

# Creating Interactive Figures with Bokeh+Python

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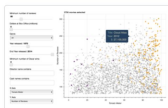




# What is Bokeh?

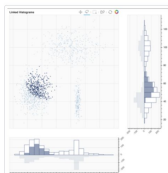
Pronounced either “boh-Kay” or “boh-Kuh”

Python’s Bokeh is a visualization library that provides tools for constructing interactive (mostly 2D) figures and apps using Python and sometimes a little Javascript. It can create interactive plots that can be embedded directly within your website.



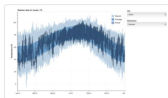
An interactive query tool for a set of IMDB data

Source code: [movies](#)



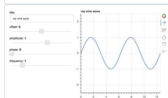
Shows axis histograms for selected and non-selected points in a scatter plot

Source code: [selection\\_histogram](#)



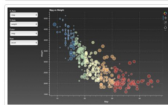
Interactive weather statistics for three cities

Source code: [weather](#)



A basic demo that has sliders for controlling a plotted trigonometric function

Source code: [sliders.py](#)



Explore the “autopg” data set by selecting and highlighting different dimensions

Source code: [crossfilter](#)



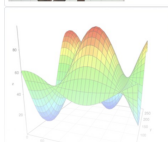
A reproduction of the famous Gapminder demo, with embedded video added using a custom page template

Source code: [gapminder](#)



Linked plots, summary statistics, and correlations for market data

Source code: [stocks](#)



An updating 3d plot that demonstrates using Bokeh custom extensions to wrap third-party JavaScript libraries

Source code: [surface3d](#)

[See the Bokeh gallery for some possibilities.](#)



# Why use Bokeh?

(Why not, e.g., Plotly, D3, Tableau, etc.?)

## Python

We love working in Python! And all of our scripts are already written in Python.

## Interactive

We want to use custom sliders, buttons, dropdowns, etc. to manipulate our plots in real time.

## Easy

We want something that is easy to get started in and doesn't require building everything from scratch.

## Shareable

We'd like to be able to create interactive plots for free that can be shared easily with collaborators, posted on websites and possibly included in online journal articles.



# Are there limitations?

(Yes, of course.)

## Look

Bokeh has its own look and feel (toolbar, axes, fonts, available symbols, possible interactions, etc.). If you don't like it, too bad.

## Big data

If you have lots of data, Bokeh may be too slow for your needs. 1000s of points are OK, but 100k (or large images) is going to push the limits.

## 3D

If you really want to plot 3D, you may want to look elsewhere. Bokeh can plot 3D functions, but not a 3D scatterplot (as far as I know).

## Docs

Though there is some documentation and some examples online, it is limited. Other libraries (e.g., D3) have way more examples online to pull from.



# How to get started

1. Decide the **story** that you want to tell with your data, and how you will do it with an interactive figure
2. Prepare your **data** in Python (pandas works well with Bokeh)
3. Make a static **plot** with matplotlib first
4. Determine which “**tools**” and “**widgets**” you will want
5. **Consult** the gallery, google for examples, look at the docs, ask me!



# Typical components

1. **ColumnDataSource** : holds a python dictionary (or a panda DataFrame) containing your data
2. **Tools** : simple manipulators (zoom, pan, select, etc.)
3. **Figure** : the plot (scatter, line, bar, etc.)
4. **Table**: a data table connected to the figure (optional)
5. **Widgets** : more sophisticated manipulators (sliders, buttons, dropdowns, etc.)
6. **Layout** : how to position the figures, tables and widgets in some grid
7. **Show** : display your plot and/or save it to an .html file



# Hands-on example

BokehDemosColab.ipynb ☆

File Edit View Insert Runtime Tools Help *Changes will not be saved*

+ Code + Text Copy to Drive

## Bokeh Demos

The "User Guide" linked on this page is a very good resource: <https://bokeh.pydata.org/en/latest/>

## Part 1

An example with a scatter plot and connected table plus a callback to allow access to the selected values.

### 1.1 Import the necessary libraries

```
[ ] # Import needed libraries.
import pandas as pd
from bokeh.plotting import *
from bokeh.layouts import row, column
from bokeh.models import ColumnDataSource, Scatter, Select, CustomJS
from bokeh.models.widgets import DataTable, TableColumn

output_notebook()
# if you uncomment the line below within a jupyter notebook, the plot will be exported to an html file
#output_file("scatterSelect.html", title='scatter')
```

### 1.2 Read in the data

I am using exoplanet data from the [NASA Exoplanet Archive](#). A description of each column is provided at the top of the file.

```
[ ] # Read in (or create) data.
df = pd.read_csv('https://raw.githubusercontent.com/ageller/IntroToPythonBokeh/main/PS_2021.10.05_11.19.37.csv', comment='#')

# for this example, I will only keep rows that have values for mass and radius
usedf = df.loc[(pd.notnull(df['pl_bmasse'])) & (pd.notnull(df['pl_rade']))].reset_index()
usedf
```

[Click here to access the notebook in colab.](#)