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.

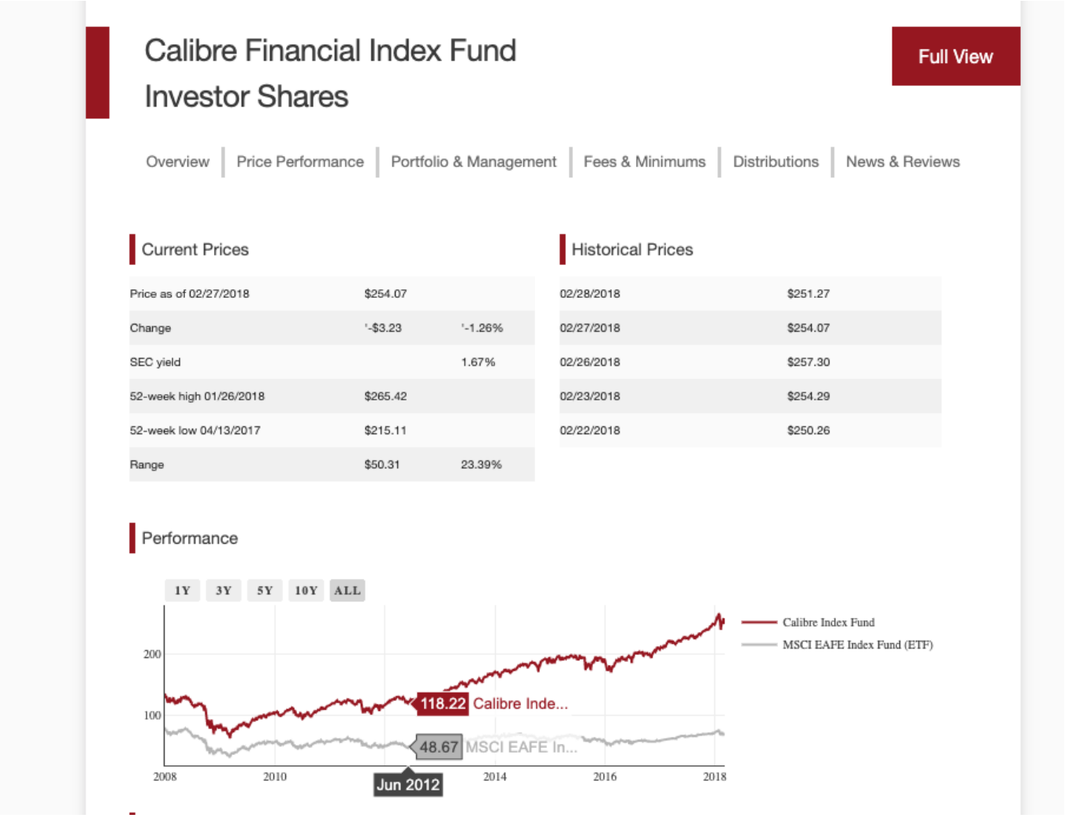
Advantages:

- 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()
```

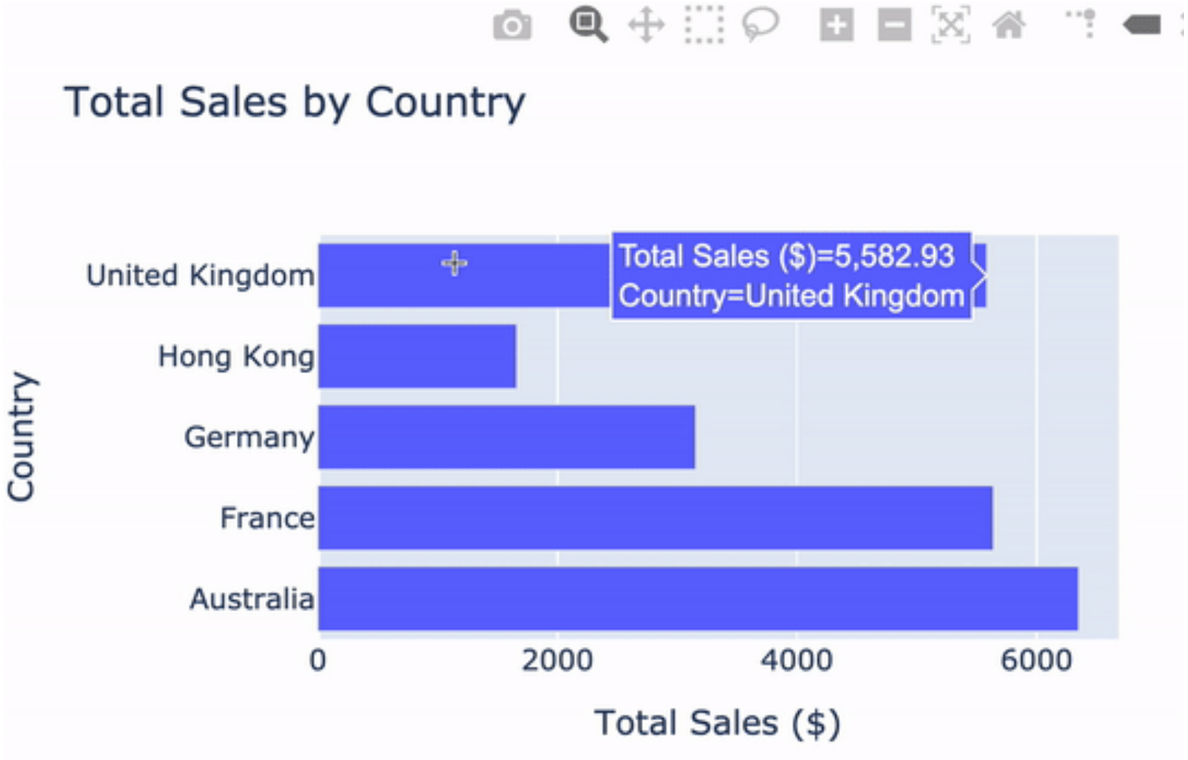
Bar charts with plotly.express

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

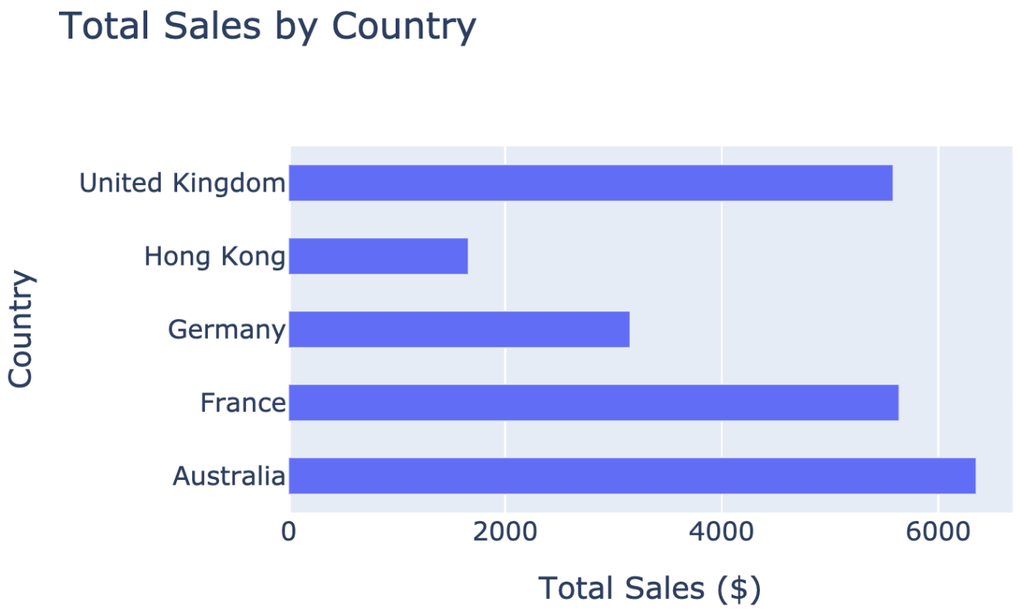
Plotly graph properties can be updated later with `update_layout()` (important for Dash apps!).

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?



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
import dash_core_components as 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
import dash_core_components as dcc
```

- `dash` is the main library that creates the app itself
- `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

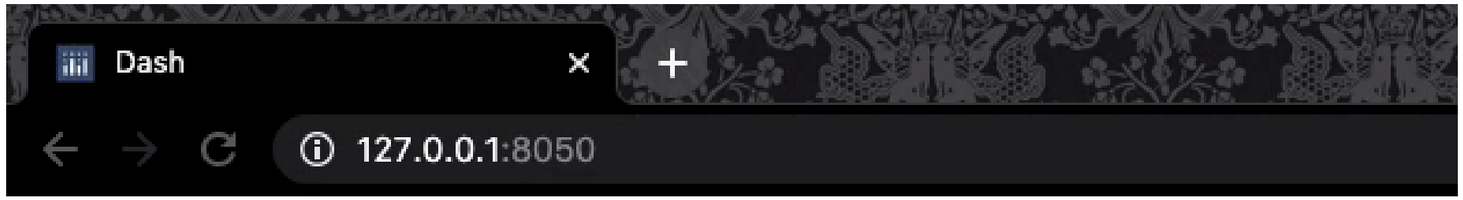
Access via a web browser such as Google Chrome

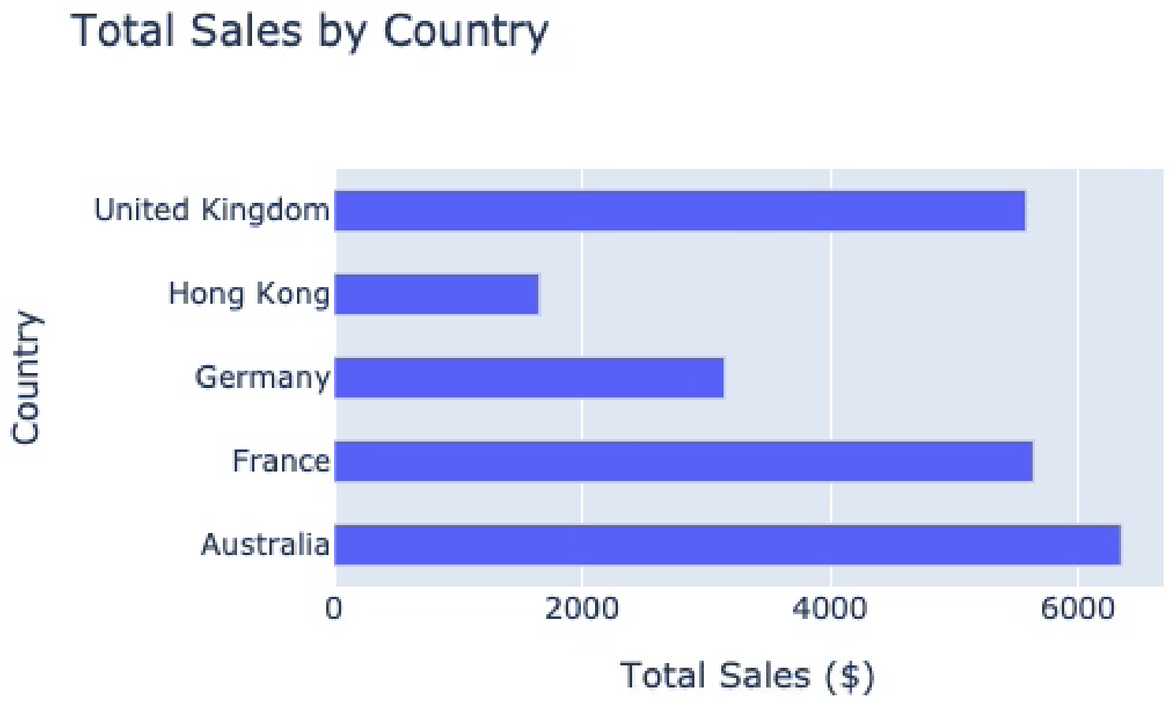
While served, update and save `.py` file to see live updates in browser

```
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





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` 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

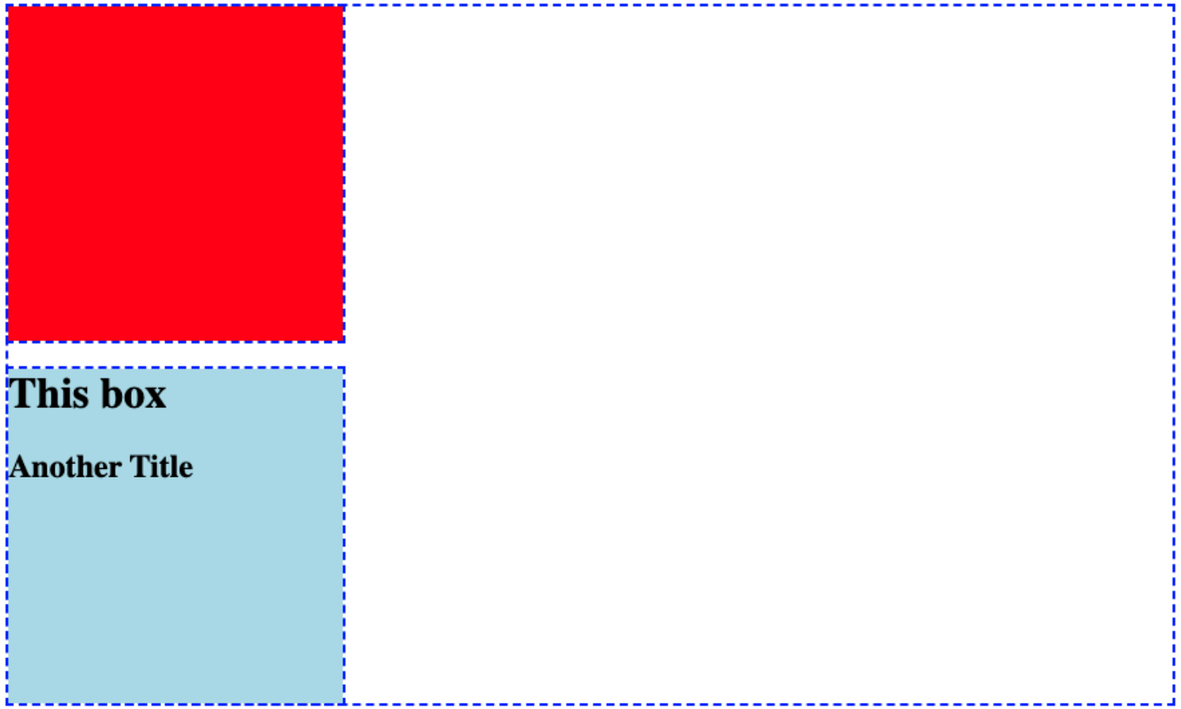
Some HTML code with:

- 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
import dash_core_components as dcc
import dash_html_components as 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.H1("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!

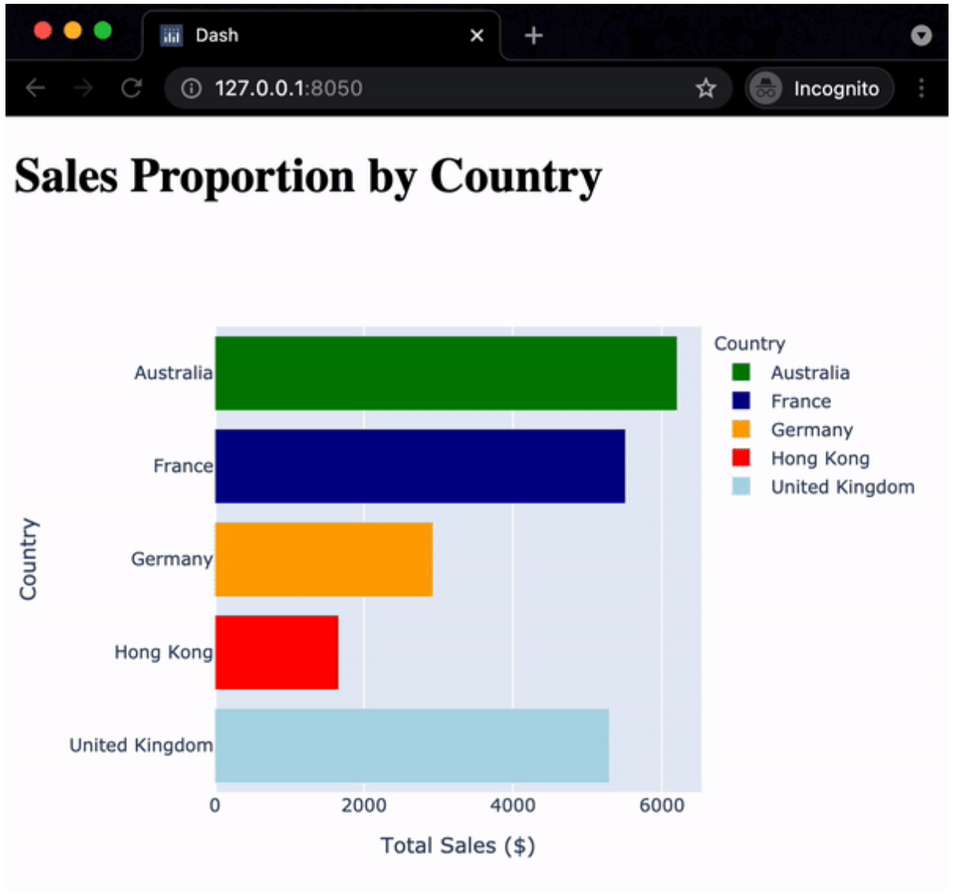
```
import dash
import dash_html_components as html
app.layout = html.Div(
  children=[
  html.Div(
    style={'background-color':'red',
           'height':250, 'width':250}),
  html.Div(
  children=[
      html.H1("This box"),
      html.H2("Another Title")]
    ,style={'background-color':'lightblue',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

Graphs in the layout

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

Produces:

```
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)])
```

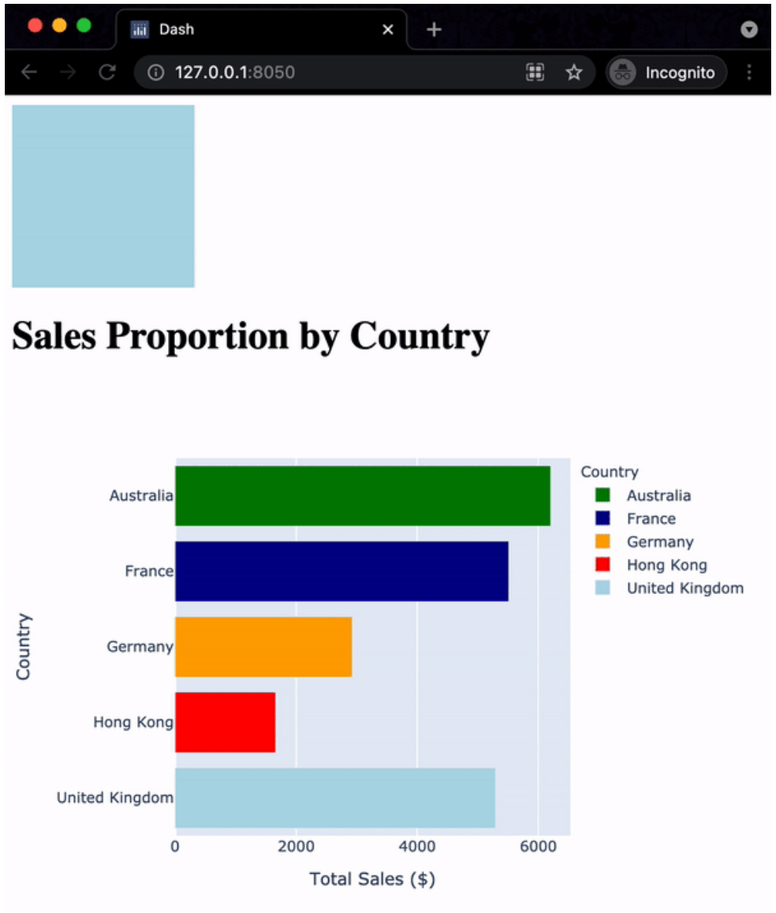


Adding more structure

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:



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