Wrapping Your Head Around Python

Coding for the Designer

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A look at what is Possible

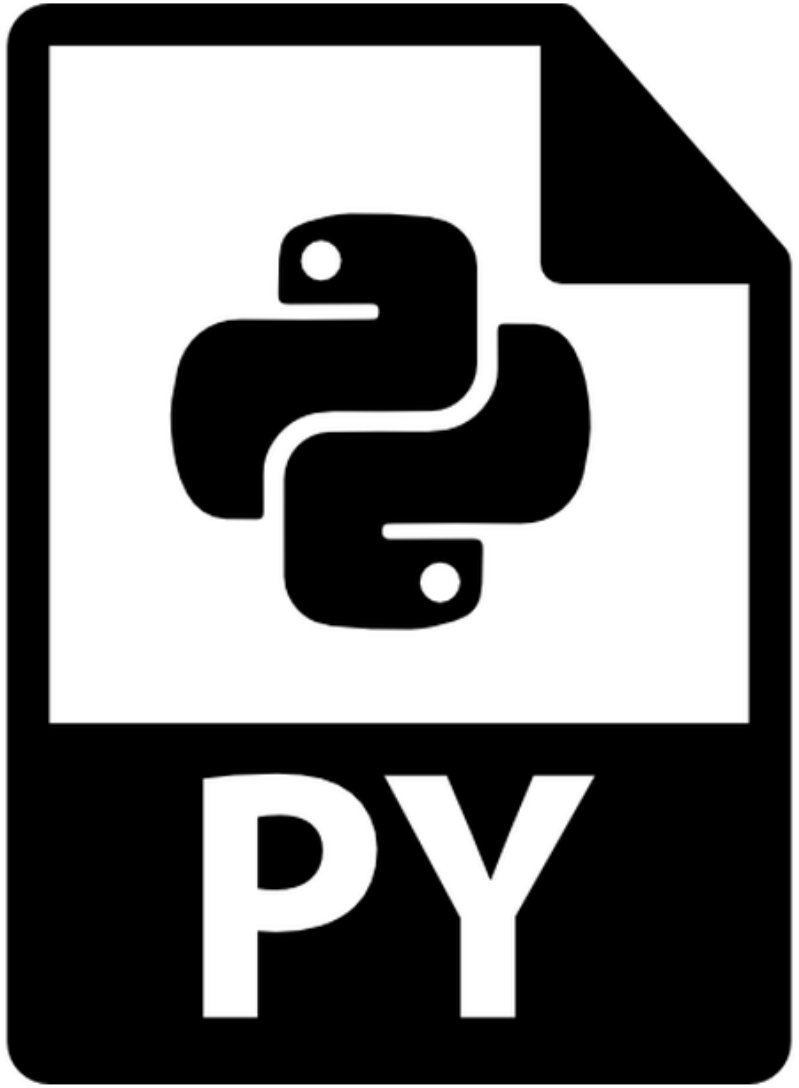
Python Use Case

Python isn’t just for coding software solutions.
It’s a gateway to hone old and new skills.
You can be use it for automating tasks, analysis, design studies and much more.

Coding isn’t just in the abstract – you can use it to make real world changes.

Python is meant for the Novice and has a lot of great uses for the design world and in general.

In this slide deck you’ll see all the things Python can be used for.



Python Use Case - Possibilities

Code shouldn't be seen as a barrier for anyone. It is like anything you use a tool that can be applied to a job.

You can be use it for automating tasks, analysis, design studies and much more.

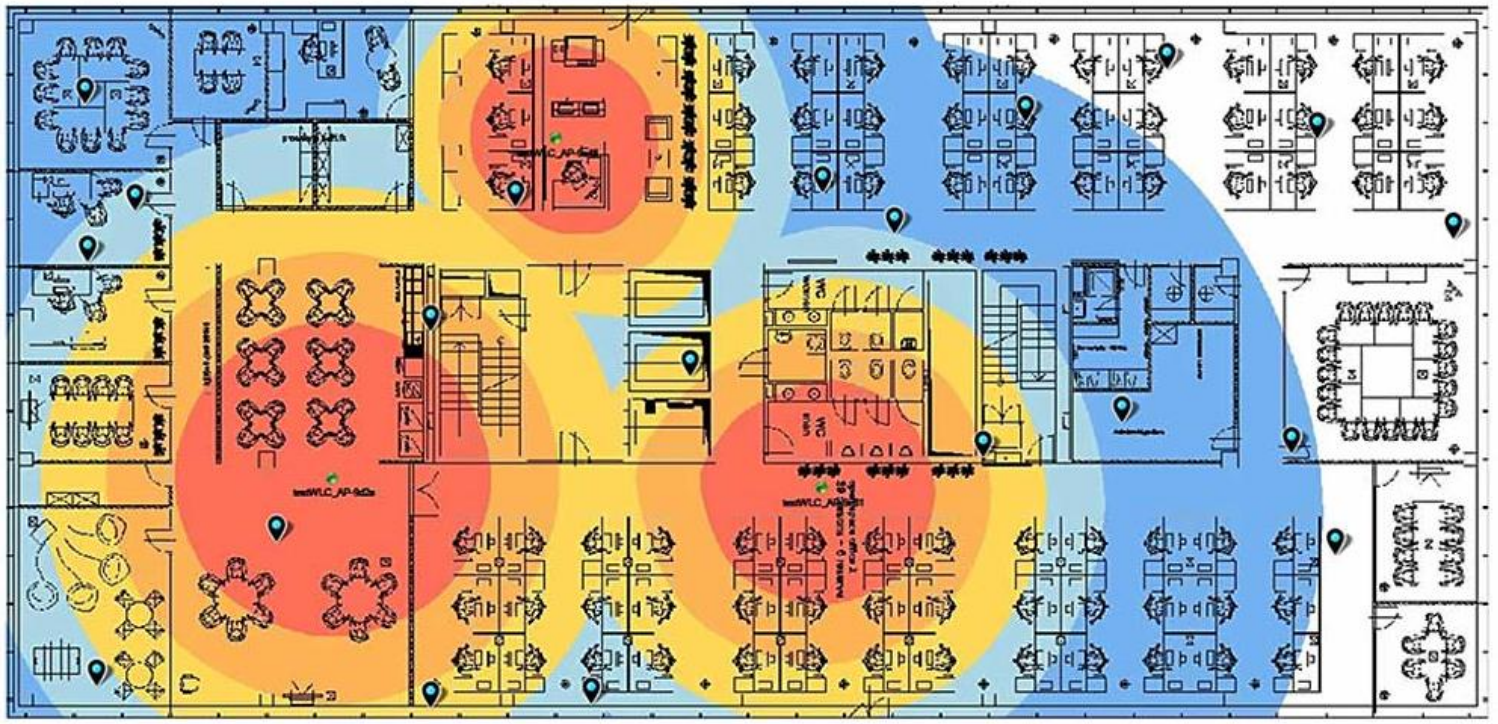
Since people usually just see lines of text they are off put by it as though it's the phonetic speech for R2D2.

It really is easy to dive into and can be applied to just about anything.

The real goal is to facilitate its use by the broadest group of people possible to reap its benefits.

Ideally you have everyone in a team aware of what it does and specialists execute the tasks with it.

That is where education and exposure to its functions comes in handy.



Analysis of path of travel radius distances in a room using Python based coding.

Python Use Case – Parametric Design

Designing with code is nothing new.

The idea of programming in Architecture goes back to Architect Christopher Alexander's 'Pattern Language' which remains relevant with programmers and Architects today.

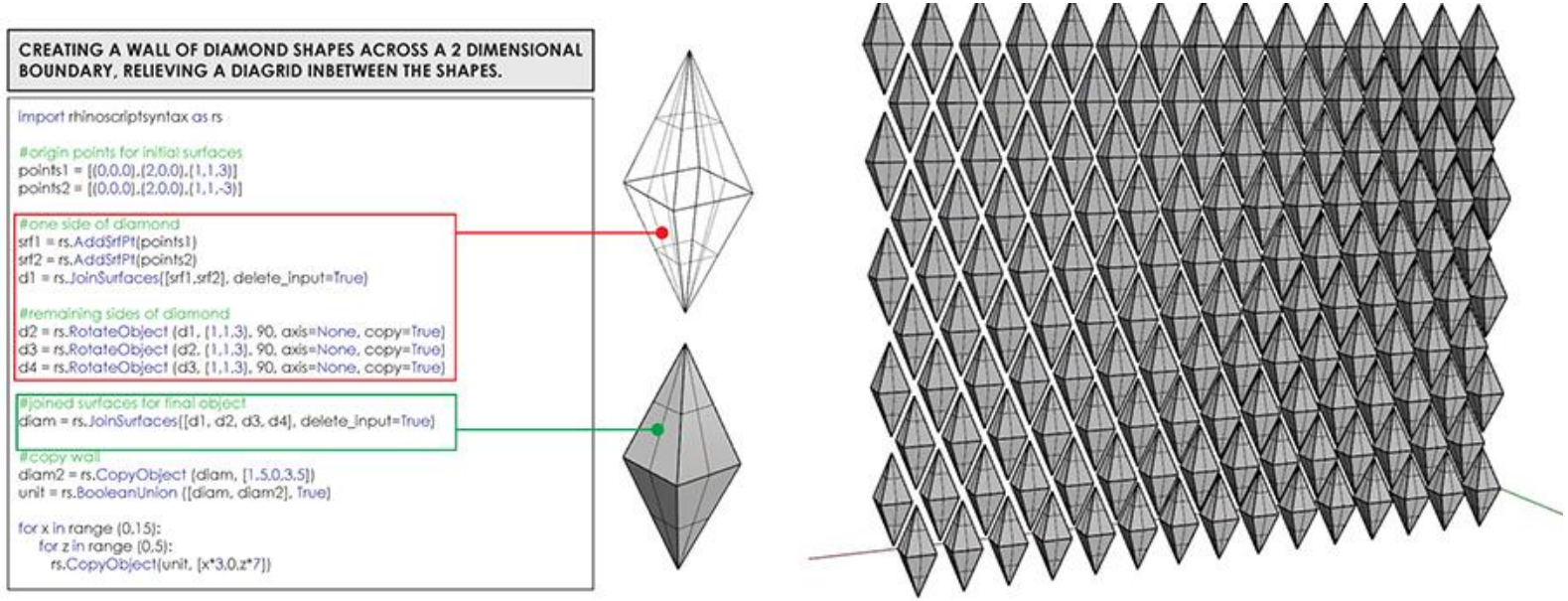
Now code can be used by anyone to make patterns in design.

Parametric design is one horizon explored using the statements and conditions in code

Rhino, Revit, Dynamo, Sketchup, Tekla – to name just a few – are modeling softwares that enable direct coding with API.

Application Programming Interface (API) is now used by designers to tap into the potential of the software platforms and freeing them from the limits of what typical tools can do.

API use can only be done with knowledge of coding languages and its toolsets.



Curtain Wall geometry using Diamond shapes configured in Python script for Rhino and Grasshopper

Python Use Case – Visual Scripting

Those unacquainted with sophisticated coding can get started as well.

Many software platforms like Rhino and Revit have visual scripting extensions like Grasshopper and Dynamo that act as an intermediary between the API and using some baseline code techniques.

Most visual scripting allows you to add your own code, like Python, and write directly to software what would otherwise be difficult to produce with conventional means.

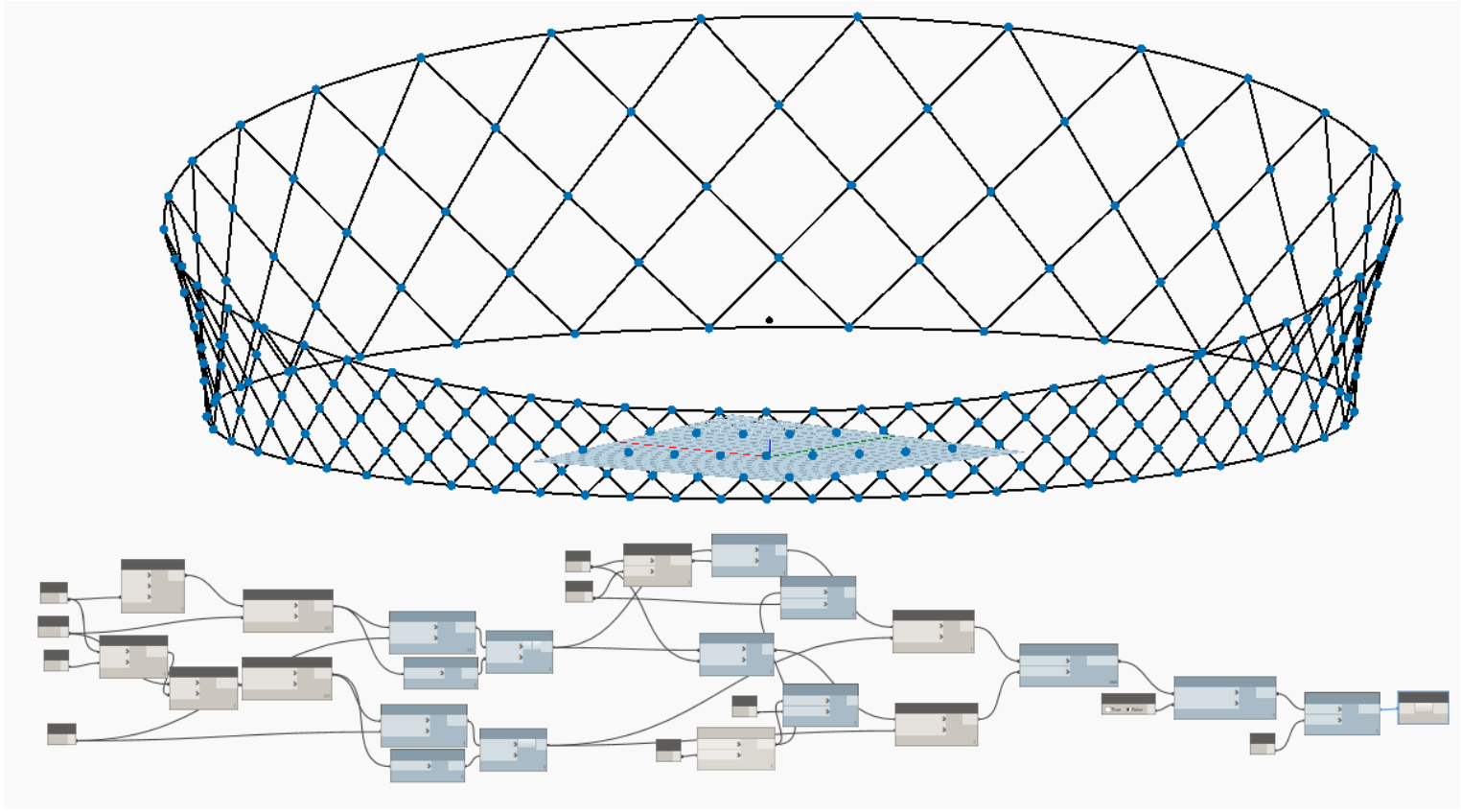
```python
import clr
clr.AddReference('ProtoGeometry')
from Autodesk.DesignScript.Geometry import *
#The inputs to this node will be stored as a list in the IN variables.
messyListOfKnots = IN [0]

list_of_knots = []
for i in range(0,5):
    list_of_knots.append([])

for i in range(0, len(messyListOfKnots)):
    if round(messyListOfKnots[0].Z)== round(messyListOfKnots[i].Z):
        list_of_knots[0].append(messyListOfKnots[i])
    if round(messyListOfKnots[1].Z) == round(messyListOfKnots[i].Z):
        list_of_knots[1].append(messyListOfKnots[i])
    if round(messyListOfKnots[2].Z) == round(messyListOfKnots[i].Z):
        list_of_knots[2].append(messyListOfKnots[i])
    if round(messyListOfKnots[3].Z) == round(messyListOfKnots[i].Z):
        list_of_knots[3].append(messyListOfKnots[i])
    if round(messyListOfKnots[4].Z) == round(messyListOfKnots[i].Z):
        list_of_knots[4].append(messyListOfKnots[i])

#Assign your output to the OUT variable.
OUT = list_of_knots
```

Accept Changes | Cancel



Façade Structure design made with a combination of Dynamo script and Python Code for Revit

Python Use Case – Design Exploration

Python also lets you do plain old cool things too.

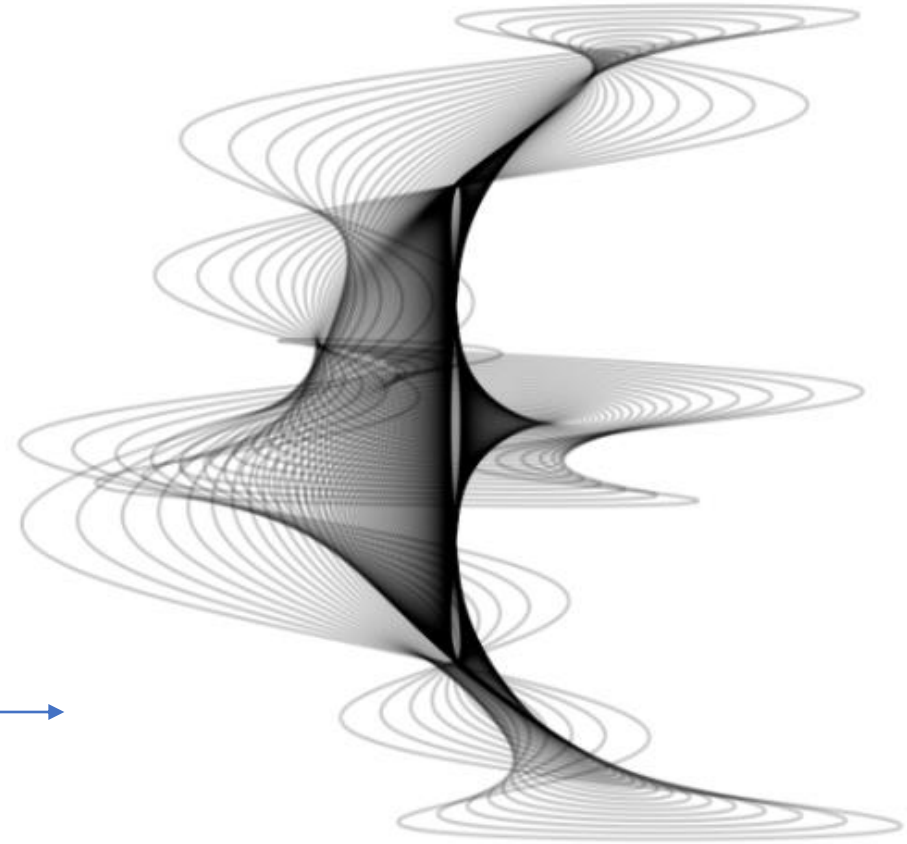
With some lines of code you can create new designs based on logical inputs to develop ideas.

What is great about this is that you don't have arbitrary content but something based upon rules and logic that can help you form a logical basis for a project.

Meaning you are not eye-balling anymore.

And anything that is written into code can be moved to another stage with that code instead of starting all over.

```
x = A1*sin(t*f1+p1)*exp(-d1*t) + A2*sin(t*f2+p2)*exp(-d2*t),
y = A3*sin(t*f3+p3)*exp(-d3*t) + A4*sin(t*f4+p4)*exp(-d4*t)
```



Mathematical Art based on inputs in a Python Package

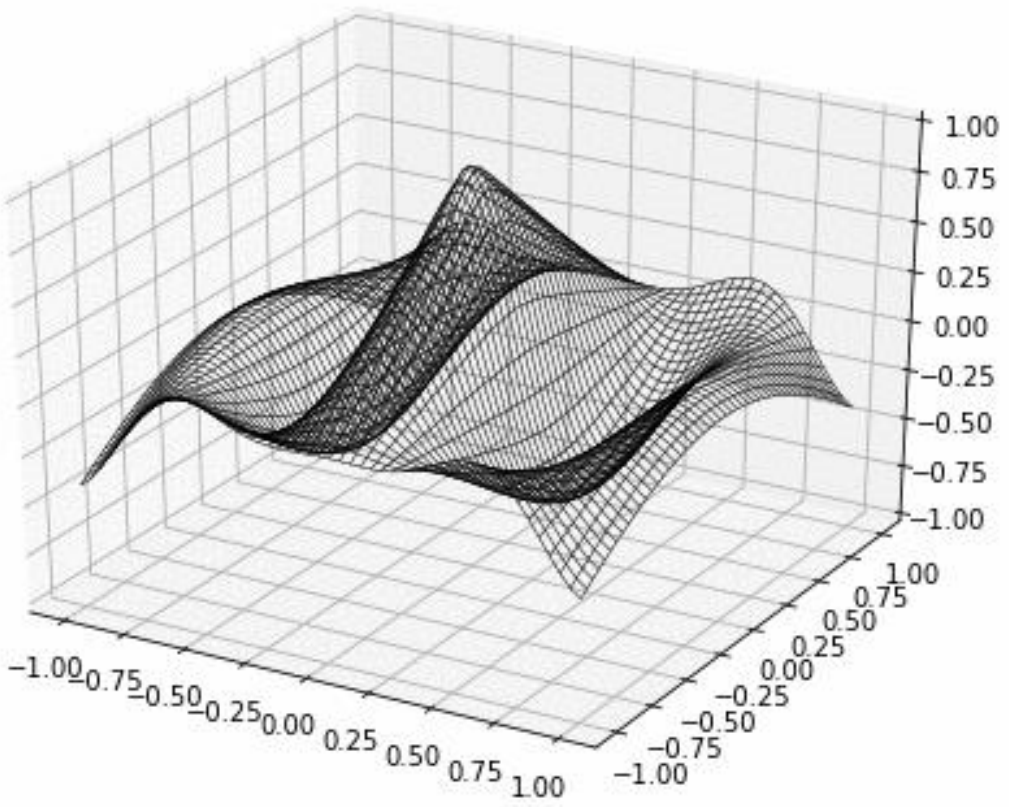
Python Use Case - Analysis

What's great about coding in general is that there are so many things you can do with it.

Beyond design you can rationalize the geometry of your design and see where a 'break' can occur with some regression analysis.

What that means is the software will tell you if your design will work with the requirements you set for it.

None of the steps is particularly hard to master with coding or software it really is up to the user to determine where they want to go with coding.



In this example you see fluid geometry being assesses in boundary conditions with a tool call MatLab that accepts Python code.

Python Use Case - Integration

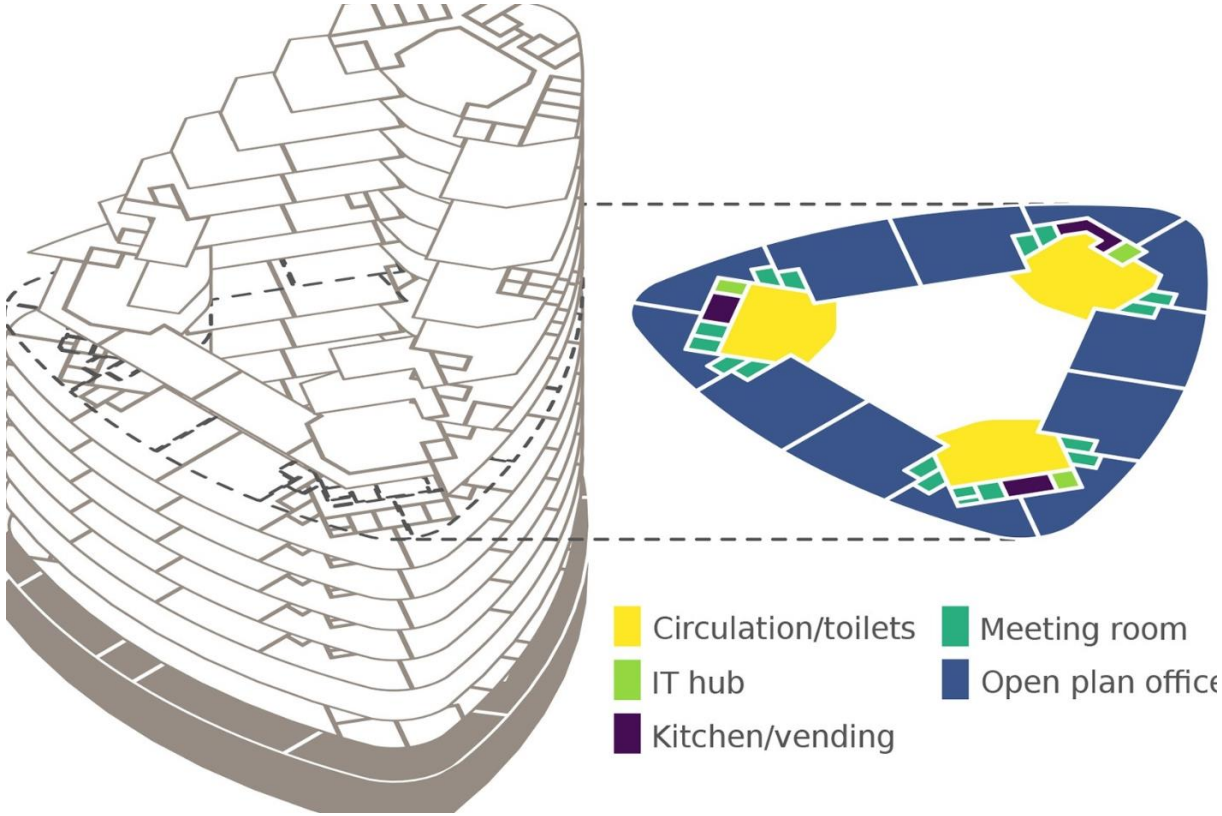
On top of all that Python is a great integrator of tools.

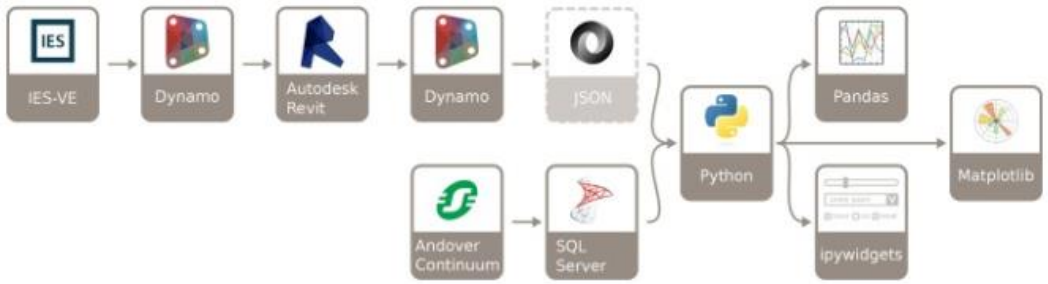
You can translate content from one software platform to another in short order with Python code.

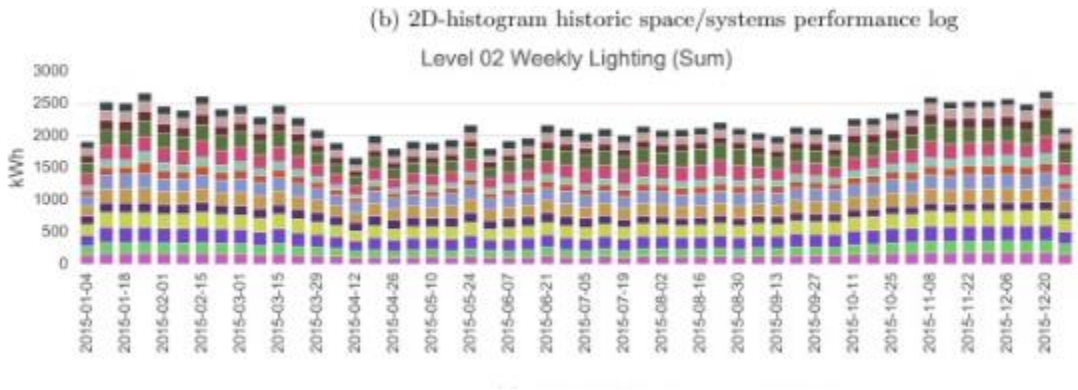
All data is fluid meaning you can take the data you want out of a given software and move it into another.

XML, CSV, HTML, JSON and other document formats can easily let you transfer data around.

The key part Python plays is that the scripts you can make with it automate the translation process and you are on your way to getting a lot of great content out of your project.







Python Use Case - Statistics

Python is a bean counter's best friend.

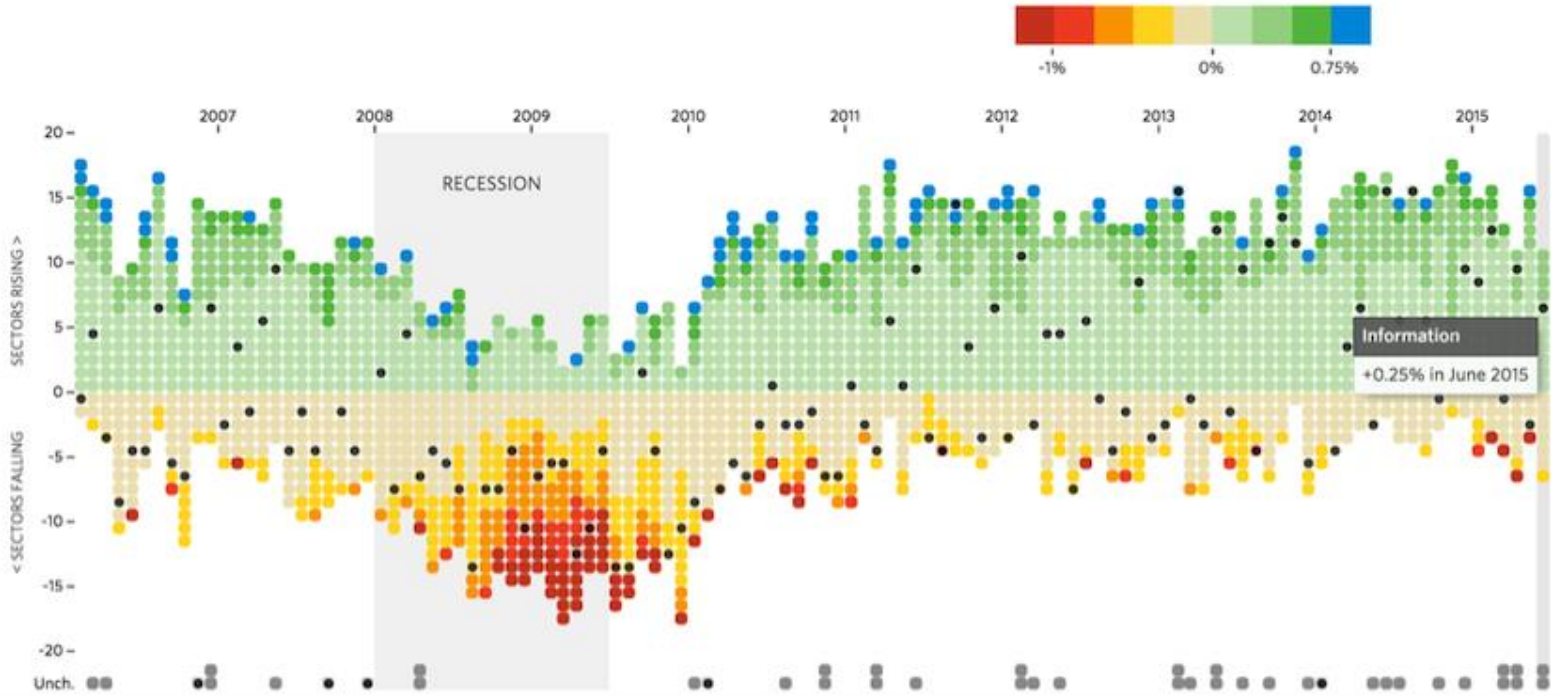
If you are interested in getting the most out of your data and making insightful analysis out of it then go no further with Python.

It is the programming language most associated with Data Science and Statistics in the world with open-source tools like Pandas providing a lot of great extensions.

You can gather data, study it, get insights from the data and report that insight to your team all with Python.

This isn't just useful for designers this is useful for *anyone anywhere.*

The world is built on data these days and Python is the leading platform for using that data.



Python Use Case – Office Tools

There are so many digital tools out there that let you get a lot detailed work done quickly.

To leverage the tools even more means combining data flows between software tools.

That's where Python comes in as a great integrator of tools.

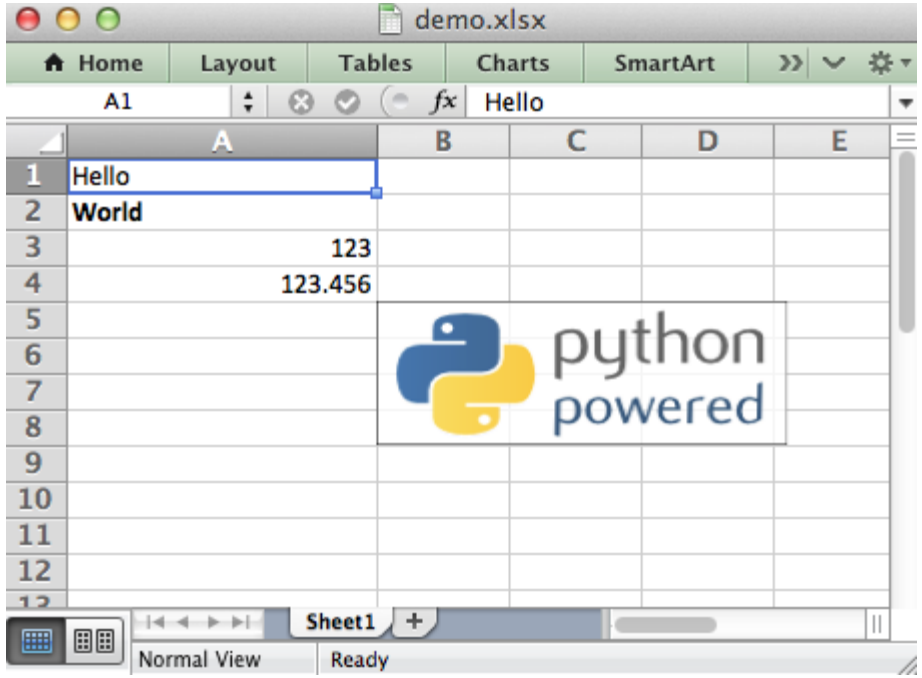
This is the practical side of Python which lets you automate tedious work with scripts.

Want to write 100 emails at once? Easy.

Want to have one Excel cell do the work of 10 functions in one? Easy.

Want to autofill a word document with a few modifications based on context? Easy.

That is the low – hanging fruit with Python which is to speed up and automate things and anyone can take advantage of that in any role as a practical part of business.



Python Use Case – More!

Python can be used for just about anything.

Statistics.

Machine Learning and AI.

Internet of Things and Hardware programming.

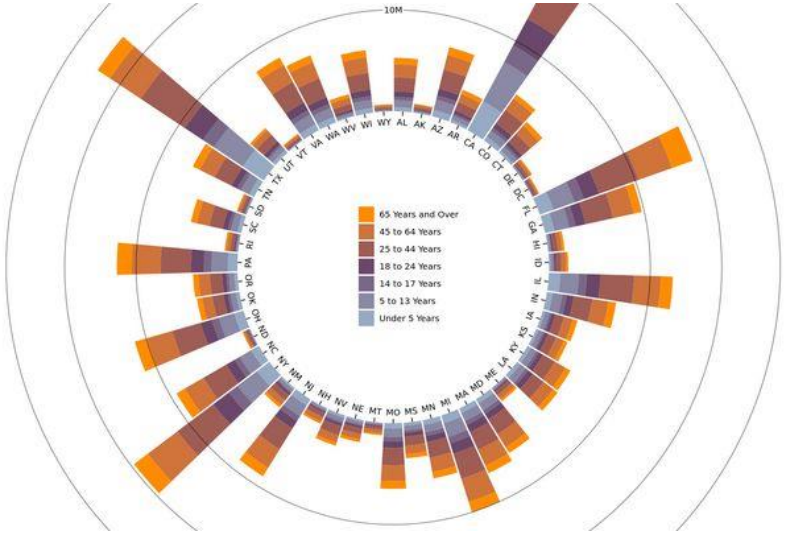
Website Development.

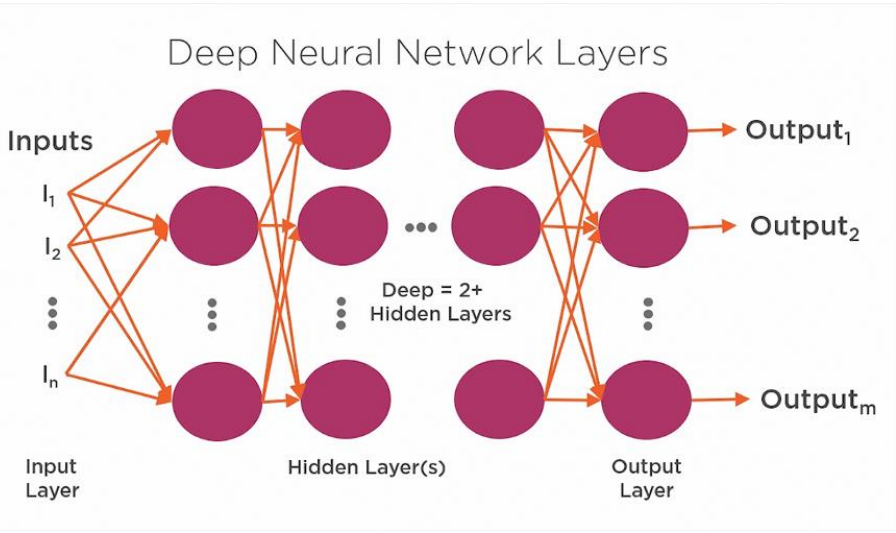
Finance.

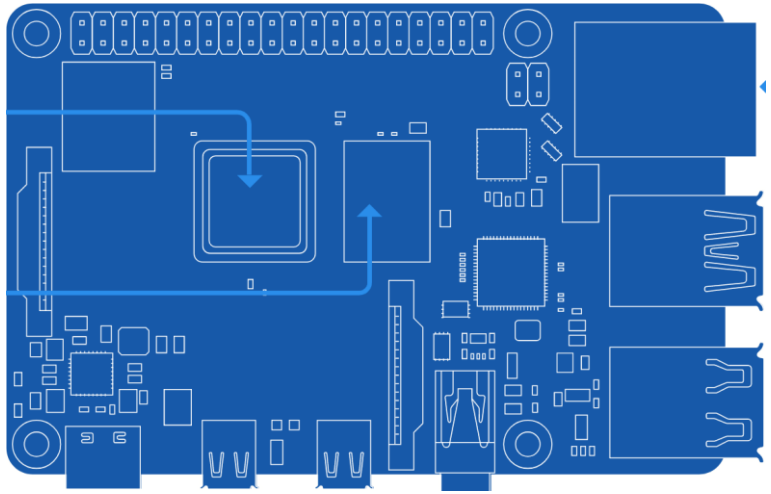
Research.

The list goes on.

Meaning you are not at all limited with your choices when it comes to using Python it is all up to you.







Python Use Case - Growth

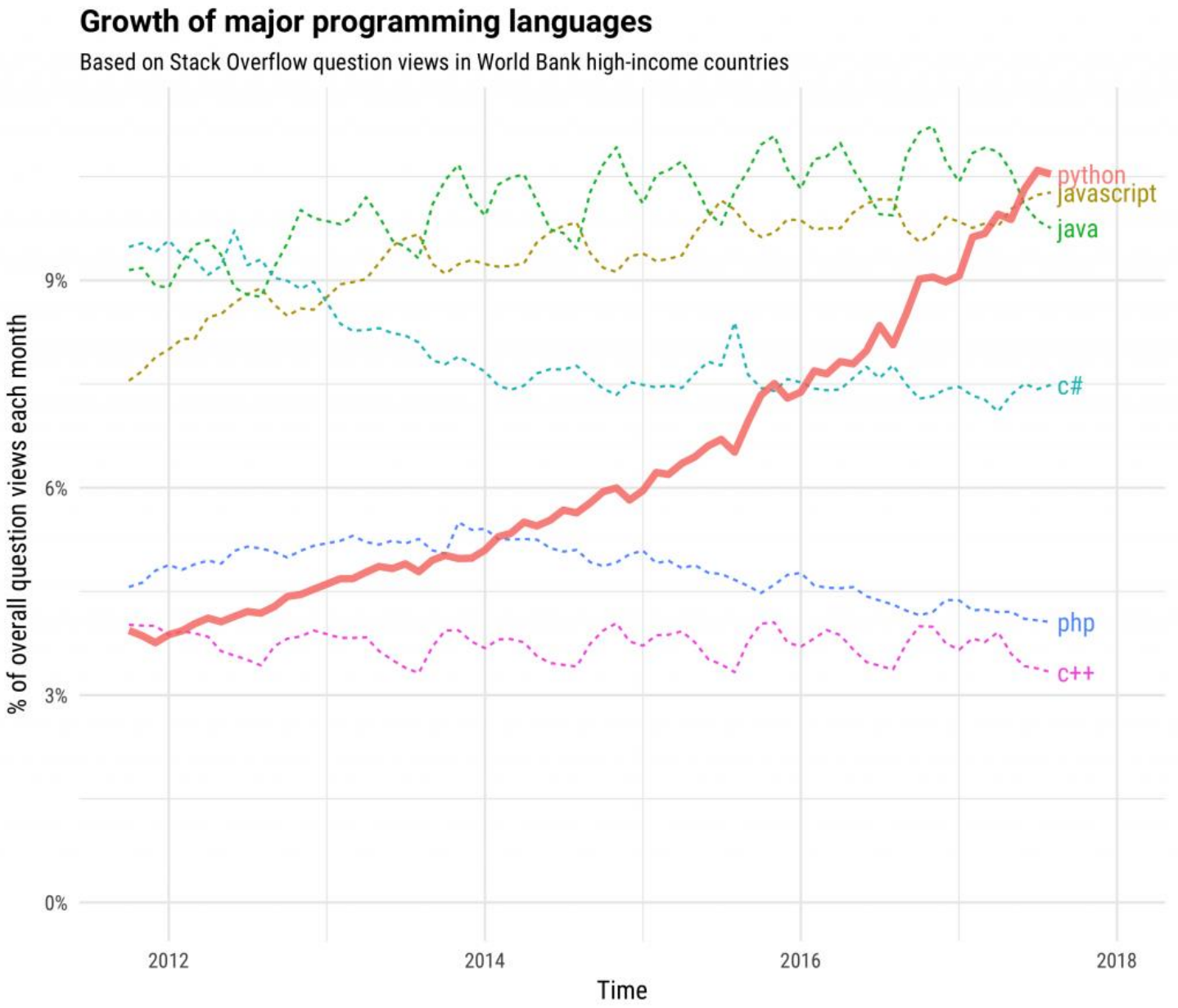
Learning a new skill must address what is a timely skill to acquire and its relevance.

In regard to coding there are many languages to learn from and Python is just one. So why choose it over others?

Python is a top pick because it is easy to pick up but has a lot of depth. Most people can pick up the code quickly and have plenty of options to grow with it.

It is in fact the top growth language in recent years and is in demand for many industries.

With this growth trend Python will be useful for years to come as a relevant language well supported by its user base.



Bonus – It's Completely Free.

Did I mention Python is open source?

There's no fee to use it, The community supporting it freely exchanges updates and coding solutions vetted by trusted developers.

Many of the packages you can download and use with Python are also free which is the community spirit of the Python Project.

Hopefully I did a good job covering what Python has to offer.

It's pragmatic, in demand and rather easy to use.

I am already a believer so I plan to convert many more to this cause.