Between-element interactivity

BUILDING DASHBOARDS WITH DASH AND PLOTLY

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What is between-element?

- Previously: Interact with **input** (e.g., dropdown); to trigger change in a figure
- Now: Interact with **figure**; to trigger change in a figure
- Two specific ways:
  - Hover to filter and regenerate (via callback)
  - Click to filter and regenerate (via callback)

The hoverData property

A familiar bar chart and text component:

```
# Create figure & dash.Dash()
html.Div(children=[
    dcc.Graph(id='bar_fig',
              figure=ecom_bar),
    html.Br(),
    html.H2("The Hover Data:"),
    html.P(id='text_output')
```

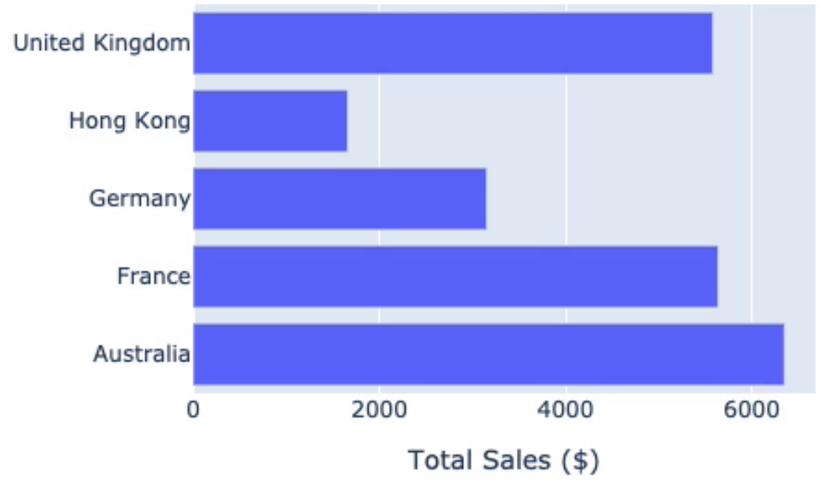
Set up a callback

```
@app.callback(
    Output('text_output', 'children'),
    Input('bar_fig', 'hoverData'))
def capture_hover_data(hoverData):
    return str(hoverData)
```

Our first hover

What happens:

- User hovers: `hoverData` property of the figure changes
- Callback takes and returns this to `.P()` tag
- We can see point-related information
  - Now: Use that information!

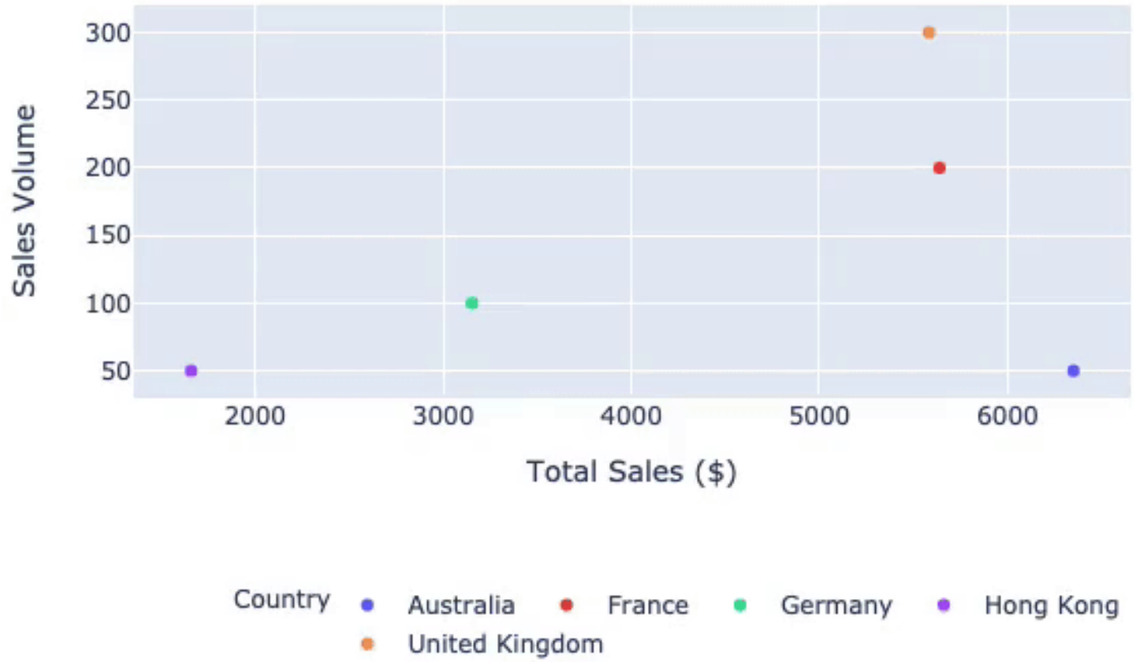


The Hover Data:

None

Beware missing info

- Aim: Use 'country' in the callback (filter and regenerate a graph)
  - Previous example - in `hoverData`
- See this scatter plot (graph type and relevant ID's updated)
  - There is no country!



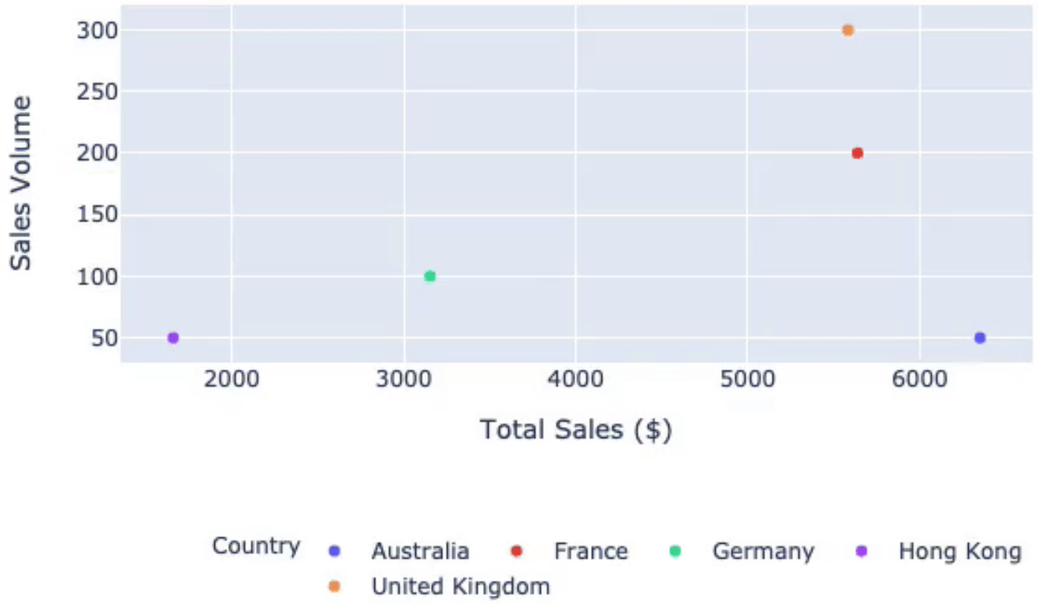
The Hover Data:

None

Adding custom data

```
ecom_scatter = px.scatter(ecom_data,
    x='Total Sales ($)',
    y='Sales Volume', color='Country',
    custom_data=['Country'])
```

- Now `customData` contains the country!



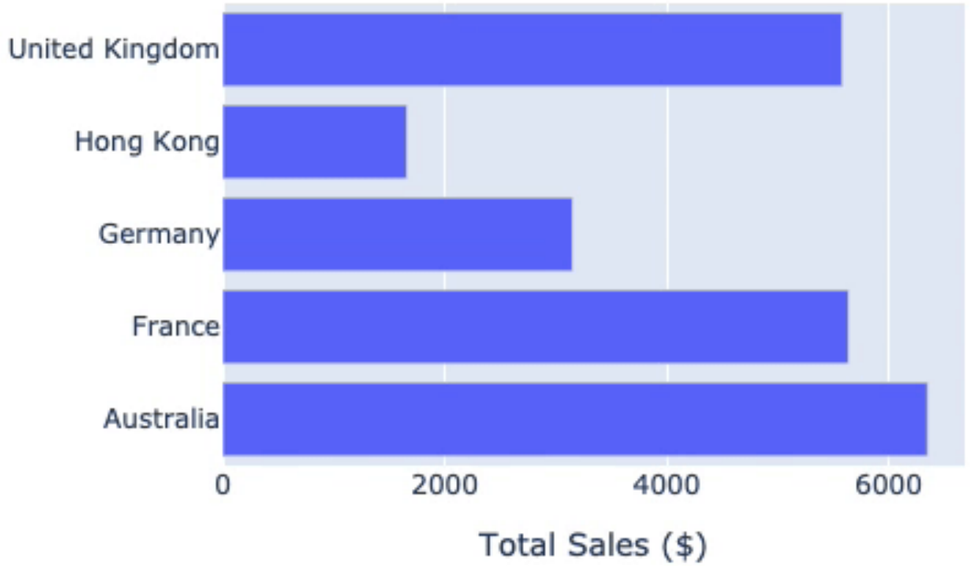
The Hover Data:

None

What about clicking?

- Can also trigger a callback when a point is clicked
  - Only one change required (`clickData` property)

```
@app.callback(
    Output('text_output', 'children'),
    Input('bar_fig', 'clickData'))
def capture_hover_data(clickData):
    return str(clickData)
```



The Click Data:

None

- Notice: Did not immediately appear

Let's practice!

BUILDING DASHBOARDS WITH DASH AND PLOTLY

Chained callbacks

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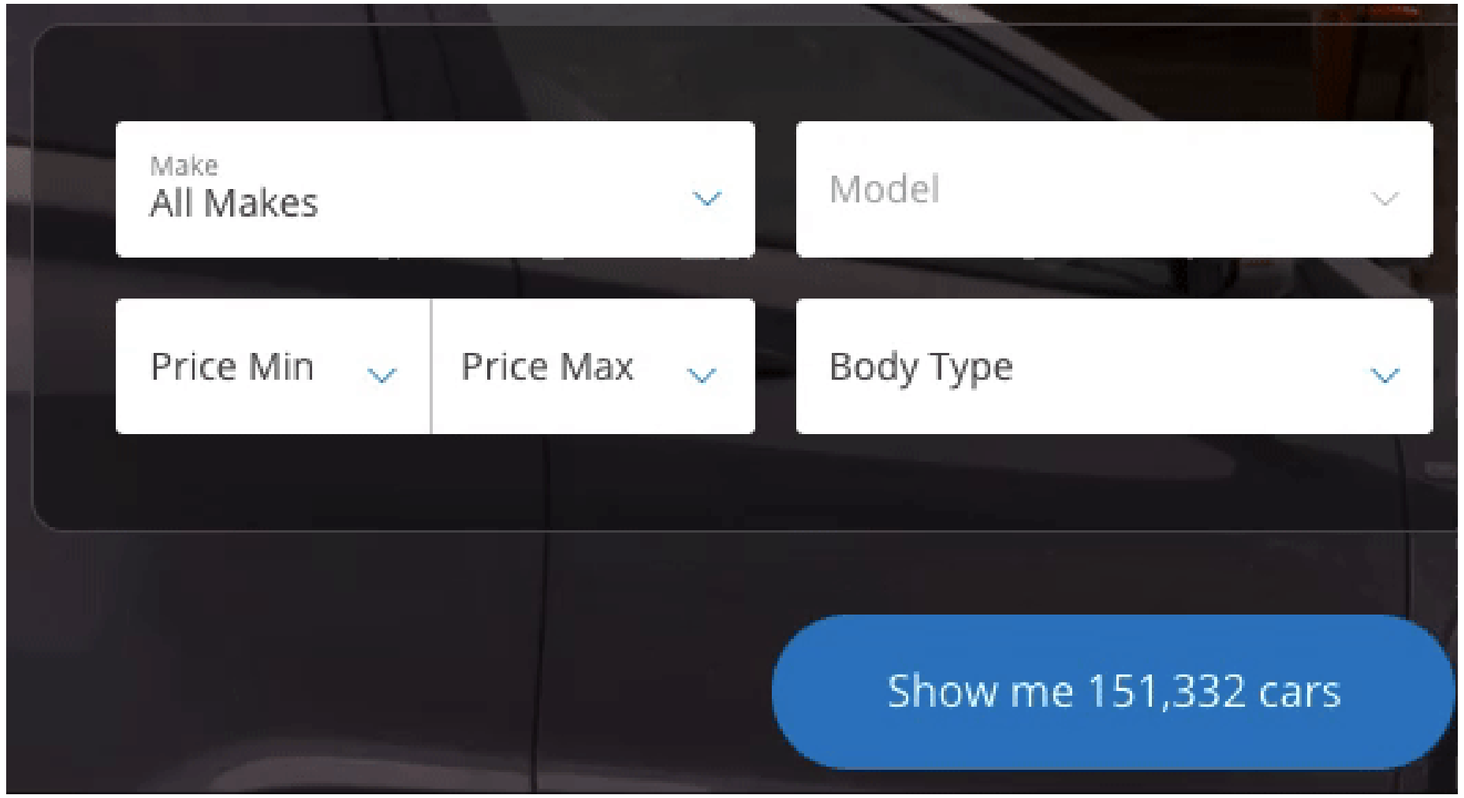
Why chain callbacks?

- So far callbacks cause:
  - Regenerate plots
  - Change HTML / text
- What about callback triggering another callback?
- Use case: conditional dropdown

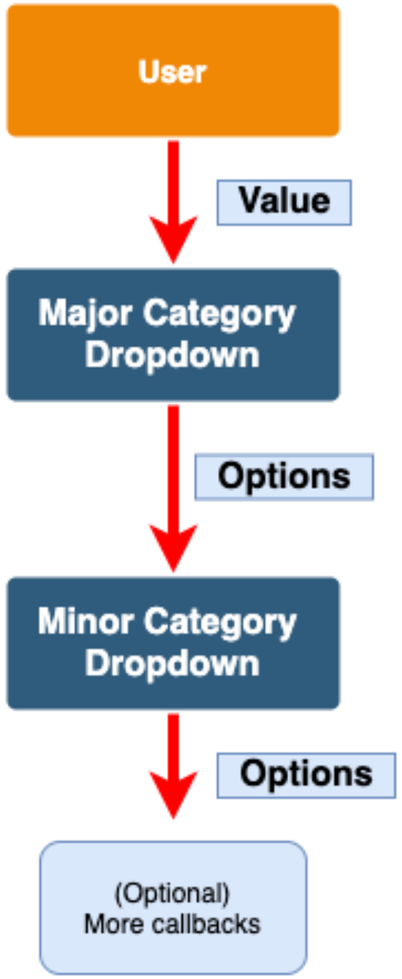
Let's do this in Dash!

A common example



Inputs and outputs

- The trick: be aware of callback pathways (inputs and outputs)
- Helpful tool: an input-output diagram
- The flow:
  - User changes `value` of first dropdown (**INPUT**)
  - A callback subsets and returns `options` of second dropdown (**OUTPUT**)
  - Another callback could be triggered (**INPUT**) by `options` change on second dropdown, and so on



Chained callbacks in Dash

The callbacks involved:

```
@app.callback(
  Output('minor_cat_dd', 'options'),
  Input('major_cat_dd', 'value'))
def update_dd(major_cat_dd):
    # Filter options (list of dicts)
    return minor_options
```

Set a default value

```
@app.callback(
  Output('minor_cat_dd', 'value'),
  Input('minor_cat_dd', 'options'))
def update_dd(minor_cat_options):
    # Pick a default value
    return chosen_value
```

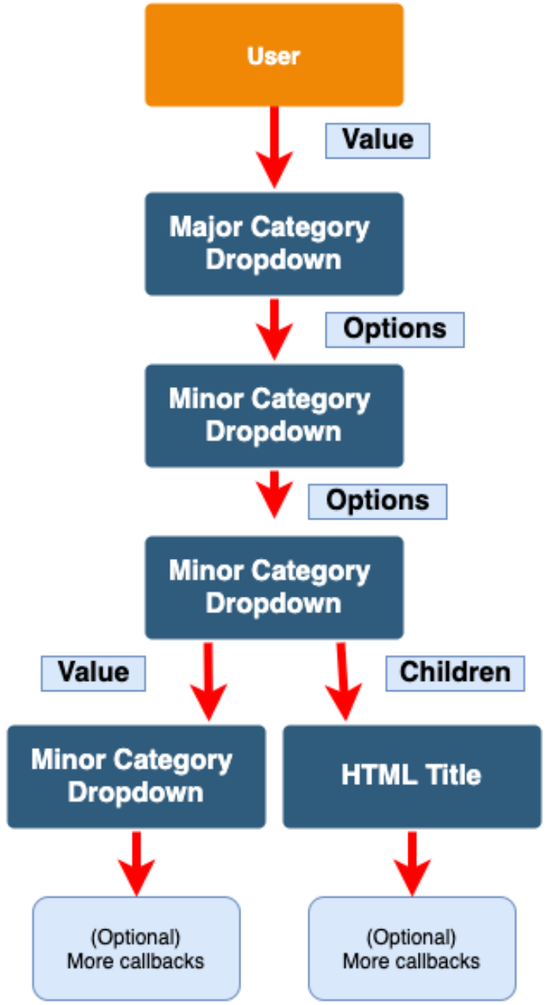
Multiple outputs

May wish to update multiple elements

- In our example: update a HTML title as well
- Add another output

```
@app.callback(
  Output('my_title', 'children'),
  Output('minor_cat_dd', 'value'),
  Input('minor_cat_dd', 'options')
)
def some_function(input):
  # function body
  return title_value, dropdown_value
```

Multiple outputs diagram



Let's practice!

BUILDING DASHBOARDS WITH DASH AND PLOTLY

Dash Data Table introduction

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What is a Dash Data Table?

- HTML has a native table tag (available in **Dash** `html.Table()`)
- Problem: HTML tables are static
- Introducing Dash Data Tables (component for the `app.layout()`)
  - Many visual & interactive customizations
    - e.g., Filter, hiding, export, pagination, hover, styling
  - Enhance user experience

The basic table

```
from dash_table import DataTable
d_columns = [
 {"name": 'Major Category',
  "id": "Major Category"},
 {"name": 'Total Sales ($)',
  "id": "Total Sales ($)"},
 {"name": 'Sales Volume',
  "id": "Sales Volume"}]
```

```
d_table = DataTable(
  columns=d_columns,
  data=major_cat_tb.to_dict('records'),
  cell_selectable = False)
```

Major Category	Total Sales ($)	Sales Volume
Clothes	4950.370000000002	176
Garden	6040.080000000002	189
Household	4986.580000000001	163
Kitchen	6407.9	172

Format the numbers

- Problem 1: Financial number formatting
  - Solution: `FormatTemplate`

```
from dash_table import FormatTemplate
money_format = FormatTemplate.money(2)
d_columns=[{"name": 'Total Sales ($)',
    "id": "Total Sales ($)",
    'type':'numeric',
    'format':money_format}
  # Other column definitions
]
```

Nicely formatted!

Major Category Stats

Major Category	Total Sales ($)	Sales Volume
Clothes	$4,950.37	176
Garden	$6,040.08	189
Household	$4,986.58	163
Kitchen	$6,407.90	172

Add sorting

Adding sorting:

```
d_table = DataTable(
  columns=d_columns,
  data=major_cat_tb.to_dict('records'),
  cell_selectable=False,
  # Add sort ability
  sort_action='native')
```

With Sorting:

Major Category	Total Sales ($)	Sales Volume
Clothes	$4,950.37	176
Garden	$6,040.08	189
Household	$4,986.58	163
Kitchen	$6,407.90	172

Add filtering

Adding Filtering:

```
d_table = DataTable(
  columns=d_columns,
  data=major_cat_tb.to_dict('records'),
  cell_selectable=False,
  # Add filter ability
  filter_action='native'
)
```

With Filtering:

Major Category	Total Sales ($)	Sales Volume
filter da...a...		
Clothes	$4,950.37	176
Garden	$6,040.08	189
Household	$4,986.58	163
Kitchen	$6,407.90	172

Pagination

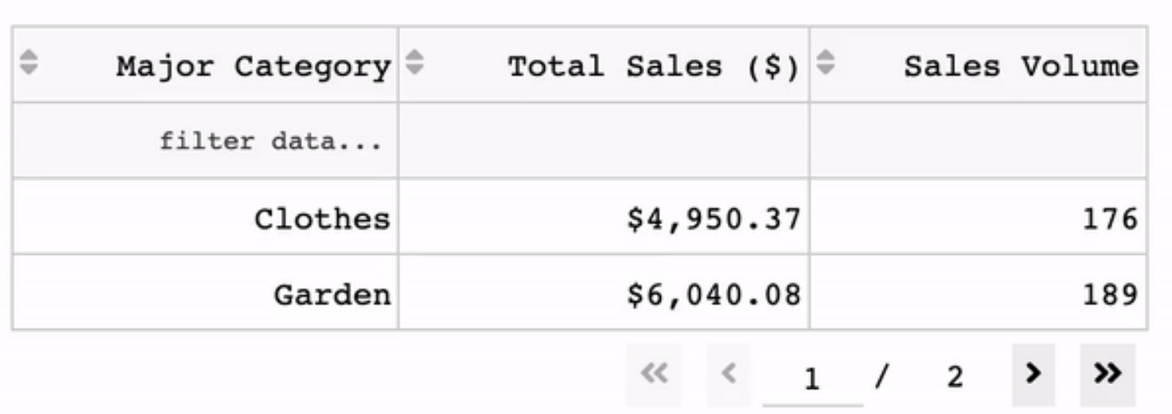
Problem: long tables

- Pagination: show (n) entries per 'page' with navigation buttons
  - `page_current` = page to start on
  - `page_size` = entries per page

```
d_table = DataTable(
    # Previous options
    page_current= 0,
    page_size= 2,
    page_action="native")
```

Pagination in action:

- Next, previous, first and last buttons
- Enter page number
- Filter and sort still works!



Let's practice!

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Dash Data Table interactivity

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Styling all Data Table cells

- Can't use the 'style'
- For all cells use `style_cell`

```
d_table = DataTable(
  # Other table properties
  style_cell=(
    {'textAlign':'left'}
))
```

Major Category	Total Sales ($)
Clothes	$4,950.37
Garden	$6,040.08
Household	$4,986.58
Kitchen	$6,407.90

Styling some Data Table cells

- For a specific cell use `style_cell_conditional`

```
d_table = DataTable(
  # Other table properties
  style_cell={
    {'textAlign':'left'}),
  style_cell_conditional=[
 {'if': {'column_id':'Sales Volume'},
 'textAlign':'center'}])
```

Major Category	Total Sales ($)	Sales Volume
Clothes	$4,950.37	176
Garden	$6,040.08	189
Household	$4,986.58	163
Kitchen	$6,407.90	172

Styling Data Table headers

- Styling column headers is similar
  - All: `style_header`
  - Specific: `style_header_conditional`

```
d_table = DataTable(
    # Other table properties
style_header={
  'background-color':'black',
  'color':'white'},
style_header_conditional=[
  {'if': {'column_id':'Sales Volume'},
   'background-color':'blue'}])
```

Styled column headers;

Major Category Stats

Major Category	Total Sales ($)	Sales Volume
Clothes	$4,950.37	176
Garden	$6,040.08	189
Household	$4,986.58	163
Kitchen	$6,407.90	172

Selecting cells

- Selecting cells first (then rows, columns)
- Set DataTable's `cell_selectable` argument to `True`
- A callback to print available data

```
@app.callback(
  Output('test_text', 'children'),
  Input('my_dt', 'selected_cells'))
def print_it(input):
  return str(input)
```

Selecting cells:

Major Category Stats

Major Category	Total Sales ($)	Sales Volume
Clothes	$4,950.37	176
Garden	$6,040.08	189
Household	$4,986.58	163
Kitchen	$6,407.90	172

Select output

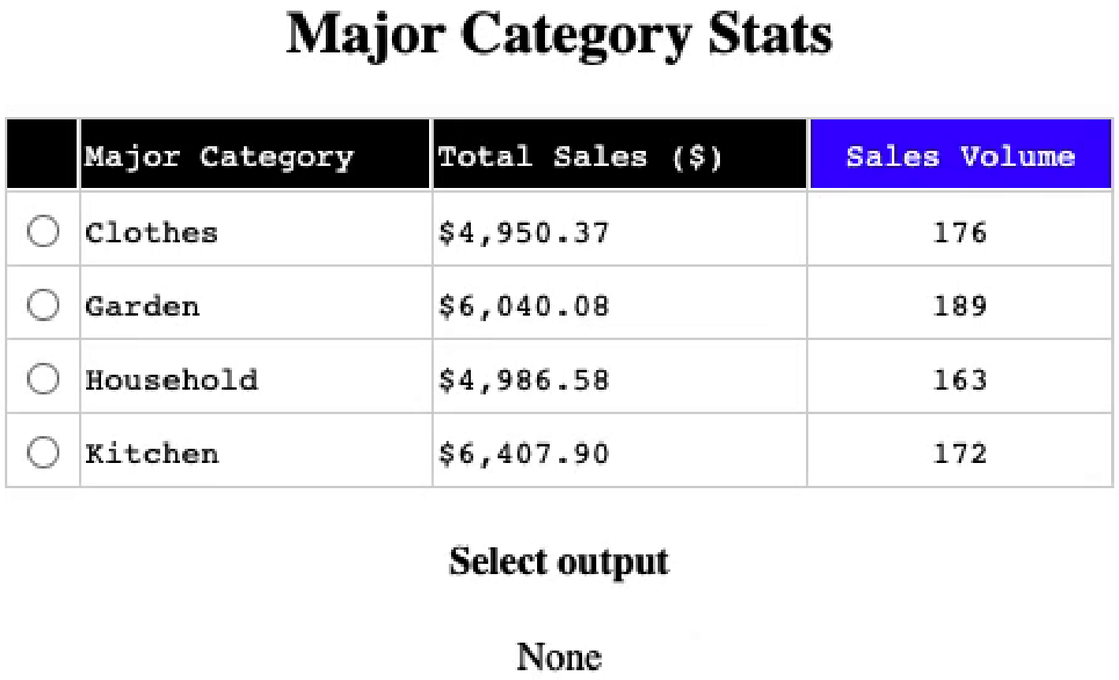
None

Selecting rows

- Set Data Table `row_selectable` to `single` or `multi`
- A callback to print available data

```
@app.callback(
  Output('test_text', 'children'),
  Input('my_dt', 'selected_rows'))
def print_it(input):
  return str(input)
```

The row index is returned;

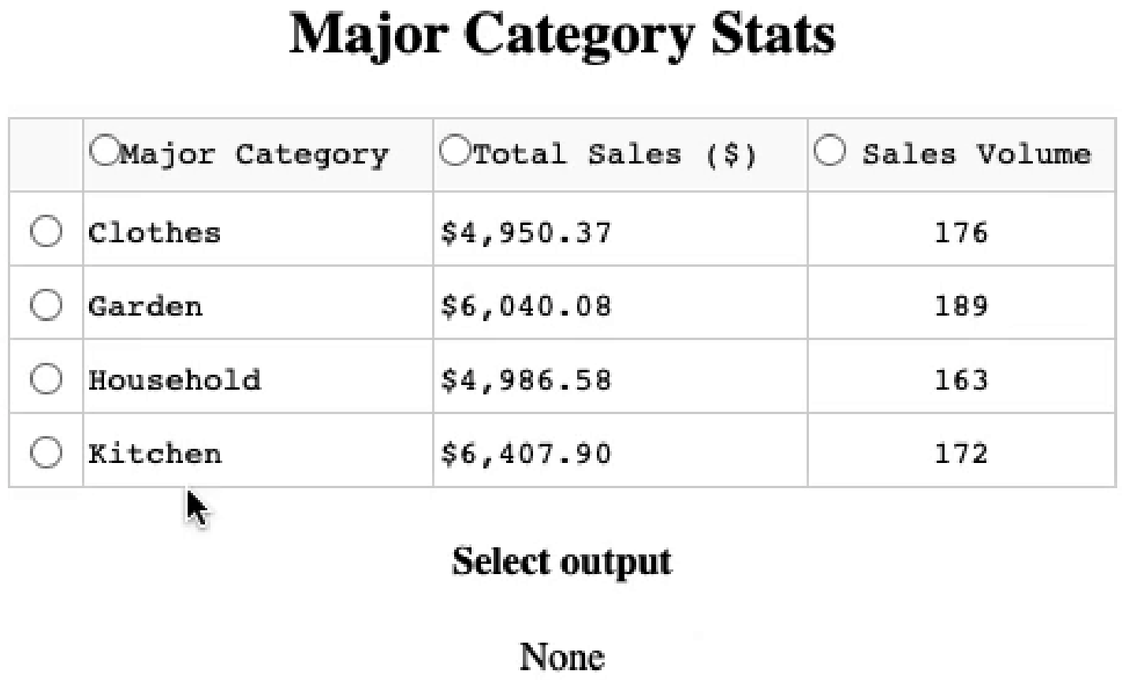


Selecting columns

- Set Data Table `column_selectable` to `single` or `multi`
  - Add `'selectable': True` to column definitions
  - e.g.,
    ```
    {"name": "Sales Volume", "id":
    "Sales Volume", "selectable":True}
    ```
- A callback to print available data

```
@app.callback(
  Output('test_text', 'children'),
  Input('my_dt', 'selected_columns'))
def print_it(input):
  return str(input)
```

Column ID is returned



Let's practice!

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Wrap-up video

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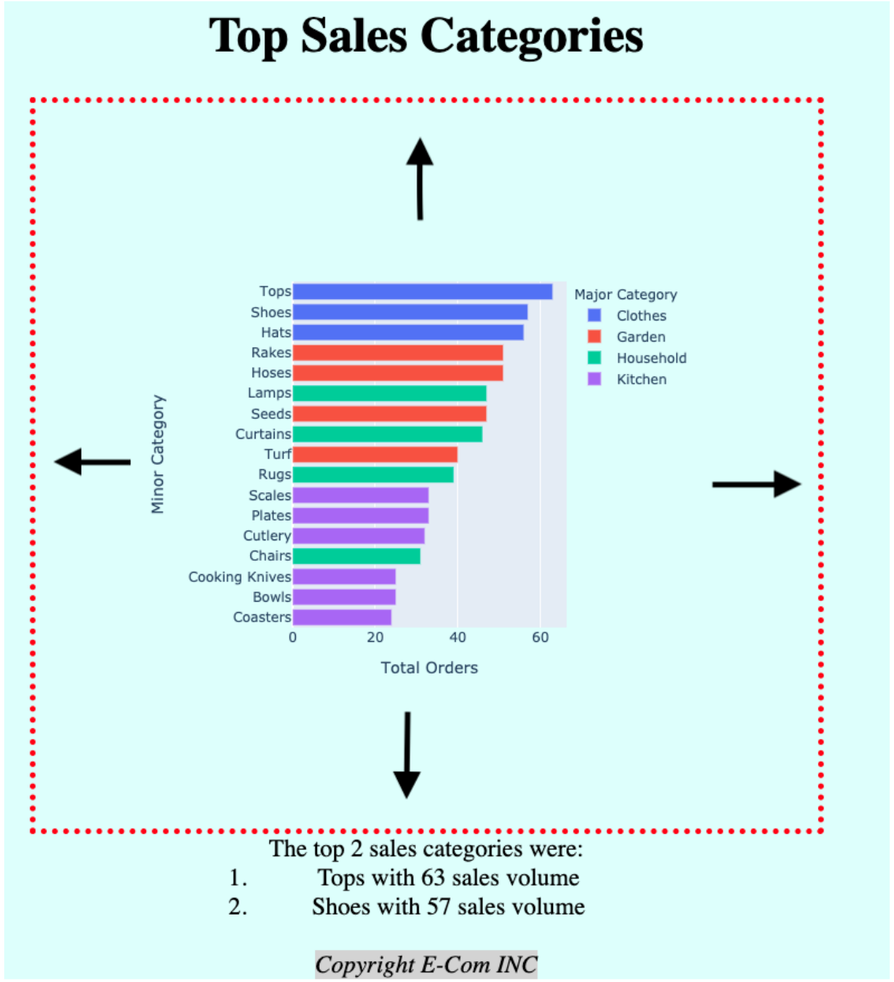
Chapter 1

- Revised Plotly, discovered Dash
- Created first Dash app
- An overview of HTML

Chapter 2

- Deeper dive into HTML and CSS
- Place, size, and style app elements
  - The important `style` dictionary

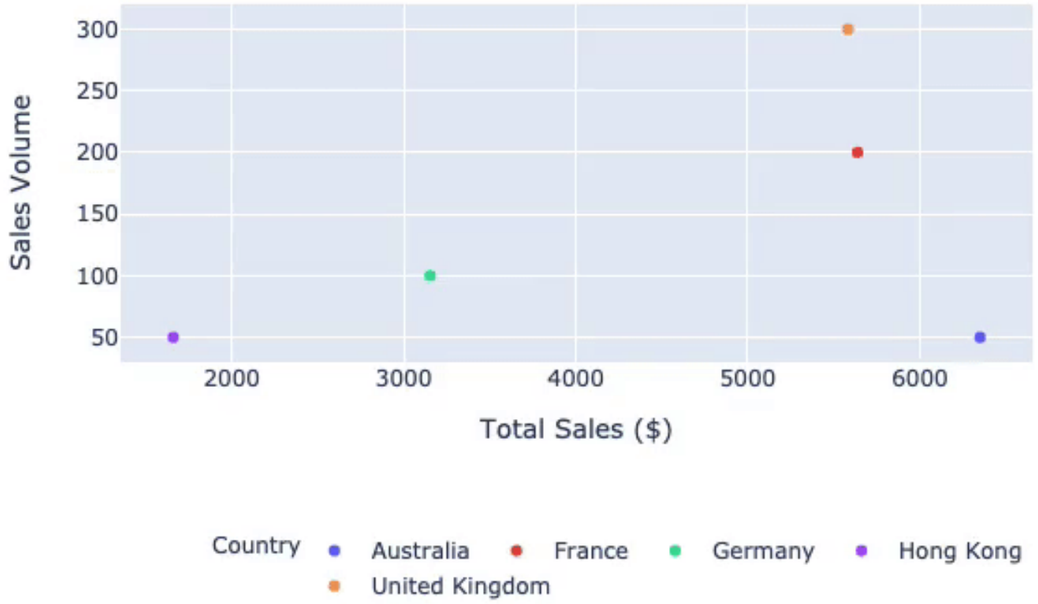


Chapter 3

- Enhanced interactivity with callbacks
- Advanced user experiences with interactive components
  - Dropdowns, date pickers and free-text entry

Chapter 4

- Next level interactivity from hover and click
- Building Data Tables
  - Making them interactive



The Hover Data:

None

Next steps?

- Build your own dashboards (practice!)
- Experiment with callback chains
- Continue learning DataTable

Thank you!

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