



# Using props and state - Adding Properties to Components

Developing Applications using ReactJS





## Objectives

- To understand what props are and how to use them
- To understand how Components can have and manipulate state
- To understand how state can be passed to child components using props



## What are props?

- **“props are a way of passing data from parent to child”**  
<http://facebook.github.io/react/docs/thinking-in-react.html>
  - i.e. a communication channel between components that always moves from the top (parent) to the bottom (child)
- **props are immutable**
  - Once set, they cannot change
- **props can be added as attributes in the component used when rendering the component from ReactDOM.render**

```
...<App headerProp = "Header from attr" />, doc...
```

- **And/or default props can be defined under the class declaration in the .jsx file:**

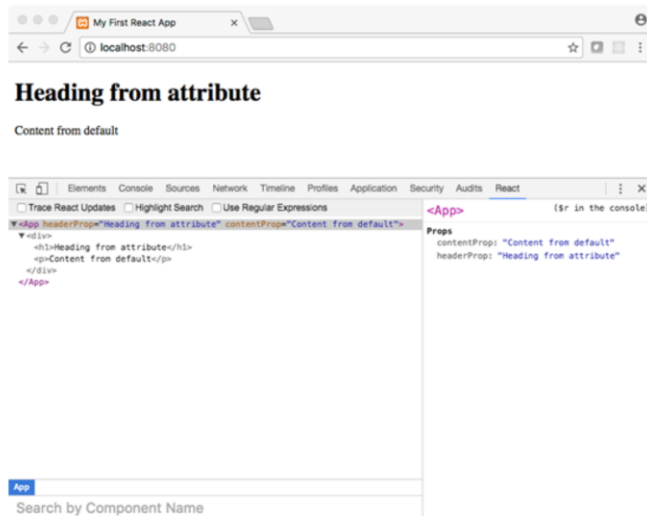
```
App.defaultProps = {  
  headerProp : 'Header from default',  
  contentProp : 'Content from default'  
}
```



## Using props in components

- props rendered to the browser through the component return – either the default, or overriding value (if supplied)

```
...<h1>{this.props.headerProp}</h1>  
<p>{this.props.contentProp}</p>...
```





## props example (just in main.js file)

```
import React from 'react';
import ReactDOM from 'react-dom';

class App extends React.Component {
  render() {
    let headerProp = this.props.headerProp;
    let contentProp = this.props.contentProp;
    return (
      <div>
        <h1>{headerProp}</h1>
        <p>{contentProp}</p>
      </div>
    );
  }
}

App.defaultProps = {
  headerProp: 'This is the default heading',
  contentProp: 'This is default content'
}

ReactDOM.render(<App headerProp = "Header from attribute" />,
  document.querySelector('#app'));
```

props rendered in the component here

Default props set here

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This component will be rendered as expected with the header being displayed from the overriding attribute setting and the content being rendered from the default.



## props can have type and validation...

- **Subobject propTypes can be used for both typing and validation**
  - Uses `PropTypes` class from **prop-types** npm package
  - Useful for ensuring correct usage of components
  - Makes code more readable – can see how component should be used
- **Typing**
  - Any valid JavaScript type can be used
  - Will produce console warning if correct type is not used for prop
- **Validation**
  - To ensure that a prop has a value supplied
  - `.isRequired` is chained to **propTypes** declaration
  - Will produce console warning if prop is not available
- **Undeclared props are ignored by the browser**

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To avoid the bloating of the React package, `React.PropTypes` (along with `React.createClass`) was removed from it when v15.5 was released. They are now sourced from the `prop-types` npm package.



## prop typing and validation example

```
import React from 'react';
import ReactDOM from 'react-dom';
import PropTypes from 'prop-types';

class App extends React.Component {
  render() {
    return (
      <div>
        <h1>{this.props.headerProp}</h1>
        <p>{this.props.contentProp}</p>
        <p>Value of numberProp is: {this.props.numberProp}</p>
      </div>
    );
  }
}

App.propTypes = {
  headerProp: PropTypes.string.isRequired,
  contentProp: PropTypes.string.isRequired,
  numberProp: PropTypes.number
}

App.defaultProps = {
  headerProp: 'This is the default heading',
  contentProp: 'This is default content'
}

ReactDOM.render(<App numberProp = {10} />,
  document.querySelector('#app'));
```

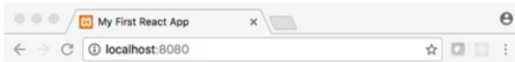
Declaration of  
type and  
validation  
done here

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In this example, the number prop has to be a number if it is supplied, else there will be a console warning. Therefore, this component will be rendered as expected with the header and content being displayed from the default and numberProp being evaluated to 10 through the attributes.



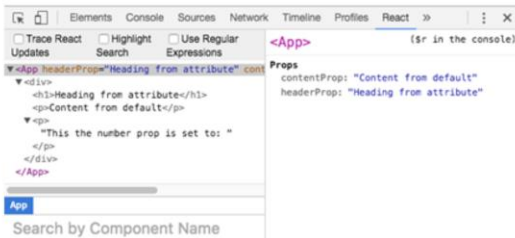
## prop type and validation



### Heading from attribute

Content from default

This the number prop is set to:



- **Unset prop is ignored by the browser with no errors (above)**

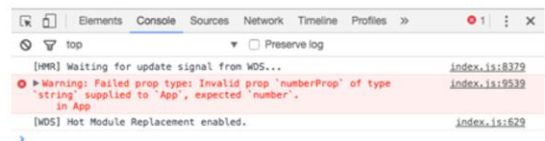
- **Incorrect type used in prop produces console warning but is still rendered (below)**



### Heading from attribute

Content from default

This the number prop is set to: Ten







## What is state?

- **Best described as how a component's data looks at a given point in time**
  - Means that data can be updated
- **Different from props**
  - State is mutable whereas props are not
- **Defined at instantiation of the component**
  - i.e. In class' constructor method
  - Defined as an object with key/value pairs
- **Can be accessed by the render method to allow output to the browser**
  - Uses JavaScript expressions syntax to access state of component



## state example (in App.jsx file)

```
import React from 'react';

class App extends React.Component {
  constructor() {
    super();
    this.state = {
      stateText: 'This is state text'
      stateNumber: 10
    }
  }

  render() {
    return (
      <div>
        <p>{this.state.stateText}</p>
        <p>Value of stateNumber is: {this.state.stateNumber}</p>
      </div>
    );
  }
}

export default App;
```

Initial state set in the constructor for the class

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As with props, any state that is not declared in the constructor and then used in the render function will be ignored by the browser.



## Setting initial state – a history lesson...

- **Pre-ES2015:**
- **getInitialState() was used to return an object that contained the state**

```
var MyComponent = React.createClass ({
  getInitialState: function() {
    return {
      stateText: 'This is state text'
    };
  },

  render: function() {
    <p>{this.state.stateText}</p>
  }
});
```

- **State could then be used as a JavaScript expression.**

The constructor function in ES6 class declarations has done away with the need for the `getInitialState()` method.



## Changing state

- **`this.setState()` method used to change state values**
  - By default, the `render()` method for the component is called so the state is updated in the UI
- **Usually called as part of some event handler function**
- **Functions have to be bound to the to the instance of the object**
  - Several methods for doing this:
    1. Append the call `.bind()` to `this.functionName`
      - Either in the component itself or the constructor
    2. Use the fat arrow function `() =>` to preserve the context of this
    3. Use the function bind syntax ::
      - Either in the component itself or the constructor
  - Method 1 is most explicit and reliable

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1. Appending the call `bind()` to `this.functionName`:
  - a. `<button onClick={this.functionName.bind(this)}>Click</button>`  
    // Used in the component's render function
  - b. `this.functionName = this.functionName.bind(this)`  
    // Used as part of the constructor
2. Using the fat arrow function:
 

```
functionName = () => this.functionName();
```

 // Used as a class variable or as part of constructor
3. Using the bind function syntax
  - a. `this.functionName = ::this.functionName;`  
    // Used as part of the constructor
  - b. `<button onClick={::this.functionName}>Click</button>`

From here on in, the example given in 1b will be used as it is the most explicit and reliable at the time of the course being authored.



## Changing state example (.jsx file)

```
import React from 'react';

export default class App extends React.Component {
  constructor() {
    super();
    this.state = {
      stateText: 'This is state text'
      stateNumber: 10
    }
  }
  update(e) {
    this.setState({stateText: 'New state text' })
  }
  render() {
    return (
      <div>
        <button onClick={this.update.bind(this)}>Click me</button>
        <p>{this.state.stateText}</p>
        <p>The value of stateNumber is: {stateNumber}</p>
      </div>
    );
  }
}
```

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## forceUpdate()

- **Components can be updated manually (although it is discouraged)**
  - Use `forceUpdate()` to be the result of an event handler

```
import React from 'react';

export default class App extends React.Component {
  constructor() {
    super();
  }
  forceUpdateHandler() {
    this.forceUpdate();
  }
  render() {
    return (
      <div>
        <button onClick={this.forceUpdateHandler.bind(this)}>
          UPDATE
        </button>
        <p>Random number: {Math.random()}</p>
      </div>
    );
  }
}
```

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`forceUpdate()` is a React function that causes a component to be re-rendered (if the DOM mark-up has changed). Its use is discouraged, even by the API for the function, which states:

Normally you should try to avoid all uses of `forceUpdate()` and only read from `this.props` and `this.state` in `render()`.

<https://facebook.github.io/react/docs/react-component.html#forceupdate>

It is sometimes unavoidable and this example forces an update on the Component, which in turn generates a new random number to be displayed, as the `Math.random()` function is called when the component is re-rendered. However, this example could have been written using a `randomNumber` state and using a function to update the state rather than re-rendering the whole component.



## Passing state through props

- **State should only be set and updated in a containing component**
  - Child components can receive state through props
  - `render()` uses child components passing in prop values to use in it

```
// Containing component App in App.jsx

class App extends React.Component {
  constructor() {
    super();
    this.state = {
      header: Header from props
      content: Content from props
    }
  }
  render() {
    return (
      <div>
        <Header headerProp={this.state.header} /> // Use Header component
        <Content contentProp={this.state.content} /> // Use Content
      </div>
    );
  }
}
```



## Passing state through props

- **The child components could be declared as:**

```
class Header extends React.Component {
  render() {
    return (
      <div><h1>{this.props.header}</h1></div>
    );
  }
}

class Content extends React.Component {
  render() {
    return (
      <div><p>{this.props.content}</p></div>
    );
  }
}
```





## Using props to create a Functional Component

- **React 0.14 introduced a new syntax for defining components as a function of props**

```
const myComponent = (props) => (  
  <div>Some Content</div>  
) ;
```

- Useful if the component is stateless
- Reduces code needed to create a component
- Future enhancements will allow performance optimisation by avoiding memory checks and allocations
- **The <Header> and <Content> components could have been declared using the following syntax:**

```
const Header = (props) => (  
  <div><h1>{props.header}</h1></div>  
) ;  
const Content = (props) => (  
  <div><p>{props.content}</p></div>  
) ;
```

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Some advantages of making a functional component if it is a stateless component:

1. No class declaration is needed
2. No need to use the this keyword – which means no need to bind functions (as the component is not an instance of an object!)
3. Focuses on UI behaviour – state managed by higher-level ‘container’ components
4. Less code for same/more output
5. Bloated components and poor data structures more easily spotted.
6. Easy to understand – even if it contains a lot of markup
7. Easy to test – assertions are straightforward: Given these props, I expect this markup returned.



## Lifting Up State

- **Several components often need to reflect same changing data**
- **Recommended way is to lift up a shared state to their closest common ancestor**
- **Child components can use state from ancestor components through props**
  - Change in state in ancestor will result in re-rendering of ancestor and all child components
  - Provides “single source of truth” for data
- **If something can be derived from props or state, it probably should not be in state**



## Objectives

- To understand what props are and how to use them
- To understand how Components can have and manipulate state
- To understand how state can be passed to child components using props

## Exercise Time



- **Complete EG04 – Using props and state in components to produce a simple application**