# SOFTWARE: APPS

## (PROGRAMS THAT DO THINGS)

OT 699 – WEEK 3

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# OBJECTIVES THIS WEEK

1) Basic concepts for App design
2) Build a fully functional graphical user interface in Python!

# BASIC CONCEPTS

What is an App?

A game, a word processor, even a website with more than simple text

Due to the popularity of the App store, “App” has started to mean “on my phone”, although this is not a distinction made in the app development community

What an App usually isn’t?

Command line code that you write yourself to do some math on data you collect

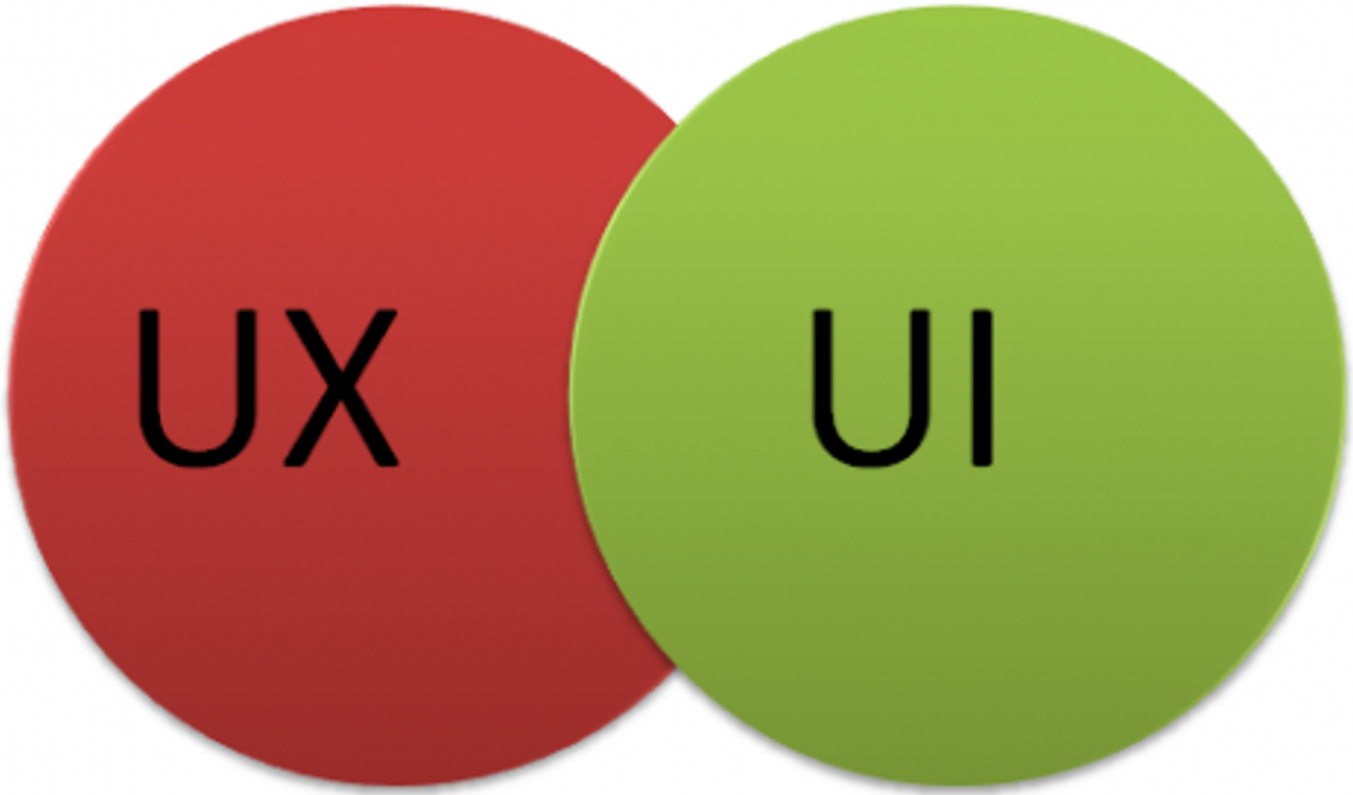
| | Desktop | Web | Mobile | Mobile Web |
|---|---|---|---|---|
| **Facebook** | None | Open through browser on computer (Chrome, Safari, FireFox, IE, etc) | Open through icon downloaded in Google Play, iTunes, etc. | Open through browser on device at http://m.facebook.com |
| **Photo Editing** | iPhoto, Paint, Microsoft Office Picture Manager | Sites like Flickr and PicMonkey—launched by computer | Instant Retro Photo, PicSay (Android); PicStitch, Be Funky Photo Editor (Apple) | Flickr, etc, launched through mobile browser |
| **Solitaire** | Comes stock on Microsoft in “Accessories” —doesn’t need Internet | worldofsolitaire.com; games.com; solitaire-cardgame.com | The Solitaire Games (Apple); Solitaire Free Pack (Android) | worldofsolitaire.com; games.com; solitaire-cardgame.com opened in mobile browser |

# CONSIDERATIONS BEFORE YOU TRY MAKING AN APP:

- Who is it for
- What does it do
- Why is this needed
- How and where should a user interact with it
- Limitations of device hardware or software
- Who will build it?  How fast? And for how much?

# *Know the Difference*

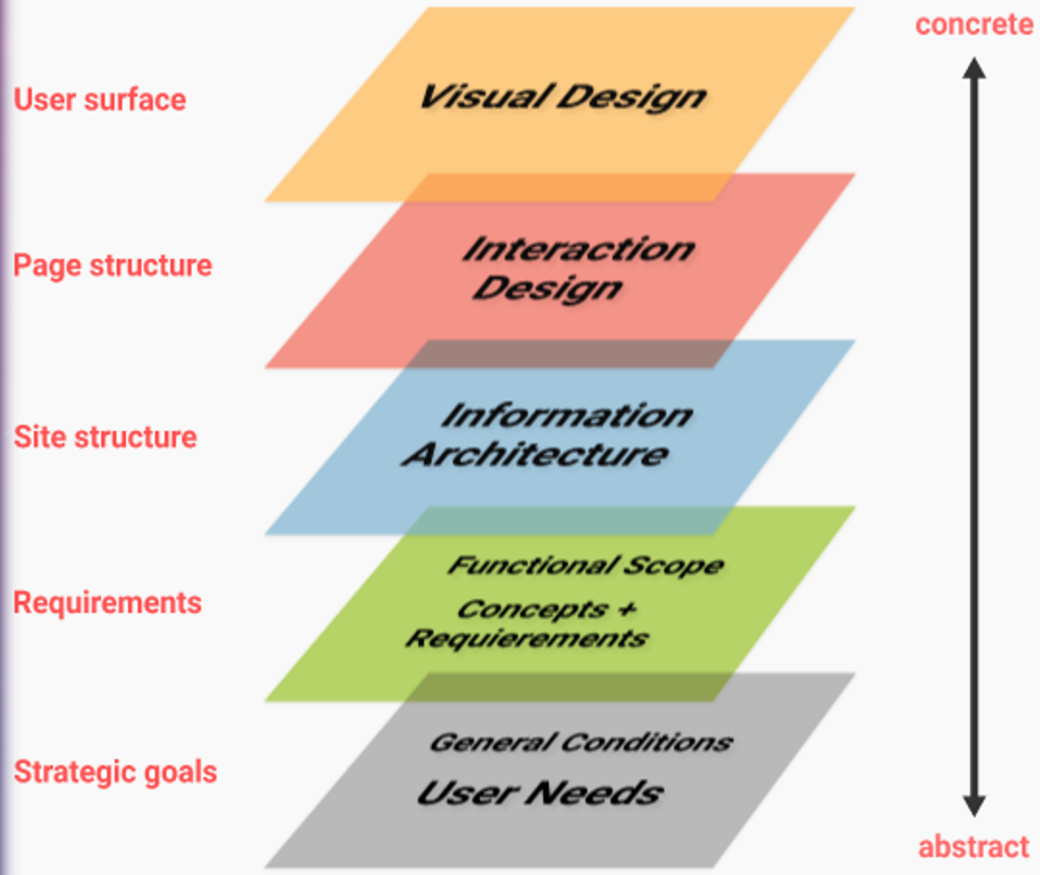
- User Stories
- Usability Testing
- User Research
- Personas




- Layout
- Visual Design
- Branding

* GUI = graphical user interface.  Not all interfaces are graphical.

https://addontraining.com/what-is-ux-design-all-about/



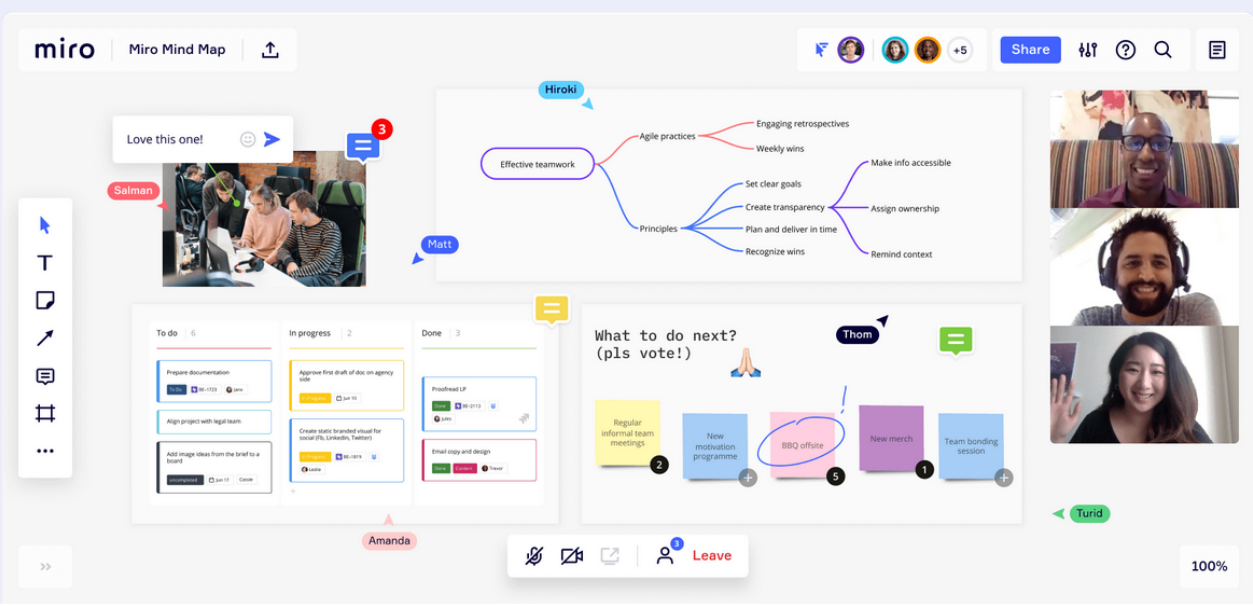

In 2002, Jesse James Garrett published *The Elements of User Experience*, a standard work on how UX design can be implemented in companies. His model of the five layers of the user experience design forms the basis for this.

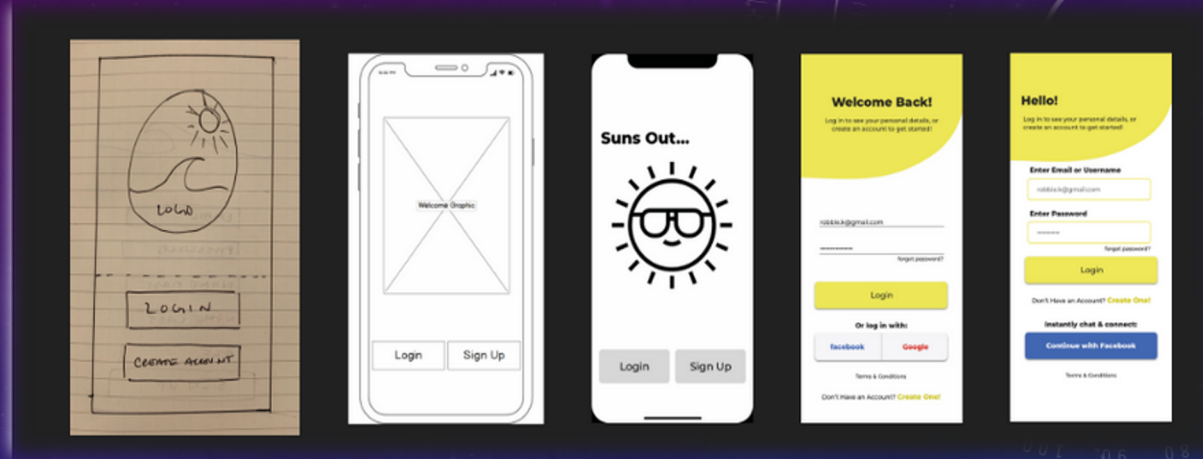
Nearly all app development in industry is an iterative process that starts with abstract, high level thinking about the user.

This process is full of sketches, sticky notes, polls, and interviews.  The end is essentially a layout design of your app… something that can be handed off to a software developer.

https://thomas-sokolowski.com/the-ideal-ux-design-workflow/

# FROM UX TO UI




Brainstorming software, various online whiteboard sites, trello (simple) or **miro** (e.g. https://miro.com/) are valuable for team efforts.
Help to link subgroups during design phase (e.g. developers with user experience specialists)

Wireframe stage: usually starts as a sketch and then you can use dedicated wireframing software or graphics design software of your choosing… This is where UI begins to depart from UX.
**Software**: Balsamiq, Framer, Figma, SmartDraw Webflow, Sketch.

Short 4 minute video: https://balsamiq.com/learn/

## UX designer vs UI designer vs Front-end Developer roles comparison

| | UX designer | UI designer | Front-end dev |
|---|---|---|---|
| Skills and knowledge | Needs marketing, technological and psychological knowledge | Needs graphic design skills, should know some specifics of front-end | Needs web development skills |
| Responsibilities | Navigates the design process | Designs the visual of the user interface | Develops part of the web application |
| What they need to start working? | Works on the basis of the research of users needs | Works on the basis of requirements | Works on the basis of requirements and design |
| Stage of development | Designs the user journey | Prepares the graphic layout according to the user journey | Writes code that connects the layout and the user journey |
| The role in UX design | Conducts user research, gathers feedback, works closely with the (internal or external) customer and end-user | Should be part of the UX design team | May play a role in the development team and/or in the UX design team |
| Do they work on development? | Is present before, throughout and after the development process | Usually, ends job with hand-over to developers | Should not start development before getting requirements (and the design) |

For web app design, UI is often still conceptual.

The actual code making is split between:

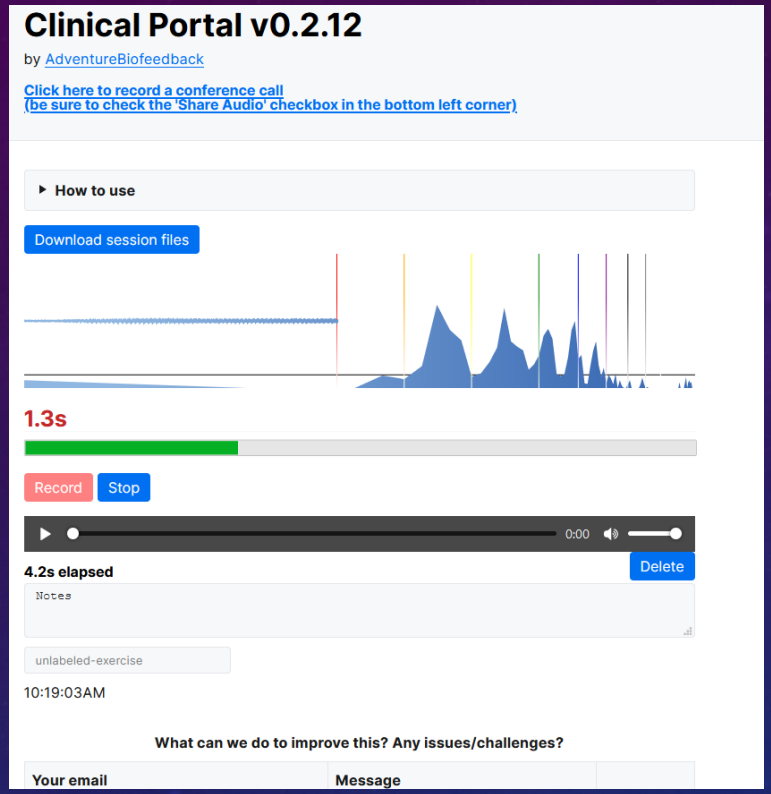
**Front End:** the normal code for your website. Software: **JavaScript, CSS, HTML**

**Back End:** if your website needs to communicate with a cloud server or database, do new fancy functions, etc.
Software: **Java, PHP, Node.js, Python**

https://www.ideamotive.co/blog/difference-between-ux-and-ui-designer-and-front-end-developer

# Example of a web app (old beta test from adventurebiofeedback.com):

https://www.adventurebiofeedback.com/slp/




Fully Front End.
html, CSS, and JavaScript were the primary languages.

We ran into issues going across platforms and browsers, especially trying to collect data from the computer's speaker (the other person on a zoom call) rather than the microphone.

We'll eventually have to hire developers, and do most of our real data processing using an AWS cloud server (Back End) running python scripts and sending data back to the web page.

What can a pro developer do vs. someone who knows a bit of programming?
Example
https://musiclab.chromeexperiments.com/Spectrogram/

# WEB APPS- WHERE TO START

- Might be best to start with **WordPress** or **Wix** to get a foot in the door.
  - Then you can add little gadgets to your website (e.g. Java Applets or IFTTT (if this then that) to start turning a text+ picture website into a kind of user interface.

- Along the way you'll learn some internet jargon too…. Like how a web client (e.g. a browser) communicates via an FTP or HTTP protocol with a web server that hosts your HTML code and other website resources, how an extra step might be added if you want to use another server for data storage or analysis, etc.

- Overview of what modern web development entails: https://www.youtube.com/watch?v=VfGW0Qiy2I0

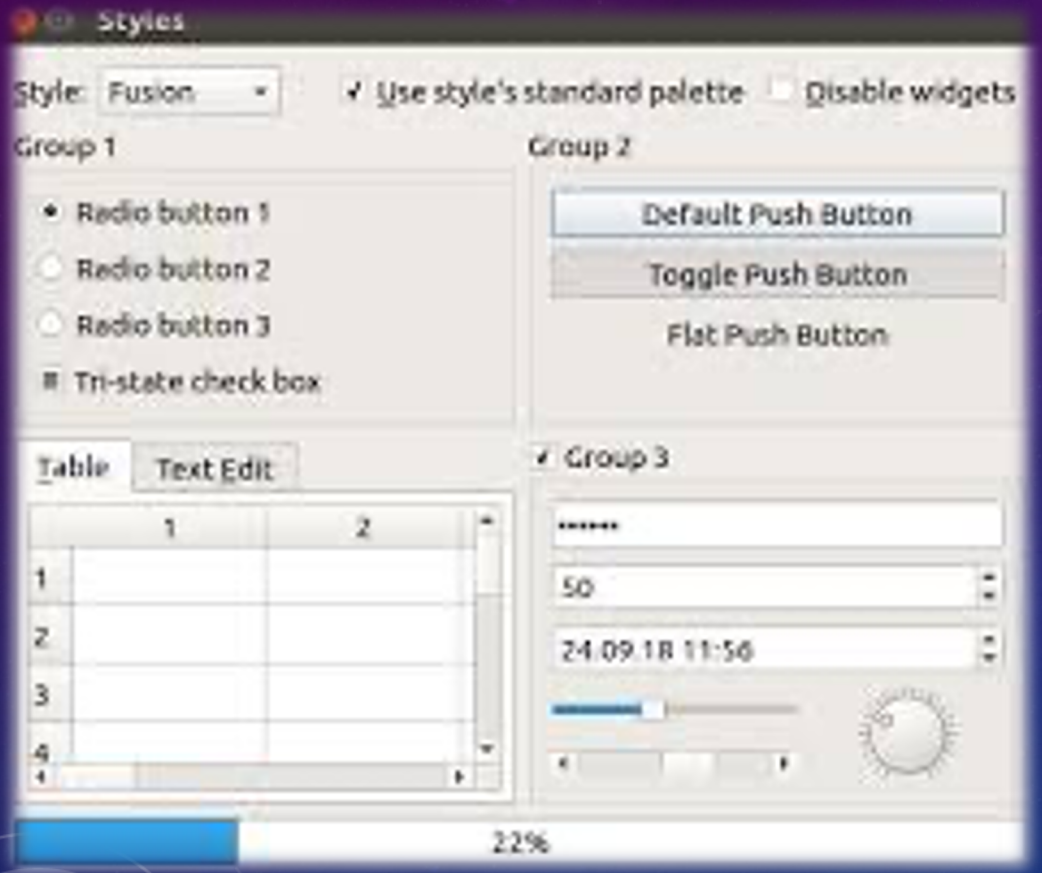
# So, if web apps are a bit complicated..... are you stuck with mockups that don't do anything? NO!

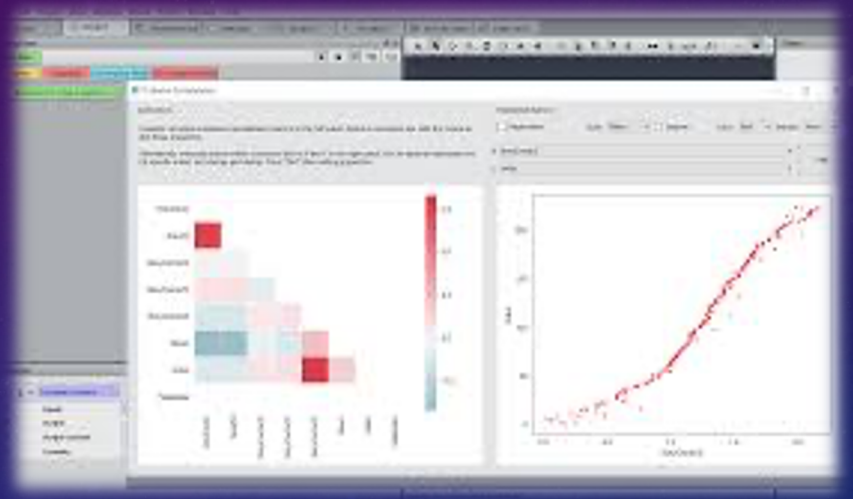
Development of desktop apps (which also work on mobile devices that use windows or android) use general purpose programming languages

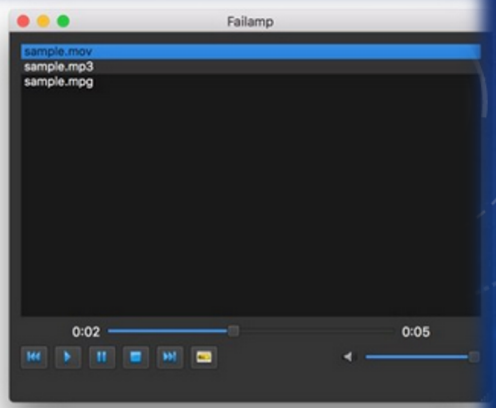
For hacking/innovation, it may be better to start by building something, then if it seems really good, hire a developer who can put it in the App store

Also, …. computers haven't been replaced by phones yet… people still use computer-based programs even if the word "App" seems to imply iPhone lately.

**Python** can be used to make apps.
Many are able to work on all operating systems



PyQt5

Kivy

Tkinter

PySide

PySimpleGUI

BeeWare

Flask

Flexx

Django

Python can create stand alone applications with graphical interfaces
Combined with standard python programming, this allows you to be creative and develop your own applications.  On the left are some possible tools for developing GUIs and apps.

**PyQt5** is the largest, most well documented, with the easiest learning curve
It is mainly for Windows/Linux/Mac, but is increasingly Android friendly

It also has a “designer” interface within Anaconda so that you only need to code the functions that run when you push buttons, rather than coding the visuals.

*Some occasional bugs appear when using Mac.  These are typically solvable with some wrestling and trial & error, but if you have a choice, use a PC!

# PYQT5 DESIGNER + DEVELOPMENT IN PYTHON (SPYDER)

PyQt5 is a library (just a set of functions) that you can import into your favorite IDE (e.g. Spyder) at the start of a program.

Using these functions, you can get pop-up windows, buttons, text boxes, etc. and interacting with these “widgets” can trigger other python functions to run (e.g. printing something, doing a computation, etc.)

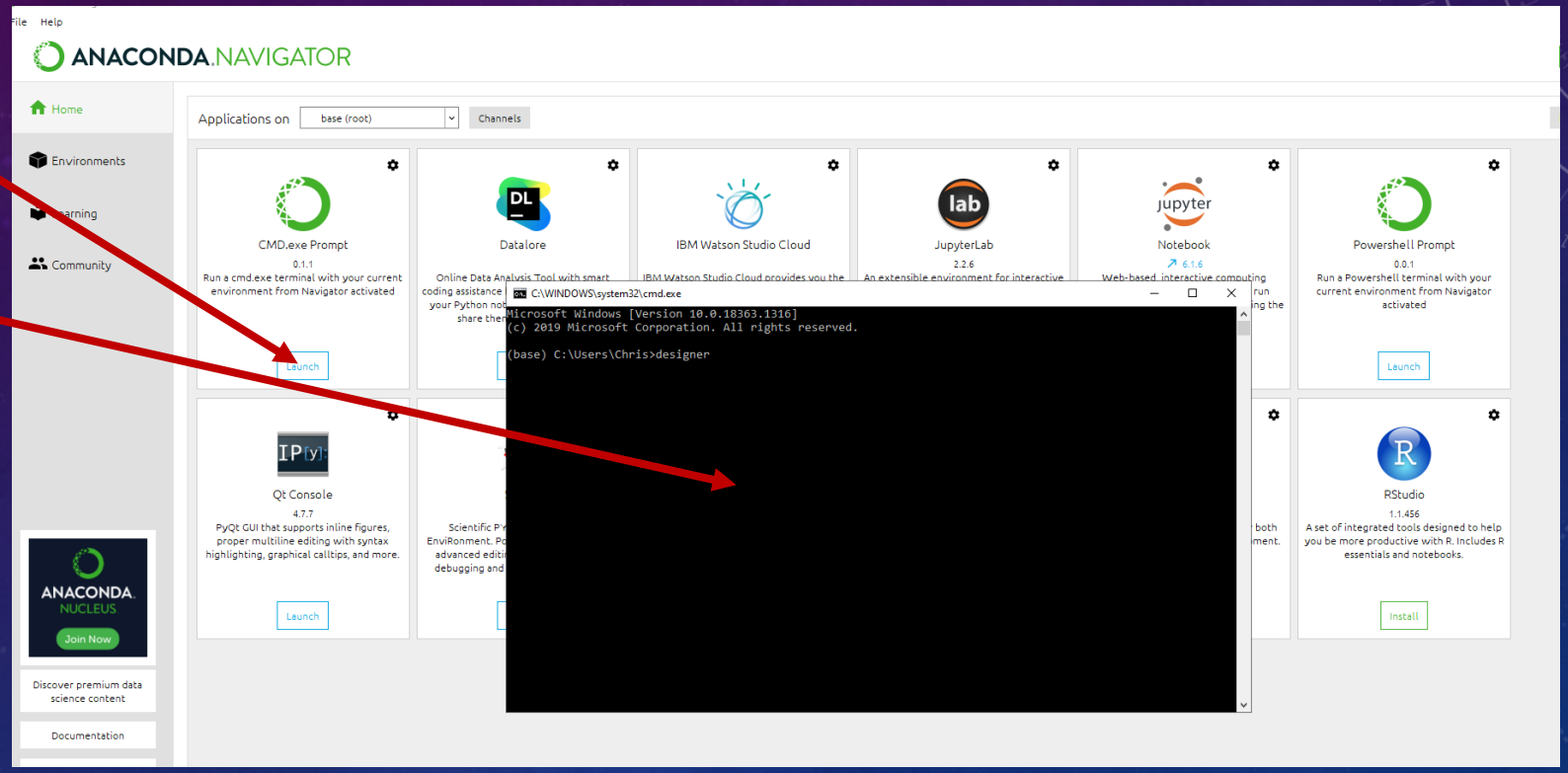
Many tutorials exist, for example a calculator made from absolute scratch is here: https://realpython.com/python-pyqt-gui-calculator/

# NOW WE'RE GOING TO MAKE A GRAPHICAL USER INTERFACE IN PYTHON

- Follow along/take notes… The steps shown in the recording are summarized in the following slides.
- You should make the program described herein for yourself so that it runs prior to class on Thursday.

# THE DESIGNER: MAKES THE UI MOSTLY CODE-LESS

- Go to Anaconda Navigator
- Launch the prompt
- Type " designer " in the command line (no quotes)
- Hit enter

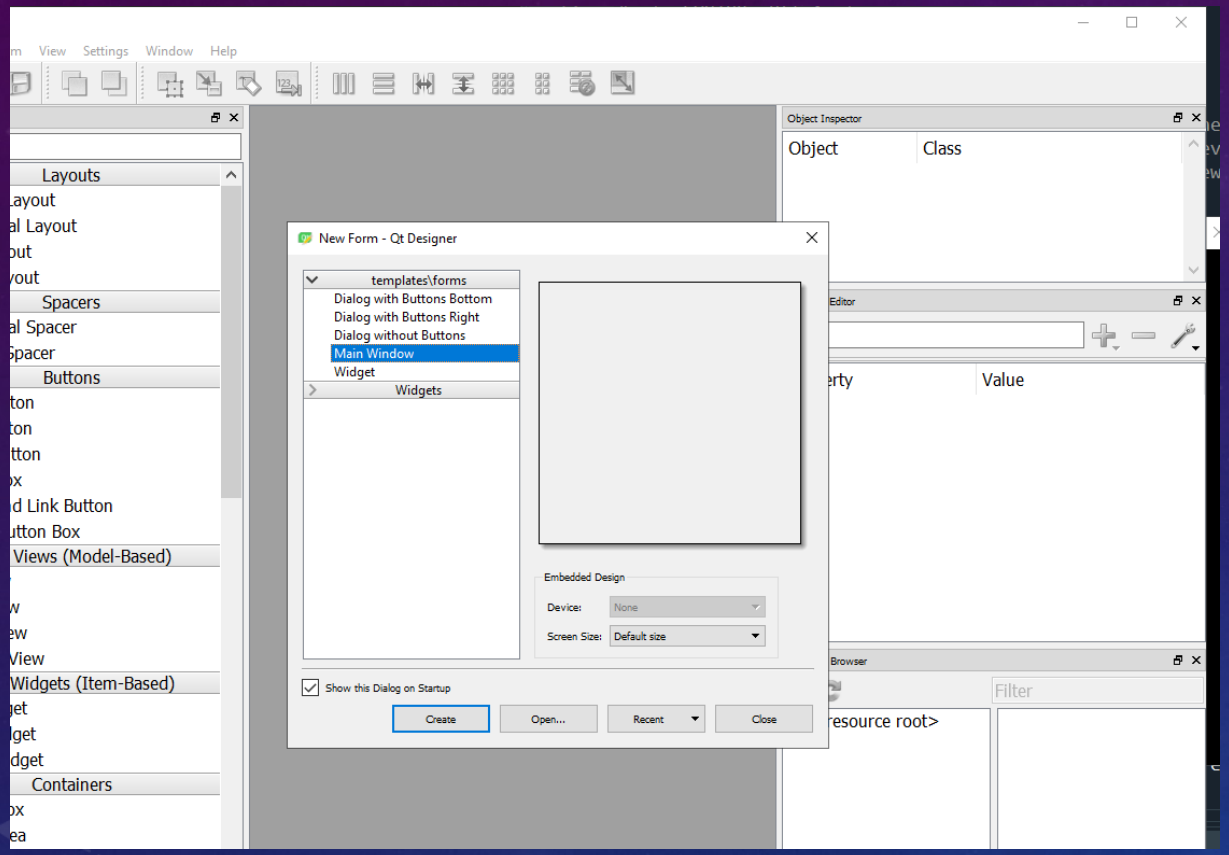



For Mac:

Open Terminal (the regular Mac Terminal. From Launchpad, type Terminal, you should see something like the terminal above, but a Mac version): now type

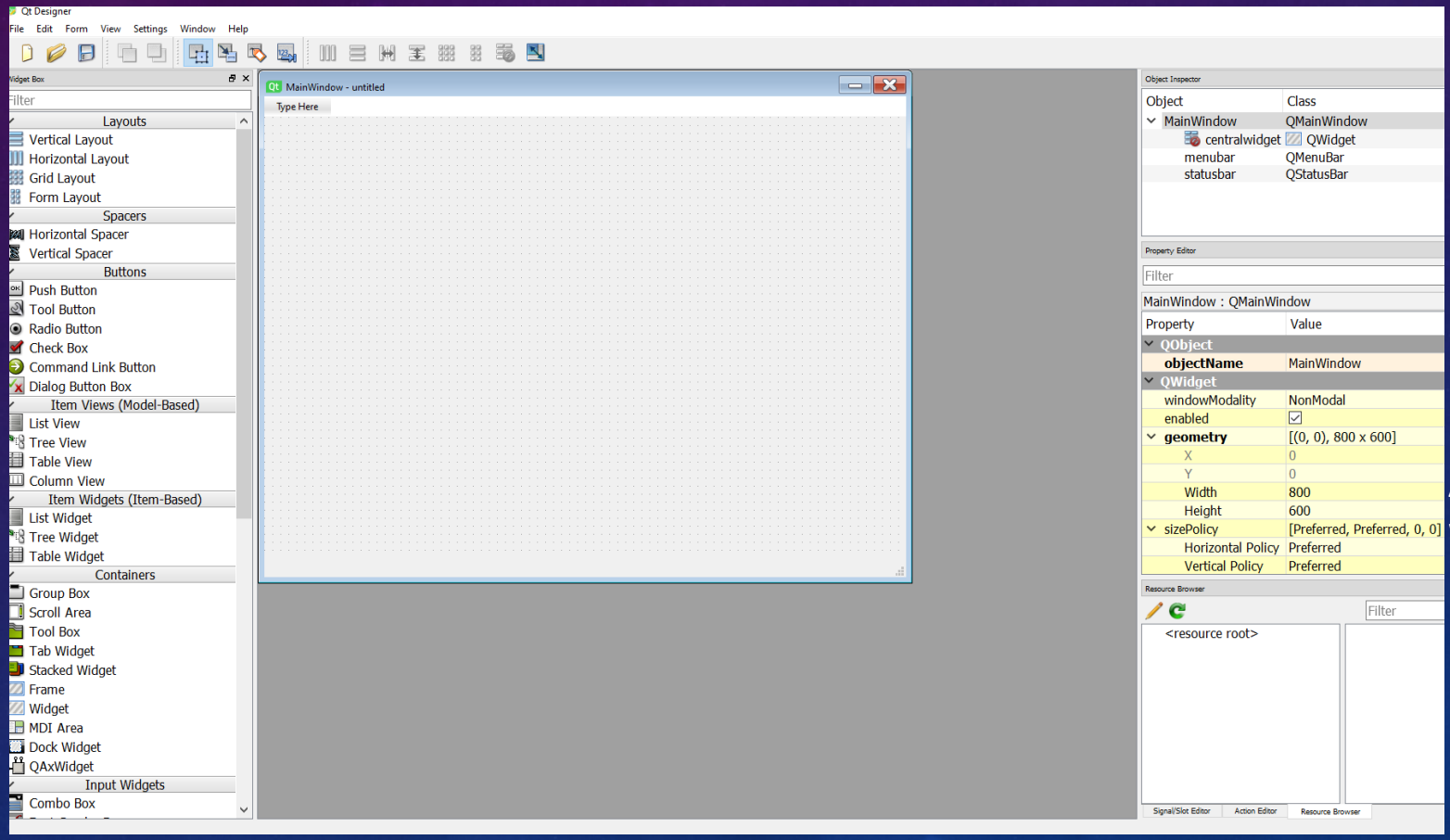
"open –a Designer" in the command line, with no quotes. Hit enter.

# QUICK TOUR OF DESIGNER




The “main Window” should be highlighted
Click “Create”

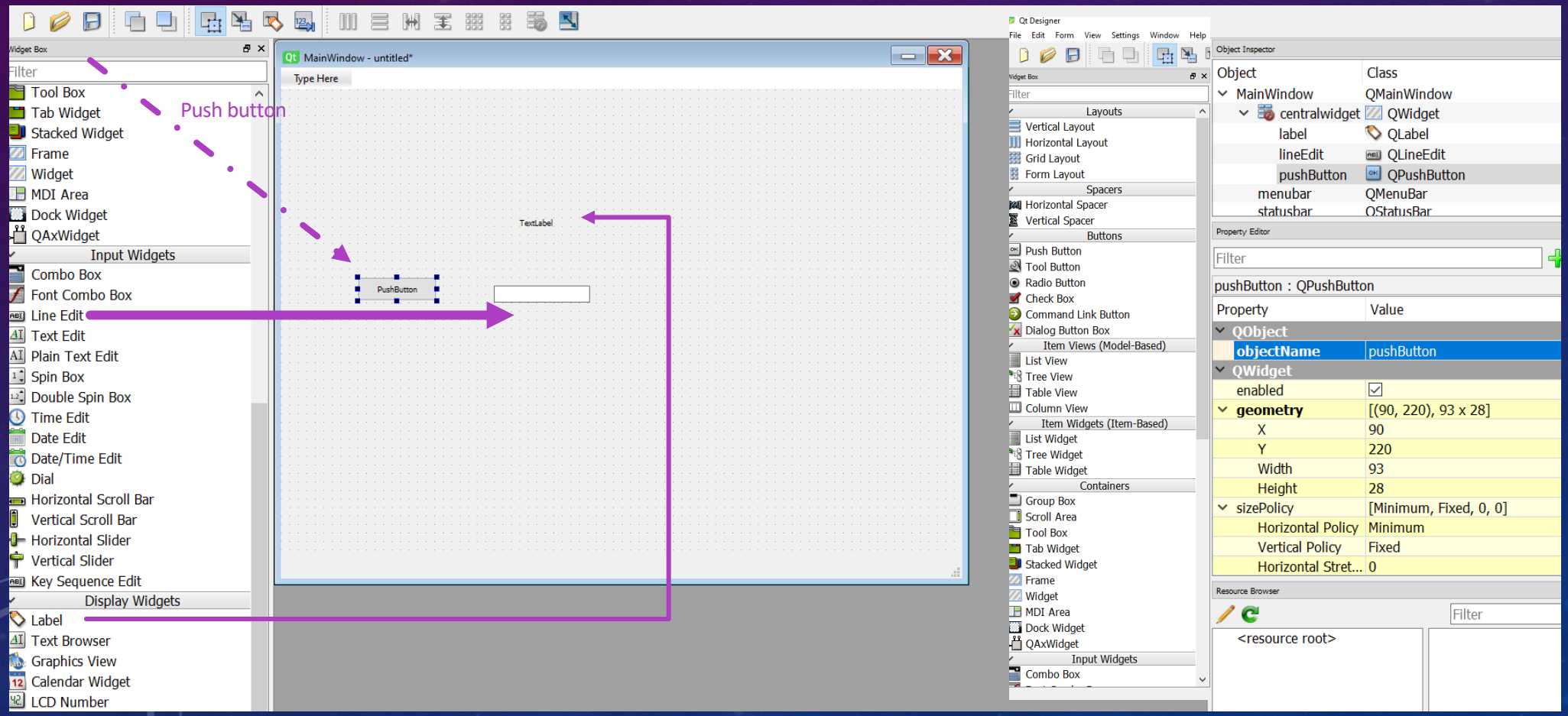
Left:
Widgets
To drag and drop
Onto the main window




Right: properties of
Anything in the main
Window that is highlighted

# ADDING WIDGETS

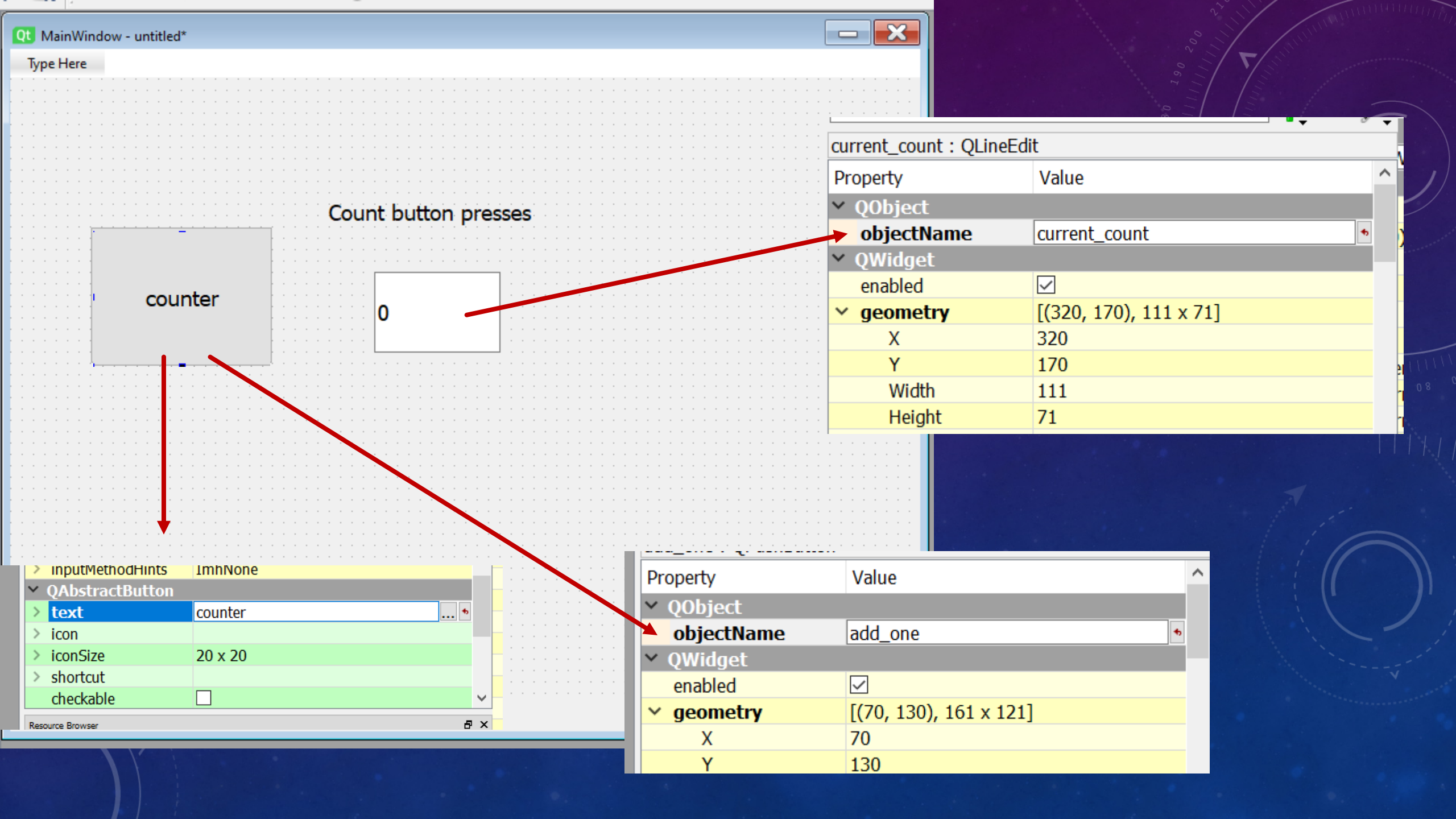
Drag a “PushButton”, a “Line Edit”, and a “Label” from the left into the main window




Note,
When you select the PushButton, you can look over on the right where the yellow is, and you will see “objectName” is “pushButton”.

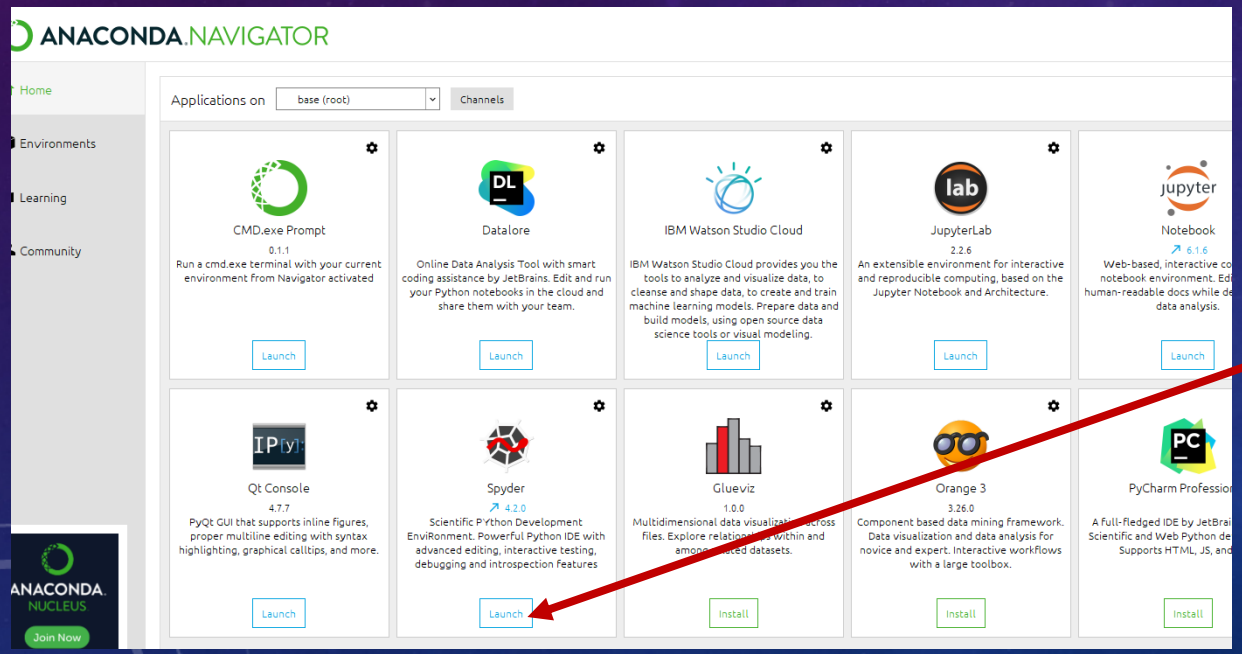
# MANIPULATING WIDGET PROPERTIES

1) Resize the widgets so they are big enough to see, physically drag their corners like any other window
2) Change font and text size by scrolling down under where “objectName” was.. You’ll see a “font” option. Click in the cell to the right of “font” to make it readable
3) Do that for all 3 widgets.
4) Change the “TextLabel” widget’s text by selecting it, scrolling down beyond “font” to where it says “Text” in bold. Change the text to “count button presses”
5) Select the empty text box and give it a starting value of 0. Scroll down to where it says “text” and add a 0 to the “value” column next to it.
6) Change the “objectName” (first property) as follows
    1) PushButton -> add_one
    2) lineEdit -> current_count
7) Change the PushButton’s text to say “counter”


MainWindow - untitled*
Type Here
Count button presses
counter
0
current_count : QLineEdit
Property
Value
QObject
objectName
current_count
QWidget
enabled
geometry
[(320, 170), 111 x 71]
X
320
Y
170
Width
111
Height
71
inputMethodHints
ImhNone
QAbstractButton
text
counter
icon
iconSize
20 x 20
shortcut
checkable
Resource Browser
Property
Value
QObject
objectName
add_one
QWidget
enabled
geometry
[(70, 130), 161 x 121]
X
70
Y
130

# FILE→ SAVE AS→ DemoGui Into your OT699 folder

It doesn't have to be OT699 folder necessarily, just the same folder from which you will run your spyder programs.



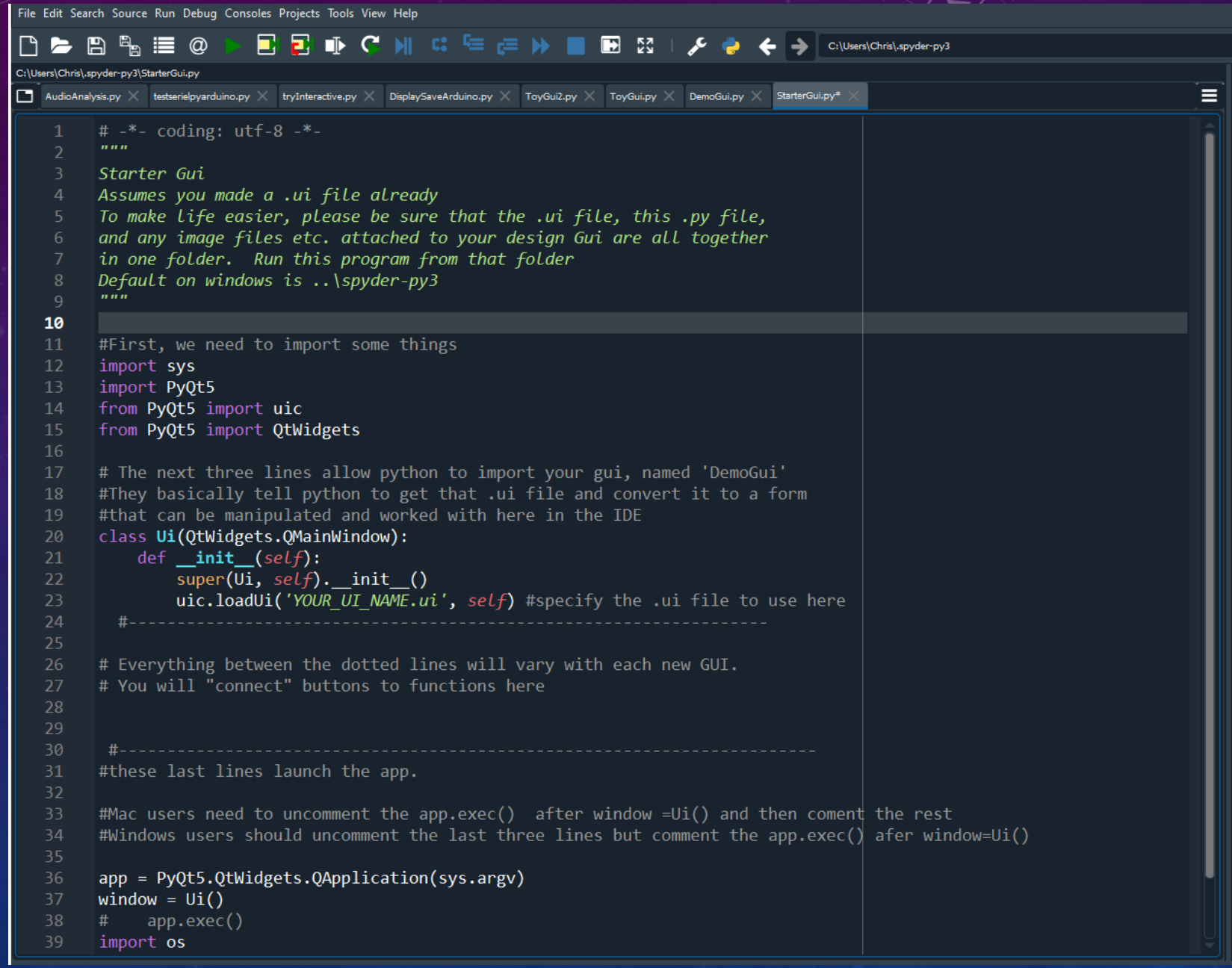

After saving, launch spyder from anaconda navigator

# START THE CODE

This code to the right is the start of your GUI.
Other than the name of the UI file, which is labeled ‘your UI_NAME.ui’ as a placeholder, this .py starter code will be the same for any GUI you want to make.

You will have this file to work with.
Please note the Mac-specific instructions at the bottom.

You will fill in the middle yourselves, following the instructions in the lecture.
A written synopsis is also provided in the next slides.



# WRITTEN STEPS: THE MAIN PROGRAM LOGIC:

*First make sure that you have a .ui file named 'DemoGui' in the same folder as this template .py file you are using. Note that if you click the "open" icon in the top left of spyder, you may have to select "all files" instead of "supported text files" to confirm that the .ui file is there.*

*In the blank part of the code, you will connect buttons to functions. Write:*

self.add_one.clicked.connect(self.counter_function)

*And since that's the only button, we can tell the GUI to show itself. Write:*

self.show()

*The next step is to define the function specified above, called "counter_function". Write:*

Def counter_function(self)

*If the objectName of your lineEdit text box is called "current_count", then to extract that you could write:*

*self.current_count.text()*

*But, writing that command gives you text, you want a number to do math with, so you can convert this text to whole number using the int() command like this: int(self.current_count.text())*

*Now you can create a variable that is always the number in the counter text box +1. write:*

newcount= Int(self.current_count.text())+1

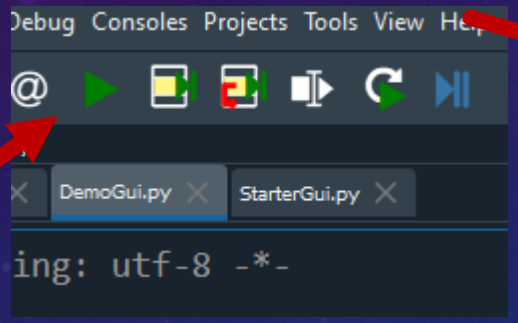
*And then you can make the variable newcount be the new text in the counter box. Write:*

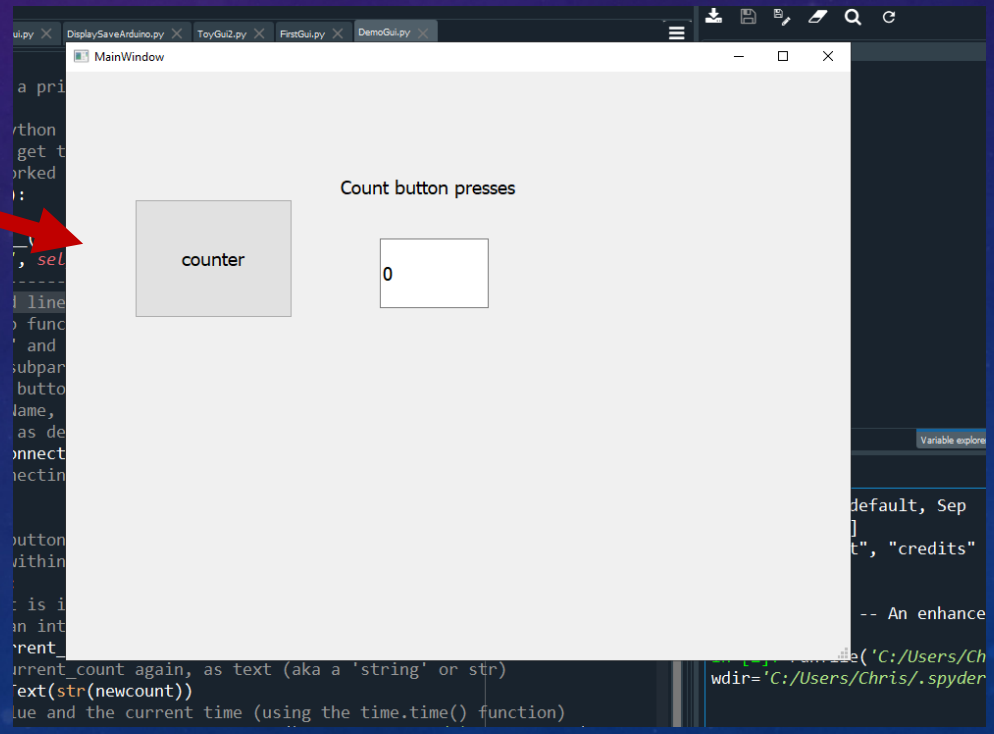
self.current_count.setText(str(newcount))

Note that newcount was converted back to a string using str() first before putting it in the text box

# COMPLETE THE CODE

To to File, Save As, and save this as DemoGui
This will put a .py file called DemoGui in your OT699 window.
Confirm now that the .py file is in the same folder as the .ui file we created earlier.
Now try running this code by clicking the green triangle.



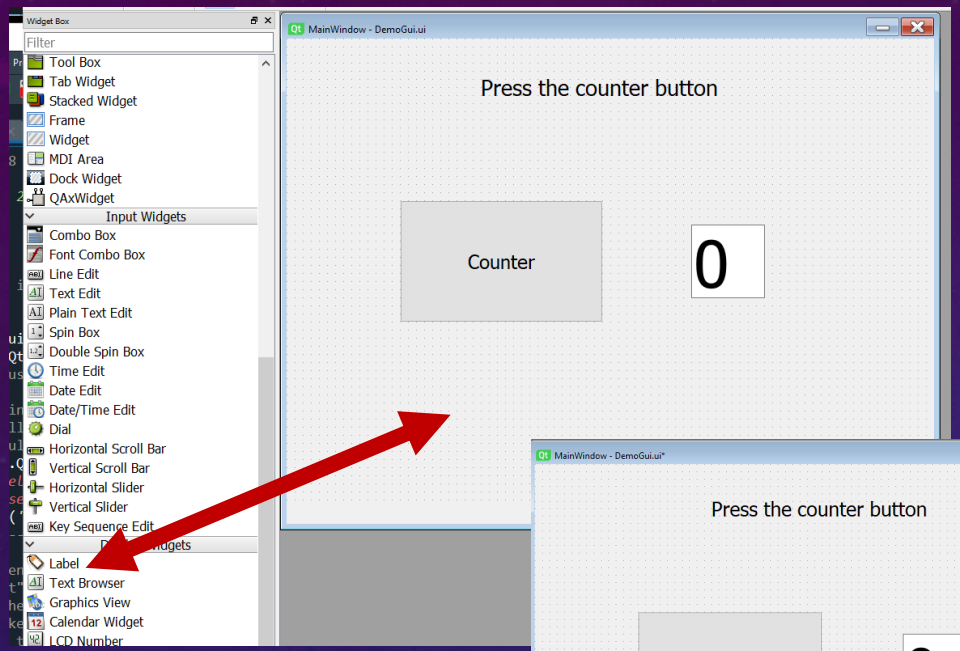



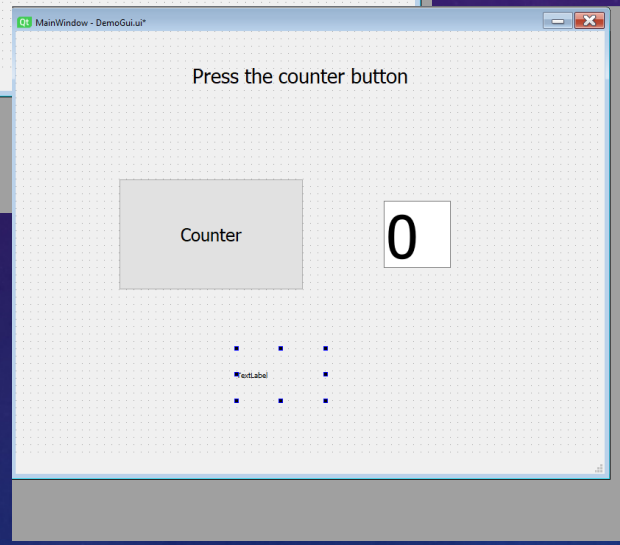
# NOW WE CAN SOME VISUALS

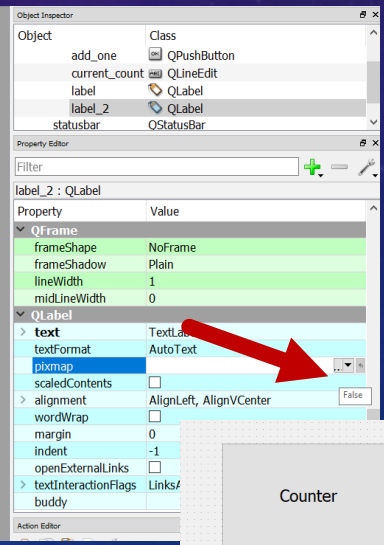
You can add images to your GUI!
It won't even change the code.

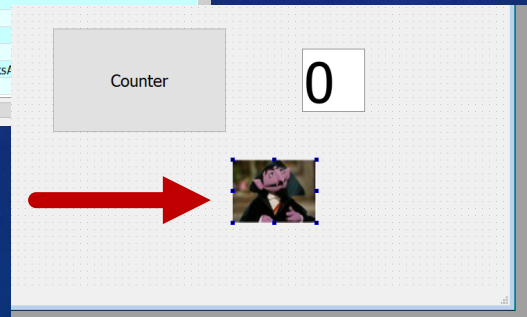
Drag a "Label" onto the main window

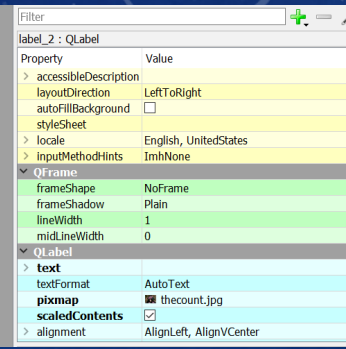
Then go to "pixmap" under Qlabel
There is a down arrow on the right of the empty text box that lets you select a file
Just make sure that the image is stored in the same folder as the .ui file before running the .py code

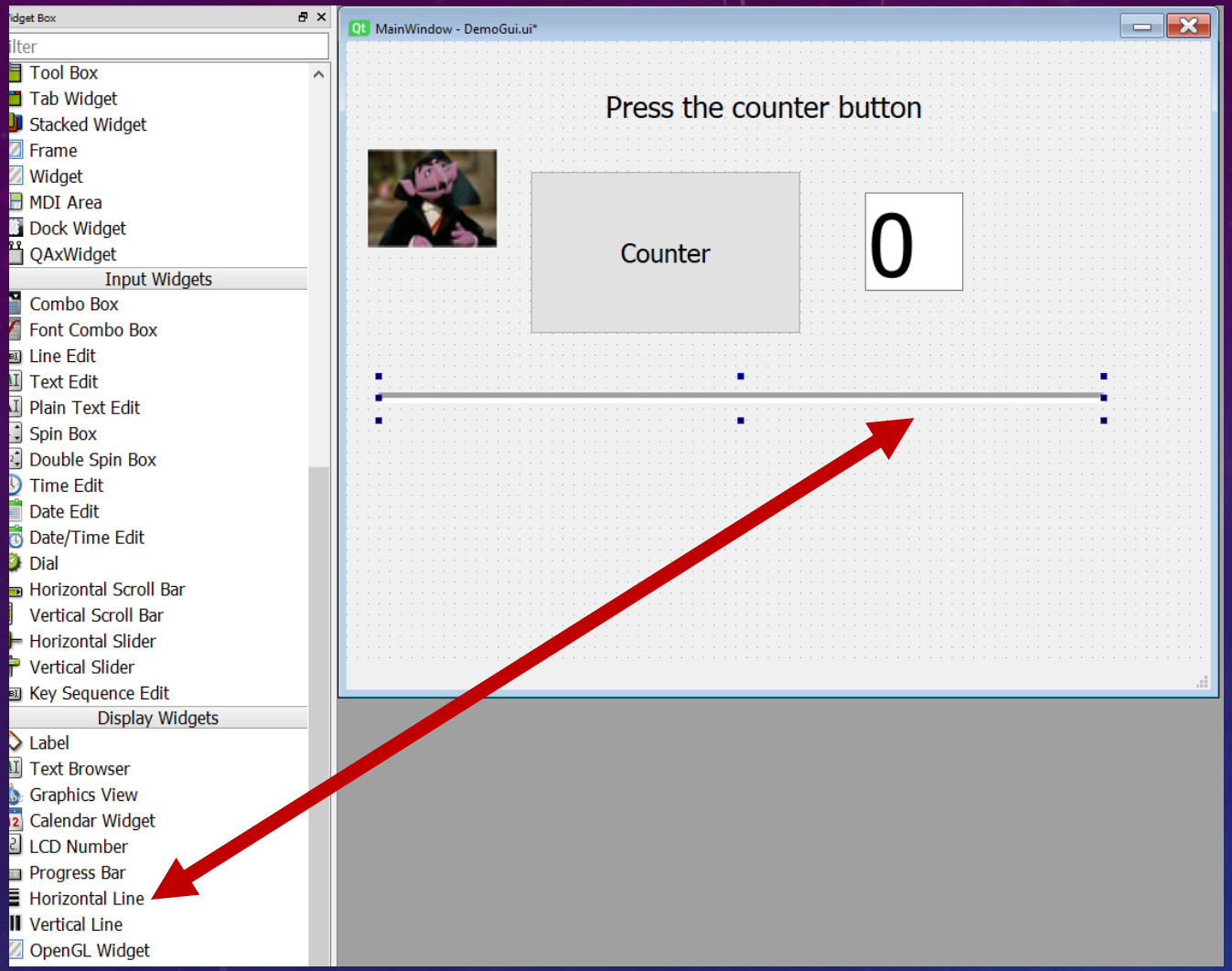


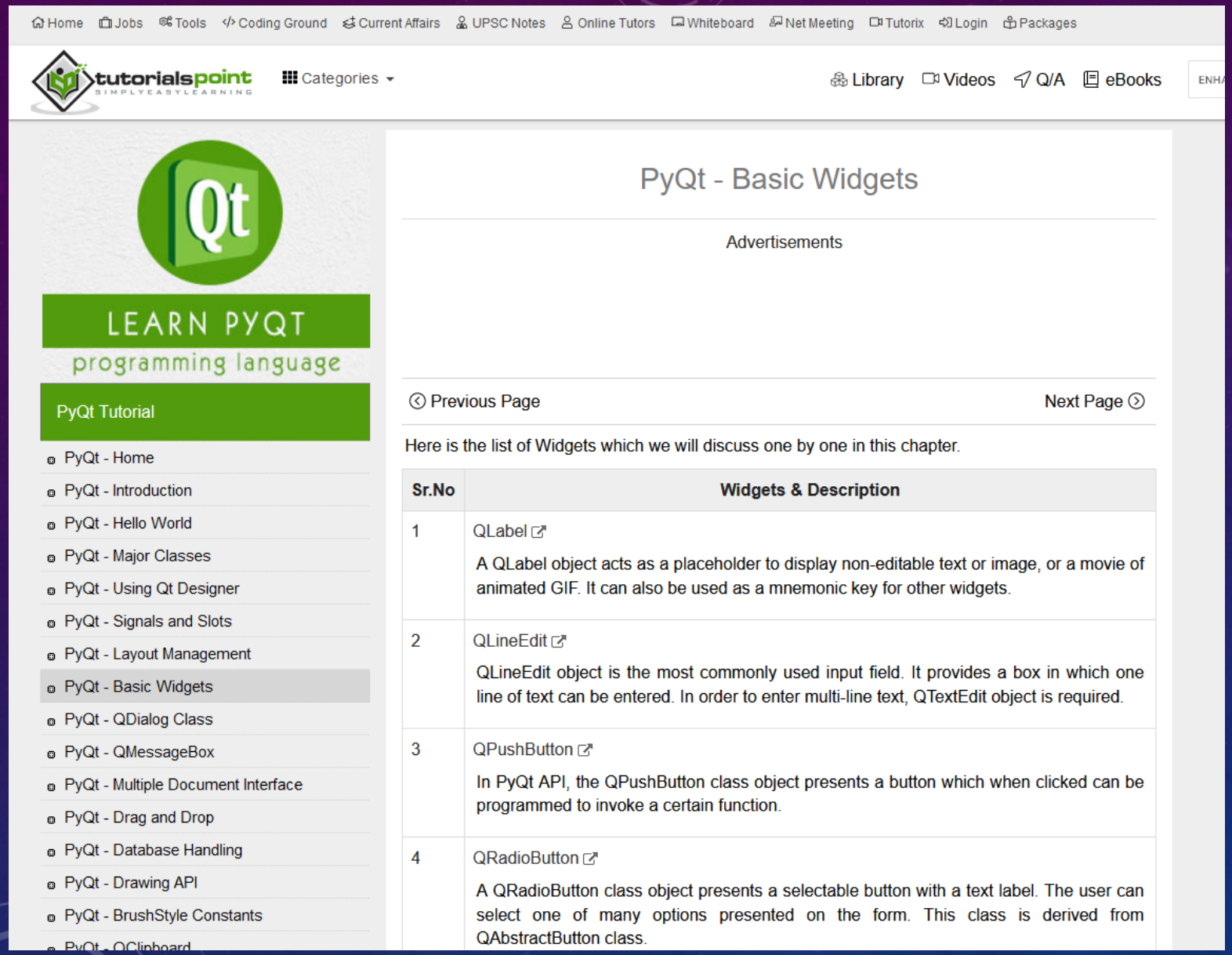



Horizontal/Vertical lines
Can be added from the “Display” widgets
And “linewidth” can be adjusted from the property editor

# THAT'S AN APP

The more python you know, the more you can do when various buttons are pushed.

Now just a few notes on moving forward:

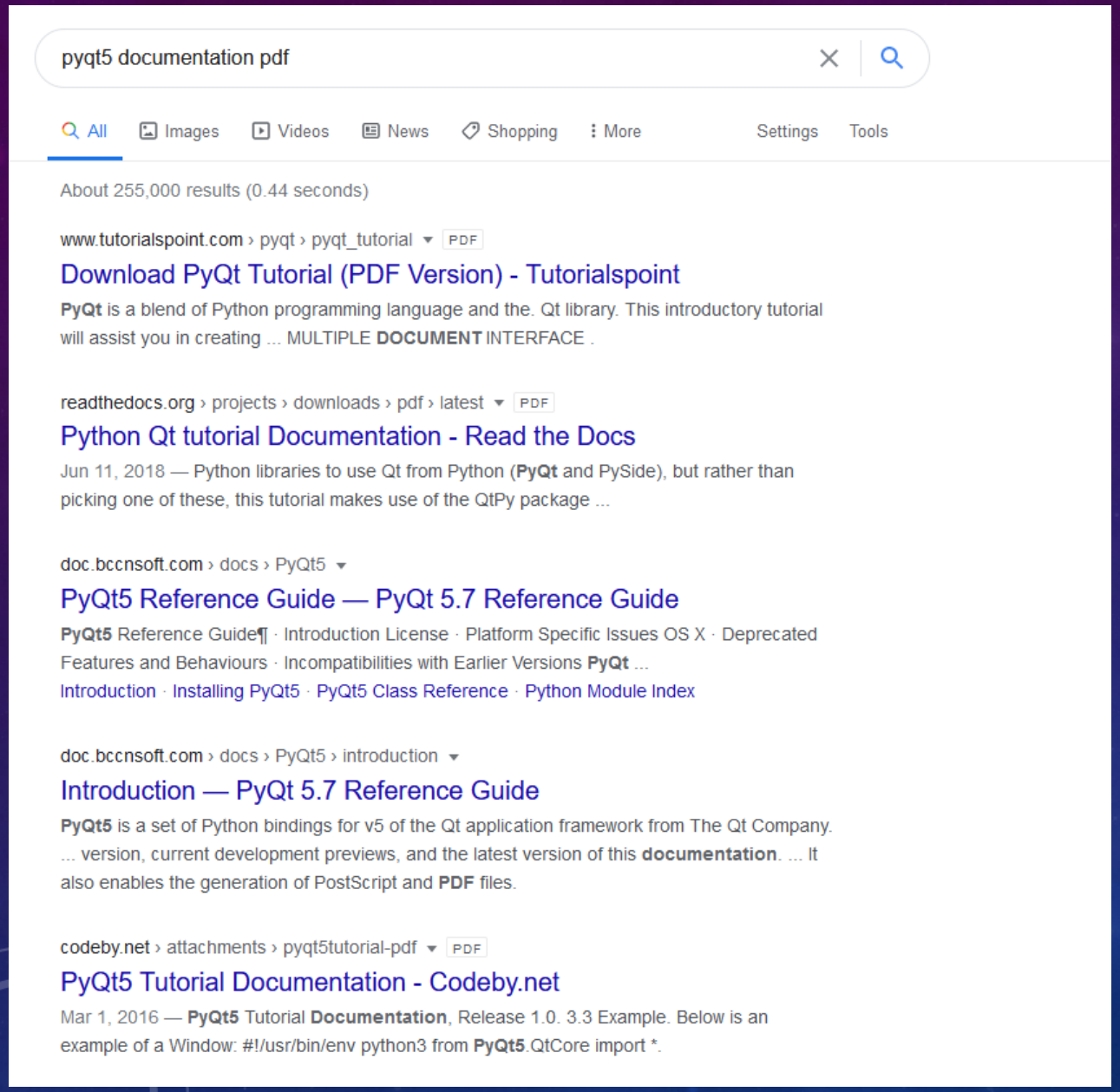



--https://www.tutorialspoint.com/pyqt/pyqt_basic_widgets.htm

Keep in mind when using the internet:
There isn't one way to create a GUI. Sources of information can sometimes present code that solves the same problem in different ways. That's normal, you may need to try a few alternatives.

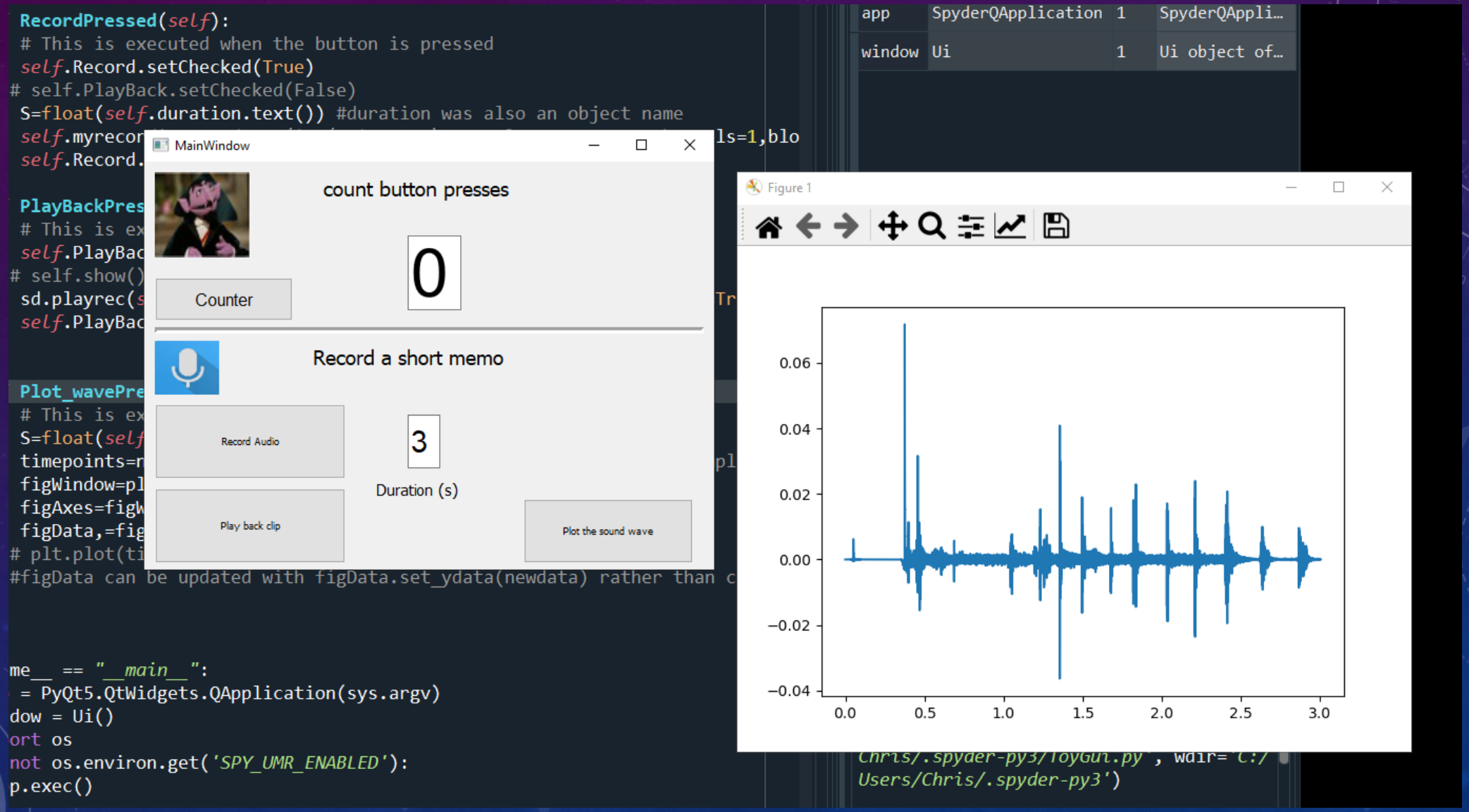
The StarterGui I've provided should be a quick way to learn about PyQt5 and how to make interactive graphical programs, but many tutorials start from scratch without using designer, so there will be some differences in how the windows are labeled.

To learn more about how to set up and interact with different widgets, the tutorial on the left should be very helpful. This is where to find commands like "setText()"




Lots of resources for documentation

# EXAMPLE NEXT STEPS: THE POSSIBILITIES ARE ENDLESS



# GOOD LUCK!