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Forms

The Foundations of User Interaction

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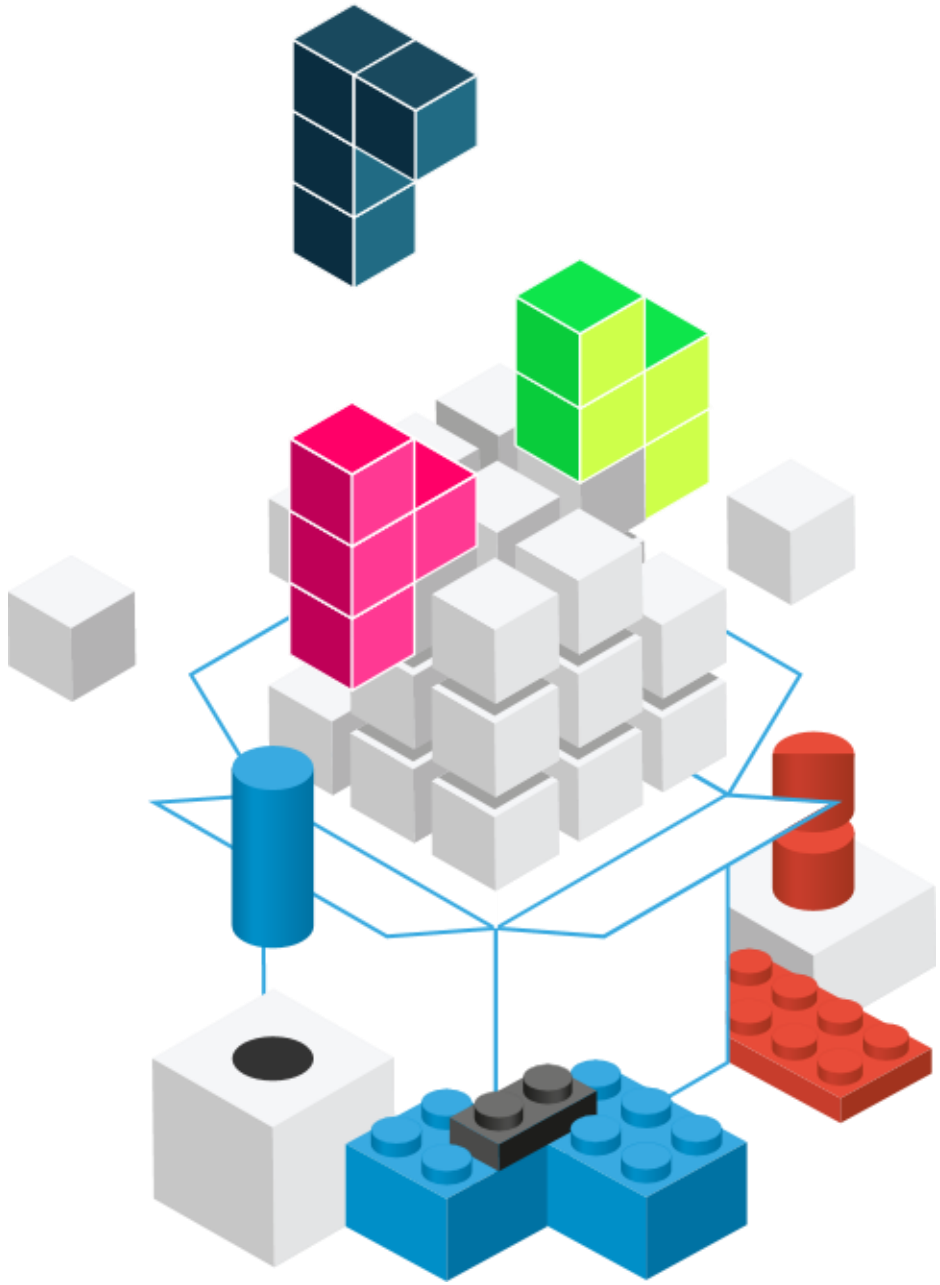

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https://react.dev/reference/react-dom/components#form-components

Full Stack React, Chapter “Forms”

React Handbook, Chapter “JSX”

Forms, Events and Event Handlers

FORMS IN JSX

HTML Forms

- (Native) HTML Forms are *inconsistent*: different ways of handling values, events etc. depending on the type of input element
  - Consequence of backward compatibility
- For instance:
  - onChange on a radio button is not easy to handle
  - `value` in a `textarea` does not work, etc.
- React flattens this behavior exposing (via JSX) a more uniform interface
  - Synthetic Events

Value in JSX forms

- The **`value`** attribute always holds the current value of the field
- The **`defaultValue`** attribute holds the default value that was set when the field was created
- This also applies to
  - `textarea`: the content is in the `value` attribute; it is NOT to be taken from the actual content of the `<textarea>…</textarea>` tag
  - `select`: do not use the `<option selected>` syntax, but `<select value='id'>`

Change Events in JSX Forms

- React provides a more consistent **onChange** event
- By passing a function to the `onChange` attribute you can subscribe to events on form fields (every time `value` changes)
- `onChange` fires when typing a single character into an `input` or `textarea` field
- It works consistently across fields: even `radio`, `select` and `checkbox` input fields fire a `onChange` event

Event Handlers

- An Event Handler callback function is called with one parameter: an event object
- All event objects have a standard set of properties
  - `event.target`: *source* of the event
- Some events, depending on categories, have more specific properties

Synthetic Events

https://react.dev/reference/react-dom/components/common#react-event-object

- "High level events" wrap the corresponding DOM Events
- Same attributes as `DOMEvent`
- `target` points to the source of the event.
- In case of a *form element*
  - `target.value` = current input value
  - `target.name` = input element name

```
boolean bubbles
boolean cancelable
DOMEventTarget currentTarget
boolean defaultPrevented
number eventPhase
boolean isTrusted
DOMEvent nativeEvent
void preventDefault()
boolean isDefaultPrevented()
void stopPropagation()
boolean isPropagationStopped()
DOMEventTarget target
number timeStamp
string type
```

Synthetic Events

https://reactjs.org/docs/events.html

Category	Events
Clipboard	onCopy onCut onPaste
Composition	onCompositionEnd onCompositionStart onCompositionUpdate
Keyboard	onKeyDown **onKeyPress** onKeyUp
Focus	**onFocus onBlur**
Form	**onChange** onInput **onInvalid** onReset **onSubmit**
Generic	onError **onLoad**
Mouse	**onClick** onContextMenu onDoubleClick onDrag onDragEnd onDragEnter onDragExit onDragLeave onDragOver onDragStart onDrop onMouseDown onMouseEnter onMouseLeave onMouseMove onMouseOut onMouseOver onMouseUp
Pointer	onPointerDown onPointerMove onPointerUp onPointerCancel onGotPointerCapture onLostPointerCapture onPointerEnter onPointerLeave onPointerOver onPointerOut
Selection	onSelect
Touch	onTouchCancel onTouchEnd onTouchMove onTouchStart
UI	onScroll
Wheel	onWheel
Media	onAbort onCanPlay onCanPlayThrough onDurationChange onEmptied onEncrypted onEnded onError onLoadedData onLoadedMetadata onLoadStart onPause onPlay onPlaying onProgress onRateChange onSeeked onSeeking onStalled onSuspend onTimeUpdate onVolumeChange onWaiting
Image	onLoad onError
Animation	onAnimationStart onAnimationEnd onAnimationIteration
Transition	onTransitionEnd

Tip: Defining Event Handlers

- Define the function as…
  - an arrow function
  - a function expression

```
const handler = () => { ... }
```

```
handler = function() { ... }
```

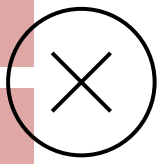
Tip: Defining Event Handlers

- Pass the *name* of the function as a prop
  - As a function object (not string)
  - Don't *call* the function

```
return <div handler={handler} />
```

```
return <div handler={handler()} />
```

```
return <div handler='handler' />
```



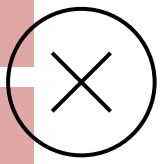
Tip: Defining Event Handlers

- Specify the *name* of the function prop in the event handler

- If you need to pass *parameters*, use an *arrow* function

```
return <button onClick=
  {props.handler} />
```

```
return <button onClick=
  {props.handler()} />
```



```
return <button onClick=
  {props.handler(a, b)} />
```

```
return <button onClick=
  {()=>props.handler()} />
```

```
return <button onClick=
  {()=>props.handler(a, b)} />
```

Who Owns The State?

- Form elements are inherently stateful: they hold a value
  - Input text form, selection, etc.
- React components are designed to handle the state
- The props and state are used to render the component
  - To correctly render the component from the virtual DOM, React needs to know which value must be set in the form element
  - Hence, on every change (onChange) React *must be notified* to get the new value and update the component state

Where Is The Source of Truth?

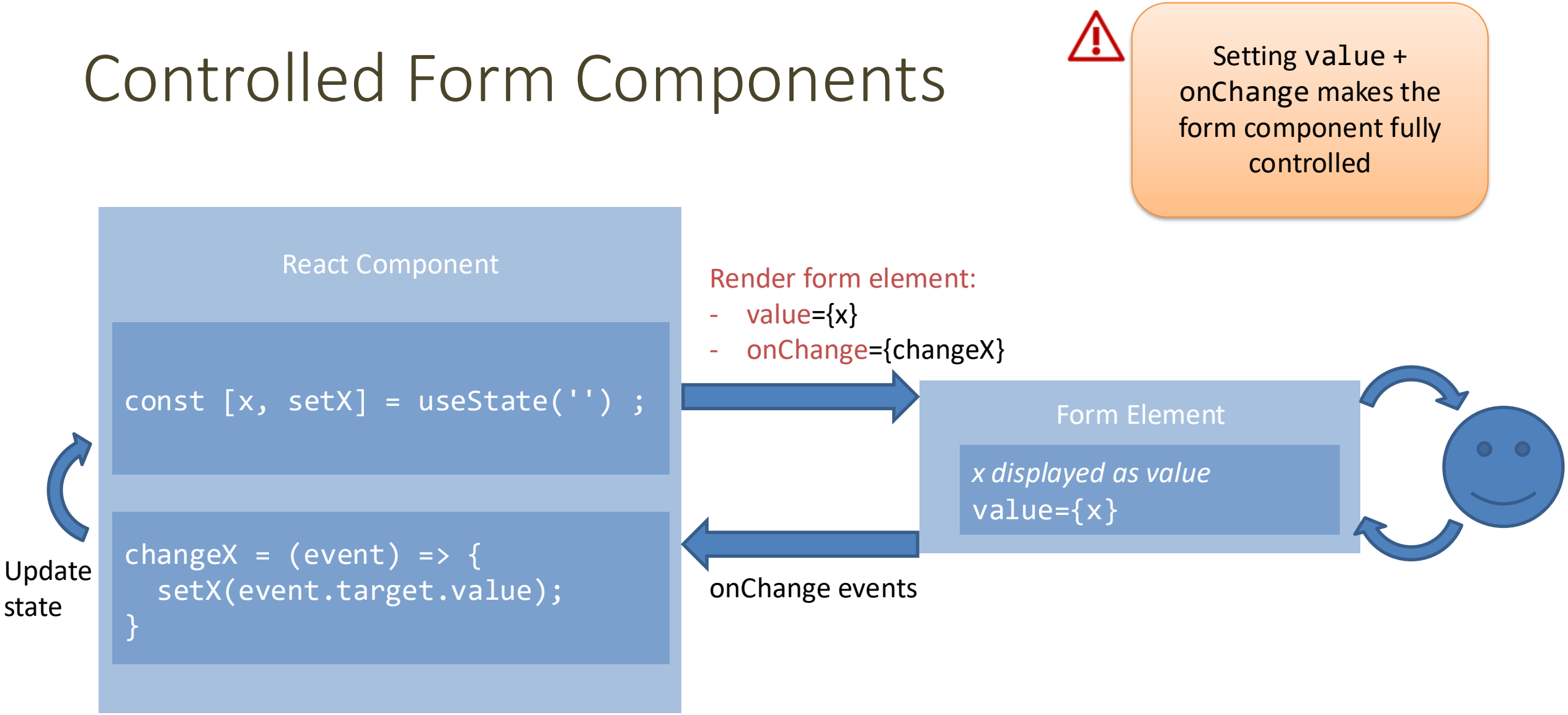
Controlled Form Components

- When the React component holds, in its state, the value to be shown in the form element, it is named a **controlled** form component

Uncontrolled Form Components

- In some occasions, it could be useful to keep the value directly in the HTML form element in the DOM: **uncontrolled** form component

Controlled Form Components



Controlled Form Component

- The event handler changes the state, *setXXX()* starts the update of the virtual DOM that then updates the actual DOM content

```
function MyForm (props) {
  const [name, setName] = useState();
  return <form onSubmit={handleSubmit}>
    <label> Name:
      <input type="text" value={name}
        onChange={handleChange} />
    </label>
    <input type="submit" value="Submit" />
  </form> ;
}
```

```
handleSubmit = (event) => {
  console.log('Name submitted: ' +
    name);
  event.preventDefault();
}

handleChange = (event) => {
  setName(event.target.value) ;
};
```

Uncontrolled Form Components

Not setting `value` + onChange makes the form component uncontrolled

React Component

NO
state

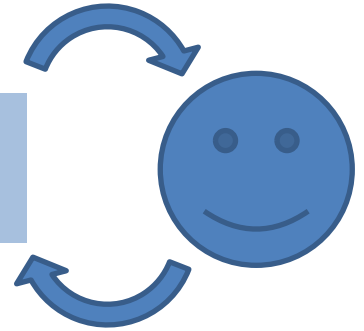
```
submitForm = (event) =>
{
   props.saveData(…);
}
```

Render Form Element
- defaultValue={props.x}
- onSubmit={submitForm}

Form Element
x displayed as initial value

onSubmit

onChange



Uncontrolled components will not be described in depth

Tip: Form Submission

- The `onSubmit` event is generated by the `<form>` element
- Always call `event.preventDefault()` to avoid the submission (and reloading of the page)
- Perform *validation* of *all form data* before proceeding
  - Using checks on `state` variables (on a controlled component, they contain updated information)
  - May use validator https://github.com/validatorjs/validator.js

`useActionState` (React 19)

- Sometimes, it is tedious to use controlled form components
  - Need to write an event handler for every way data can change
  - Need to declare a state for each form component
  - Pipe all of the input state through a React component
- `useActionState` simplifies the process of handling forms
  - **New** hook in React 19
  - Remove the need for creating individual states and manually managing values, while providing a state to the form component
  - Built-in *loading state* available
  - Improve performance as there is no state updates/re-renders on every keystroke

https://react.dev/reference/react/useActionState

useActionState

- Create a component state that is updated when a *form action* is invoked
  - Get a form action function and an initial state
- It returns
  - A new action that you use in your form
  - The latest form state, initially set to provided initial state
  - An optional loading state that you can use while your action is processing

```
import { useActionState } from "react";

const increment = async (previousState, formData) => {
  return previousState + 1;
}

function SimpleForm() {
  const [formState, formAction, isPending] =
useActionState(increment, 0);
  return (
    <form action={formAction}>
      {formState}
      <button type="submit">Increment</button>
    </form>
  )
}
```

Creating a `useActionState`

- `import{ useActionState } from "react";`
- `const [state, formAction, isPending] = useActionState(increment, 0);`
  - `state`: name of the form state
  - `formAction`: name of the function to use in the form's `action` attribute
  - `isPending`: a boolean state that says whether the form action is still pending
  - `increment`: the action function, i.e., what happens when the form is submitted
  - `0`: the initial state
  - Array destructuring assignment to assign 3 values at once
- Setting an initial state is not mandatory, but **recommended**
  - Any serializable value that represents the entire initial state of the form
  - Ignored after the action is first invoked

The Action Function

- `const actionFunction => async(prevState, formData) {…}`
  - async function called when the form is submitted
- `prevState`, the latest available form state
  - The form state is the value *returned* by the action function when the form was last submitted
  - At the first call, it is the initial state passed to `useActionState`
- `formData`, the data submitted by the form
  - According to the standard `FormData` interface, https://developer.mozilla.org/en-US/docs/Web/API/FormData
- The function automatically calls `event.preventDefault()`
  - No need to explicitly write it!

Example

```
handleSubmit = async (prevState, formData) => {
  const submittedName = formData.get('name');

  console.log('Name submitted: ' + submittedName);

  return {name: submittedName };
}
```

```
function MyForm (props) {
  const [state, formAction] = useActionState(handleSubmit, {name: props.name});

return <form action={formAction}>
    <label> Name:
      <input name="name" type="text" defaultValue={state.name} />
    </label>
    <input type="submit" value="Submit" />
  </form> ;
}
```

Advanced Usages

- A form can have multiple `useActionState` defined
  - e.g., what happens when the same form has a *delete* and *update* button
- In this case, instead of using `action` in the `<form>` component, you can use `formAction` inside any form components:
  - `<button formAction={updateAction}>Update</button>`

- `useActionState` works well with the other hooks and can be used along controlled form components, if needed

Alternatives to Built-in React Forms

- Formik
  - Keep things organized without hiding them too much
  - Form state is inherently ephemeral and local: does not use state management solutions (e.g., Redux/Flux) that would unnecessary complicate things
  - Includes validation, keeping track of the visited fields, and handling form submission
  - https://jaredpalmer.com/formik
- React Hook Form
  - Abstract some of the form boilerplate code
  - Lightweight and extensible via plugins
  - Supports validation out of the box with error messages
  - https://react-hook-form.com

Tips: Handling Arrays in State

- React `setXXX()` with arrays requires that a new array is returned (cannot mutate the current state)
  - What is the correct way to handle arrays in React state?
- Use a new array as the value of the property
  - When referencing objects, use a *new object* every time a property changes
- Use a callback to ensure no modifications are missed
- Typical cases -- mostly triggered by form events
  - Add items
  - Update items
  - Remove items

https://www.robinwieruch.de/react-state-array-add-update-remove

Adding Items in array-valued state

```
// Append at the end: use .concat()
// NO .push(): it returns the number of
elements, not the array
...

const [list, setList] = useState(['a',
'b', 'c']);
...

setList(oldList =>
    return oldList.concat(newItem);
)
```

```
// Insert value(s) at the beginning
// use spread operator

...

const [list, setList] = useState(['a',
'b', 'c']);

...

setList(oldList =>
    return [newItem, ...oldList];
)
```

https://www.robinwieruch.de/react-state-array-add-update-remove

Updating Items in array-valued state

```
// Update item: use map()
...
const [list, setList] = useState([11, 42, 32]);
...
// i is the index of the element to update
setList(oldList => {
      const list = oldList.map((item, j) => {
        if (j === i) {
          return item + 1;  // update the item
        } else {
          return item;
        }
      });
      return list ;
});
```

https://www.robinwieruch.de/react-state-array-add-update-remove

Updating Items in array-of-objects state

```
// Update item: use map(); if items are objects, always return a new object if modified
...
const [list, setList] = useState([{id:3, val:'Foo'},{id:5, val:'Bar'}]);
...
// i is the id of the item to update
setList(oldList => {
  const list = oldList.map((item) => {
    if (item.id === i) {
      // item.val='NewVal'; return item;  // WRONG: the old object must not be reused
      return {id:item.id, val:'NewVal'};  // return a new object: do not simply change content
    } else {
      return item;
    }
  });
  return list ;
});
```

Removing Items in array-valued state

```
// Remove item: use filter()


...
const [list, setList] = useState([11, 42,
32]);
...



// i is the index of the element to remove
setList(oldList=> {
   return oldList.filter(
       (item, j) => i !== j );
});
```

```
// Remove first item(s): use destructuring


...
const [list, setList] = useState([11, 42,
32]);
...

setList(oldList => {
   const [first, ...list] = oldList;
   return list ;
});
```

https://www.robinwieruch.de/react-state-array-add-update-remove

Tip: Heuristics for State Lifting

- Presentational components
  - Forms, Tables, Lists, Widgets, …
  - Should contain local state to represent their display property
  - Sort order, open/collapsed, active/paused, …
  - Such state is *not interesting outside* the component
- Application components (or Container components)
  - Manage the information and the application logic
  - Usually don’t directly generate markup, generate props or context
  - Most application state is “lifted up” to a Container
  - Centralizes the updates, single source of State truth

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