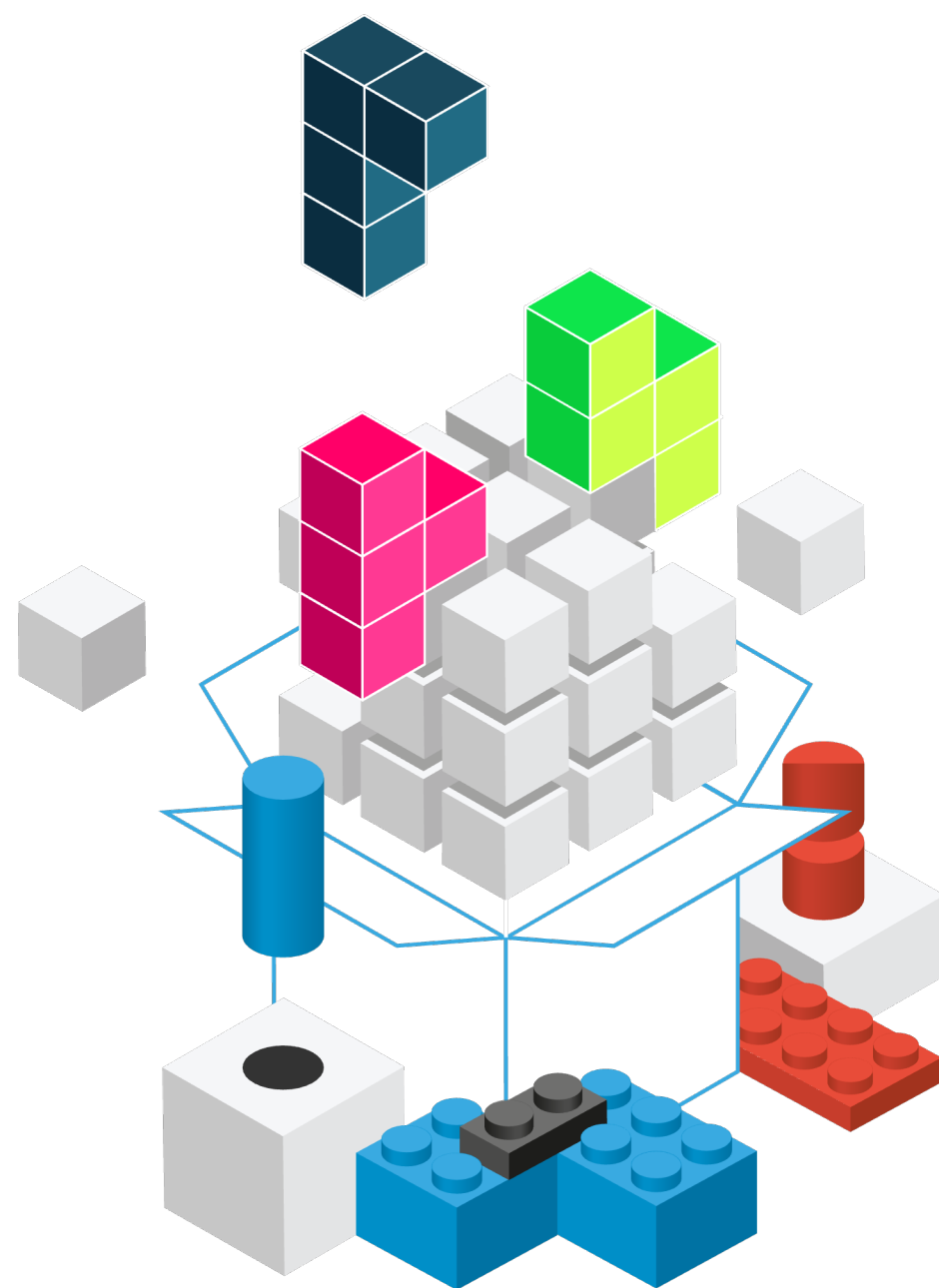


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2024

Components and State

The Foundations of React

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Outline

- React Hooks
- React Components
 - Props and State
 - The useState hook
- React design process
 - Top-down information flow



Full Stack React, “Appendix C: React Hooks”

React Handbook, chapter “Hooks”

<https://react.dev/reference/react>

Supercharge function components

HOOKS



Limitations of Function Components

- Simple
- Pure function (props->render)
- No state
- No side effects
- No lifecycle
- May define handler functions (not very useful, in absence of state)

Hooks

- Proposed in October 2018 – <https://youtu.be/dpw9EHDh2bM>
 - Stable since React 16.8 (February 2019)
- Additions to function components to access advanced features
 - Special mechanism for overcoming some limitations of “pure” functions, **in a controlled way**
 - Managing **state**, accessing **external resources**, having **side-effects**, ...
- One *hook* call for each requested functionality
 - Hooks = special functions called by function components

Most popular Hooks

Hook	Purpose
useState	Define a state variable in the component
useEffect	Define a side-effect during the component lifecycle
useContext	Act as a context consumer for the current component
useReducer	Alternative to useState for Redux-like architectures or complex state logic
useMemo	“Memoizes” a value (stores the result of a function and recomputes it only if parameters change)
useCallback	Creates a callback function whose value is memoized
useRef	Access to childrens’ ref properties
useLayoutEffect	Like useEffect, but runs after DOM mutations
useDebugValue	Shows a value in the React Developer Tools

<https://react.dev/reference/react>



<https://react.dev/learn/describing-the-ui>

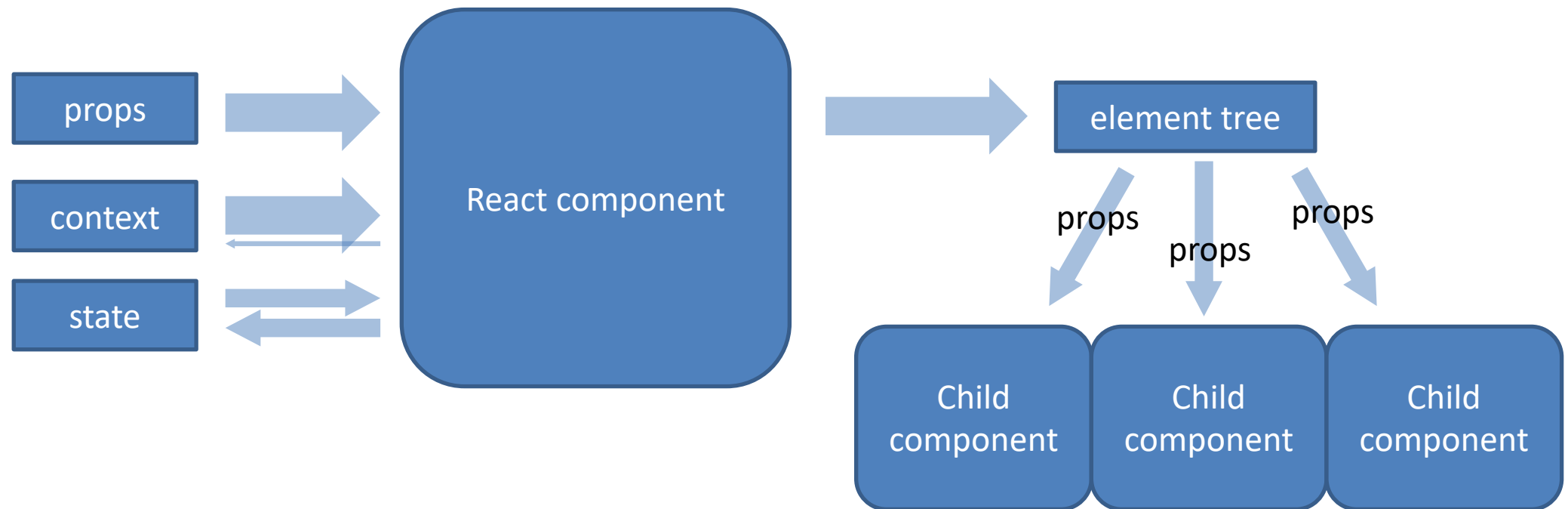
Full Stack React, Chapter “Advanced Component Configuration with props, state, and children” and “Appendix C: React Hooks”

React Handbook, Chapters “Props”, “State”, and “Hooks”

<https://react.dev/learn/managing-state>

COMPONENTS: PROPS AND STATE

Props, State, Context



Props, State, Context

- **Props** are immutable pieces of data that are passed **into** child components **from** parents
- **State** is where a component holds data, locally
 - When state changes, usually the component needs to be re-rendered
 - State is *private* to the component and is *mutable* from inside the component, only
- **Context** is a sort of “global” and “implicit” props, that are automatically passed to all interested components (later in the course...)

Passing Props

- In JSX, every attribute is converted to a prop
 - `<Header headerText='Hello' />`
 - `props.headerText` will contain the string "hello"
- `props` is the argument of the Component Function and collects all passed props
 - They are all read-only
- May be any JS `object`, or other `React` elements
 - `<UserError level={3} />`
 - `<ResultsTable displayData={latestResults} />`

State

- An object containing local data, private to a component, that may be mutated by the component itself
- To define a state variable, use the `useState` hook

useState

- Creates a new state variable
 - Usually, a “simple” value
 - May be an object
 - Does not need to represent the whole complete component state
- It returns
 - A reference to the current value
 - A function to update the state value
- Update
 - With the new value
 - With a callback function

```
import React, { useState } from 'react';

function ShortText(props) {
  const [hidden, setHidden] = useState(true);
  return (
    <span>
      {hidden ?
        `${props.text.substr(0, props.
maxLength)}...` : props.text }
      {hidden ? (
        <a onClick={() => setHidden(false)}>more</a>
      ) : (
        <a onClick={() => setHidden(true)}>less</a>
      )}
    </span>
  );
}
```

<https://daveceddia.com/usestate-hook-examples/>

Creating a State Variable

- `import{ useState } from 'react';`
- `const [hidden, setHidden] = useState(true);`
 - Creates a new state variable
 - `hidden`: name of the variable
 - `setHidden`: update function
 - `true`: default (initial) value
 - Array destructuring assignment to assign 2 values at once
- Creates a state variable of any type
 - **Remembered** across function calls!
- The default value sets the initial *value* (and *type*)
- The variable name can be used inside the function (to affect rendering)
- The `setVariable()` function will replace the current state with the new one
 - And trigger a re-render

Example

```
function WelcomeButton(props) {  
  let [english, setEnglish] =  
    useState(true) ;  
  
  return (<button>  
    {english ? 'Hello' : 'Ciao'}  
    </button>) ;  
}
```

- Call useState with the *initial version* of an object describing the component state
- Inside the component, you may refer the state variable to customize the result according to the current state

Updating the State

- **All** modifications to the state must be requested through *setVariable(newValue)*
- **Never n-e-v-e-r** modify the state variable directly
 - Always use the *setVariable* function
- It will apply the modification asynchronously (not immediately)

Updating the State

- With a new value
 - Dependent on `props` and constant values
 - Will **replace** the current one
 - Should have the same type (for consistent rendering)
- With a function
 - `(oldState) => { return newState; }`
 - Executed as a callback
 - When the *new state depends on the old state*
 - The function return value will **replace** the current state
 - Must return a **new** state value
 - Must **not** mutate the passed-in state

```
setHidden(false) ;
```

```
setSteps(oldSteps => oldSteps + 1);
```


Function or Object in setVariable?

- If the logic for computing the next state depends on the current state, **always** use a function
- **✗** `setCounter(counter+1)`
 - counter is evaluated when `setCounter` is **called**
 - The new state will be assigned later, asynchronously
 - In case many asynchronous requests are made, **some update may rely on out-of-date information**
- **✓** `setCounter((cnt)=>(cnt+1))`
 - The arrow function will be evaluated when the async call is made, with an up-to-date value of `cnt`: guaranteed to have the latest value

<https://medium.com/@wisecobbler/using-a-function-in-setstate-instead-of-an-object-1f5cfd6e55d1>

Calling State Changes

- State changes are usually determined by asynchronous events
 - DOM event handlers
 - Server responses (e.g., API calls)
- The event handler is a function that in turn calls *setVariable*

```
function WelcomeButton(props) {  
  let [english, setEnglish] =  
    useState(true) ;  
  
  const toggleLanguage = () => {  
    setEnglish( e => !e ) ;  
  }  
  
  return (<button onClick={toggleLanguage}>  
    {english ? 'Hello' : 'Ciao'}  
    </button>);  
}
```

Calling State Changes

- State changes are usually determined by asynchronous events
 - DOM event handlers
 - Server responses (e.g., API calls)
- The event handler is a function that in turn calls *setVariable*
 - Often implemented as an arrow function

```
function WelcomeButton(props) {  
  let [english, setEnglish] =  
    useState(true) ;  
  
  return (<button  
    onClick={()=>setEnglish((eng)=>(!eng))}>  
    {english ? 'Hello' : 'Ciao'}  
  </button>);  
}
```

The default value

- Used during the **first** render of the component, only
 - Never used in successive renders
- May be a value, or a function
 - The function is called only during the initial render
- May be computed from the props
 - But will not update if the props change (beware bugs!)
 - Not recommended

Example

```
function Counter(props) {
  const [count, setCount] = useState(props.initialCount);
  return (
    <>
      Count: {count}
      <button onClick={() => setCount(props.initialCount)}>Reset</button>
      <button onClick={() => setCount(prevCount => prevCount - 1)}>-</button>
      <button onClick={() => setCount(prevCount => prevCount + 1)}>+</button>
    </>
  );
}
```

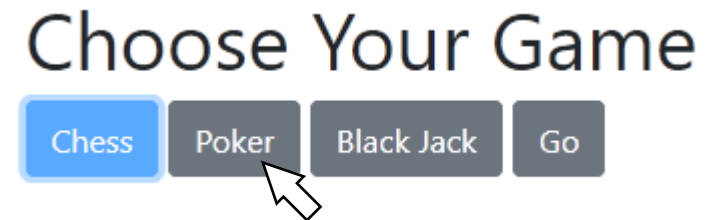
Multiple State Variables

- Do not use a single object for holding many (unrelated) properties
- Create as many state variables as needed, they are all independent
- Component will re-render if any state changes
- Children components will re-render only if *their* props change

```
function Example(props) {  
  
    [hidden, setHidden] = useState(true) ;  
    [count, setCount] = useState(0) ;  
    [mode, setMode] = useState('view') ;  
  
    . . .  
    setHidden(false) ;  
  
    . . .  
    setCount( c => c+1 ) ;  
  
    . . .  
    setMode('edit') ;  
  
    . . .  
}
```

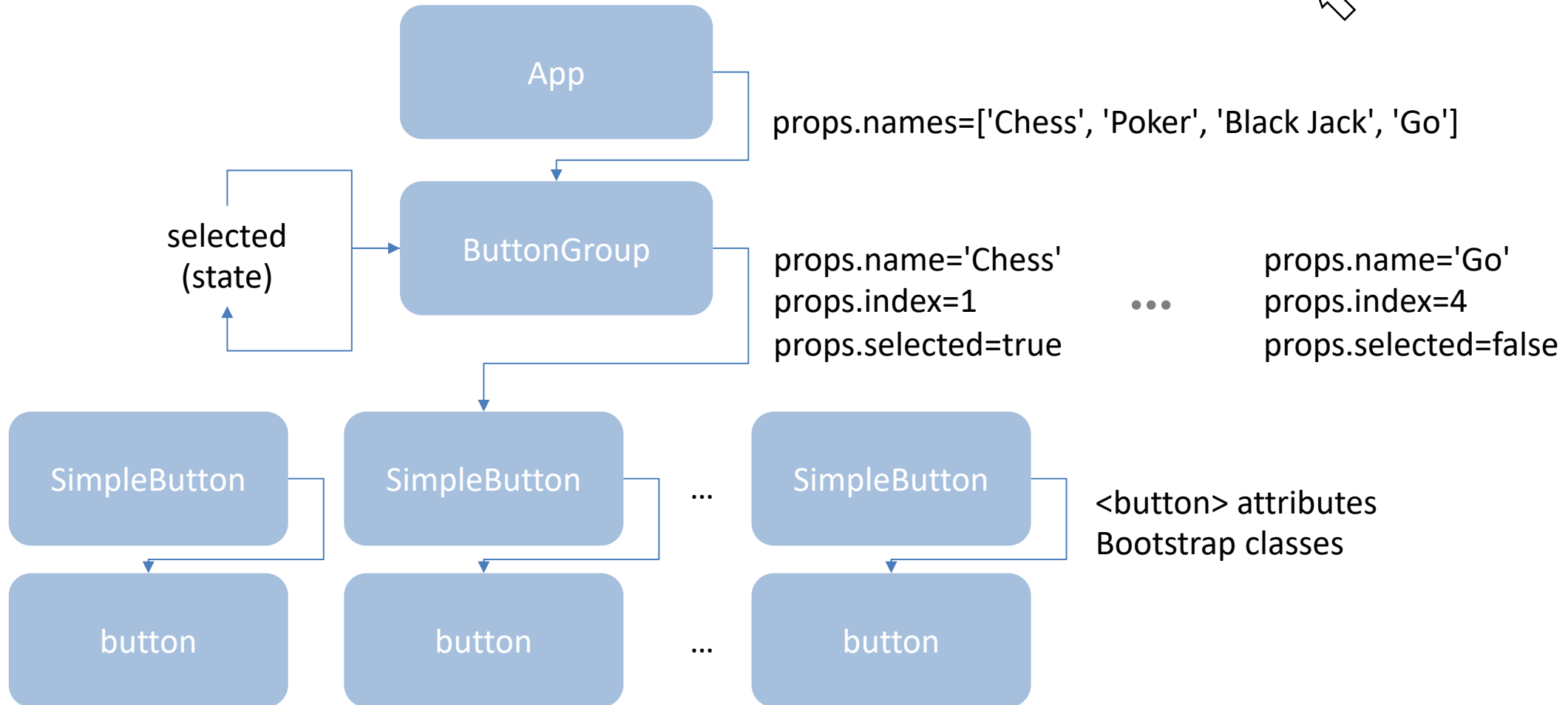
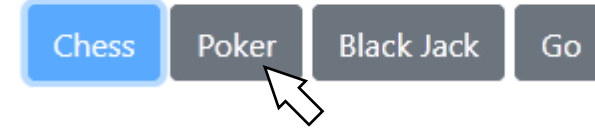
Can Children Mutate Parent's State?

- Each button may be selected or not, but only one may be selected at a time
- The information about what button is selected may not be in the button
- It is a state of a container component for “button group”



Analysis

Choose Your Game

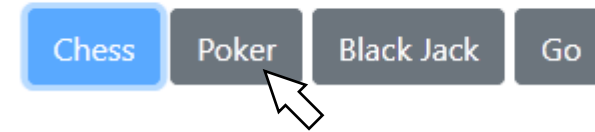


How To Change The Chosen Button?

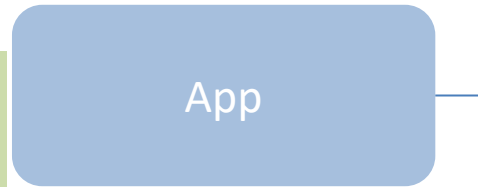
- Handle `onClick` event from the button
- ButtonGroup must offer a method for changing the chosen option
 - will call `setSelected()`
- The method reference must be passed down to SimpleButton, with all other props

A Possible Solution

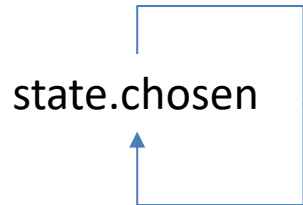
Choose Your Game



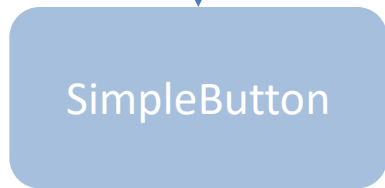
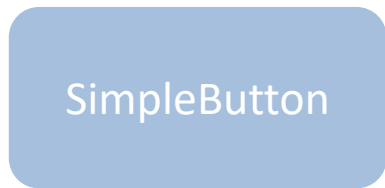
```
const chooseButton =  
  (index) =>  
    setSelected(index);
```



props.names=['Chess', 'Poker', 'Black Jack', 'Go']



props.name='Poker'
props.index=1
props.selected=false
props.choose -> choose={chooseButton}



<button> attributes
Bootstrap classes



onClick={() =>
 props.choose(props.index)}

React Design Hints

- Try to implement *stateless* components instead of *stateful* ones
 - Stateless components are more reusable
 - Stateless components are faster to execute
- Move *state* to common ancestors (“state lifting”)
- Pass *state* down to the children using *props*
- Allow children to ask for state updates, by passing down callback functions



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