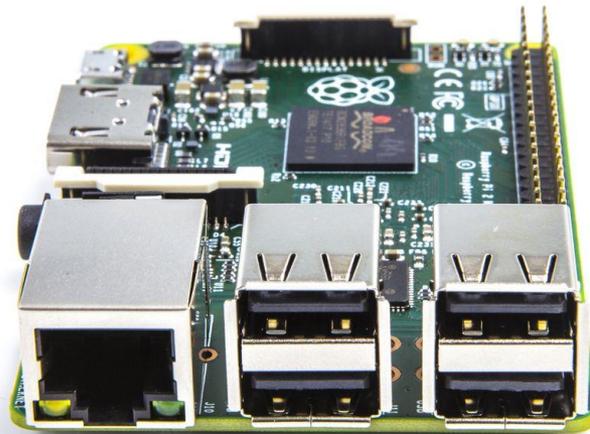
- Learn about the Raspberry Pi
- See demos of what the Pi can do
- Short break

Second Half:

- Setup the Raspberry Pi
- Learn how to use the command line
- See demos of the Pi Camera
- Learn how to use Python to interact with the Pi Camera

What is the Raspberry Pi?

- Affordable credit-card sized computer
- Plugs into a computer monitor or TV
- Uses standard keyboard and mouse
- Can browse the internet and play HD video
- Can also interact with the outside world!

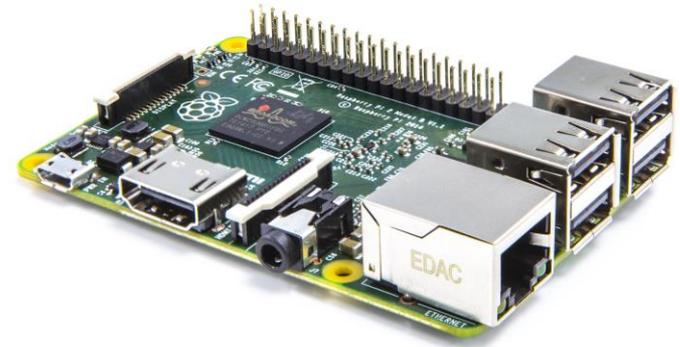


Raspberry Pi Foundation

Educational charity based in the UK

The Foundation's goal is to advance the education of adults and children in the field of computers, computer science, and related subjects.

<https://www.raspberrypi.org/about>



Why was the Pi created?

Concern over the decline in computer literacy

- In the 1990s most new Computer Science students were experienced hobbyist programmers.
- The 2000s were very different; a typical applicant may have only done a little web programming.



Your Raspberry Pi

Raspberry Pi 2 Model B Camera Kit



Camera Kit Contents

Raspberry Pi 2 B



Micro SD Card



WiFi Dongle



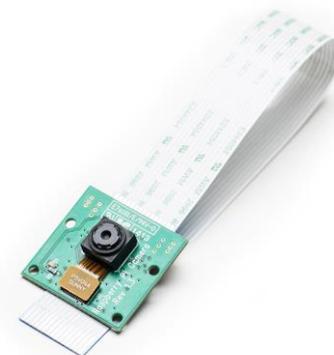
Raspberry Pi Case



Power Supply

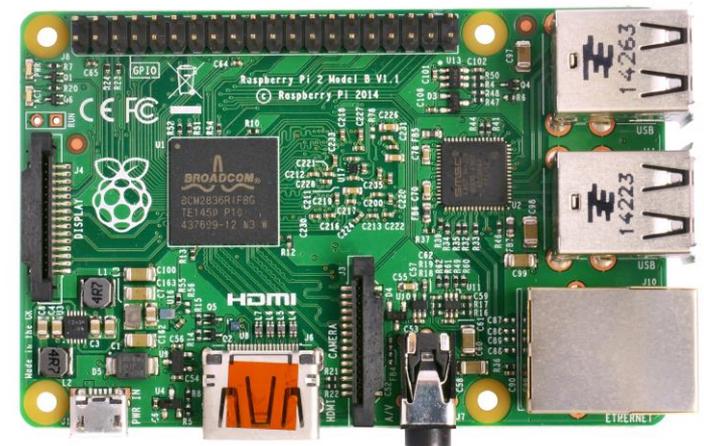


Pi Camera



Raspberry Pi 2 Model B Stats

- 900MHz quad-core ARM Cortex-A7 CPU
- VideoCore IV 3D graphics core
- 1GB RAM
- 4 USB ports
- Full HDMI port
- Ethernet port
- Micro SD card slot
- Combined 3.5mm audio jack and composite video
- Camera and display interface
- 40 General Purpose Input / Output pins (GPIOs)



Helpful Websites

Official Raspberry Pi website

<https://www.raspberrypi.org/>

The MagPi, online Raspberry Pi magazine

<https://www.raspberrypi.org/magpi/>

PiWeekly, online Raspberry Pi newsletter

<http://piweekly.net/>

Raspberry Pi IV Beginners

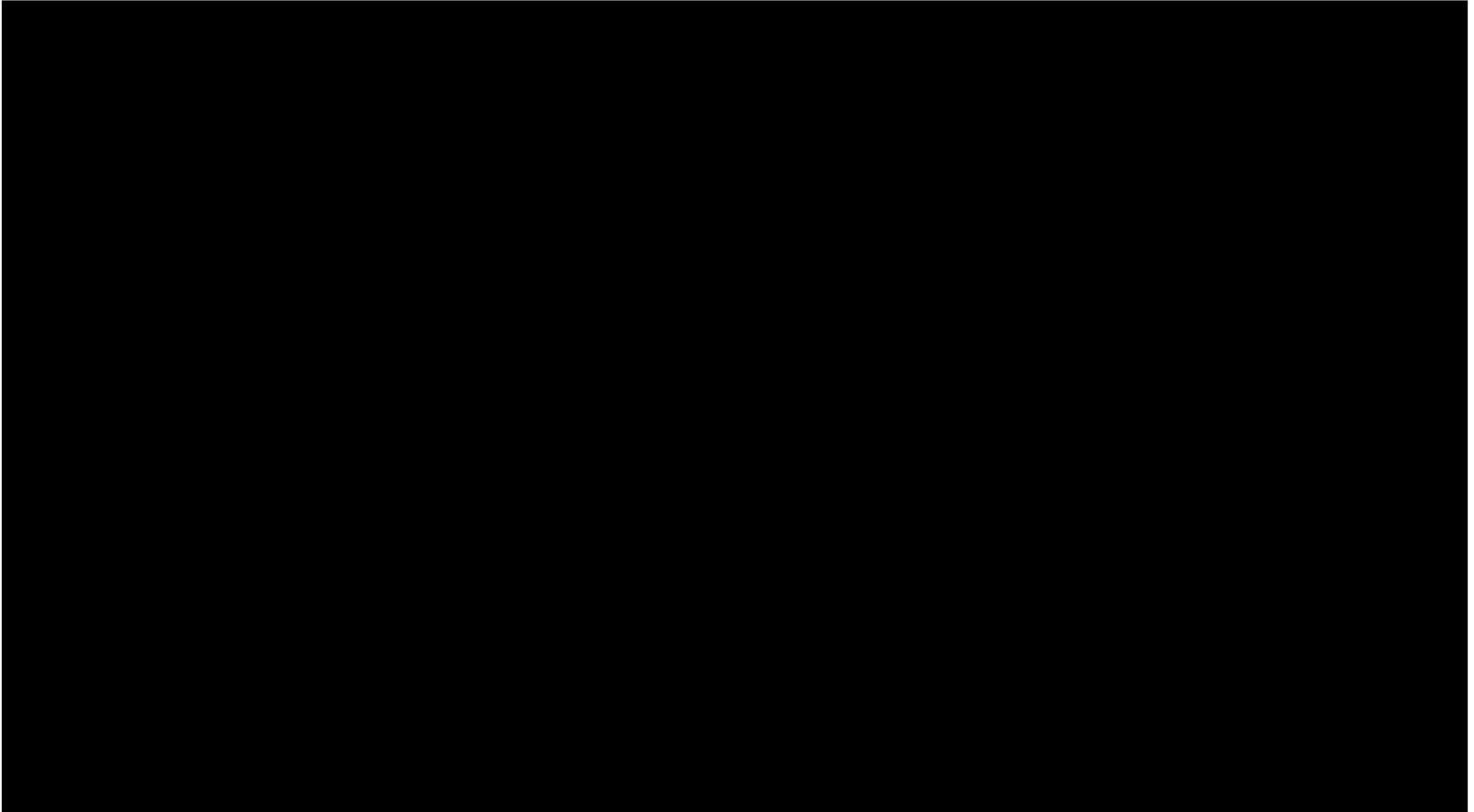
<https://www.youtube.com/user/RaspberryPiBeginners>

The Raspberry Pi Guy

<http://www.theraspberrypiguy.com/>

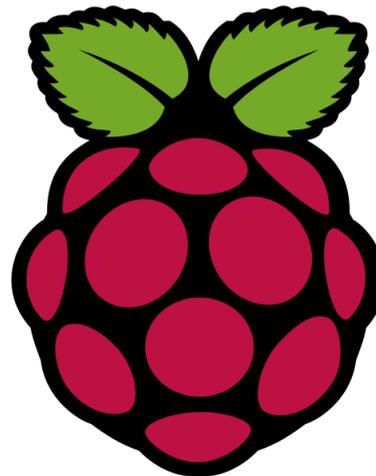


What you can do with the PI



Raspberry Pi Demo

George Sparrow



Hands-On: Assembling the Pi

Setup your Raspberry Pi components in front of you

Camera Kit Supplies

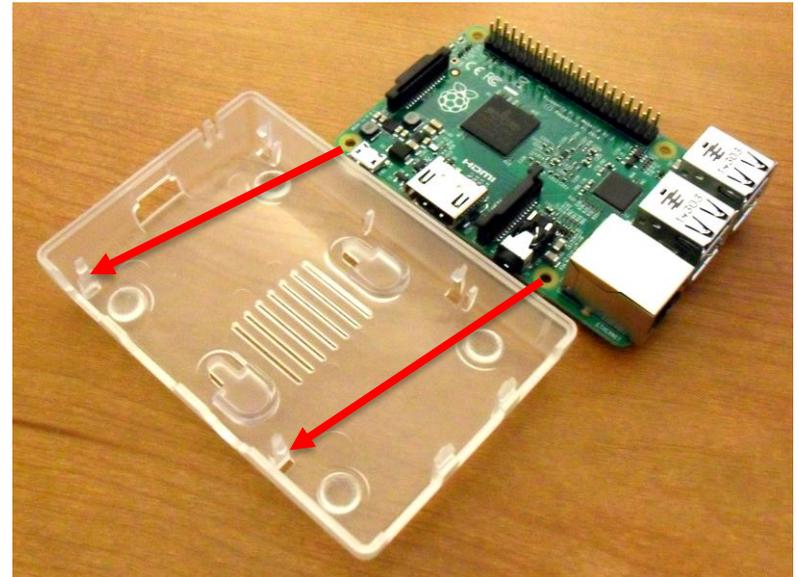
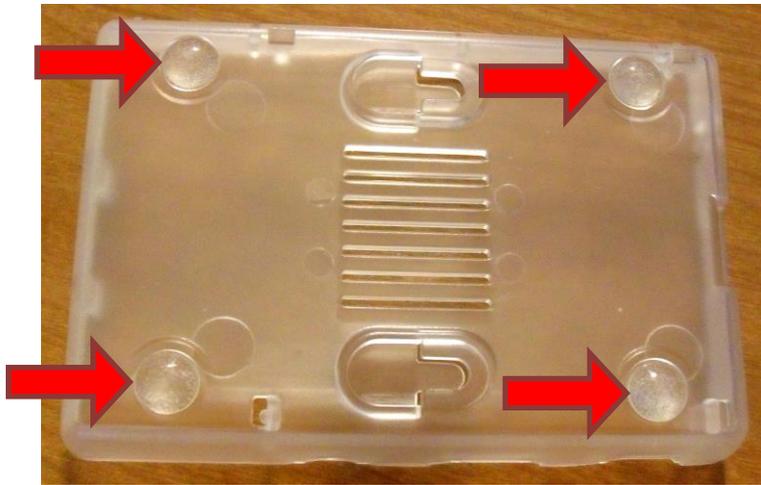


Additional Hardware



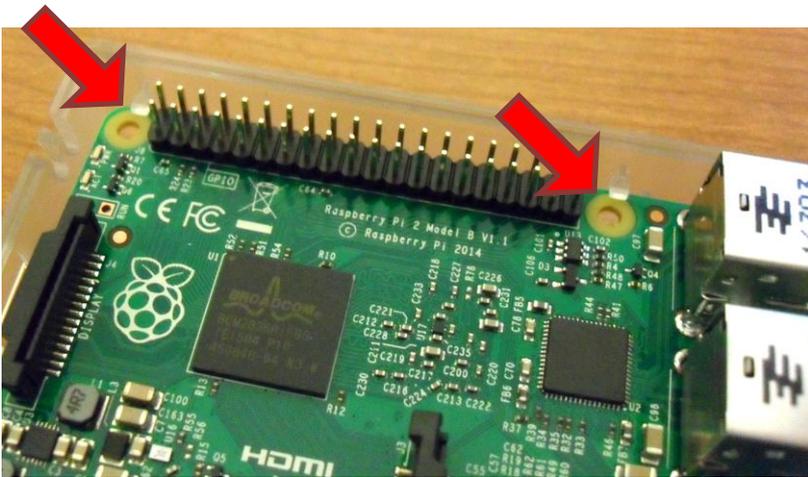
Hands-On: Assembling the Pi

1. Attach rubber adhesive feet to the Pi case
2. Examine how the pegs inside the case match holes on the Raspberry Pi



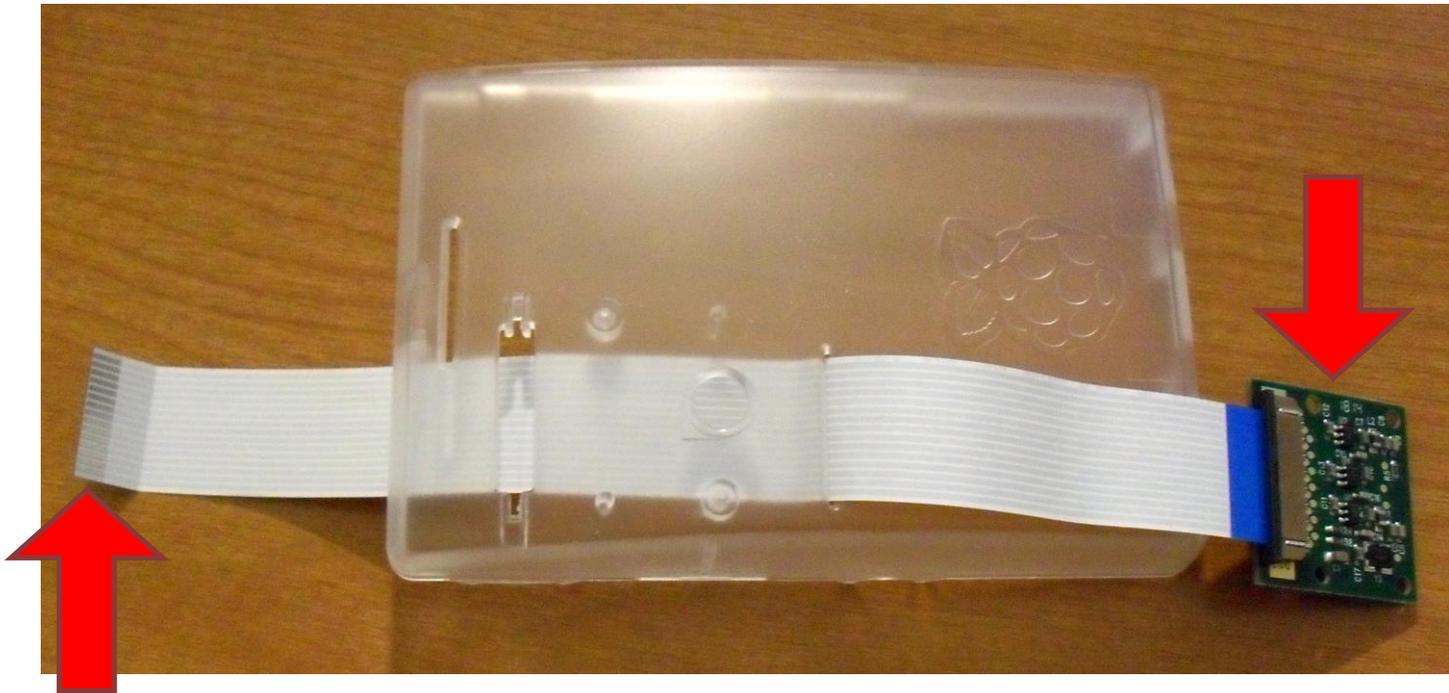
Hands-On: Assembling the Pi

3. Slide the Raspberry Pi into the case on the GPIO side with the small plastic clips next to the stand-off holes
4. Gently push down until it snaps into place on the opposite side



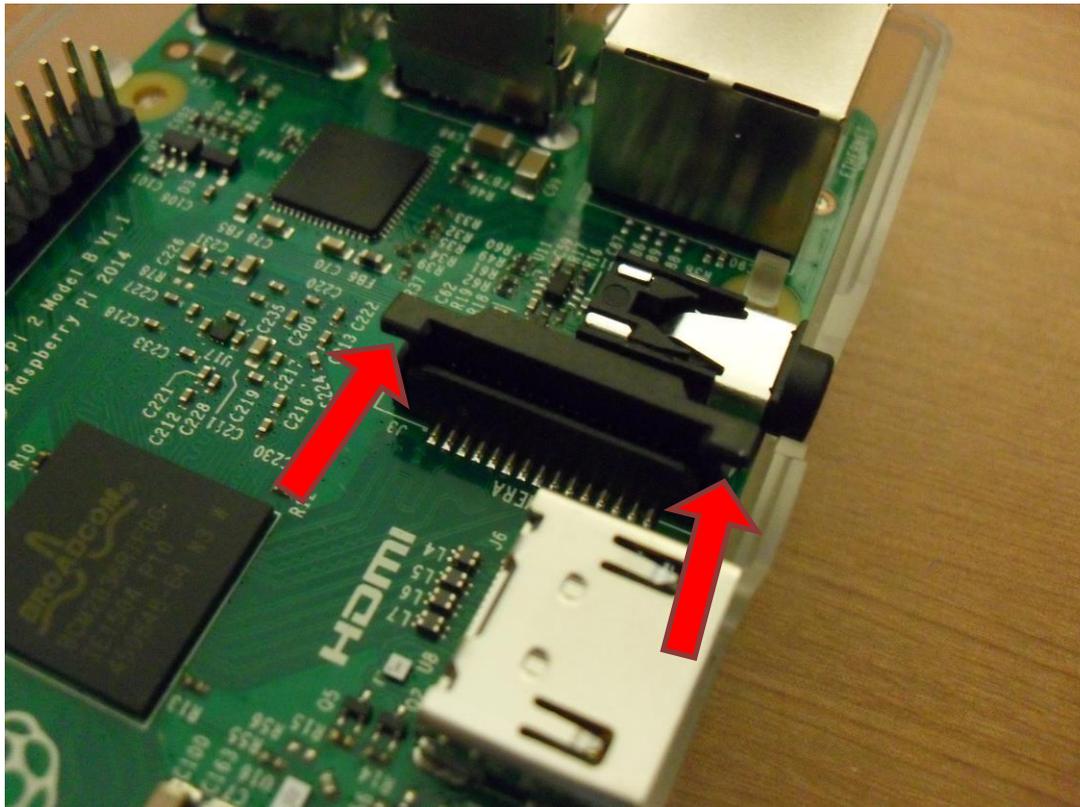
Hands-On: Assembling the Pi

5. Thread the camera cable into the top of the Pi case with the camera facing down and the tin contacts facing up



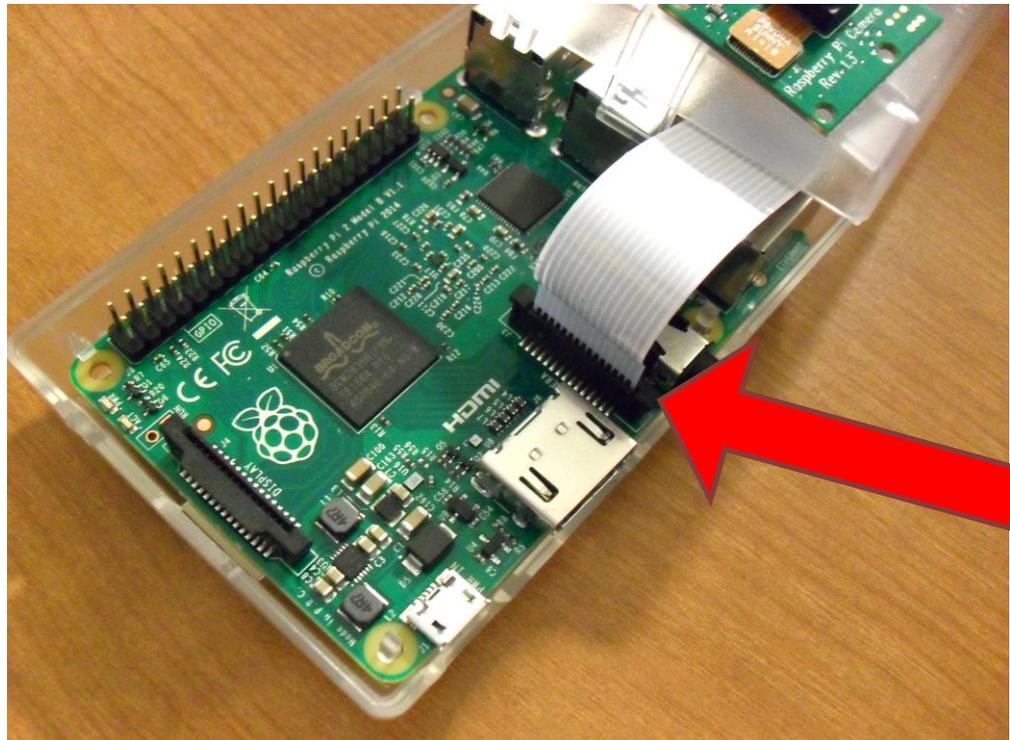
Hands-On: Assembling the Pi

6. Gently pull up the camera socket locking lever



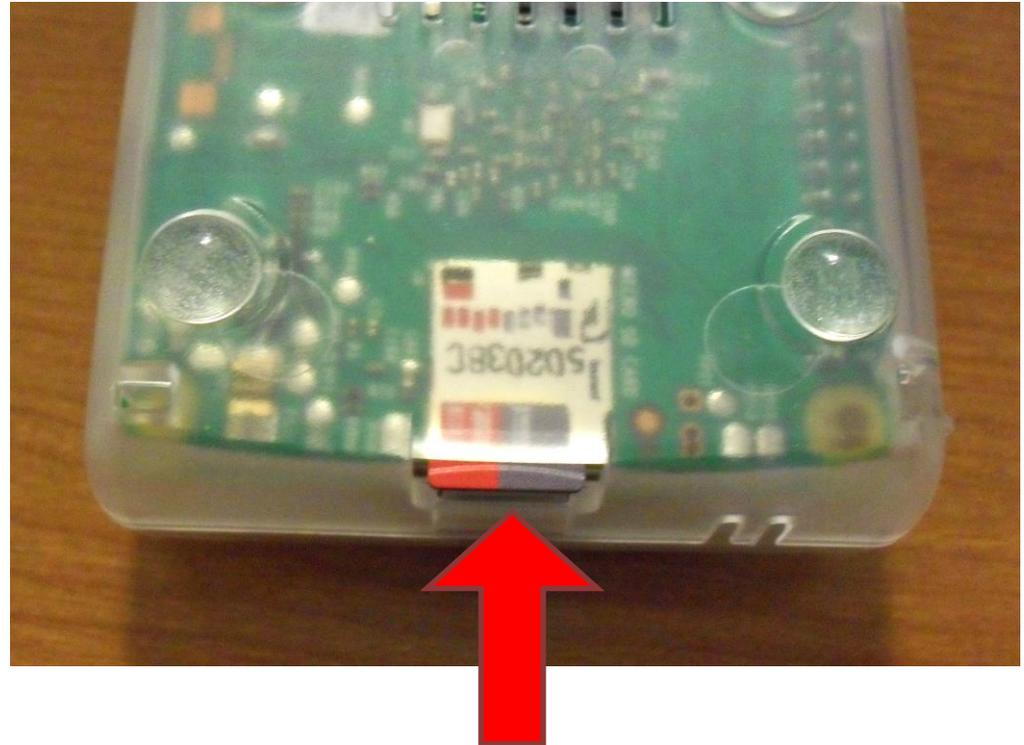
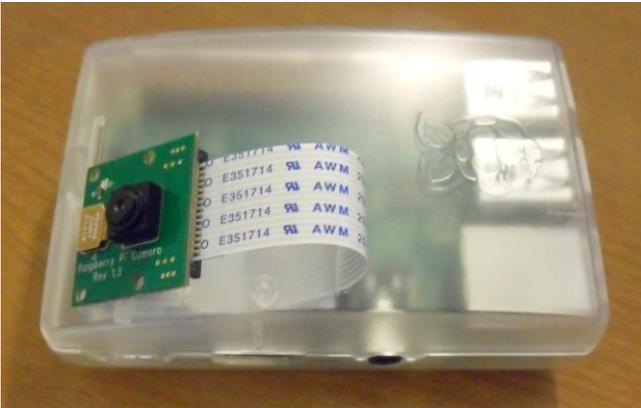
Hands-On: Assembling the Pi

7. Insert the camera cable evenly with the tin connectors facing the HDMI port and gently secure the locking lever



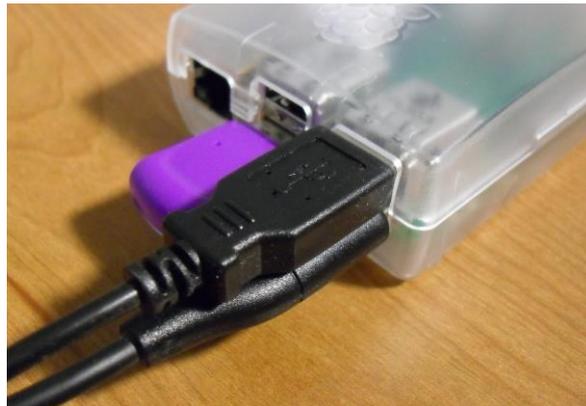
Hands-On: Assembling the Pi

8. Snap the two halves of the Pi case together
9. Insert the micro SD card into the slot on the underside of the Pi case



Hands-On: Assembling the Pi

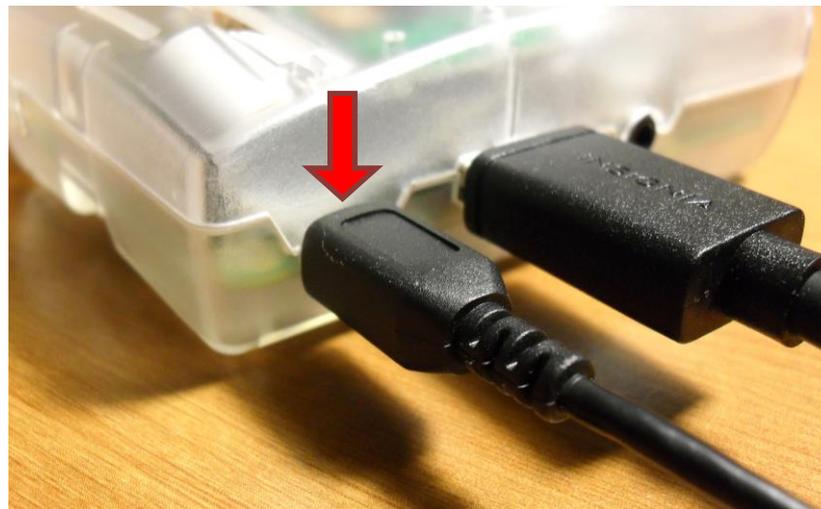
10. Plug the USB WiFi dongle into one of the USB ports
11. Plug in keyboard and mouse
12. Plug in monitor using the HDMI port
13. Make sure monitor is turned on
14. Don't plug in the power supply just yet



Hands-On: Assembling the Pi

Where is the power button?

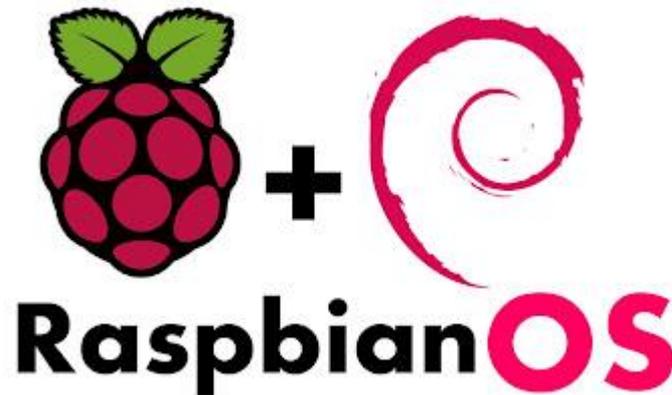
- The Raspberry Pi doesn't have a power button. It boots up as soon as you plug in the power supply.
- If you've completed all the previous steps, plug in the power supply to boot the Raspberry Pi.



Hands-On: Configuring the Pi

Installing the Operating System

The micro SD that you have comes pre-installed with the Linux based Raspbian OS. Raspbian is a fork of another Linux distribution called Debian.



Hands-On: Configuring the Pi

How to log into the Raspberry Pi for the first time

You won't see the password as you type it. This is a Linux security feature.

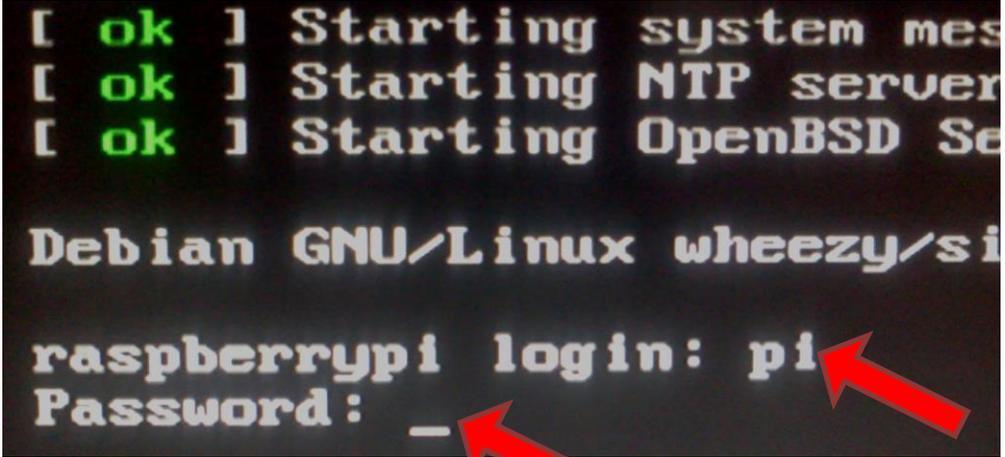
Login: **pi**

Password: **raspberrypi**

```
[ ok ] Starting system mes
[ ok ] Starting NTP server
[ ok ] Starting OpenBSD Se

Debian GNU/Linux wheezy/si

raspberrypi login: pi
Password: _
```

A terminal window showing the boot process of a Raspberry Pi. The output includes status messages for starting system messages, NTP server, and OpenBSD services. Below these, it shows the Debian GNU/Linux wheezy/sid logo. The prompt 'raspberrypi login:' is followed by the user 'pi' and a password prompt 'Password:' with a single underscore character. Three red arrows point to the 'pi' in the login prompt, the underscore in the password prompt, and the underscore in the password prompt.

Hands-On: Configuring the Pi

Configuring the Raspberry Pi for the first time

Launch the Raspberry Pi Configuration Tool

```
~$ sudo raspi-config
```

```

Raspberry Pi Software Configuration Tool (raspi-config)
Setup Options
1 Expand Filesystem      Ensures that all of the SD card storage is available to the OS
2 Change User Password   Change password for the default user (pi)
3 Enable Boot to Desktop/Scratch Choose whether to boot into a desktop environment, Scratch, or the command-line
4 Internationalisation Options Set up language and regional settings to match your location
5 Enable Camera          Enable this Pi to work with the Raspberry Pi Camera
6 Add to Rastrack        Add this Pi to the online Raspberry Pi Map (Rastrack)
7 Overclock              Configure overclocking for your Pi
8 Advanced Options       Configure advanced settings
9 About raspi-config     Information about this configuration tool

<Select>                                <Finish>
  
```

Hands-On: Configuring the Pi

Setting the keyboard layout

1. Choose option 4 Internationalization Options

Raspberry Pi Software Configuration Tool (raspi-config)

- | | |
|---------------------------------------|---|
| 1 Expand Filesystem | Ensures that all of the SD card storage is available to the OS |
| 2 Change User Password | Change password for the default user (pi) |
| 3 Enable Boot to Desktop/Scratch | Choose whether to boot into a desktop environment, Scratch, or the command-line |
| 4 Internationalisation Options | Set up language and regional settings to match your location |
| 5 Enable Camera | Enable this Pi to work with the Raspberry Pi Camera |
| 6 Add to Rastrack | Add this Pi to the online Raspberry Pi Map (Rastrack) |
| 7 Overclock | Configure overclocking for your Pi |
| 8 Advanced Options | Configure advanced settings |
| 9 About raspi-config | Information about this configuration tool |

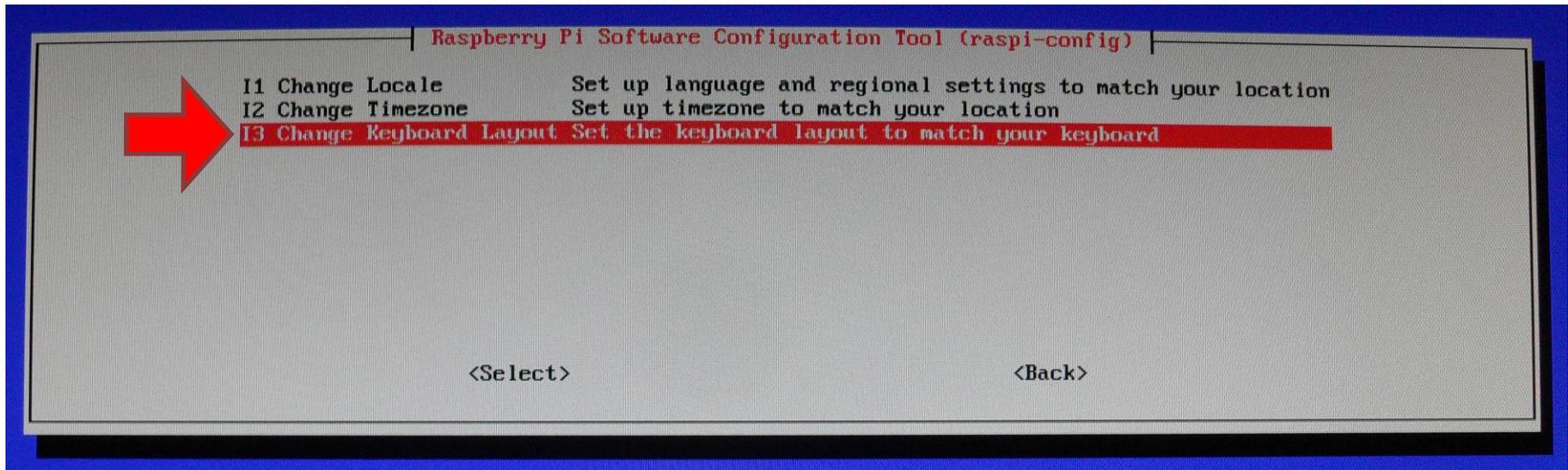
<Select>

<Finish>

Hands-On: Configuring the Pi

Setting the keyboard layout

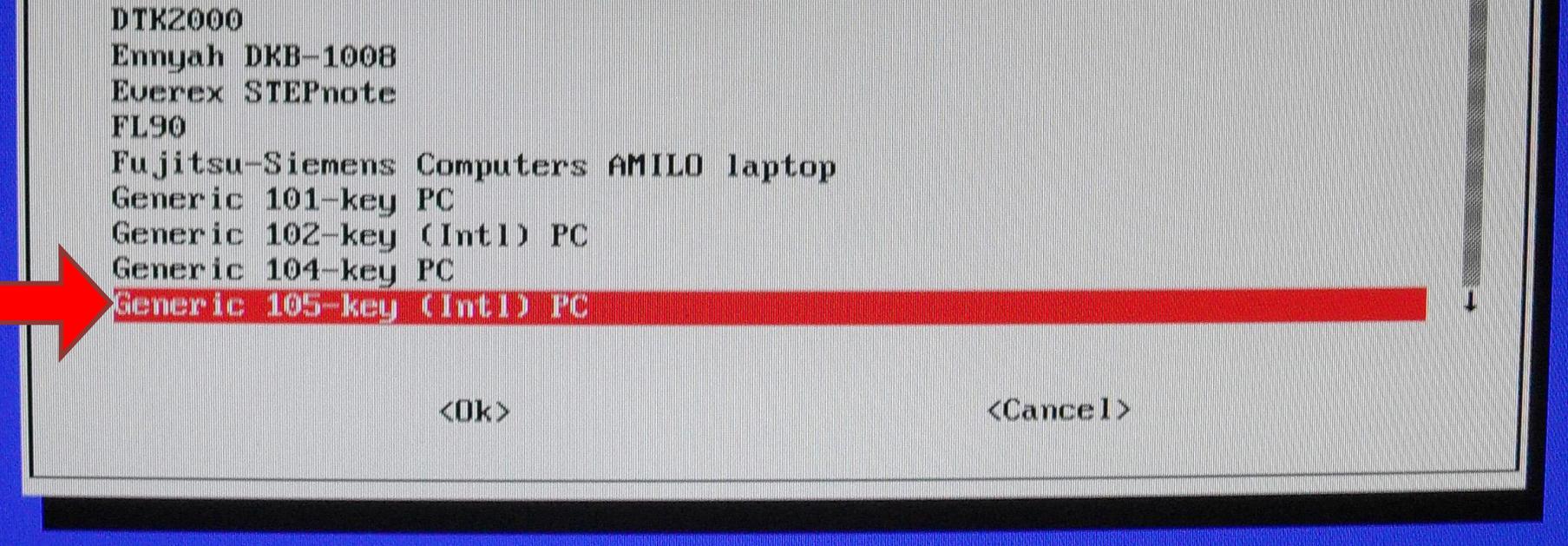
2. Choose option **I3 Change Keyboard Layout**



Hands-On: Configuring the Pi

Setting the keyboard layout

3. Choose an appropriate US keyboard type



```
DTK2000
Emmyah DKB-1008
Everex STEPnote
FL90
Fujitsu-Siemens Computers AMILO laptop
Generic 101-key PC
Generic 102-key (Int1) PC
Generic 104-key PC
Generic 105-key (Int1) PC
```

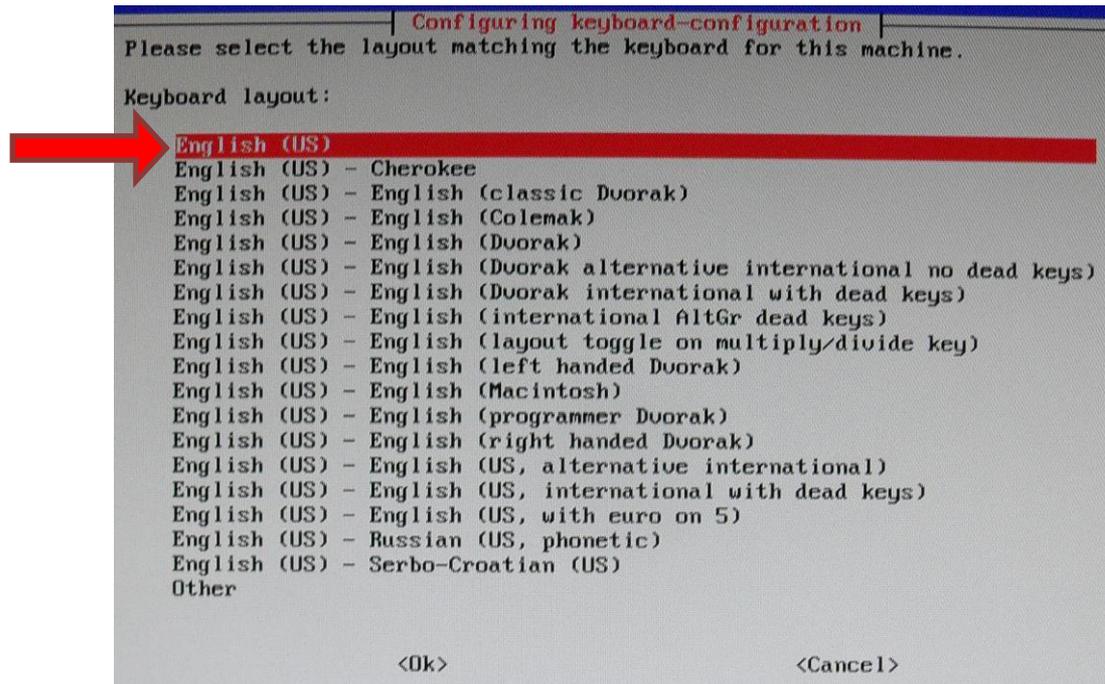
<Ok>

<Cancel>

Hands-On: Configuring the Pi

Setting the keyboard layout

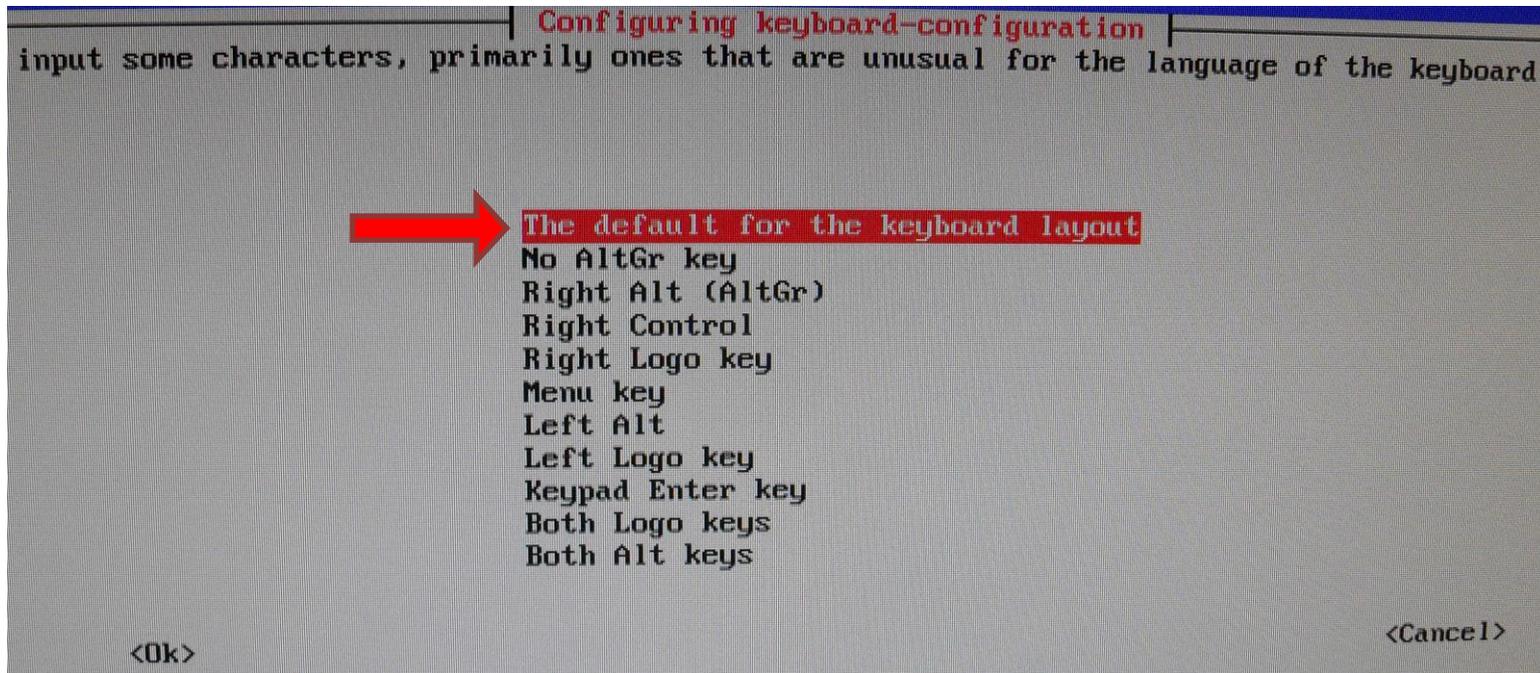
4. Choose **English (US)** for keyboard layout



Hands-On: Configuring the Pi

Setting special command keys for the keyboard

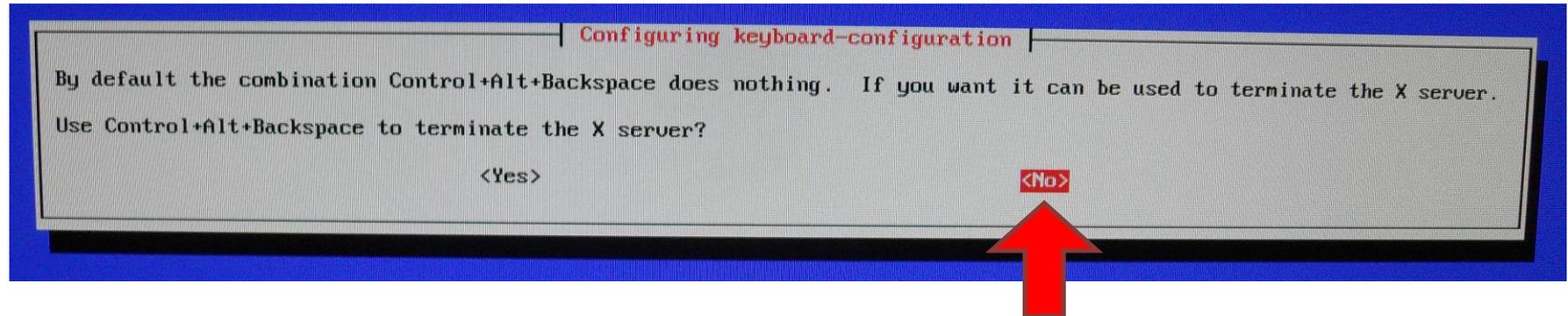
5. Choose the default for the keyboard layout



Hands-On: Configuring the Pi

Setting special command keys for the keyboard

6. Select **No** for the Control+Alt+Backspace command



Hands-On: Configuring the Pi

Enabling the camera socket

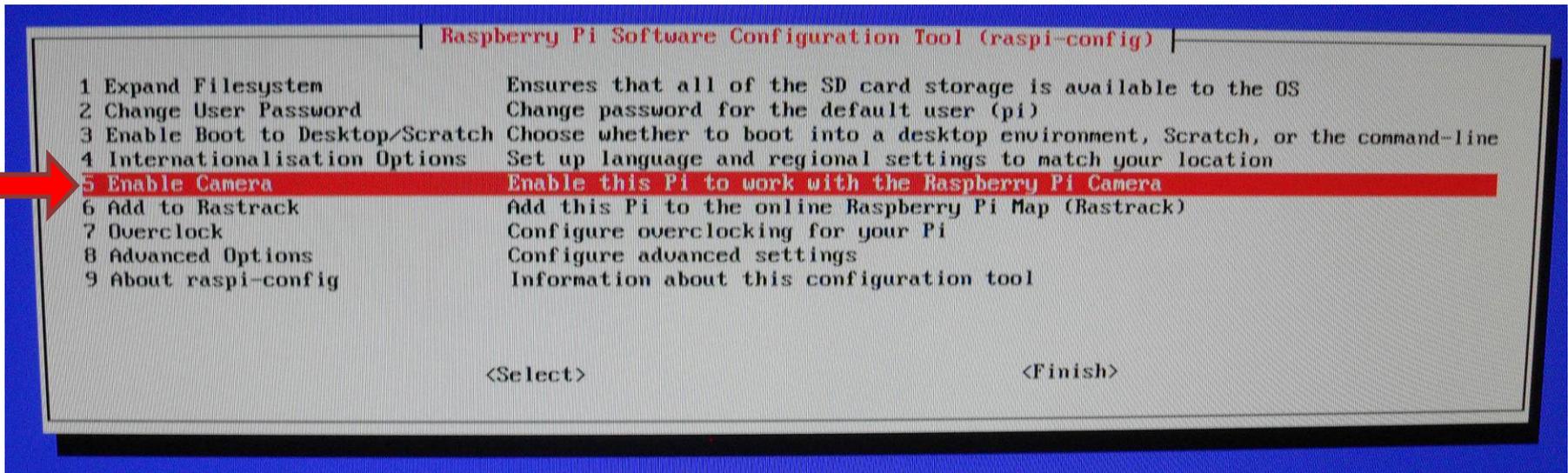
7. Choose option **5 Enable Camera**

```

Raspberry Pi Software Configuration Tool (raspi-config)

1 Expand Filesystem           Ensures that all of the SD card storage is available to the OS
2 Change User Password        Change password for the default user (pi)
3 Enable Boot to Desktop/Scratch Choose whether to boot into a desktop environment, Scratch, or the command-line
4 Internationalisation Options Set up language and regional settings to match your location
5 Enable Camera                Enable this Pi to work with the Raspberry Pi Camera
6 Add to Rastrack              Add this Pi to the online Raspberry Pi Map (Rastrack)
7 Overclock                   Configure overclocking for your Pi
8 Advanced Options            Configure advanced settings
9 About raspi-config           Information about this configuration tool

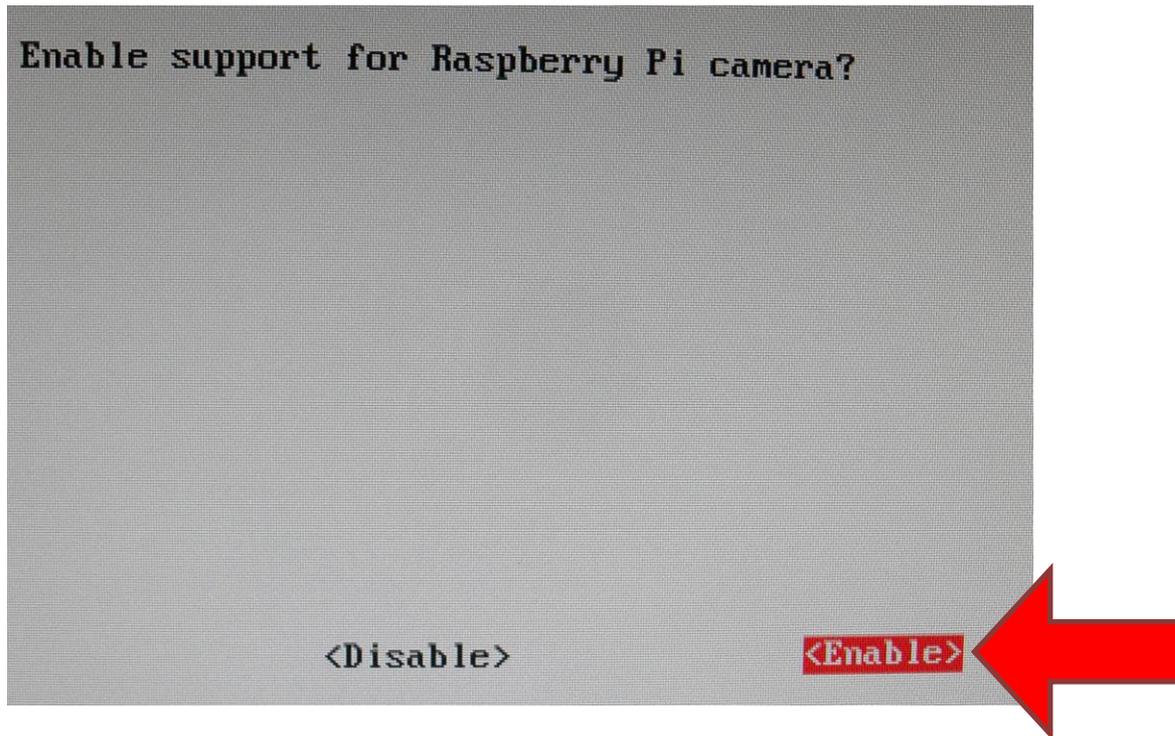
                                <Select>                                <Finish>
  
```



Hands-On: Configuring the Pi

Enabling the camera socket

8. Select **Enable**



Hands-On: Configuring the Pi

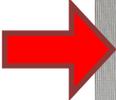
Optional: Set to automatically boot to GUI

9. Choose option **3 Enable Boot to Desktop/Scratch**

```

Raspberry Pi Software Configuration Tool (raspi-config)
1 Expand Filesystem           Ensures that all of the SD card storage is available to the OS
2 Change User Password        Change password for the default user (pi)
3 Enable Boot to Desktop/Scratch Choose whether to boot into a desktop environment, Scratch, or the command-line
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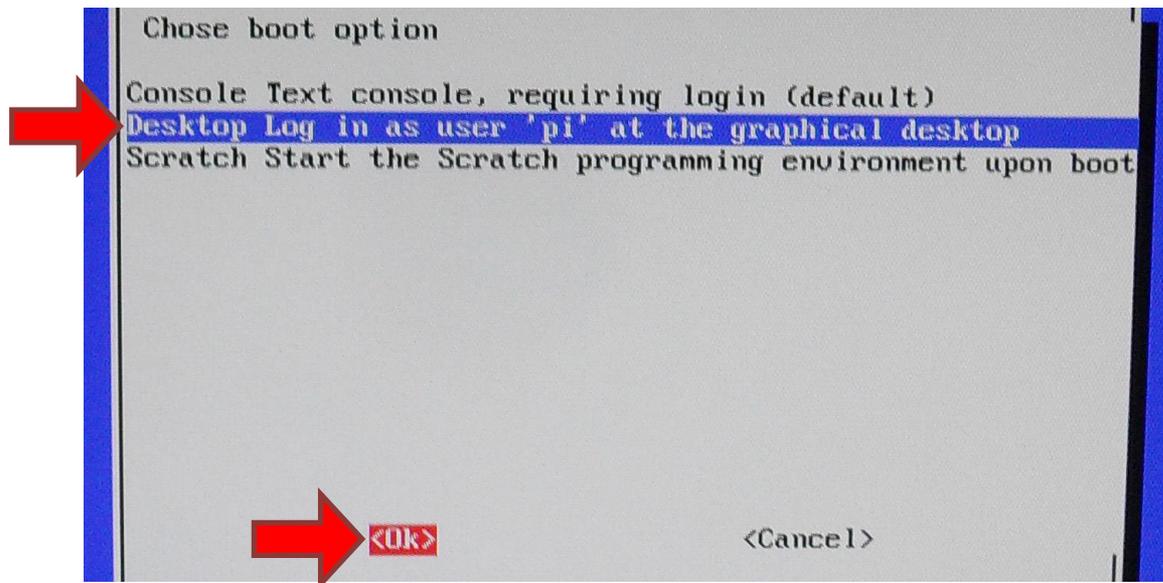
                                <Select>                                <Finish>
  
```



Hands-On: Configuring the Pi

Optional: Set to automatically boot to GUI

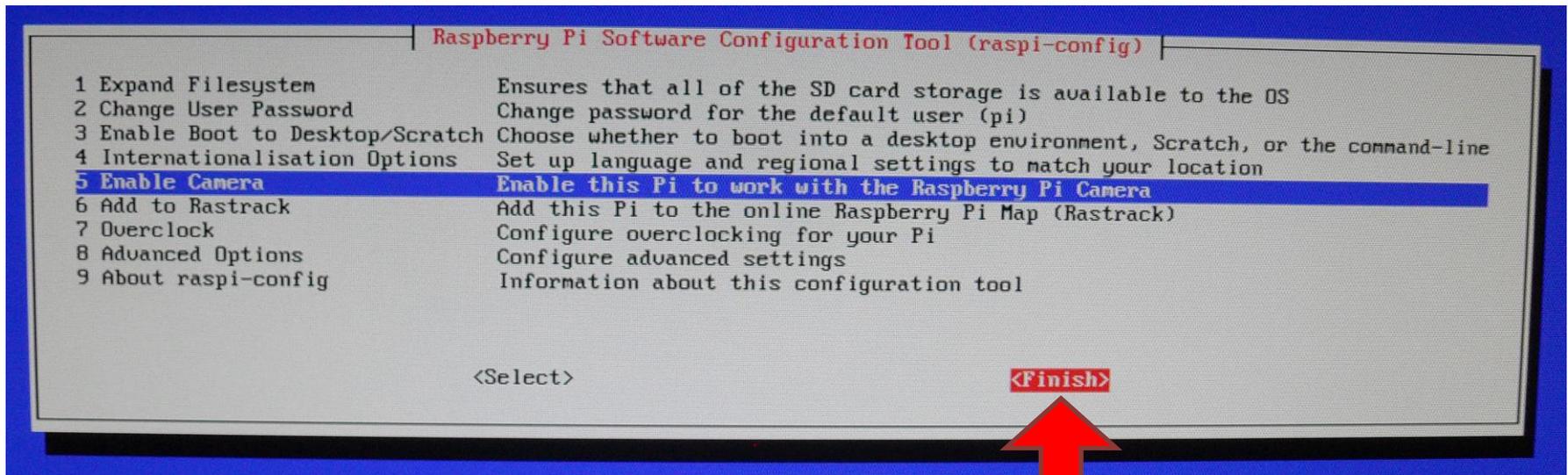
10. Select **Log in as user 'pi' at the graphical desktop** then select **Ok**



Hands-On: Configuring the Pi

Exit the configuration tool

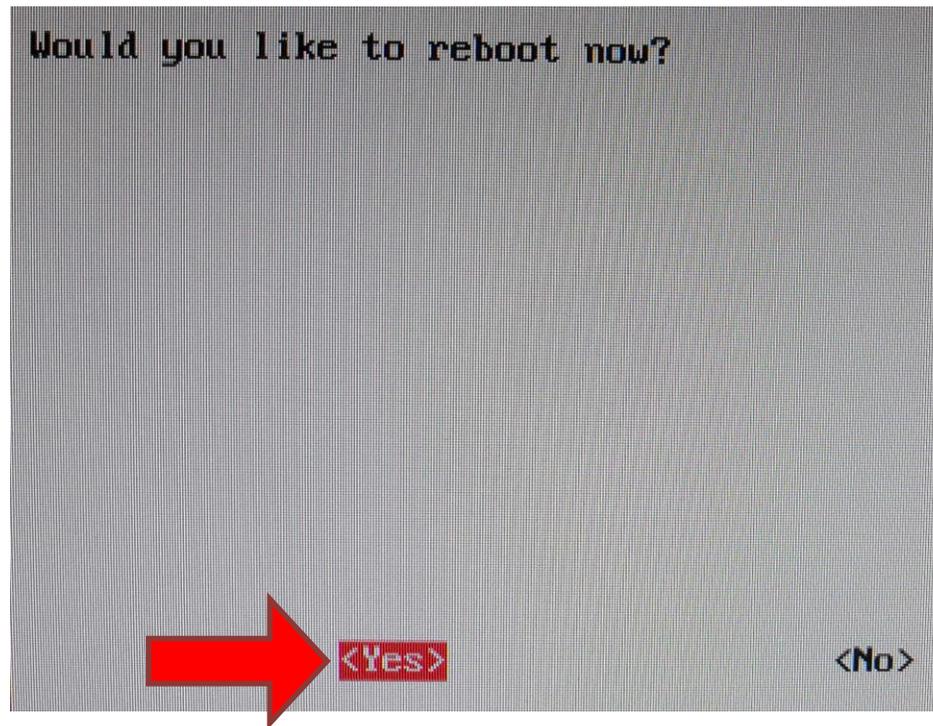
11. Select **Finish**



Hands-On: Configuring the Pi

Exit the configuration tool

12. Select **Yes** if prompted to reboot



Hands-On: WiFi Setup

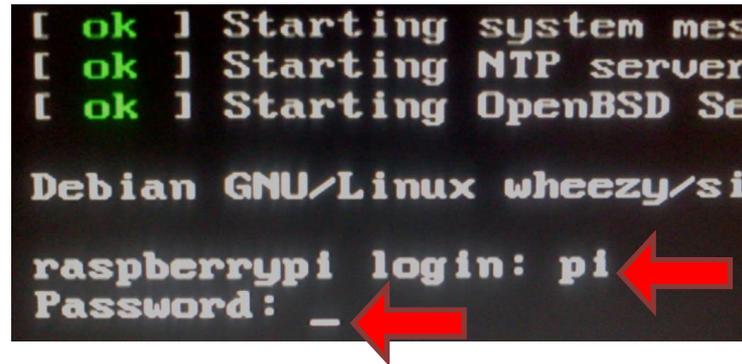
Login: `pi`

Password: `raspberry`

```
[ ok ] Starting system mes
[ ok ] Starting NTP server
[ ok ] Starting OpenBSD Se

Debian GNU/Linux wheezy/si

raspberrypi login: pi
Password: _
```



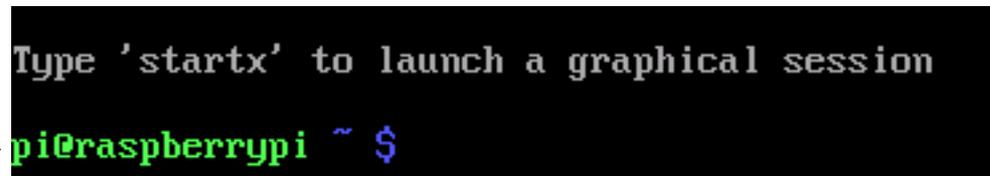
The Command Line

`~$`



```
Type 'startx' to launch a graphical session

pi@raspberrypi ~ $
```

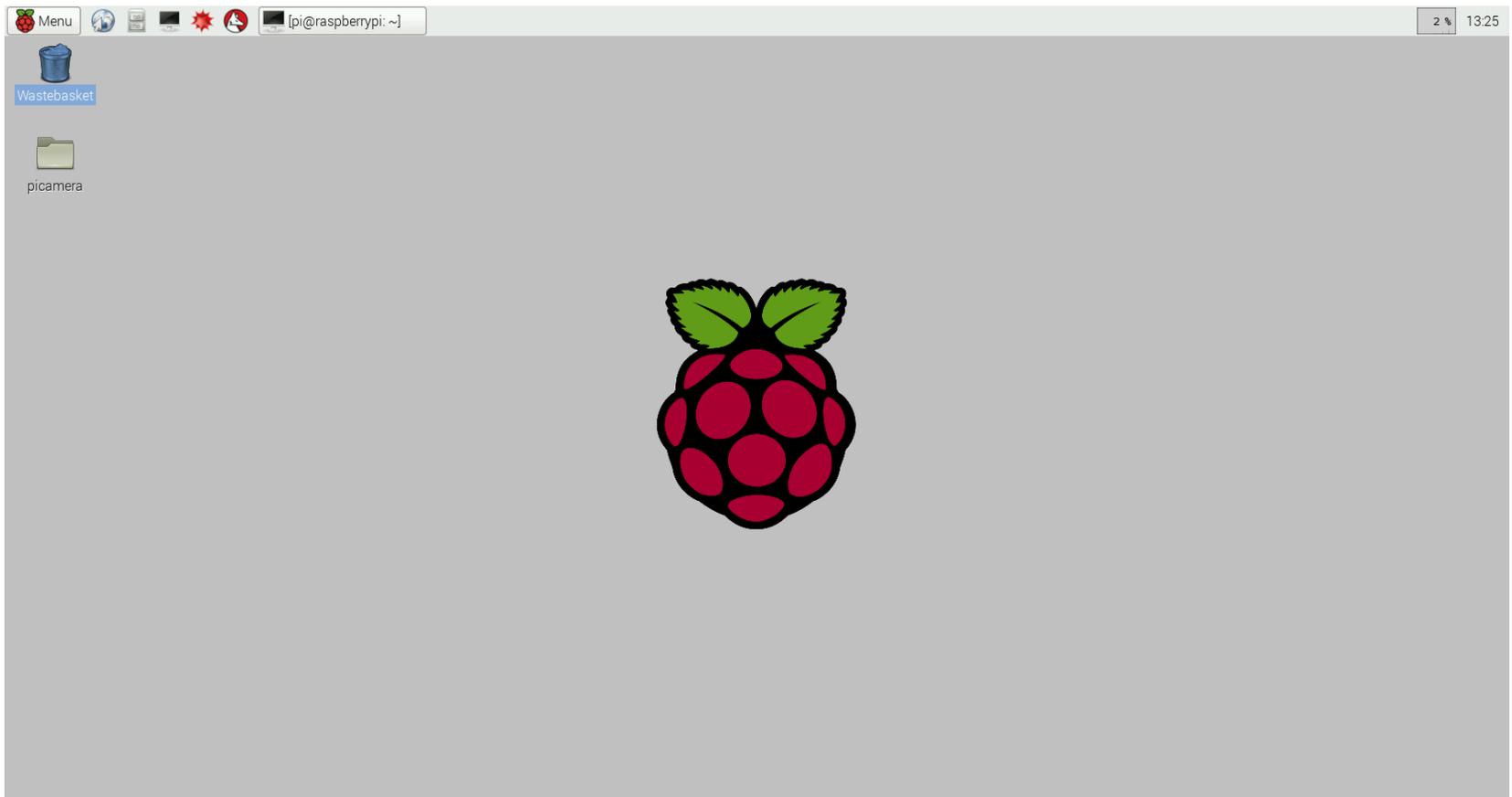


Type the following command and press ENTER

`~$ startx`

Hands-On: WiFi Setup

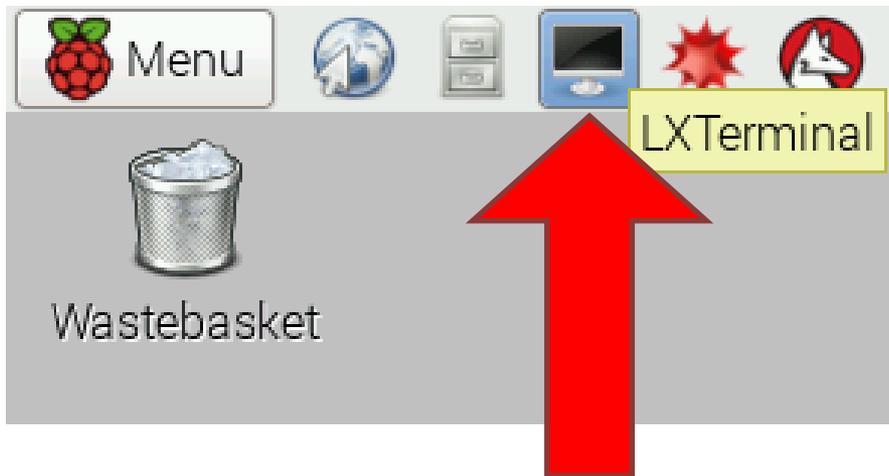
The Raspbian Desktop



Hands-On: WiFi Setup

Confirm that the WiFi dongle has been detected

1. Click the **LXTerminal** button in the top left menu bar
2. Type the command below into the command line



```
pi@raspberrypi ~ $
```

```
~$ ifconfig
```

Hands-On: WiFi Setup

Confirm that the WiFi dongle has been detected

3. You should see **wlan0** in the list
4. You can close the terminal by typing **exit** and pressing **ENTER** if **wlan0** is in the list



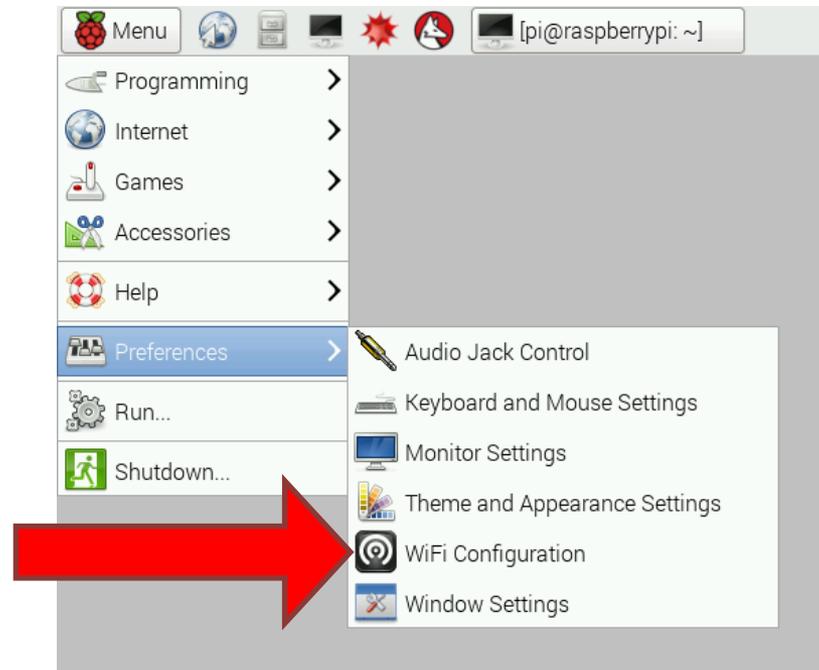
```
wlan0      Link encap:Ethernet  HWaddr 00:c1:41:29:39:97
UP BROADCAST MULTICAST  MTU:1500  Metric:1
RX packets:22 errors:0 dropped:0 overruns:0 frame:0
TX packets:26 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:3428 (3.3 KiB)  TX bytes:5682 (5.5 KiB)

pi@raspberrypi ~ $ █
```

Hands-On: WiFi Setup

Connect to ND-Guest

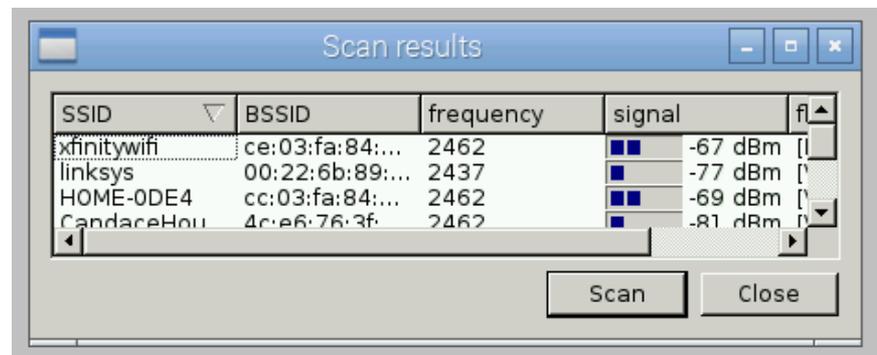
5. Click the menu button find **Preferences**
6. From Preferences select **WiFi Configuration**



Hands-On: WiFi Setup

Connect to ND-Guest

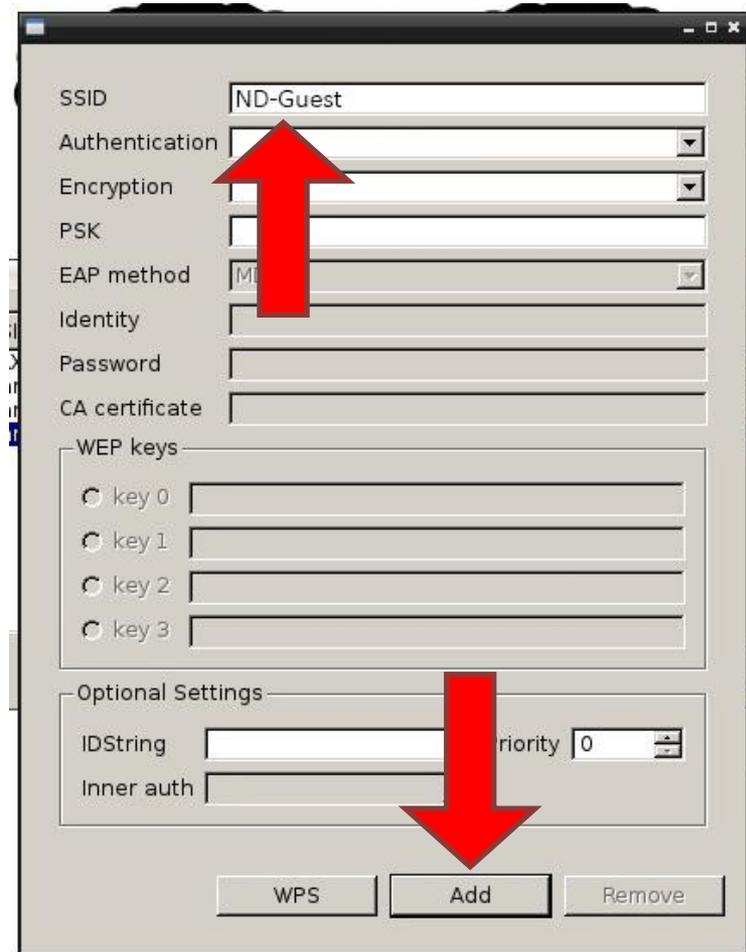
7. Click the **Scan** button
8. Double click **ND-Guest** from the list



Hands-On: WiFi Setup

Connect to ND-Guest

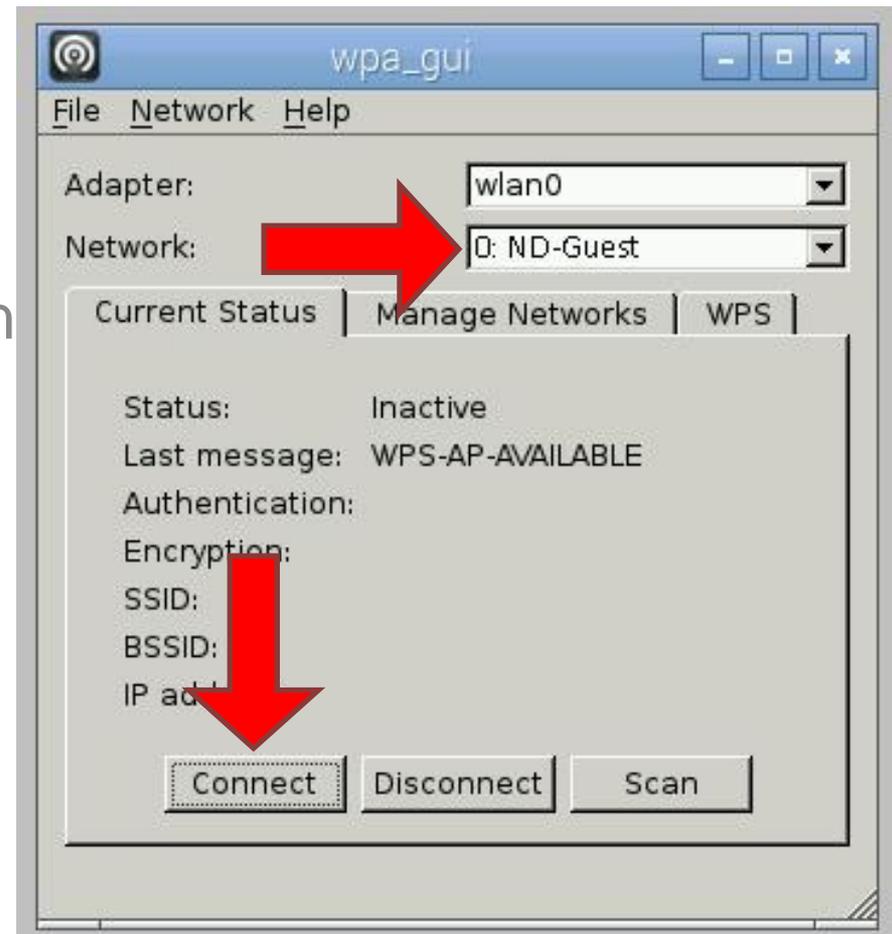
- Click on the **Add** button without making any changes to ND-Guest



Hands-On: WiFi Setup

Connect to ND-Guest

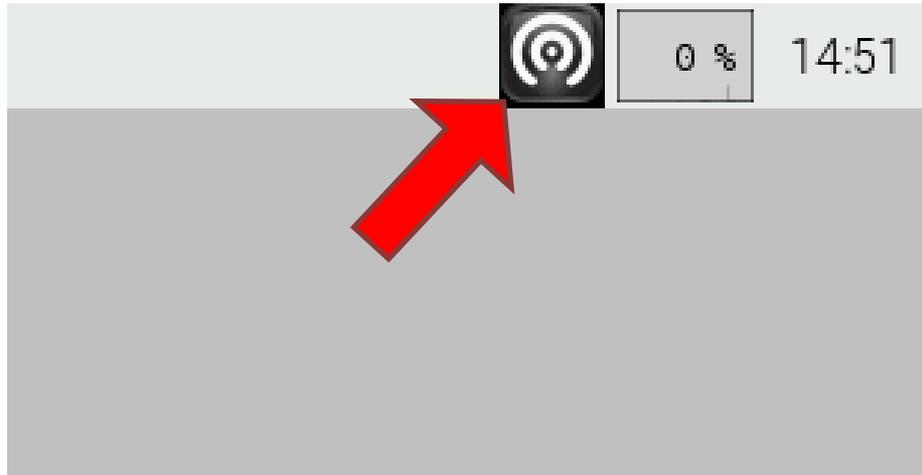
10. Make sure **ND-Guest** is the selected network
11. Click the **Connect** button



Hands-On: WiFi Setup

The Wifi connection should now be working

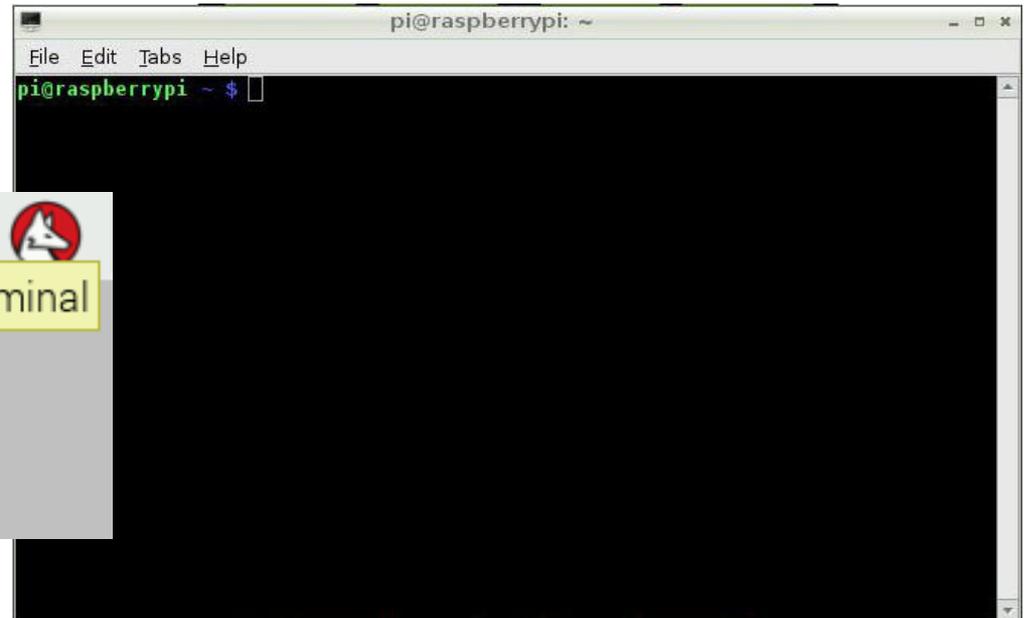
The WiFi Configuration Tool will be running in the background. You might see it in the top right corner of your screen.



Hands-On: The Command Line

The command line gives you more control

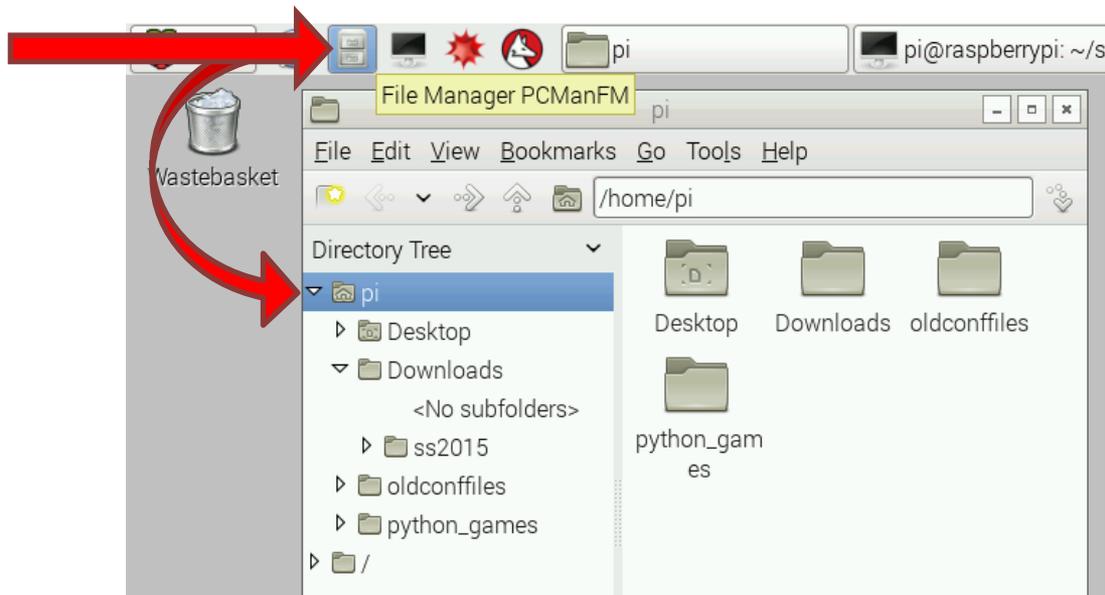
Click on the **LXTerminal** button in the top left menu bar. This will give you access to a console that can do everything the GUI can and more.



Hands-On: The Command Line

Learning how to use the command line

As we go through the command line lesson you can also have your file system opened in the GUI so you can see some of the changes we make.



Hands-On: The Command Line

Learning how to use the command line

You may have already used a few different commands during this presentation.

```
~$ sudo raspi-config
```

```
~$ startx
```

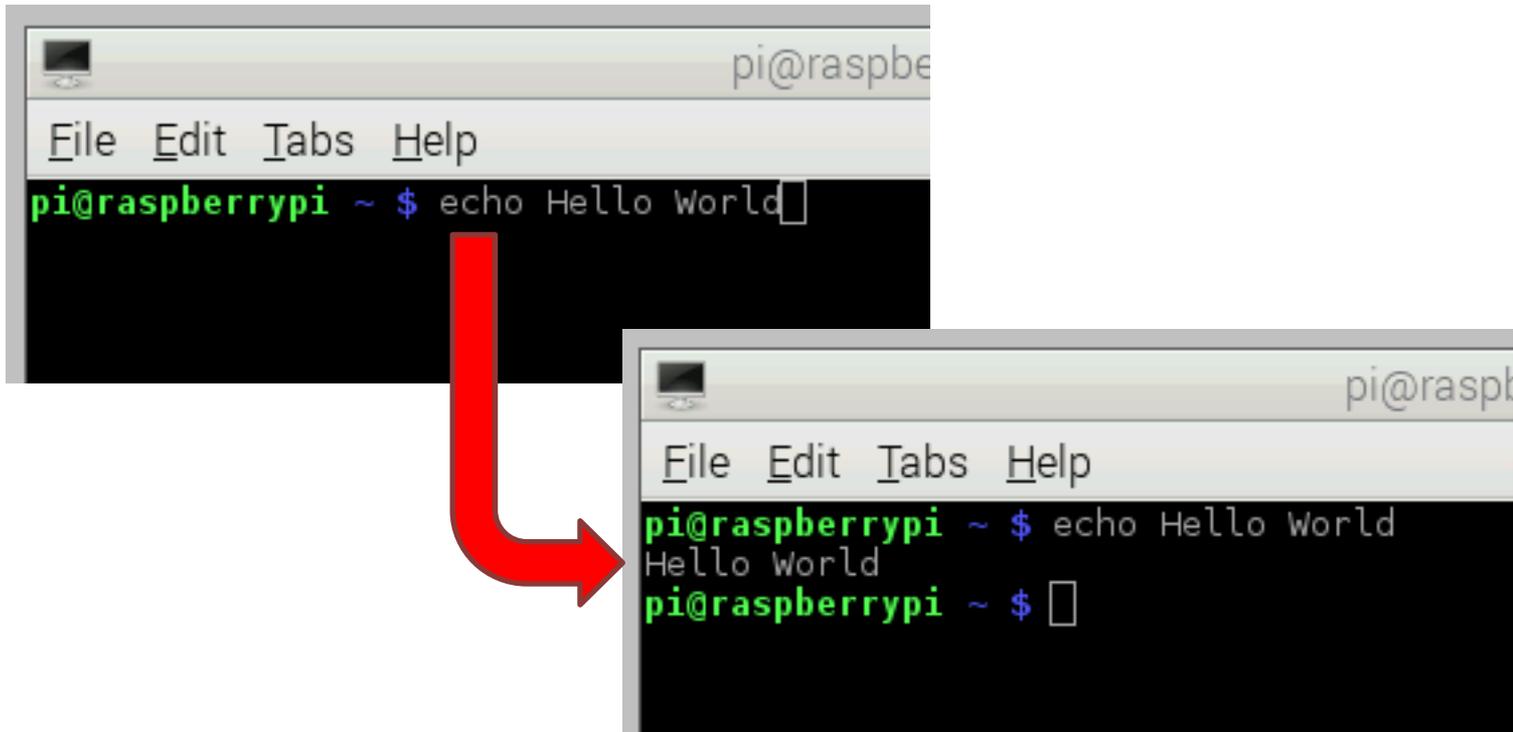
```
~$ ifconfig
```

Now we can learn some more commands. Try each command as we go through them.

Hands-On: The Command Line

Learning how to use the command line

Echo will print the argument to the console.



The image shows two terminal windows from a Raspberry Pi. The top window shows the command `echo Hello World` being typed at the prompt `pi@raspberrypi ~ $`. A large red arrow points from this window to the bottom window. The bottom window shows the same command executed, with the output `Hello World` printed on the line below the command. The prompt `pi@raspberrypi ~ $` is now on a new line, indicating the command has finished.

```
pi@raspberrypi ~ $ echo Hello World
```

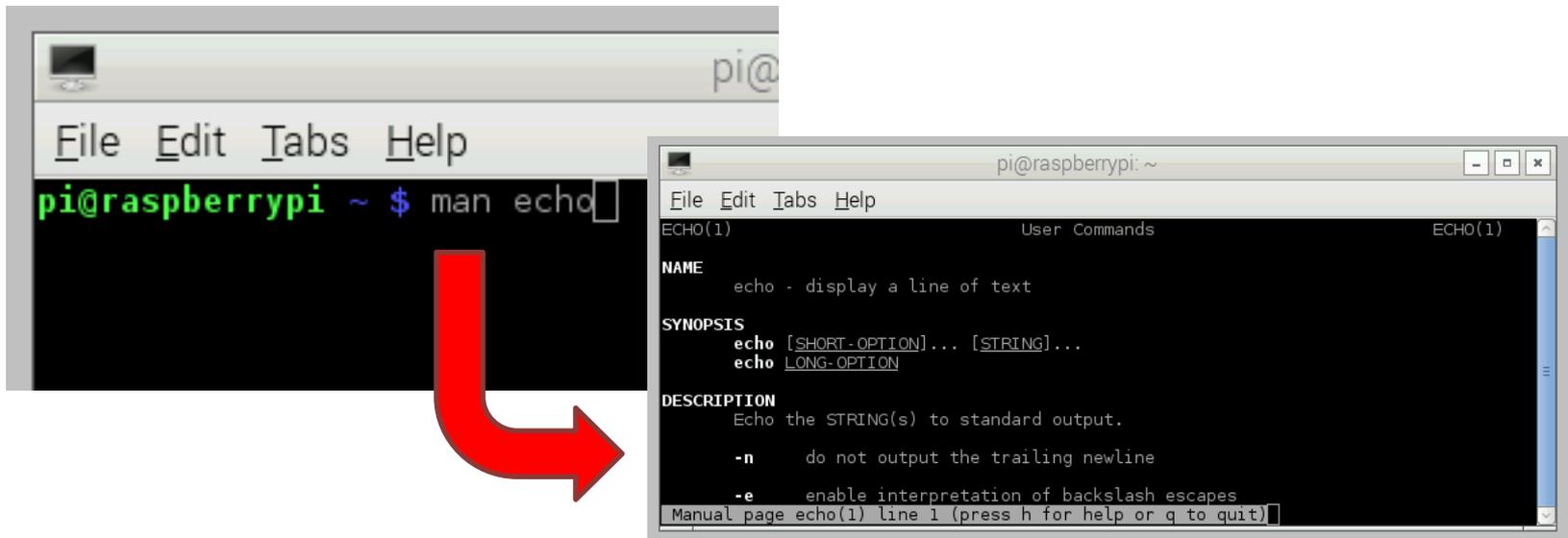
```
pi@raspberrypi ~ $ echo Hello World
Hello World
pi@raspberrypi ~ $
```

Hands-On: The Command Line

Learning how to use the command line

Man will show you the manual page for the argument.

Press **Q** on the keyboard to exit the manual page.



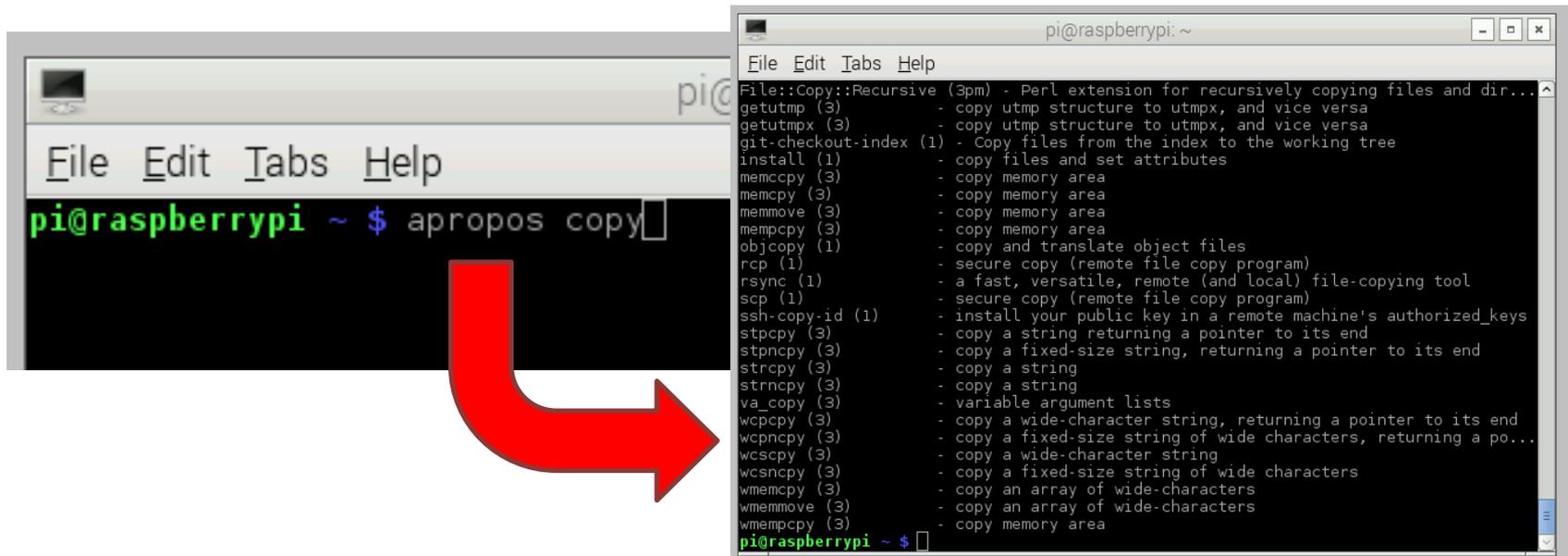
```
pi@raspberrypi ~ $ man echo
```

```
File Edit Tabs Help
ECHO(1) User Commands ECHO(1)
NAME
  echo - display a line of text
SYNOPSIS
  echo [SHORT-OPTION]... [STRING]...
  echo LONG-OPTION
DESCRIPTION
  Echo the STRING(s) to standard output.
  -n    do not output the trailing newline
  -e    enable interpretation of backslash escapes
Manual page echo(1) line 1 (press h for help or q to quit)
```

Hands-On: The Command Line

Learning how to use the command line

Apropos is used to search the manual page descriptions for the specified keyword. You can find commands with “copy” in their descriptions as an example.



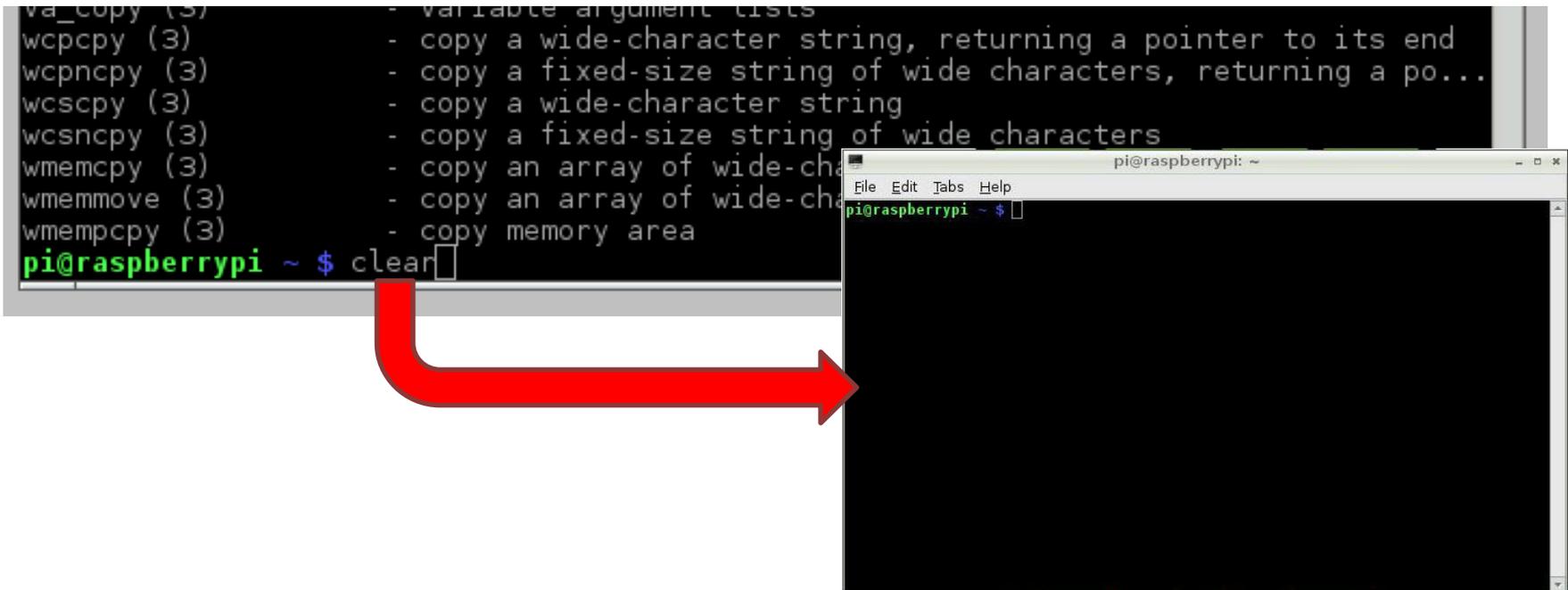
```

pi@raspberrypi ~ $ apropos copy
File::Copy::Recursive (3pm) - Perl extension for recursively copying files and dir...
getutmp (3) - copy utmp structure to utmpx, and vice versa
getutmpx (3) - copy utmp structure to utmpx, and vice versa
git-checkout-index (1) - Copy files from the index to the working tree
install (1) - copy files and set attributes
memccpy (3) - copy memory area
memcpy (3) - copy memory area
memmove (3) - copy memory area
mempcpy (3) - copy memory area
objcopy (1) - copy and translate object files
rcp (1) - secure copy (remote file copy program)
rsync (1) - a fast, versatile, remote (and local) file-copying tool
scp (1) - secure copy (remote file copy program)
ssh-copy-id (1) - install your public key in a remote machine's authorized_keys
stpcpy (3) - copy a string returning a pointer to its end
stpncpy (3) - copy a fixed-size string, returning a pointer to its end
strcpy (3) - copy a string
strncpy (3) - copy a string
va_copy (3) - variable argument lists
wcpncpy (3) - copy a wide-character string, returning a pointer to its end
wcsncpy (3) - copy a fixed-size string of wide characters, returning a po...
wcsncpy (3) - copy a wide-character string
wcsncpy (3) - copy a fixed-size string of wide characters
wmemcpy (3) - copy an array of wide-characters
wmemmove (3) - copy an array of wide-characters
wmemcpy (3) - copy memory area
    
```

Hands-On: The Command Line

Learning how to use the command line

Clear will move the prompt to the top of the console window. This effectively clears the console.



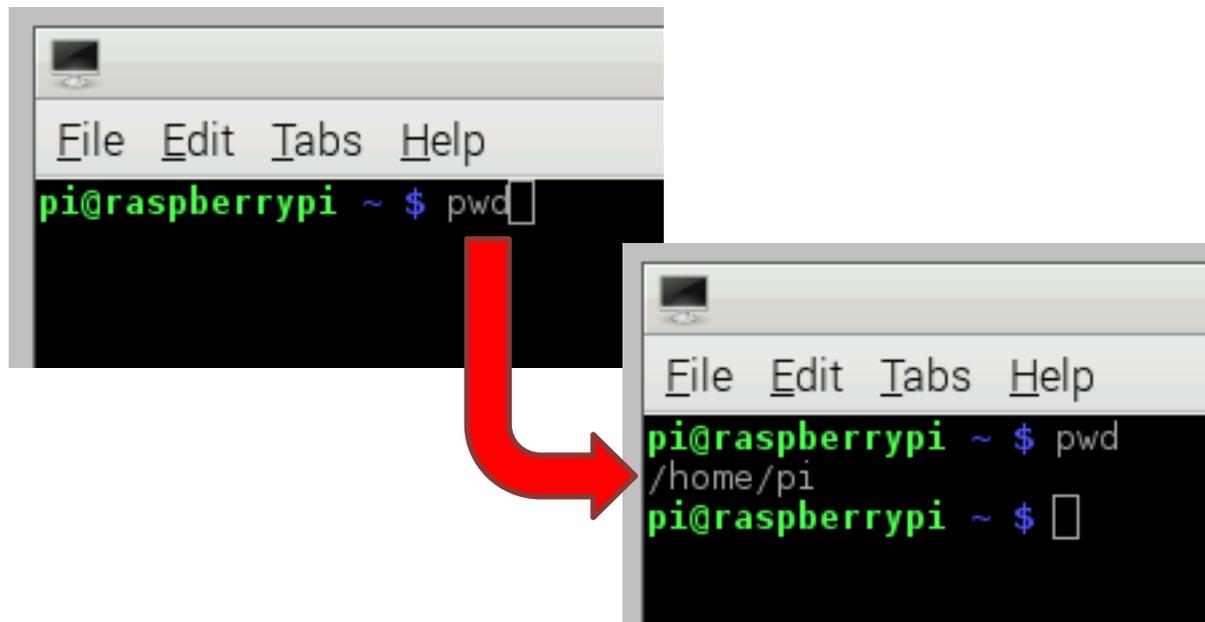
```
va_copy (3) - variable argument lists
wcpcpy (3) - copy a wide-character string, returning a pointer to its end
wcpncpy (3) - copy a fixed-size string of wide characters, returning a po...
wscpy (3) - copy a wide-character string
wcsncpy (3) - copy a fixed-size string of wide characters
wmemcpy (3) - copy an array of wide-chara
wmemmove (3) - copy an array of wide-ch
wmemcpy (3) - copy memory area
pi@raspberrypi ~ $ clear
```

```
pi@raspberrypi: ~
pi@raspberrypi ~ $
```

Hands-On: The Command Line

Learning how to use the command line

Pwd will print the current working directory path. This is basically “where you are” with this console.



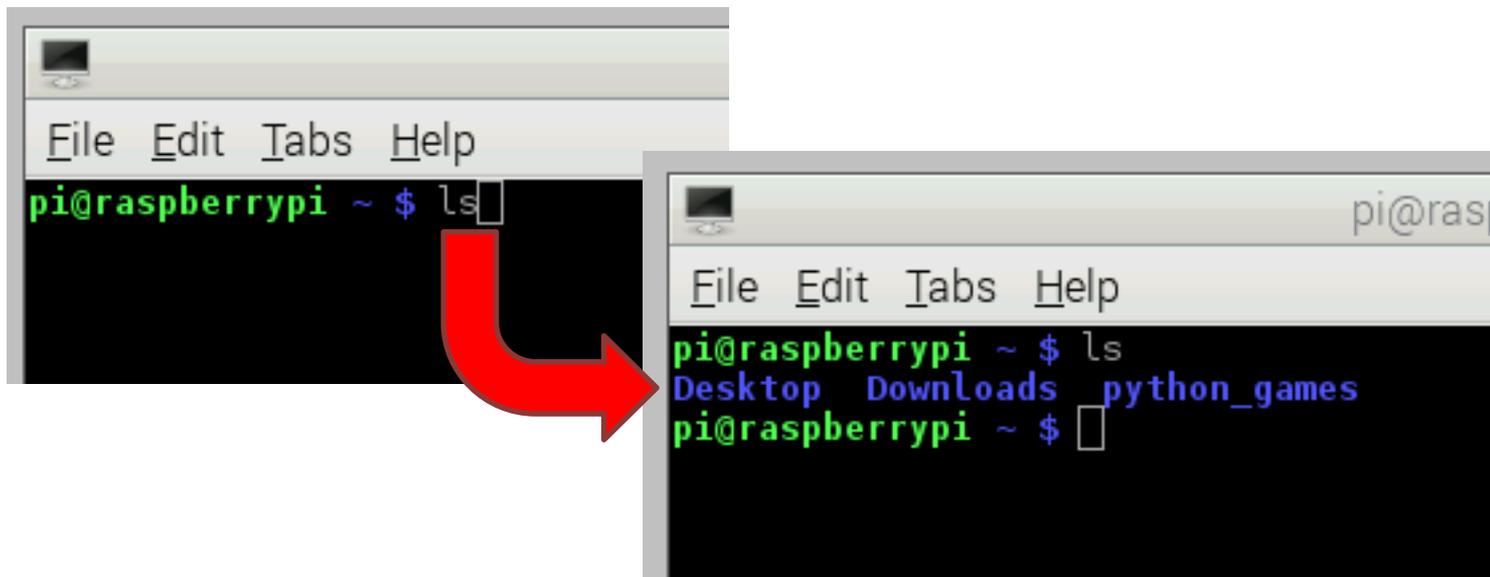
```
File Edit Tabs Help
pi@raspberrypi ~ $ pwd

File Edit Tabs Help
pi@raspberrypi ~ $ pwd
/home/pi
pi@raspberrypi ~ $
```

Hands-On: The Command Line

Learning how to use the command line

Ls will list the directories in the current working directory.



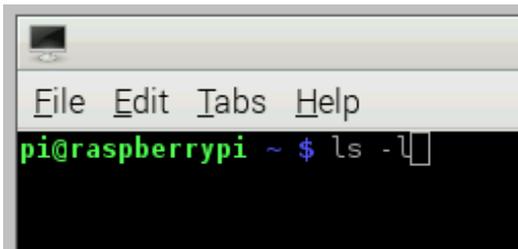
```
File Edit Tabs Help
pi@raspberrypi ~ $ ls

File Edit Tabs Help
pi@raspberrypi ~ $ ls
Desktop Downloads python_games
pi@raspberrypi ~ $
```

Hands-On: The Command Line

Learning how to use the command line

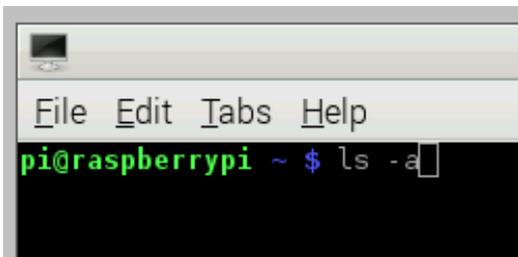
Most commands have options (arguments) that change their behavior. The options usually start with a “-” and are typed after the command.



```

File Edit Tabs Help
pi@raspberrypi ~ $ ls -a
  
```

~\$ `ls -a`  *Display hidden files*



```

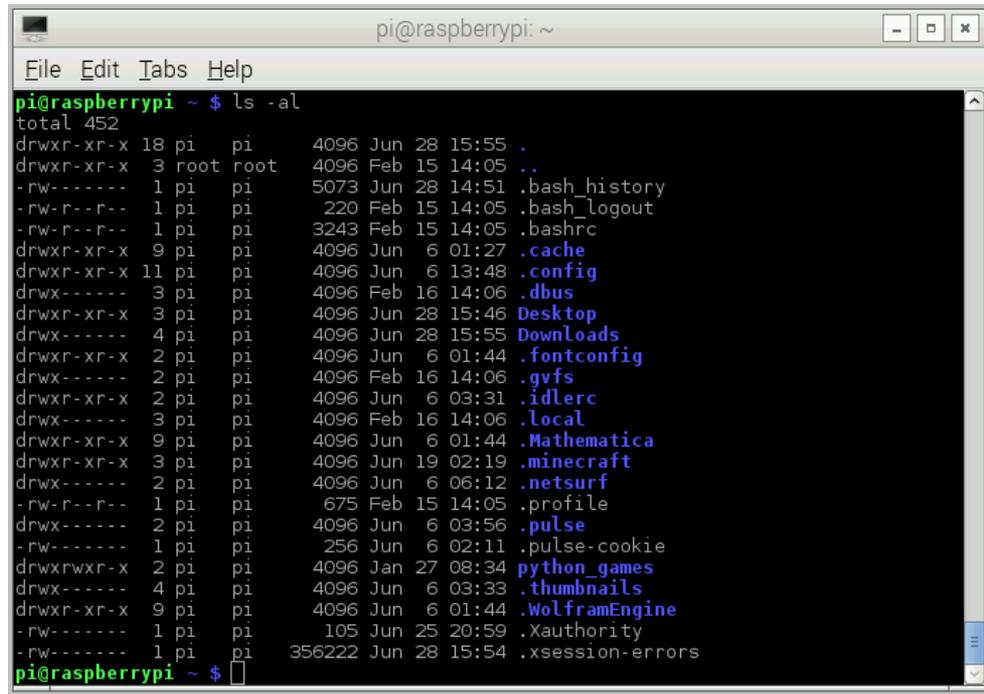
File Edit Tabs Help
pi@raspberrypi ~ $ ls -l
  
```

~\$ `ls -l`  *List files in long format*

Hands-On: The Command Line

Learning how to use the command line

You can combine most arguments. Try using both “a” and “l” after the **ls** command.



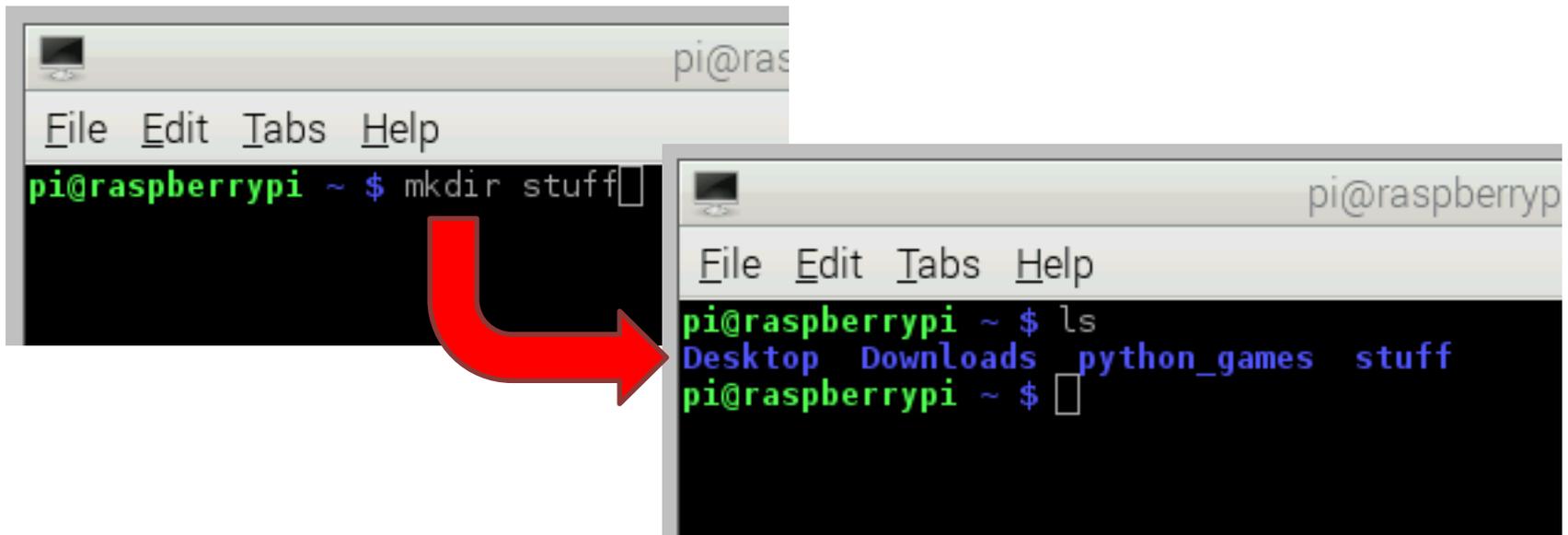
```

pi@raspberrypi: ~
File Edit Tabs Help
pi@raspberrypi ~ $ ls -al
total 452
drwxr-xr-x 18 pi pi 4096 Jun 28 15:55 .
drwxr-xr-x 3 root root 4096 Feb 15 14:05 ..
-rw-r----- 1 pi pi 5073 Jun 28 14:51 .bash_history
-rw-r--r-- 1 pi pi 220 Feb 15 14:05 .bash_logout
-rw-r--r-- 1 pi pi 3243 Feb 15 14:05 .bashrc
drwxr-xr-x 9 pi pi 4096 Jun 6 01:27 .cache
drwxr-xr-x 11 pi pi 4096 Jun 6 13:48 .config
drwx----- 3 pi pi 4096 Feb 16 14:06 .dbus
drwxr-xr-x 3 pi pi 4096 Jun 28 15:46 Desktop
drwx----- 4 pi pi 4096 Jun 28 15:55 Downloads
drwxr-xr-x 2 pi pi 4096 Jun 6 01:44 .fontconfig
drwx----- 2 pi pi 4096 Feb 16 14:06 .gvfs
drwxr-xr-x 2 pi pi 4096 Jun 6 03:31 .idlerc
drwx----- 3 pi pi 4096 Feb 16 14:06 .local
drwxr-xr-x 9 pi pi 4096 Jun 6 01:44 .Mathematica
drwxr-xr-x 3 pi pi 4096 Jun 19 02:19 .minecraft
drwx----- 2 pi pi 4096 Jun 6 06:12 .netsurf
-rw-r--r-- 1 pi pi 675 Feb 15 14:05 .profile
drwx----- 2 pi pi 4096 Jun 6 03:56 .pulse
-rw-r----- 1 pi pi 256 Jun 6 02:11 .pulse-cookie
drwxrwxr-x 2 pi pi 4096 Jan 27 08:34 python_games
drwx----- 4 pi pi 4096 Jun 6 03:33 .thumbnails
drwxr-xr-x 9 pi pi 4096 Jun 6 01:44 .WolframEngine
-rw-r----- 1 pi pi 105 Jun 25 20:59 .xauthority
-rw-r----- 1 pi pi 356222 Jun 28 15:54 .xsession-errors
pi@raspberrypi ~ $
    
```

Hands-On: The Command Line

Learning how to use the command line

Mkdir will create a new directory with the name you specify after the command. Use **mkdir** and then use **ls** to see the directory you created.



The image shows two terminal windows from a Raspberry Pi. The left window shows the command `mkdir stuff` being entered at the prompt. A large red arrow points from this window to the right window. The right window shows the command `ls` being entered, and the output listing the directory `stuff` among other files and directories: `Desktop Downloads python_games stuff`.

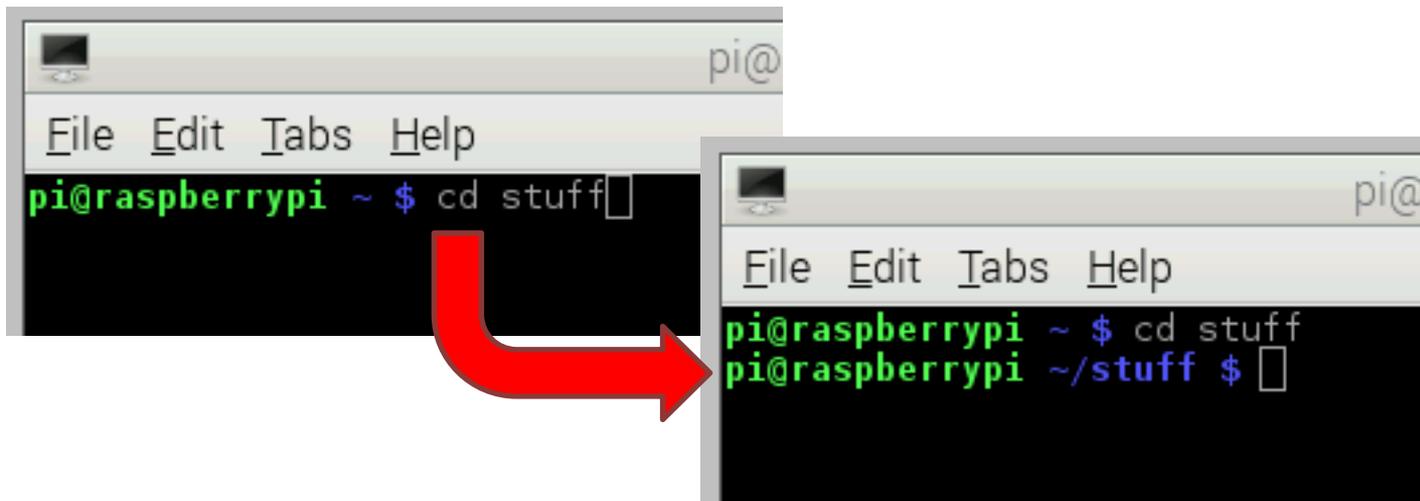
```
pi@ras  
File Edit Tabs Help  
pi@rasberrypi ~ $ mkdir stuff
```

```
pi@rasberrypi ~ $ ls  
Desktop Downloads python_games stuff  
pi@rasberrypi ~ $
```

Hands-On: The Command Line

Learning how to use the command line

Cd is used to change the current working directory. Specify the directory or directory path after the command. You can also use the **tab** key to auto-complete directory and file names in the console.



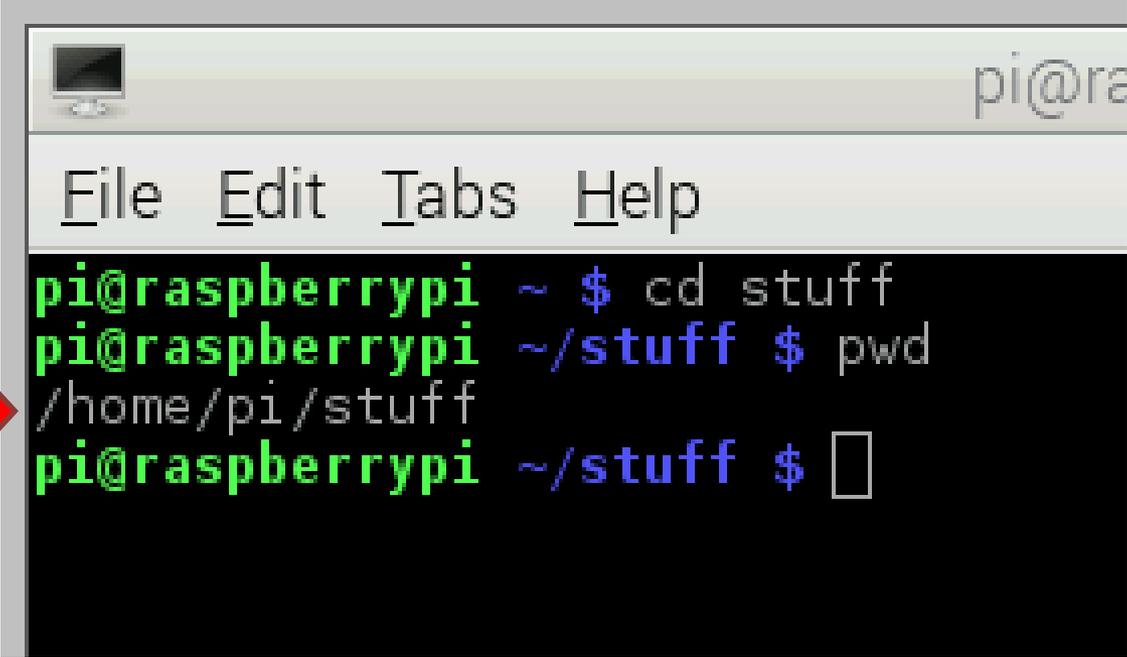
```
pi@raspberrypi ~ $ cd stuff
```

```
pi@raspberrypi ~ $ cd stuff
pi@raspberrypi ~/stuff $
```

Hands-On: The Command Line

Learning how to use the command line

Type the `pwd` command again to see how the current working directory path has changed.



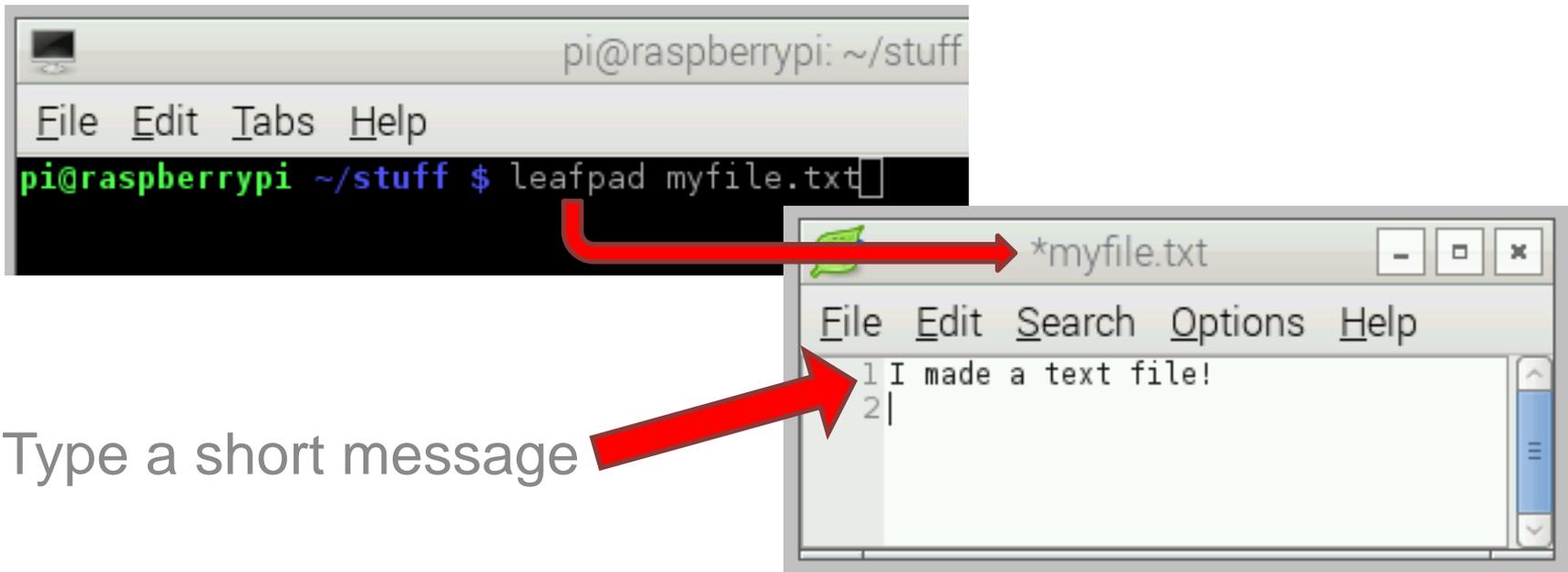
```
pi@ras  
File Edit Tabs Help  
pi@rasberrypi ~ $ cd stuff  
pi@rasberrypi ~/stuff $ pwd  
/home/pi/stuff  
pi@rasberrypi ~/stuff $
```

A red arrow points to the output of the `pwd` command, which is `/home/pi/stuff`.

Hands-On: The Command Line

Learning how to use the command line

Create and open a simple text file with **leafpad myfile.txt**
 This creates a text file called myfile.txt and opens it in a text editor called LeafPad automatically.



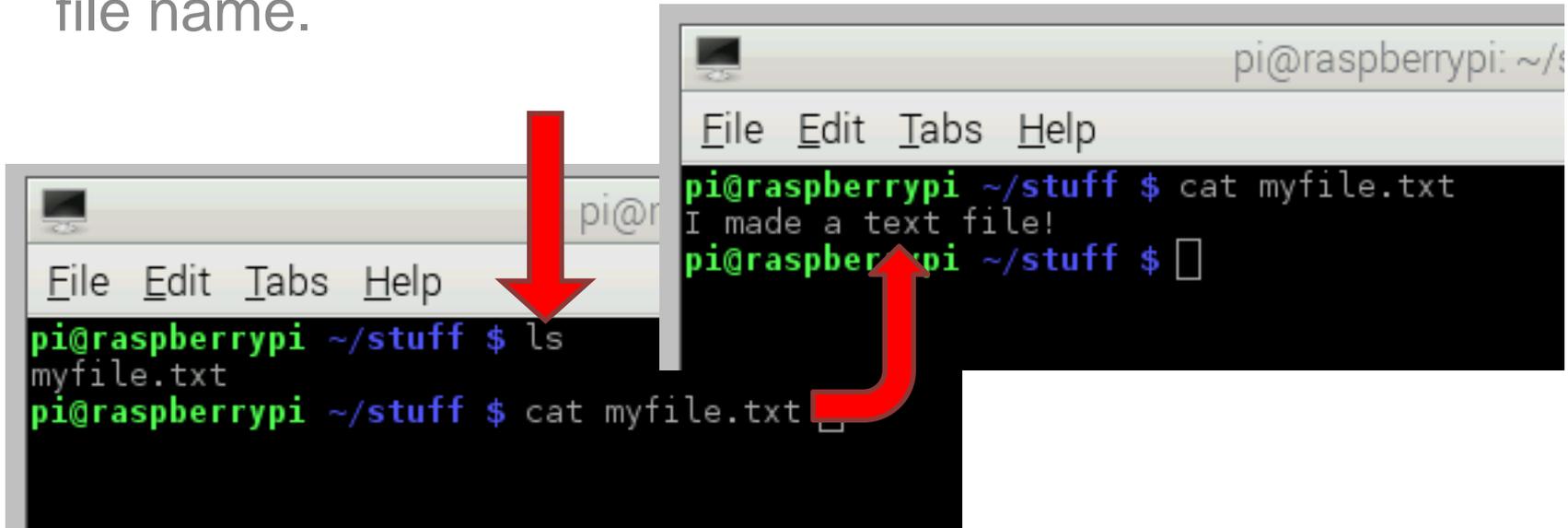
The image shows two windows. The top window is a terminal window titled 'pi@raspberrypi: ~/stuff'. It has a menu bar with 'File', 'Edit', 'Tabs', and 'Help'. The command prompt shows 'pi@raspberrypi ~/stuff \$ leafpad myfile.txt' with a cursor at the end. A red arrow points from the terminal window to the bottom window. The bottom window is a text editor titled '*myfile.txt'. It has a menu bar with 'File', 'Edit', 'Search', 'Options', and 'Help'. The text area contains two lines: '1 I made a text file!' and '2|'. A red arrow points from the text 'Type a short message' to the second line of the text editor.

Type a short message

Hands-On: The Command Line

Learning how to use the command line

Use the `ls` command to see the new text file. If you want to view the contents of the text file without opening LeafPad back up, use the `cat` command followed by the file name.

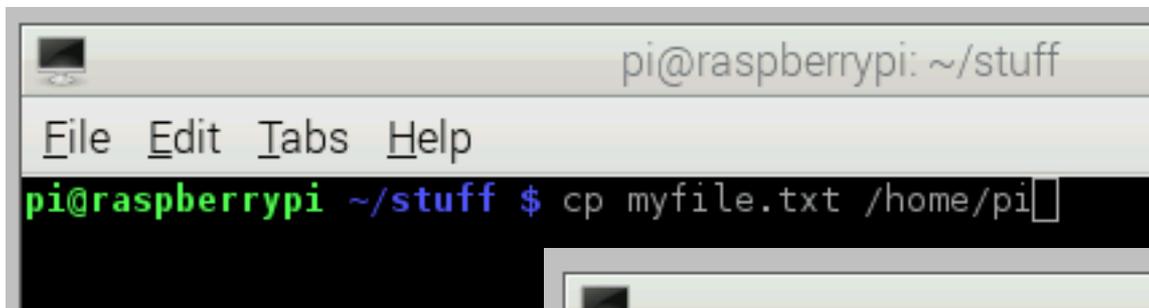


```
pi@raspberrypi ~/stuff $ ls
myfile.txt
pi@raspberrypi ~/stuff $ cat myfile.txt
pi@raspberrypi ~/stuff $ cat myfile.txt
I made a text file!
```

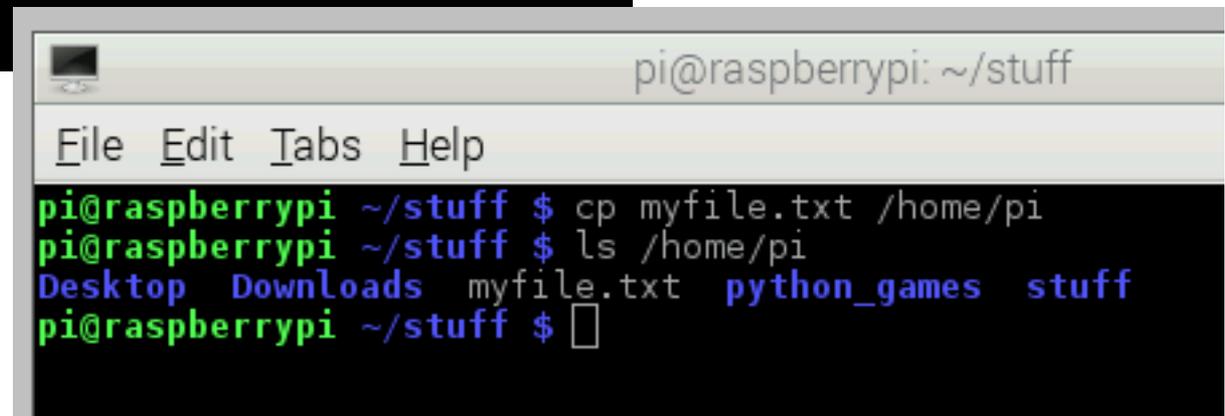
Hands-On: The Command Line

Learning how to use the command line

Cp will copy your file to the specified directory. In this example you can type **ls /home/pi** to see the copied file.



```
pi@raspberrypi: ~/stuff
File Edit Tabs Help
pi@raspberrypi ~/stuff $ cp myfile.txt /home/pi
```

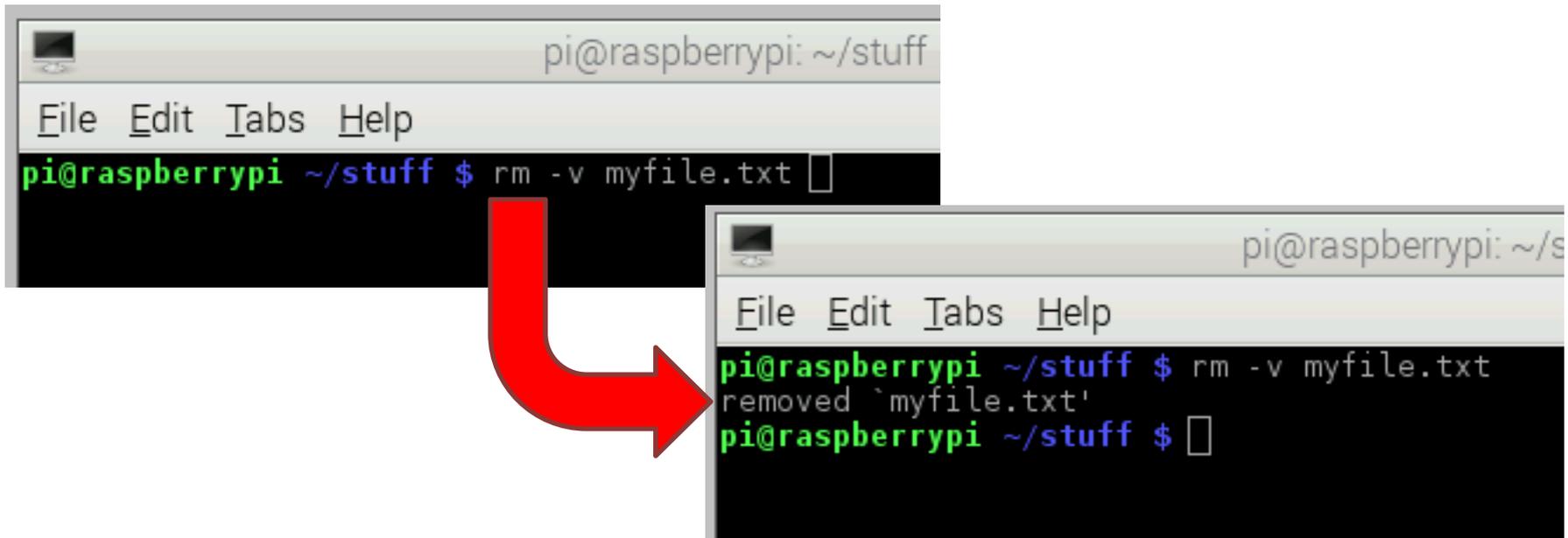


```
pi@raspberrypi: ~/stuff
File Edit Tabs Help
pi@raspberrypi ~/stuff $ cp myfile.txt /home/pi
pi@raspberrypi ~/stuff $ ls /home/pi
Desktop Downloads myfile.txt python_games stuff
pi@raspberrypi ~/stuff $
```

Hands-On: The Command Line

Learning how to use the command line

Rm will remove the specified file or files. Add the argument “-v” (verbose) to have an explanation of what is being done printed to the console.



```
pi@raspberrypi: ~/stuff
File Edit Tabs Help
pi@raspberrypi ~/stuff $ rm -v myfile.txt

pi@raspberrypi ~/stuff $ rm -v myfile.txt
removed `myfile.txt'
pi@raspberrypi ~/stuff $
```

Hands-On: The Command Line

Learning how to use the command line

To navigate back one directory use `cd ..`

To return to your home directory use `cd ~`

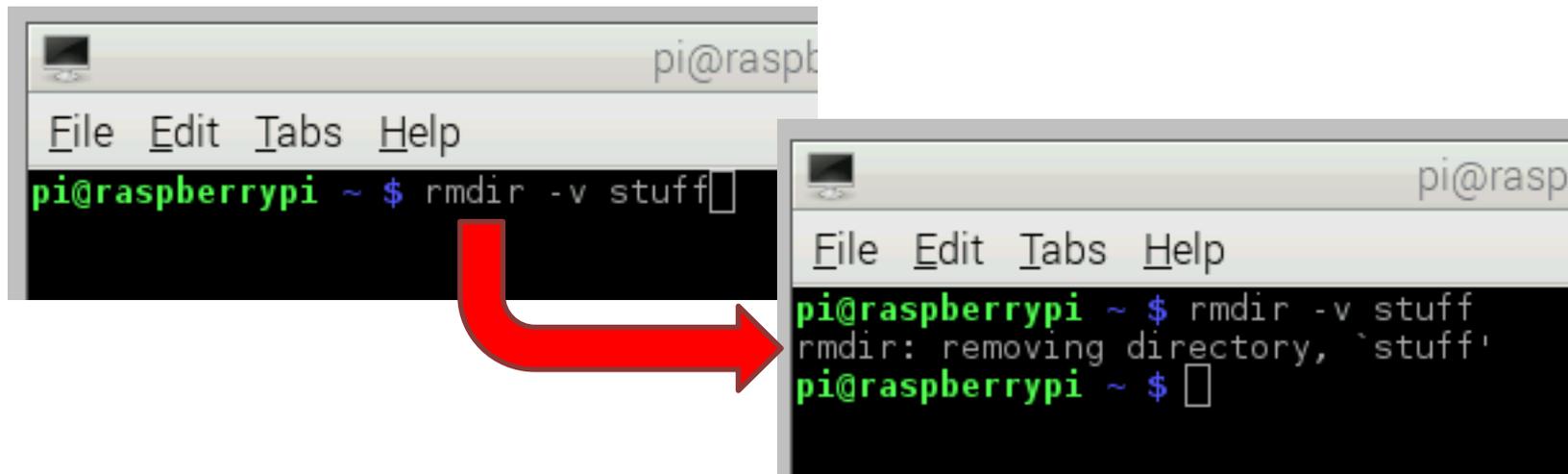


```
pi@raspberrypi ~/stuff $ cd ..  
pi@raspberrypi ~/stuff $ cd ..  
pi@raspberrypi ~ $
```

Hands-On: The Command Line

Learning how to use the command line

Use `rmdir -v stuff` to remove that directory we created earlier in the lesson.



```
pi@raspberrypi ~ $ rmdir -v stuff
```

```
pi@raspberrypi ~ $ rmdir -v stuff  
rmdir: removing directory, `stuff'  
pi@raspberrypi ~ $
```

Hands-On: The Command Line

Updating the Raspberry Pi

- **Sudo** means Super-User DO and is followed by a command that requires the super-user to complete.
- **Apt-get** is a package manager that you use to install, update, and upgrade your software.
- **Wget** is used to access files from the internet.

Hands-On: The Command Line

Updating the Raspberry Pi

Use the following command to download a file I have prepared from the internet. The file will be downloaded into your current working directory.

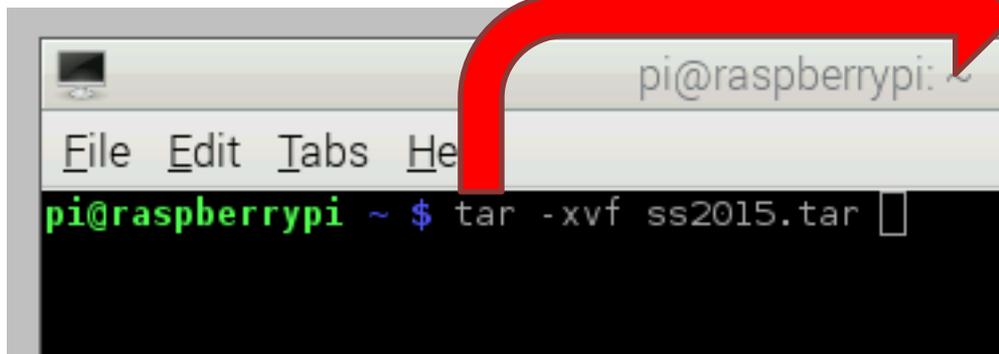
```
~$ wget https://www.dropbox.com/s/  
pLmz498wo3kgnpj/ss2015.tar
```

Hands-On: The Command Line

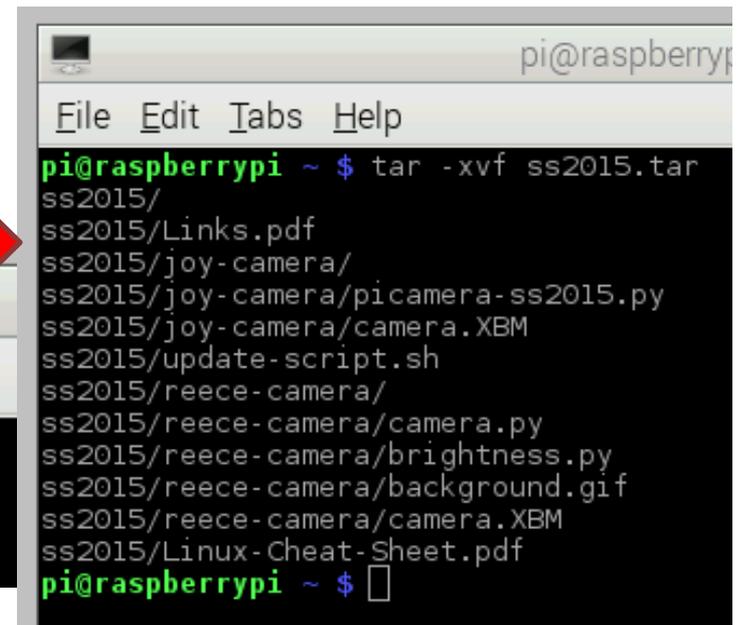
Updating the Raspberry Pi

You downloaded a type of archive called a **tar** file. To extract the contents of the tar file into your current directory, use the following command:

```
~$ tar -xvf ss2015.tar
```



```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi ~ $ tar -xvf ss2015.tar
```

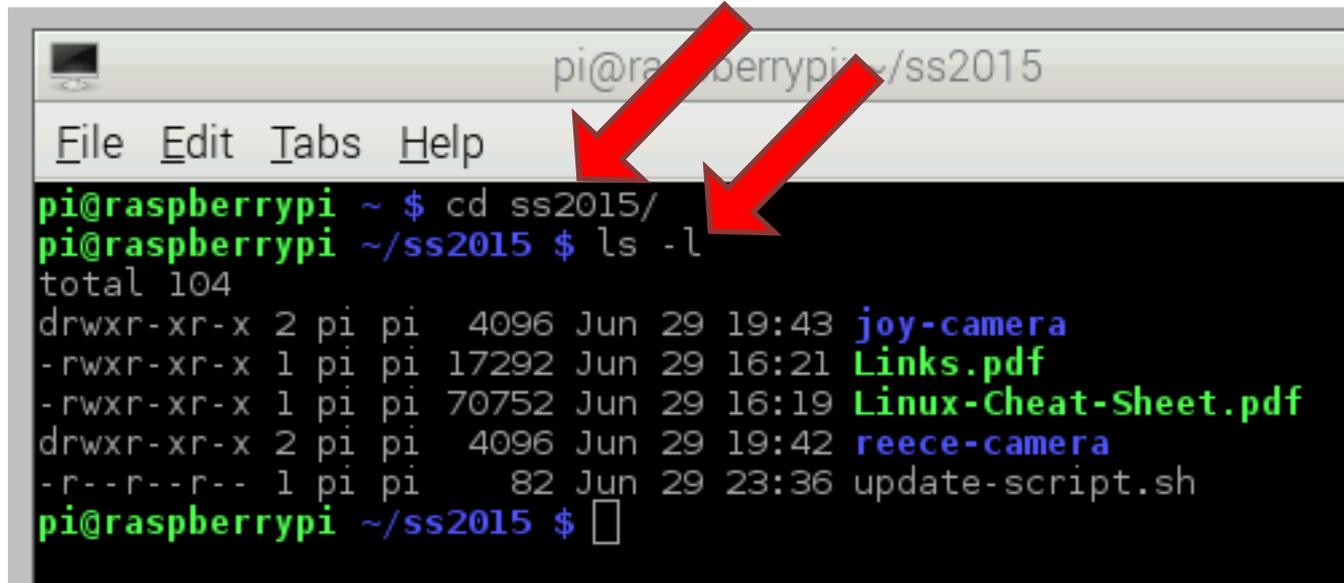


```
pi@raspberrypi ~ $ tar -xvf ss2015.tar  
ss2015/  
ss2015/Links.pdf  
ss2015/joy-camera/  
ss2015/joy-camera/picamera-ss2015.py  
ss2015/joy-camera/camera.XBM  
ss2015/update-script.sh  
ss2015/reece-camera/  
ss2015/reece-camera/camera.py  
ss2015/reece-camera/brightness.py  
ss2015/reece-camera/background.gif  
ss2015/reece-camera/camera.XBM  
ss2015/Linux-Cheat-Sheet.pdf  
pi@raspberrypi ~ $
```

Hands-On: The Command Line

Updating the Raspberry Pi

The contents of the tar file will be displayed as they are extracted because of the “-v” option we used. You can use `cd ss2015` and `ls -l` to see the contents of the directory.



A terminal window titled "pi@raspberrypi ~/ss2015" showing the execution of two commands. The first command is `cd ss2015/` and the second is `ls -l`. The output of `ls -l` shows a directory listing with permissions, owner, group, size, date, time, and filename. Two red arrows point to the command lines.

```
pi@raspberrypi ~ $ cd ss2015/
pi@raspberrypi ~/ss2015 $ ls -l
total 104
drwxr-xr-x 2 pi pi 4096 Jun 29 19:43 joy-camera
-rwxr-xr-x 1 pi pi 17292 Jun 29 16:21 Links.pdf
-rwxr-xr-x 1 pi pi 70752 Jun 29 16:19 Linux-Cheat-Sheet.pdf
drwxr-xr-x 2 pi pi 4096 Jun 29 19:42 reece-camera
-r--r--r-- 1 pi pi 82 Jun 29 23:36 update-script.sh
pi@raspberrypi ~/ss2015 $
```

Hands-On: The Command Line

Updating the Raspberry Pi

A file called **update-script.sh** is in the `ss2015` directory. This is a shell script. It's a text file that contains console commands that will execute if you run the shell script. Type **cat update-script.sh** to see the contents of the script.

```
~$ cat update-script.sh
```



```
pi@raspberrypi: ~/ss2015
File Edit Tabs Help
pi@raspberrypi ~/ss2015 $ cat update-script.sh
sudo apt-get update
sudo apt-get dist-upgrade
sudo apt-get autoremove
pi@raspberrypi ~/ss2015 $
```

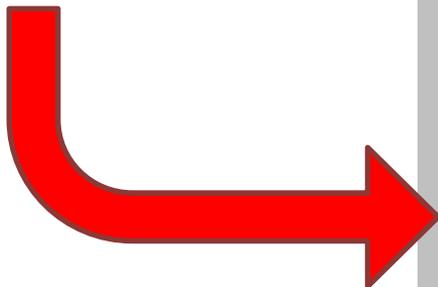
Hands-On: The Command Line

Updating the Raspberry Pi

Try to run the shell script by typing the following:

```
~$ ./update-script.sh
```

What did it do?



```
pi@raspberrypi: ~/ss2015
File Edit Tabs Help
pi@raspberrypi ~/ss2015 $ ./update-script.sh
bash: ./update-script.sh: Permission denied
pi@raspberrypi ~/ss2015 $
```

Hands-On: The Command Line

Updating the Raspberry Pi

You need to set permissions for the shell script file. Type `ls -l` to see the permissions for the files in **ss2015**.

R = read, **W** = write, **X** = execute

Owner Group World

r w x r w x r w x



```

drwxr-xr-x 2 pi pi 4096 Jun 29 19:42 /ss2015/teece-camera
-r--r--r-- 1 pi pi 70 Jun 30 01:41 update-script.sh
pi@raspberrypi ~/ss2015 $
  
```

Hands-On: The Command Line

Updating the Raspberry Pi

We want the file to have full permissions for the owner, and read/execute permissions for all others. We use the **chmod** command to accomplish this.

```
~$ chmod 755 update-script.sh
```



A screenshot of a terminal window on a Raspberry Pi. The window title is "pi@raspberrypi: ~/ss2015". The terminal shows a menu bar with "File", "Edit", "Tabs", and "Help". The command prompt is "pi@raspberrypi ~/ss2015 \$". The command "chmod 755 update-script.sh" is entered and executed. A large red arrow points from the text above to the command in the terminal.

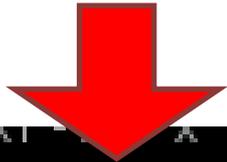
```
pi@raspberrypi ~/ss2015 $ chmod 755 update-script.sh
```

Hands-On: The Command Line

Updating the Raspberry Pi

You can use `ls -l` to see that the file now has the proper permissions.

```
-rwxr-xr-x
```



```
drwxr-xr-x 2 pi pi 4096 Jun 29 19:42 /usr/share/doc/teece-camera  
-rwxr-xr-x 1 pi pi 70 Jun 30 01:41 update-script.sh  
pi@raspberrypi ~/ss2015 $
```

Hands-On: The Command Line

Updating the Raspberry Pi

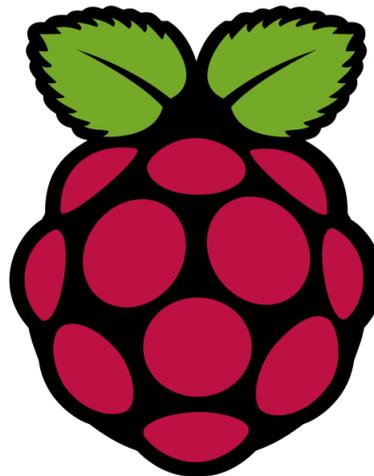
Now you can run the shell script!

```
~$ ./update-script.sh
```

If you are prompted to confirm any of your updates, just press **Y** and then press **ENTER**. Also, the update may create the **oldconffiles** directory.

Raspberry Pi Demo

Mike Reece



Hands-On: The Command Line

Installing the Python Pi Camera module

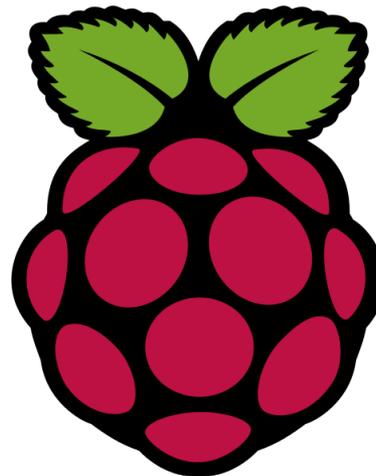
To install this module type the following:

```
~$ sudo apt-get install python-picamera
```

If you are prompted to confirm any of your updates, just press **Y** and then press **ENTER**.

Raspberry Pi Demo

Michael Joy



Hands-On: Python and PiCamera

Getting exposed to Python programming

Python is a fun and easy to learn programming language with wide use in the professional development world.



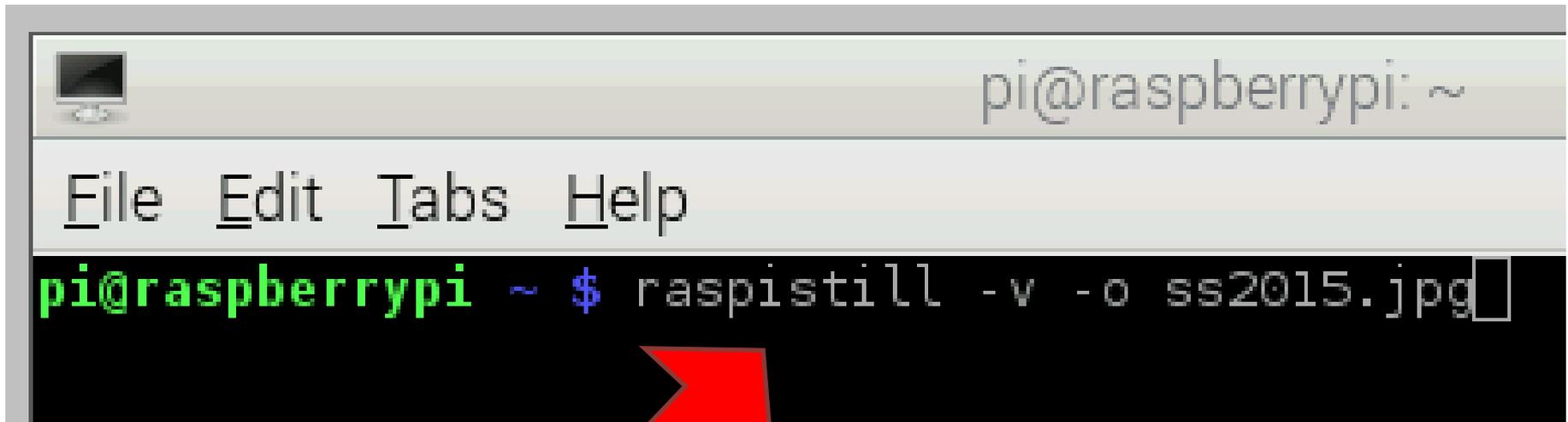
You'll only get a small taste of it here. There will be a 3 hour Python training session later in the week.

Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

Before we use Python, run this command in a console:

```
~$ raspistill -v -o ss2015.jpg
```

A terminal window on a Raspberry Pi. The title bar shows a monitor icon and the text "pi@raspberrypi: ~". Below the title bar is a menu bar with "File", "Edit", "Tabs", and "Help". The main terminal area has a green prompt "pi@raspberrypi" and a blue prompt "~ \$". The command "raspistill -v -o ss2015.jpg" is entered and followed by a white cursor. A large red arrow points from the bottom center towards the command line.

```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi ~ $ raspistill -v -o ss2015.jpg
```

Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

This command will take a picture with the Pi Camera using the default settings. The picture will be called “ss2015.jpg” (unless you called it something else).

The text that printed out are all options that we can control.

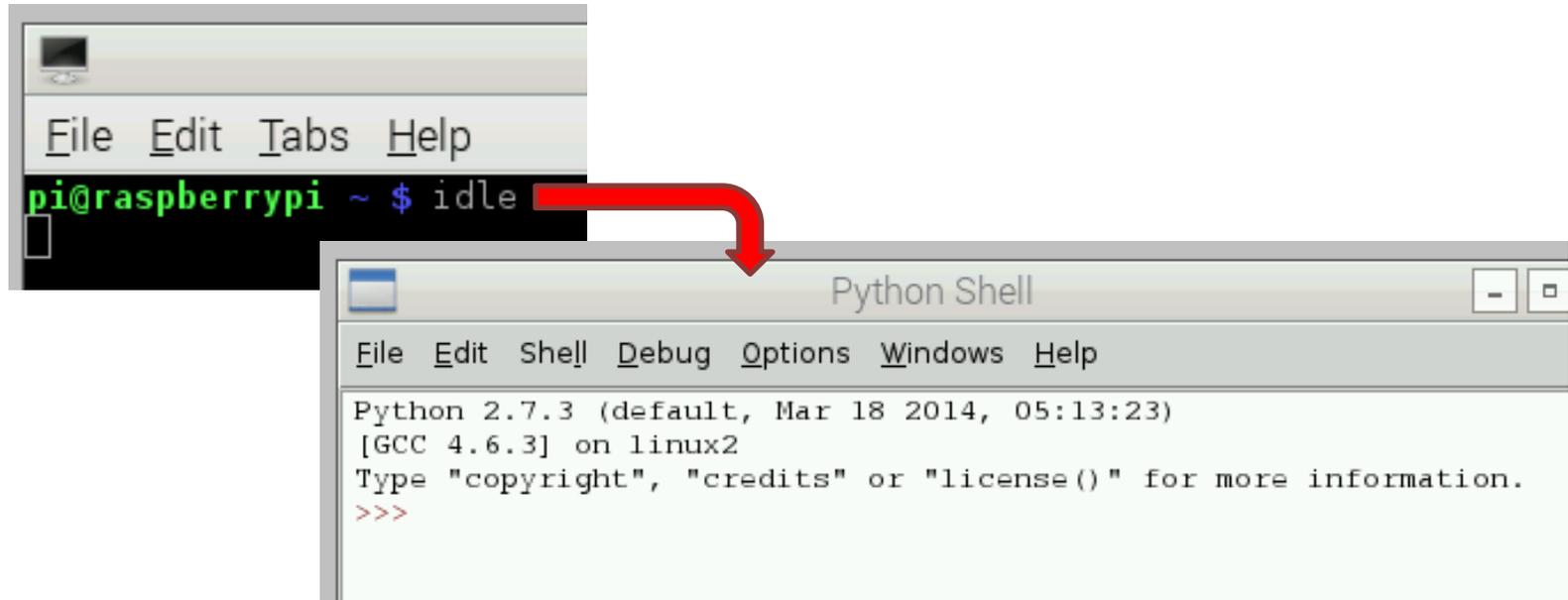


```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi ~$ raspistill -v -o ss2015.jpg  
raspistill Camera App v1.3.8  
Width 2592, Height 1944, quality 85, filename ss2015.jpg  
Time delay 5000, Raw no  
Thumbnail enabled Yes, width 64, height 48, quality 35  
Link to latest frame enabled no  
Full resolution preview No  
Capture method : Single capture  
  
Preview Yes, Full screen Yes  
Preview window 0,0,1024,768  
Opacity 255  
Sharpness 0, Contrast 0, Brightness 50  
Saturation 0, ISO 0, Video Stabilisation No, Exposure compensation 0  
Exposure Mode 'auto', AWB Mode 'auto', Image Effect 'none'  
Metering Mode 'average', Colour Effect Enabled No with U = 128, V = 128  
Rotation 0, hflip No, vflip No  
ROI x 0.000000, y 0.000000, w 1.000000 h 1.000000  
Camera component done  
Encoder component done  
Starting component connection stage  
Connecting camera preview port to video render.  
Connecting camera stills port to encoder input port  
Opening output file ss2015.jpg  
Enabling encoder output port  
Starting capture 0  
Finished capture 0  
Closing down  
Close down completed, all components disconnected, disabled and destroyed  
  
pi@raspberrypi ~$
```

Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

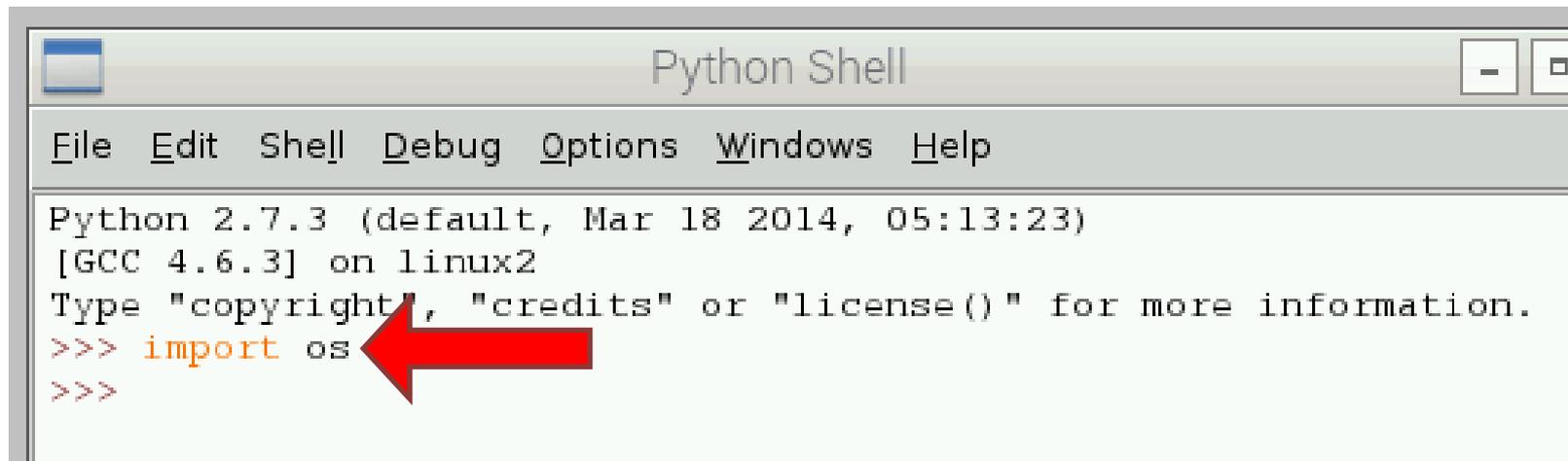
Lets launch **IDLE** from the console, which is an integrated development environment for Python.



Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

First, you'll need to type `import os` and press ENTER so you have access to operating system functionality. This will let us call the `raspistill` command from inside of IDLE with Python.



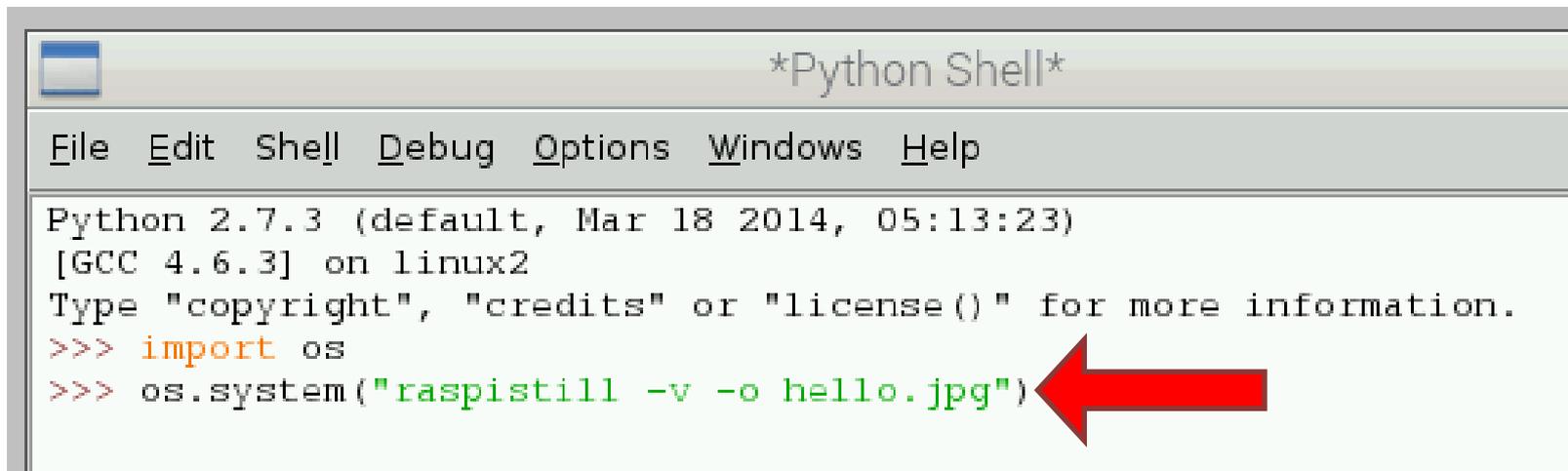
```
Python Shell
File Edit Shell Debug Options Windows Help
Python 2.7.3 (default, Mar 18 2014, 05:13:23)
[GCC 4.6.3] on linux2
Type "copyright", "credits" or "license()" for more information.
>>> import os
>>>
```

Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

Now we can call the same command we used earlier in the console. To do that type the following:

```
os.system("raspistill -v -o hello.jpg")
```



```
*Python Shell*
File Edit Shell Debug Options Windows Help
Python 2.7.3 (default, Mar 18 2014, 05:13:23)
[GCC 4.6.3] on linux2
Type "copyright", "credits" or "license()" for more information.
>>> import os
>>> os.system("raspistill -v -o hello.jpg")
```

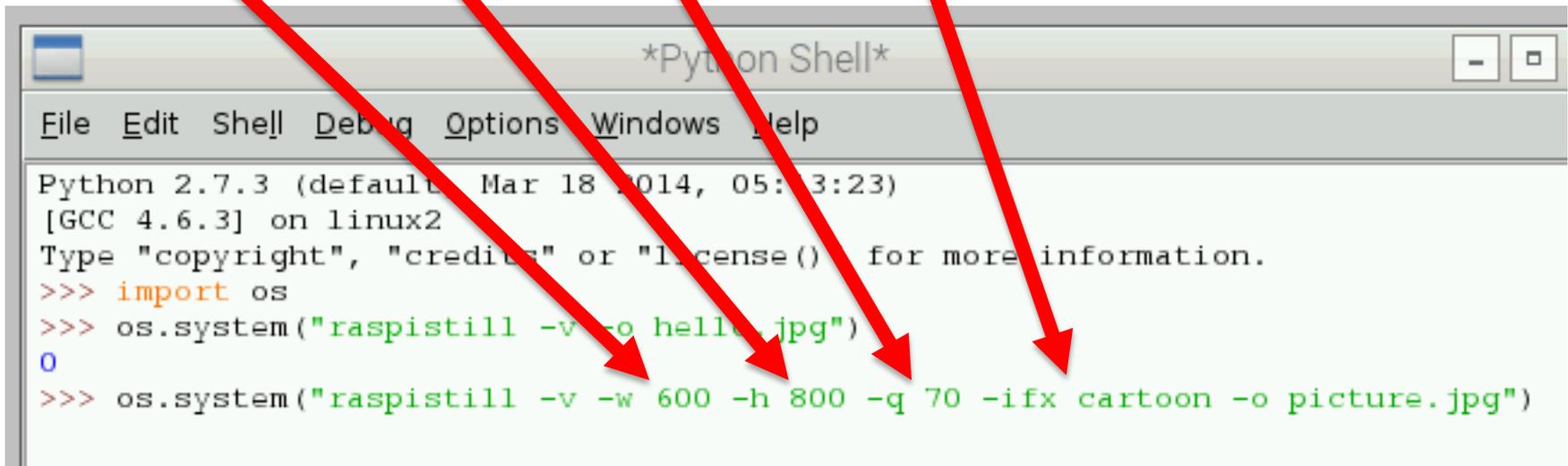
A red arrow points to the command `os.system("raspistill -v -o hello.jpg")` in the terminal output.

Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

Now try using some of these options for the camera:

`-w 600 -h 800 -q 70 -ifx cartoon`



```

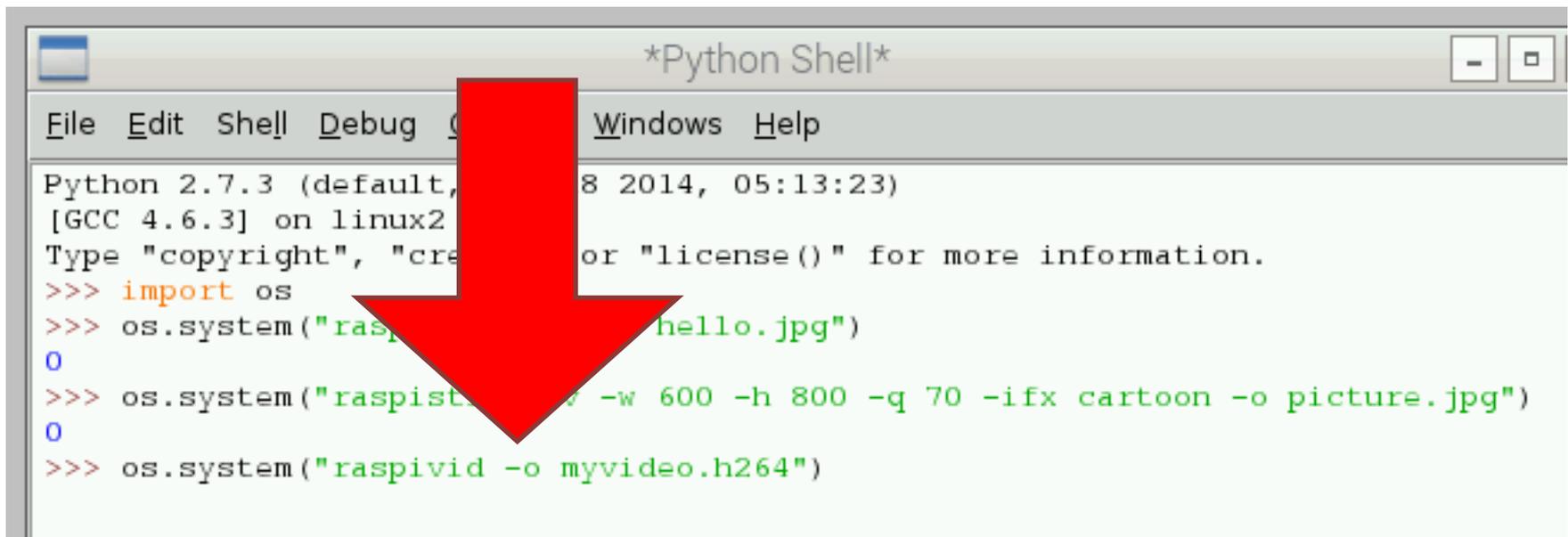
*Python Shell*
File Edit Shell Debug Options Windows Help
Python 2.7.3 (default: Mar 18 2014, 05:13:23)
[GCC 4.6.3] on linux2
Type "copyright", "credits" or "license()" for more information.
>>> import os
>>> os.system("raspistill -v -o hello.jpg")
0
>>> os.system("raspistill -v -w 600 -h 800 -q 70 -ifx cartoon -o picture.jpg")
    
```

Hands-On: Python and PiCamera

Controlling the Pi Camera with Python

You can also take video with the camera:

```
os.system("raspivid -o myvideo.h264")
```



```
*Python Shell*
File Edit Shell Debug Windows Help
Python 2.7.3 (default, 8 2014, 05:13:23)
[GCC 4.6.3] on linux2
Type "copyright", "credits()" or "license()" for more information.
>>> import os
>>> os.system("raspistill -o hello.jpg")
0
>>> os.system("raspistill -w 600 -h 800 -q 70 -ifx cartoon -o picture.jpg")
0
>>> os.system("raspivid -o myvideo.h264")
```

Hands-On: Python and PiCamera

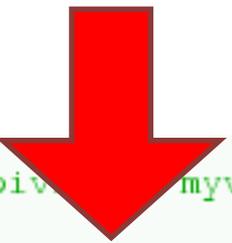
Controlling the Pi Camera with Python

Use this command to see a small preview of your video:

→ `os.system("omxplayer --win '0 0 320 240' myvideo.h264")`

Or this to see it full size:

→ `os.system("omxplayer myvideo.h264")`



```
0
>>> os.system("raspivid -o myvideo.h264")
0
>>> os.system("omxplayer --win '0 0 320 240' myvideo.h264")
```

Hands-On: Python and PiCamera

Options for the raspistill and raspivid commands

- o output file name (-o picture.jpg *or* vid.h264)
- w width (-w 600)
- h height (-h 800)
- sh sharpness, -100 to 100 (-sh 75)
- co contrast, -100 to 100 (-co 50)
- br brightness, 0 to 100 (-br 65)
- sa saturation, -100 to 100 (-sa 85)
- vf vertically flip image
- hf horizontally flip image

Hands-On: Python and PiCamera

Options for the raspistill and raspivid commands

- q jpeg image quality, 0 to 100 (-q 70)
- ifx image effects (-ifx negative, solarise, sketch, oilpaint, hatch, pastel, film, watercolour, emboss, blur, cartoon, and more!)

There are many more options for the Pi Camera:

<https://www.raspberrypi.org/documentation/raspbian/applications/camera.md>

Raspberry Pi

Feel free to experiment with the remaining time

- To exit IDLE, type **exit()** and press **ENTER** or click the **X** in the top right corner.
- To shutdown your Raspberry Pi select **Shutdown** from the menu in the top left corner then press **OK**.

Thank You!

