An introduction to React

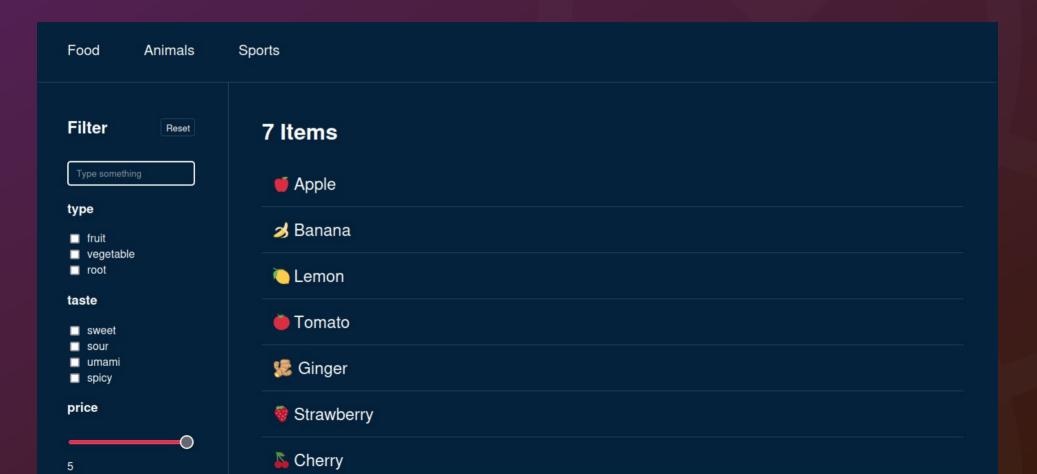
What to expect

- Hands on approach from the view of a developer
- A journey through what React has to offer
- Some Typescript
- An interactive experience

What not to expect

- A full in-depth explanation of every single feature
- Frameworks and Libraries

Let's build a filter-app together!



Why React?

- A virtual DOM implementation
- Handle state

Quick setup with Vite

- Create-react-app
- Vite
- NextJS

HTML structure with JSX

- Conditionals
- Iterations
- Fragments
- TSX for Typescript

Conditionals

```
<div>
{isLoading && Loading...}
</div>
```

```
<div>
{isLoading? Loading...: <Filter />}
</div>
```

- JavaScript expressions can be put inside JSX by placing it between {}
- There are many strategies for conditional JSX

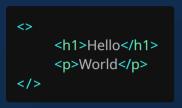
Iterations

```
<div>
{isLoading && Loading...}
</div>
```

```
<div>
{isLoading? Loading...: <Filter />}
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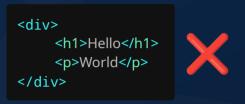
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- There are many strategies for conditional JSX

Fragments

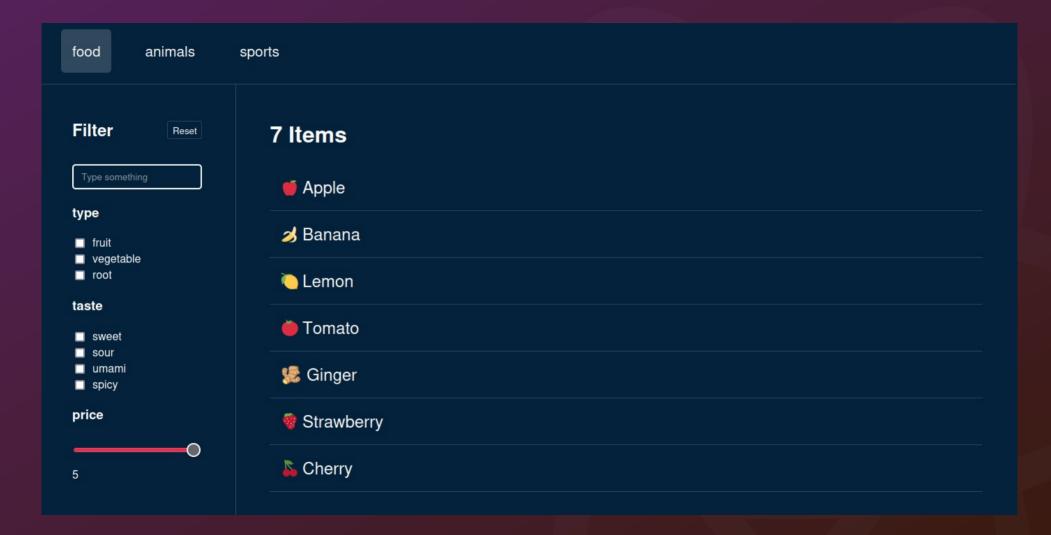








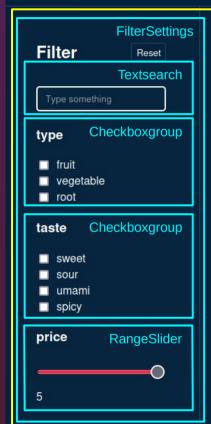
- React sometimes requires single top-level elements
- Fragments group items together without affecting the DOM (<div> could affect CSS & JS selectors)

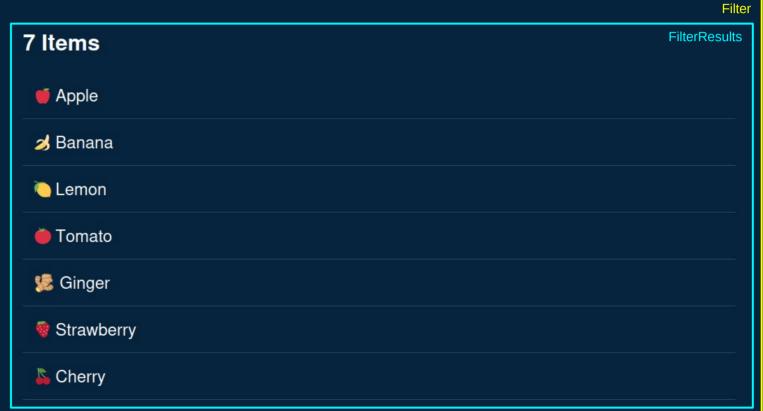


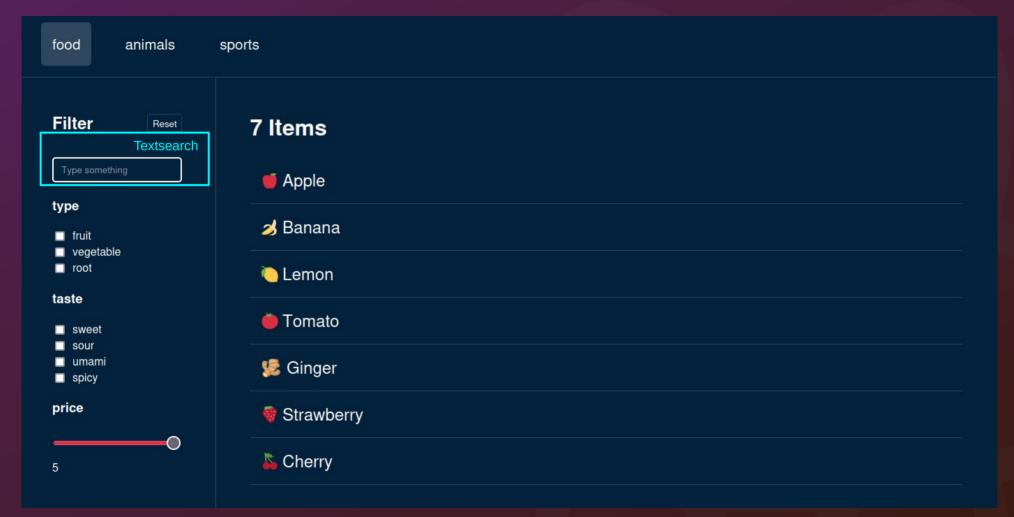
Split code into components

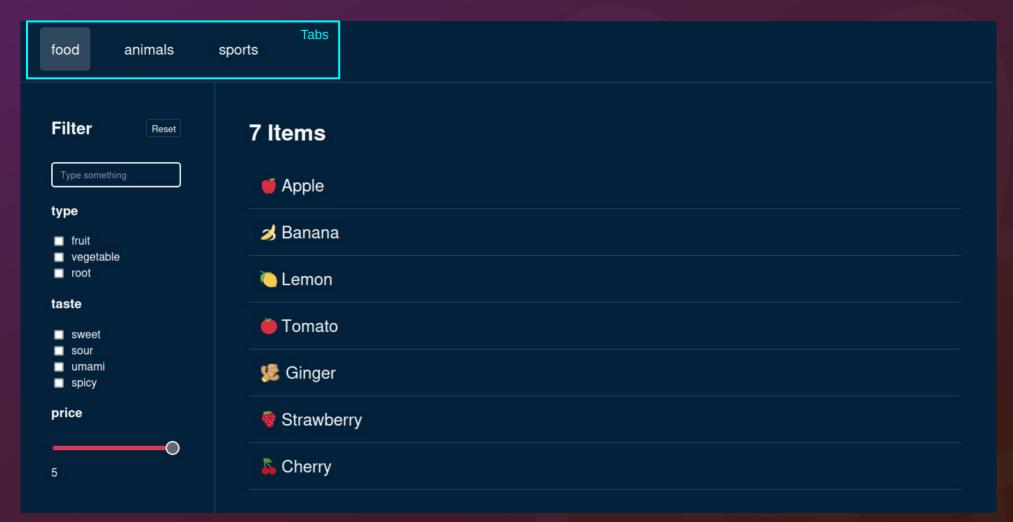
- Reusable
- Configurable
- Testable
- Readable

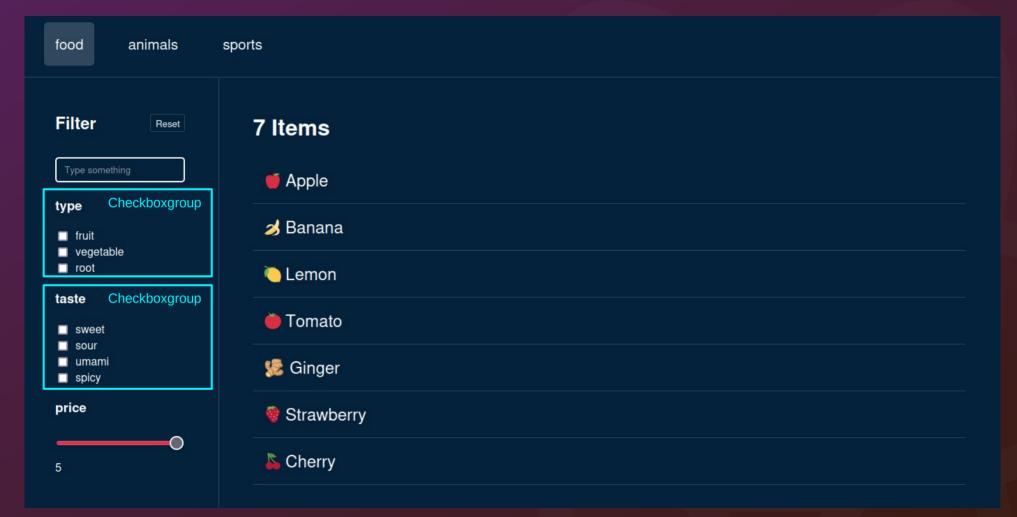
Tabs food animals sports











Component properties

Ideally this component can be used anywhere We can build new base-level components like datepickers, or a simple input[type="password"] and reuse them throughout our app

Interactivity

Before we can build our reusable components, we need to know how to make them interactive.

Interactivity

```
document.querySelector('#search').addEventListener('change', (e) => {
    updateFilterResults(e.target.value);
});
```

This is problematic because:

- React's virtual DOM frequently recreates nodes
- Every render would create additional eventhandlers

Interactivity checklist:

- Create a variable
- Use the variable in our component (JSX & JS)
- Update the variable on user-input
- Re-render the app after a variable updates

& useState()

```
const [activeTab, setActiveTab] = useState(0);
const [search, setSearch] = useState("");

<input type="search"
    value={search}
    onChange={e => setSearch(e.target.value)}
/>
```

- Allows to save state between renders
- Tells React to re-render when state changes

Interactivity checklist

Create a variable

```
const [search, setSearch] = useState("");
```

Use the variable in our component (JSX & JS)

```
<input type="search" value={search} onChange={e => setSearch(e.target.value)} />
```

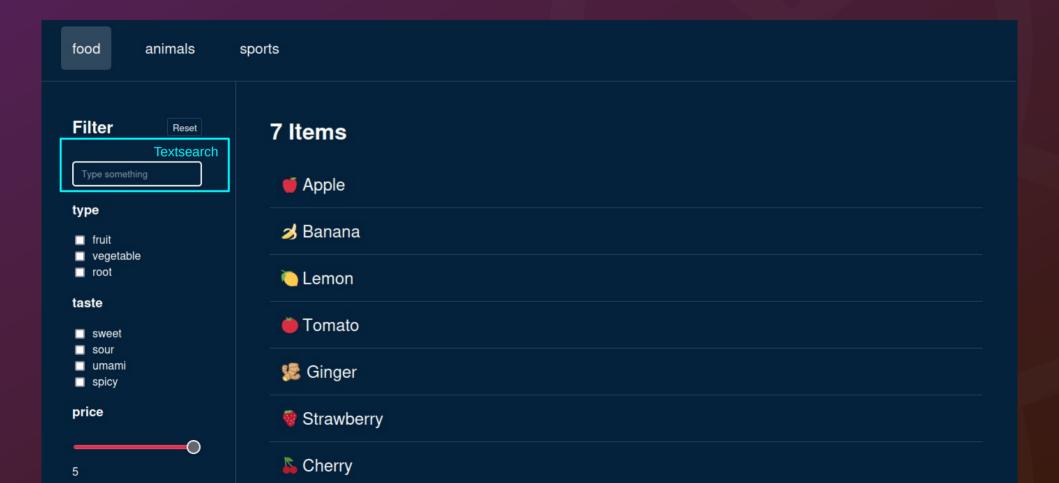
igcup UDpdate the variable on user-input

```
<input type="search" value={search} onChange={e => setSearch(e.target.value)} />
```

Re-render the app after a variable updates

```
// React re-renders automatically after state mutates!
```

Let's use our new tools



let, const, var

```
const search = ""

<input type="search"
    value={search}
    onChange={e => { search = e.target.value }}
/>
```

Wouldn't work because:

- The variable gets recreated on every render
- Updating the variable won't tell react to re-render

let, const, var

```
const [search, setSearch] = useState("");
const searchLowerCase = search.toLowerCase();
```

- Not everything needs to be defined with useState()
- For example: derived variables
 - They won't need to be changed directly
 - Their origin will already cause a re-render on change

Lifting state up

- In React data always flows from the top to the bottom
- If state needs to be shared between adjacent components, move it to a parent and pass it down with properties
- Pass setState to a child so it can change the state of a parent, from where the updated state will flow down afterwards

useState

useCallback

useEffect

useTransition

useInsertionEffect

& Hooks

useContext

useReducer

useDeferredValue

useDebugValue

useMemo

useId

& Hooks

- Hook are functions that let you "hook" into React's state
- They need to run
 - inside a functional component
 - in the same order every render
 - unconditionally

Pure Functions inside React

- Always produce same output with same input
- Have no side-effects

Functional Components

- React can easily abort incomplete renders
- Results can be cached more easily
- Components can be rendered on the server

Mutating state

- Inside event handlers
- Inside useEffect()

Detecting state changes

We want to fetch our data when the app initializes and when the category is changed

useEffect()

- Run after the component has rendered
- Has a dependency array that needs to match the effects dependencies
- If dependencies are empty it only runs once
- The returned function runs when component unmounts

useEffect()

- Its purpose is to synchronize with external systems
- Send analytics events
- Connect to a native (video) or external API (image gallery)



Can easily be misused and introduce unnecessary complexity and performance costs.

How to avoid prop drilling?

Filter.tsx

FilterSettings.tsx

```
<div className="filter">
    <FilterSettings
        filters={filters}
        updateCategory={updateCategory}
        updateRange={updateRange}
        updateSearch={updateSearch}
        reset={reset}

/>
    <FilterResults
        items={filterResults}
        search={filters.search.value}
        reset={reset}

/>
</div>
```

```
<div className="filter__settings">
    <FilterSettingsToolbar reset={reset} />

    <TextSearch
        value={filters.search.value}
        onUpdate={(e) =>
            updateSearch(e.target.value)}
        />
        ...
</div>
```

& useContext()

- Provides a shared state to all children who subscribe with the useContext hook
- Other components in between don't have to know the data exists
- Can lead to unintended re-renders

& useContext()

Filter.tsx

```
export const FilterContext = createContext(null);
```

```
<FilterContext.Provider items={items} >
          <FilterSettings />
          <FilterResults />
</FilterContext.Provider>
```

FilterSettings.tsx &
FilterResults.tsx

```
import { FilterContext } from './Filter.tsx'
```

items = useContext(FilterContext)

& useContext()



Filter.tsx:8

🕹 useRef()

Changing ref.current doesn't cause a rerender!

Bug report

We're updating the items, but the Filter still shows the old data.

key attribute

 Whenever the key attribute changes, React will treat it like a different element and cause a rerender.

How to handle complex state

The filtersettings are increasing in complexity and we want a better way than useState to handle it in a unified way.

& useReducer()

 UseReducer() is similar to useState() but it can provide multiple functions to update the state it holds

JS mutations

	сору	mutating
add	.concat(), [arr]	.push(), .unshift()
remove	.filter(), slice()	.pop(), .shift(), .splice()
replace	.map()	.splice(), arr[i] =
sort	[arr] => arr.sort()	.reverse(), .sort()

Source: https://react.dev/learn/updating-arrays-in-state

Copying deeply nested state

Copying nested state can become very tedious and hard to read:

useFilter.tsx:41

Immer (Framework)

- Immer allows state to be mutated directly
 - Replace useState() with useImmer()
 - Replace useReducer() with immerReducer()



```
case "SET_RANGE":
    state.ranges[action.payload.id].value =
    action.payload.value;
    break;
```

& Custom hooks

- Need to start with use
- Only are considered hooks if they wrap around React hooks, otherwise they're just functions
- Are essentially just wrappers like functions



Performance issues

If we had complex filters with thousands of items, slower devices might run into performance issues



& useMemo()

```
const filterResults = useMemo(() => {
  // costly filter operation

return filtereditems;
}, [filters, items]);
```

- Cache the result of a heavy computation
- Not needed for simple calculations
- Only updates when dependency array changes

& useCallback()

- Like useMemo() but it returns a function instead of a value
- Referential equality



State Management

- SWR
- React Query
- Redux & Redux Toolkit
- Zustand
- Jotai

Routing

- React-Router
- NextJS

Next steps & Ideas

- Add routing for detailviews
- Save the filter-state in url for deep linking
- Extract Filter types into separate modules

Recommendations

- Official React.dev Learn & Documentation
 https://react.dev/learn
- Jack Herrington Typescript & React https://www.youtube.com/watch?v=j8AVXNozac8
- Web Dev Simplified React Hooks Explained
 https://www.youtube.com/watch?v=O6P86uwfdR0

Thank you!