

Plotly graphs and figures

BUILDING DASHBOARDS WITH DASH AND PLOTLY



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What is Dash?

A Python library for creating interactive, modern, functional web applications easily.

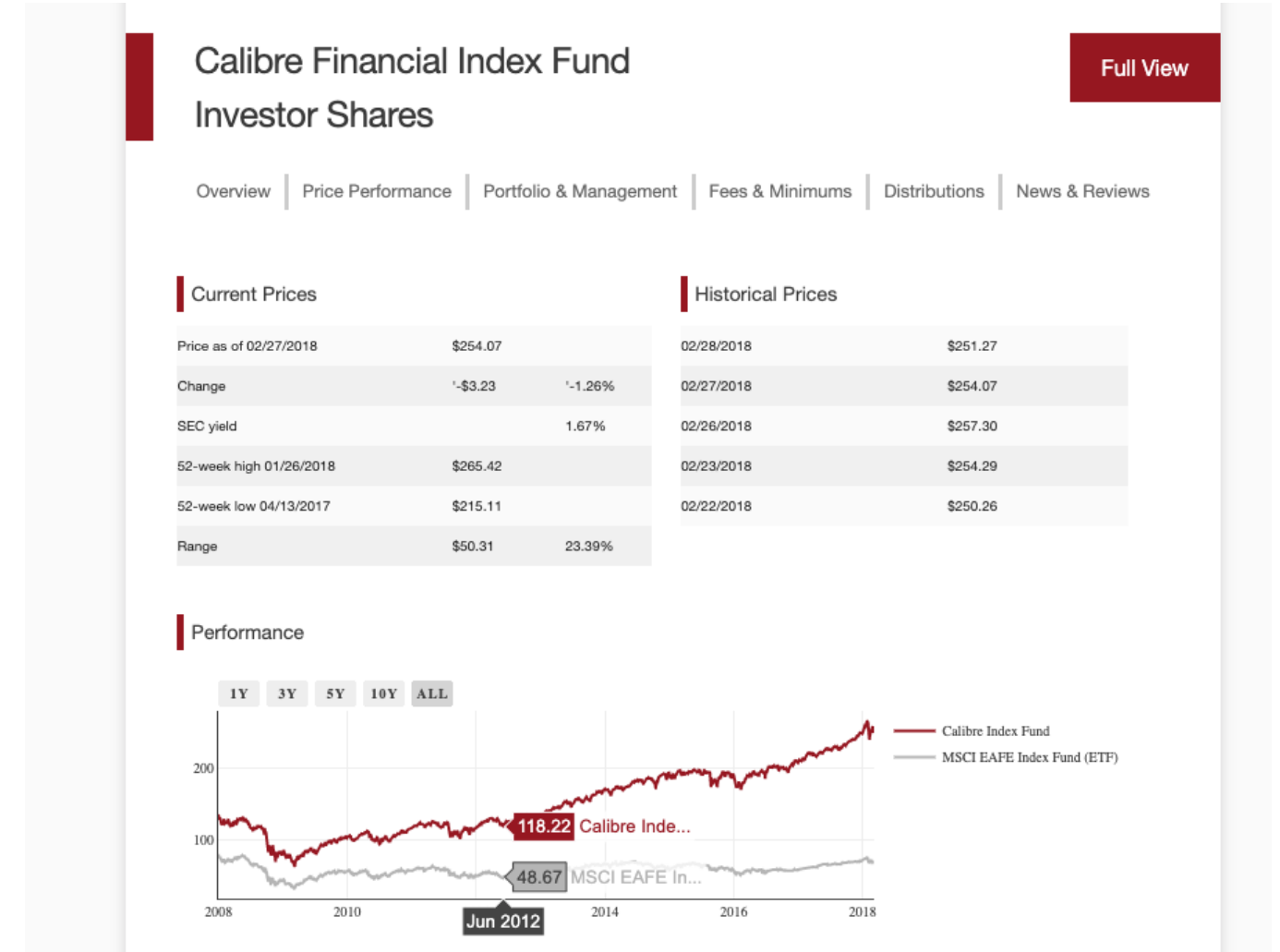
Advantages:

- Free! Unlike Tableau and PowerBI etc.
- Harness JavaScript with only Python
- Less code than web application frameworks like Django

Plotly and Dash

Plotly and Dash work together (same company creator)

- Dash: Interactive dashboards with multiple Plotly graphs
- See this [example](#)
 - Images, text and Plotly graphs
 - Check out the [source code](#) (search `go.scatter`)



What is Plotly?

- Revise Plotly, focus on Dash
- A Python library for creating modern, interactive graphs
 - Wraps JavaScript but code in Python
- `plotly.express` for graphs

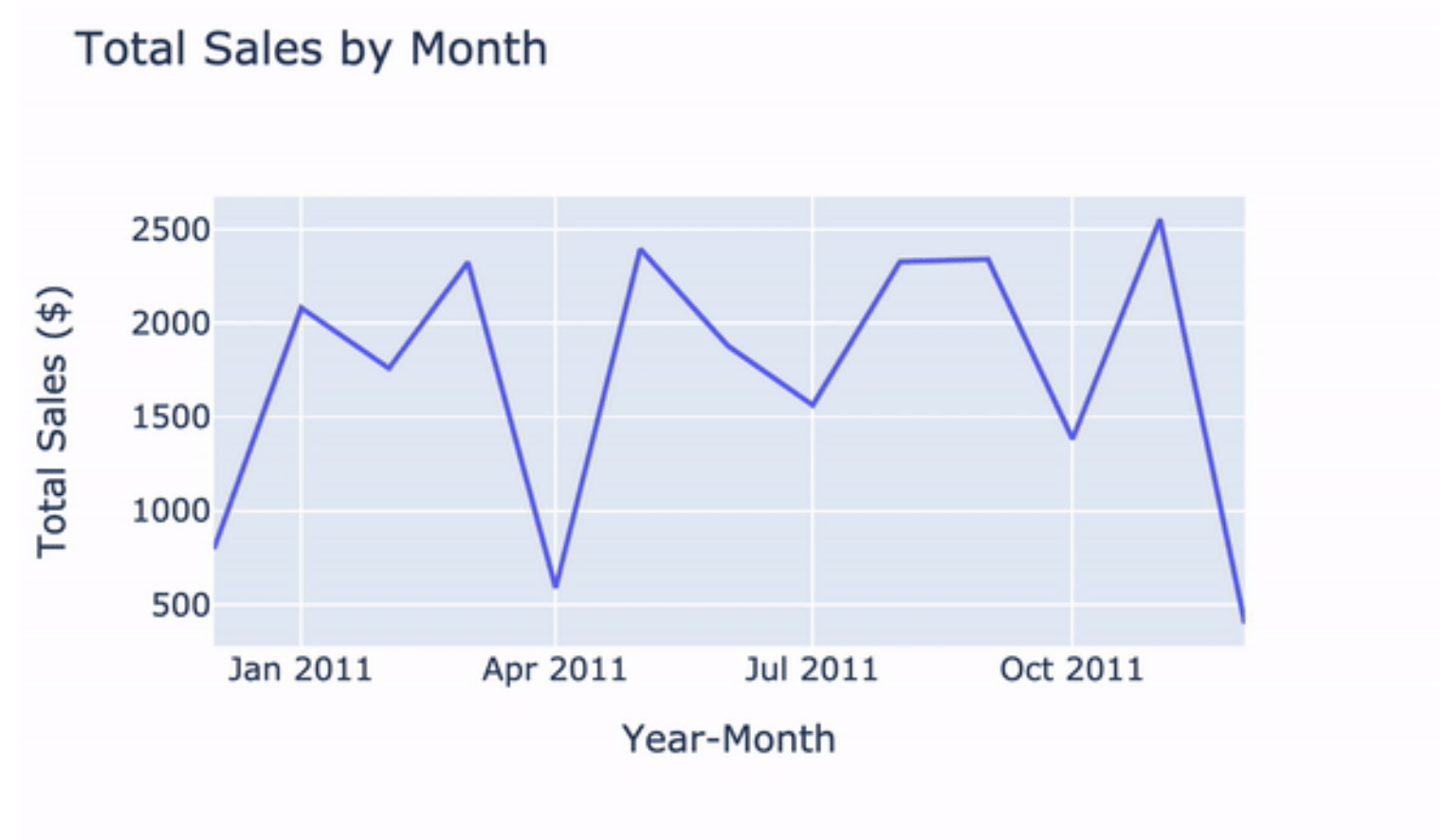
Our e-commerce data

- Dataset of e-commerce sales
- Details:
 - Item category (Major, Minor) + description
 - Unit price, quantity (+ OrderValue)
 - Country
 - Year-Month of sale

Line charts with plotly.express

Monthly sales using our e-commerce data (`ecom_sales`).

```
import plotly.express as px
line_graph = px.line(
    data_frame=ecom_sales,
    x='Year-Month',
    y='Total Sales ($)',
    title='Total Sales by Month')
line_graph.show()
```



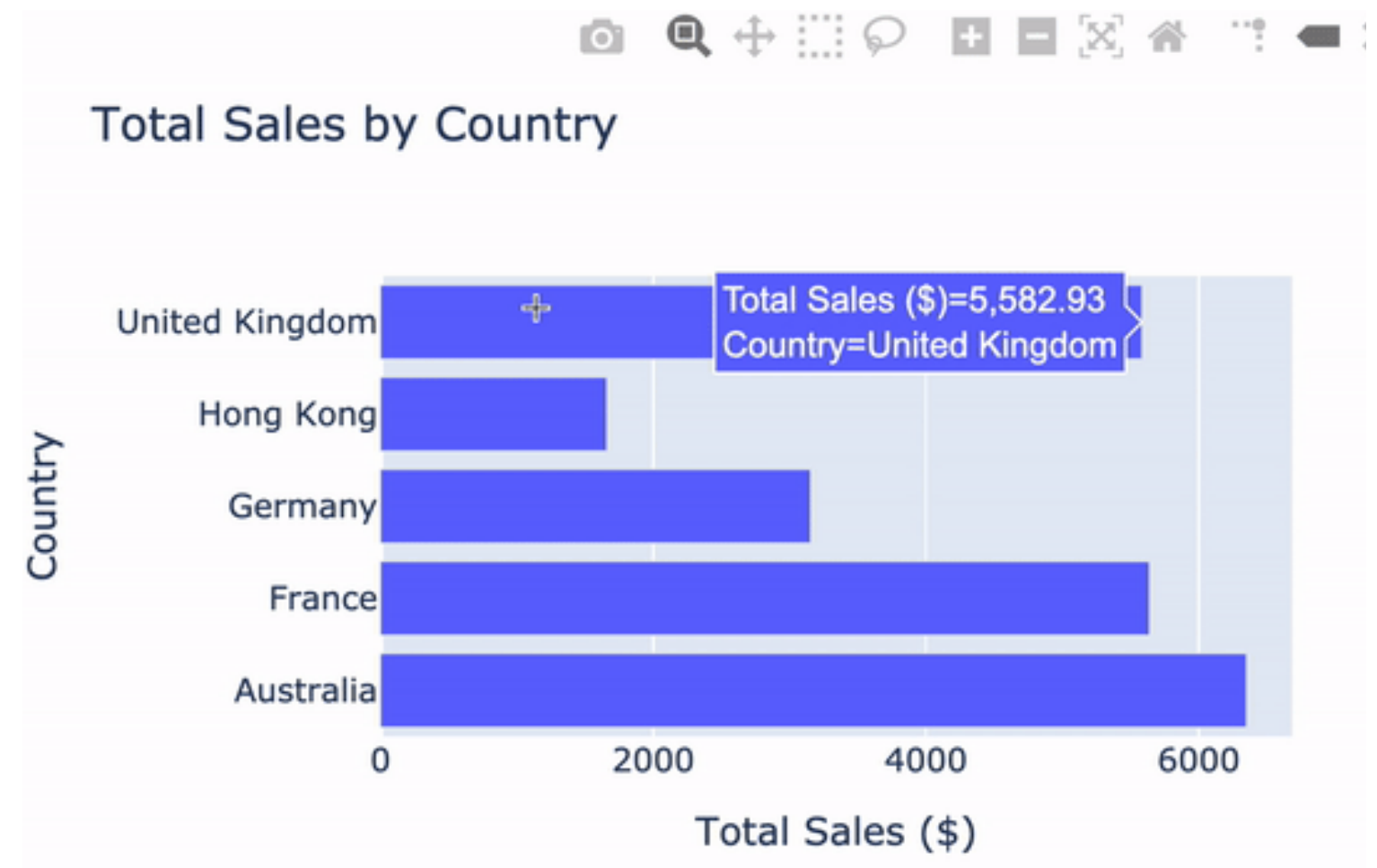
Bar charts with plotly.express

Other `plotly.express` plots are created similarly

A bar chart of the total sales by country:

```
bar_fig = px.bar(  
    data_frame=ecom_sales,  
    x='Total Sales ($)',  
    y='Country',  
    title='Total Sales by Country',  
    orientation='h')  
bar_fig.show()
```

We get an interactive bar chart!



Customizing Plotly graphs

Plotly graph properties can be updated later with `update_layout()` (important for Dash apps!).

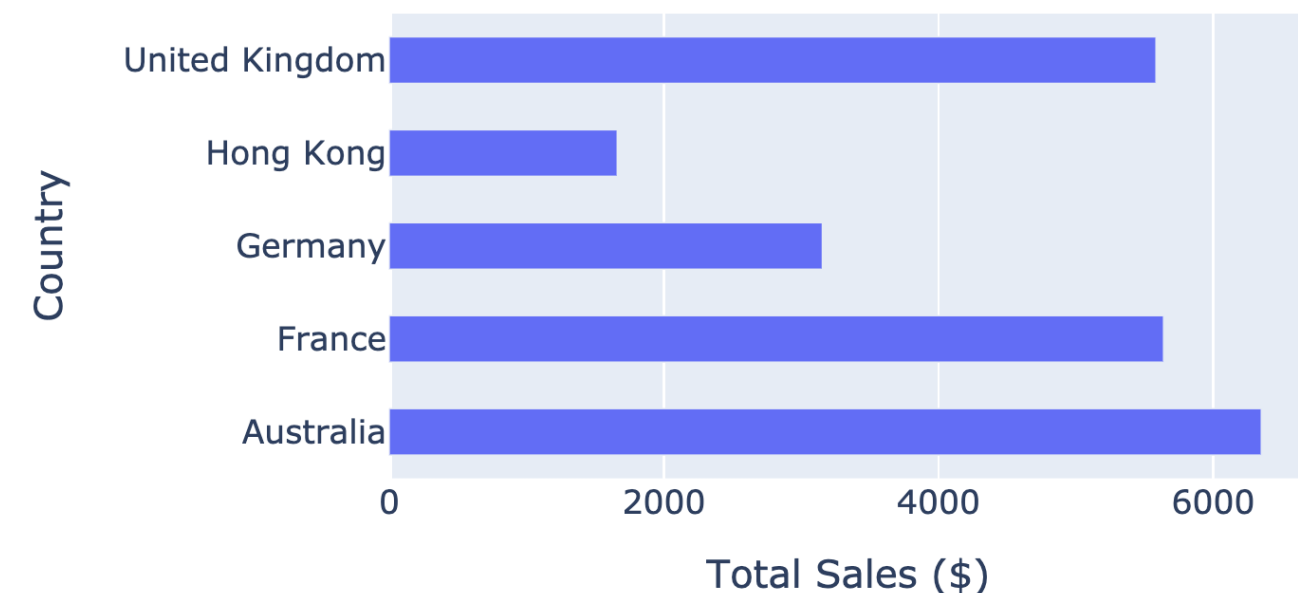
Changing the bar width of our bar graph:

```
bar_fig.update_layout({'bargap': 0.5})  
bar_fig.show()
```

Check out the [Plotly documentation](#) for specific arguments for each plot.

Notice the larger gaps between bars?

Total Sales by Country



Let's practice!

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From Plotly to Dash

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A first Dash App

A complete Dash app:

```
import dash
from dash import dcc
app = dash.Dash()
app.layout = dcc.Graph(id='example-graph', figure=bar_fig)
if __name__ == '__main__':
    app.run_server(debug=True)
```

- Python functionality possible
 - e.g., String interpolation `print("f{my_variable}")`

The main Dash imports

```
import dash  
from dash import dcc
```

- `dash` is the main library that creates the app itself
- `dcc` ('dash core components') contains the different building blocks to create the app
 - Two components in our app
 - More components throughout the course (e.g., user inputs!)

The app layout

```
app = dash.Dash()  
app.layout = dcc.Graph(  
    id='example-graph',  
    figure=bar_fig)
```

- Create an app object using `dash.Dash()`
- Set the `app.layout`
 - Here, a single graph
 - Using `dcc.Graph()`
 - `figure` = The Plotly figure to render
 - `id` = Important for callbacks later

Running the app

```
if __name__ == '__main__':  
    app.run_server(debug=True)
```

- Lastly, running the server
- Script is run from command-line (not read into a notebook)
 - i.e., `python my_app.py` in the command-line
- `debug` for helpful feedback when testing

Our app

Script is run via the command-line (`python3 script.py`), served on a local server

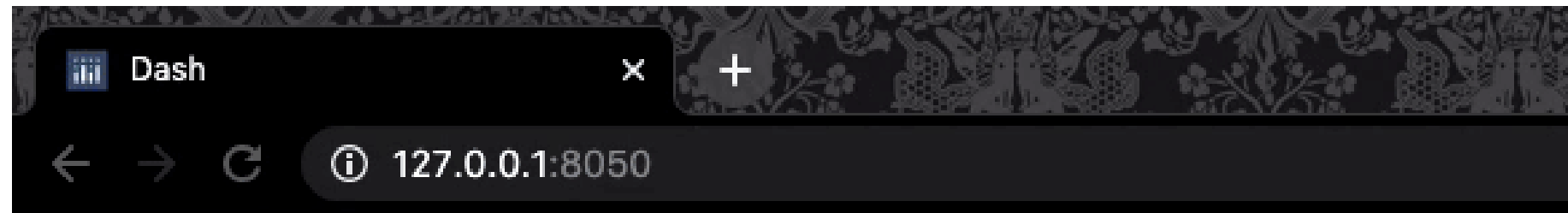
Access via a web browser such as Google Chrome

While served, update and save `.py` file to see live updates in browser

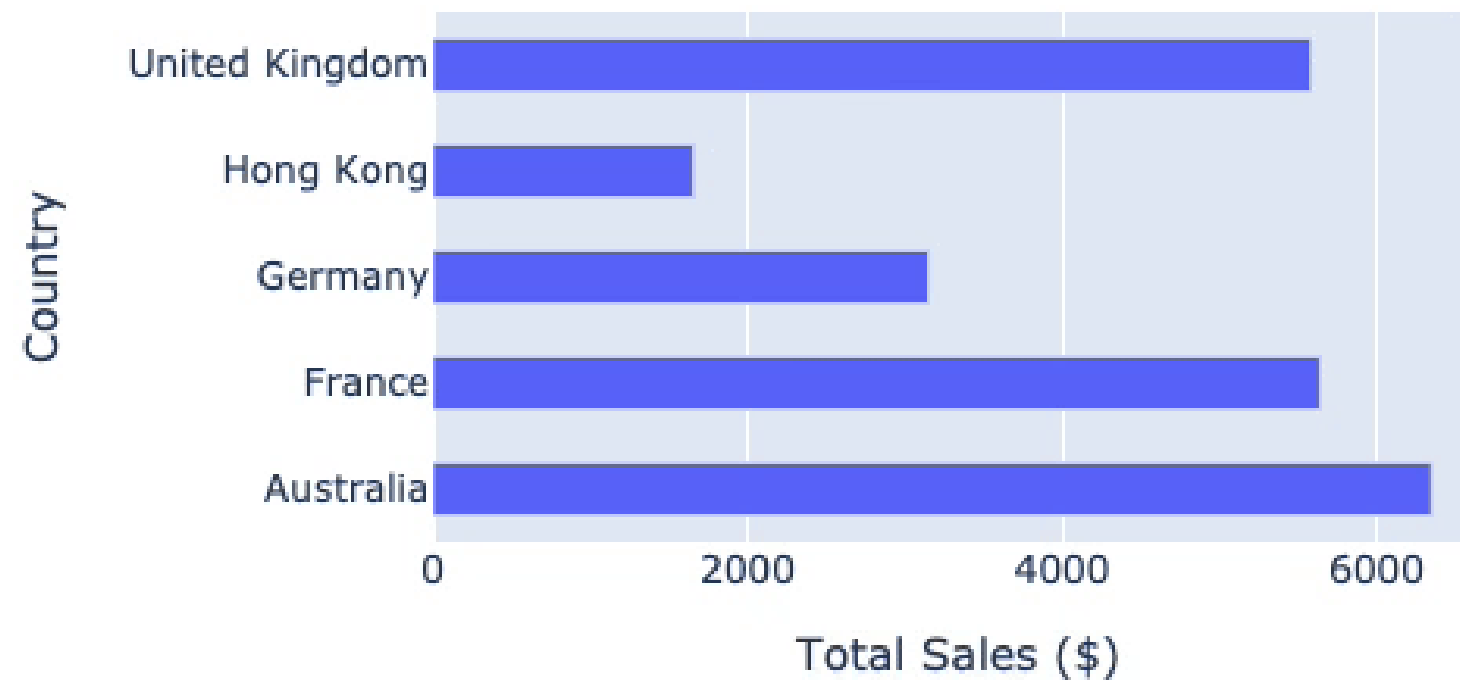
```
Dash is running on http://127.0.0.1:8050/

* Serving Flask app "simple_app" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: on
```

Our app in the browser



Total Sales by Country



Dash in DataCamp

- Some differences to other DataCamp exercises:
 - All code inside the panel (Pre-exercise, dataset etc.)
 - All executed at once (not line-by-line)
 - (Much) longer code
 - `dash.Dash(__name__)` (The `__name__` not needed locally)
- Fully-functional dashboards (expand window to see!)



Let's practice!

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Positioning Dash components

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HTML and the web

HTML: language for structuring websites

- HTML: wooden structure of a house
 - Set placement of objects
- CSS: paint color of a room
 - Style (e.g., background color) of objects
- JavaScript: Smart home clap-on lights!
 - Interactivity e.g., clickable actions



Div and H tags

Dash uses dash html components (`dash.html`) to interface between HTML and Python.

Two important HTML structures ('tags'):

- Div tags: important for structuring websites
 - Can have many different-sized divs with different things inside
- H tags: different sized titles (H1 > H6)

Using Div and H tags

Some HTML code with:

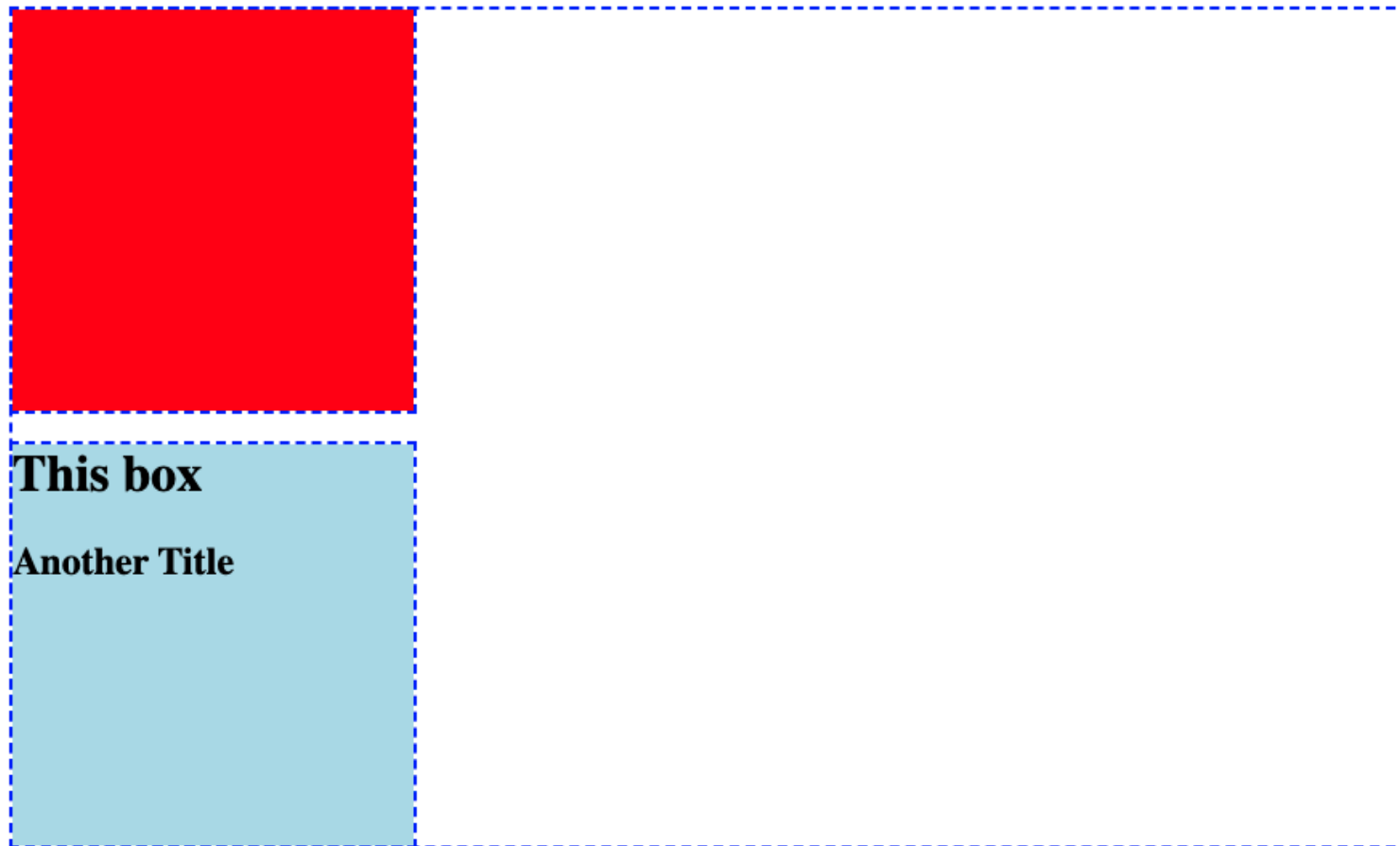
- Overall div (everything inside)
- Div inside: red background
- Div with blue background
 - H tags inside
- Ignore the `style` part - more on 'CSS' later!

```
<div>
  <div style="background-color: red;
            width:250; height:250;">

  </div>
  <div style="background-color: lightblue;
            width:250; height:250;">
    <h1>This box</h1>
    <h2>Another Title</h2>
  </div>
</div>
```

Our example displayed

Our example



Take note:

- Red background div
- Blue background div with H tags

The div tag can nest; lots of possibilities when structuring our web app.

Our example in Dash

Recreating HTML example with Dash

```
import dash
from dash import dcc, html
app = dash.Dash()
app.layout = html.Div(children=[
    html.Div(style={'height':250, 'width':250, 'background-color':'red'}),
    html.Div(children=[
        html.H1("This box"),
        html.H2("Another Title")],
        style={'background-color':'lightblue'})
    ])
```


Breaking down the layout

- HTML tags align to Dash `html.()`
 - `html.Div()` = `<div>`
 - `html.H1()` = `<h1>`
- The overall div and the last div have a `children` argument
 - A list of components go inside
 - Second Div doesn't have this (single sub-element)
- We can put `dcc.Graph()` components inside too!

```
import dash
from dash import html
app.layout = html.Div(
    children=[
        html.Div(
            style={'background-color': 'red',
                  'height': 250, 'width': 250}),
        html.Div(
            children=[
                html.H1("This box"),
                html.H2("Another Title")]
            , style={'background-color': 'lightblue',
                  'height': 250, 'width': 250})
```

Graphs in the layout

Graphs can be added inside the `children` list of a `html.Div()`

```
bar_fig_country = px.bar(ecom_sales,
x='Total Sales ($)', y='Country',
color='Country', color_discrete_map=
{'United Kingdom':'lightblue',
'Germany':'orange', 'France':'darkblue',
'Australia':'green', 'Hong Kong':'red'})
app = dash.Dash()
app.layout = html.Div(
    children=[
        html.H1("Sales Proportion by Country"),
        dcc.Graph(id='bar_graph',
            figure=bar_fig_country)])
```

Produces:

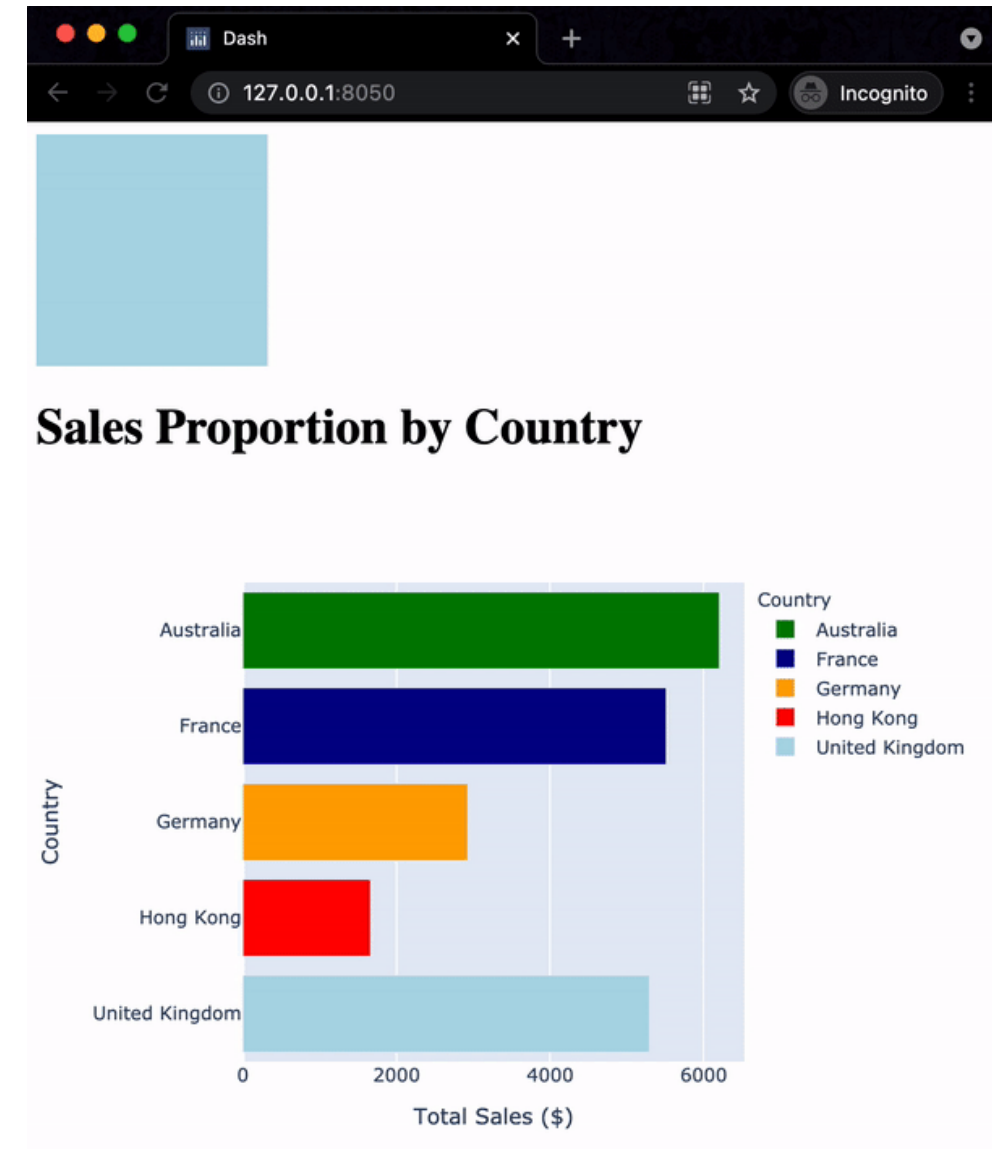


Adding more structure

Let's add another `html.Div()`. What happens?

```
app.layout = html.Div(  
    children=[  
        html.Div( style={  
            'width':150,'height':150,  
            'background-color':'lightblue'}),  
        html.H1("Sales Proportion by Country"),  
        dcc.Graph(id='bar_graph',  
            figure=bar_fig_country)])
```

Our new dashboard:



Let's practice!

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