

# [JavaScript 13]

Roi Yehoshua 2018

## [ What we learnt last time? ]

- Browser events
- Attaching events
- Event bubbling
- Drag and Drop

## [Our targets for today]

- Keyboard events
- Page events
- Input events
- Form events

# [Keyboard Events]

- Keyboard events should be used when we want to handle keyboard actions
- Note that on modern devices there are other ways to “input something”
  - For instance, people use speech recognition (especially on mobile devices) or copy/paste with the mouse
- So if we want to track any input into an `<input>` field, then keyboard events are not enough
- There's another event named **input** to handle changes of an `<input>` field, by any means, that will be discussed later

# [Keyboard Events]

- **keydown** happens when a key is pressed down, and then **keyup** – when it's released
  - In the past, there was also a **keypress** event, but now is considered deprecated
- The **key** property of the event object allows to get the character
  - The value of `event.key` can change depending on the language or CapsLock enabled
- The **code** property of the event object allows to get the “physical key code”
- For instance, the same key Z can be pressed with or without Shift:

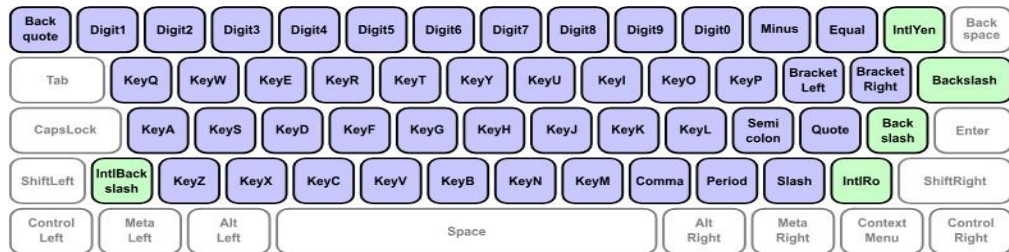
Key	event.key	event.code
Z	z (lowercase)	KeyZ
Shift+Z	Z (uppercase)	KeyZ

- For non-character keys, `key` usually has the same value as `code`, for example:

Key	event.key	event.code
F1	F1	F1
Shift	Shift	ShiftRight or ShiftLeft

# [Key Codes]

- Every key has a code that depends on its location on the keyboard
- The key codes are described in the [UI Events code specification](#)
- For example:
  - Letter keys have codes "Key<letter>": "KeyA", "KeyB" etc.
  - Digit keys have codes: "Digit<number>": "Digit0", "Digit1" etc.
  - Special keys are coded by their names: "Enter", "Backspace", "Tab" etc.



## [Keyboard Events Example]

- For example, let's say we want to implement an "Undo" action when the user presses Ctrl+Z (or Cmd+Z) for Mac
- We can set a listener on **keydown** and check event.code for the key pressed
  - we don't want event.key here, since the value of event.key can change depending on the language or CapsLock enabled

```
document.addEventListener("keydown", function (event) {  
    if (event.code == "KeyZ" && (event.ctrlKey || event.metaKey))  
    {  
        alert("Undo!");  
    }  
});
```

## [Default Actions]

- Default actions vary, as there are many possible things that may be initiated by the keyboard, for example:
  - A character appears on the screen (the most obvious outcome)
  - A character is deleted (Delete key)
  - The page is scrolled (PageDown key)
  - The browser opens the “Save Page” dialog (Ctrl+S)
- Preventing the default action on keydown can cancel most of them, with the exception of OS-based special keys
- For instance, on Windows Alt+F4 closes the current browser window, and there’s no way to stop it by preventing the default action in JavaScript



# [Default Actions]

- For instance, the `<input>` below expects a phone number, so it doesn't accept keys except digits, +, -, or ():

```
<input type="tel" id="phone" placeholder="Phone, please">
<script>
  phone.onkeydown = function (event) {
    if (!checkPhoneKey(event.key))
      event.preventDefault();
  }
  function checkPhoneKey(key) {
    return (key >= '0' && key <= '9') || key == '+' || key == '-' || key
      == '(' || key == ')';
  }
</script>
```

Phone, please

- Note that special keys like Backspace, ⌘, ⌥, Ctrl+V don't work in the input. We can relax the filter `checkPhoneKey()` to allow these keys as well if we want.
- We can still enter anything by using a mouse and right-click + Paste. So the filter is not 100% reliable. Alternatively, we could track the input event – it triggers after any modification.

## [Exercise (20)]

- Create a function **runOnKeys**(func, code1, code2, ... code\_n) that runs func on simultaneous pressing of keys with codes code1, code2, ..., code\_n.
- For instance, the code below shows alert when "Q" and "W" are pressed together (in any language, with or without CapsLock)

```
runOnKeys(  
  () => alert("Hello!"),  
  "KeyQ",  
  "KeyW"  
);
```

# [Page LifeCycle]

- The lifecycle of an HTML page has three important events:
  - **DOMContentLoaded** – the browser fully loaded HTML, and the DOM tree is built, but external resources like pictures <img> and stylesheets may be not yet loaded
  - **load** – the browser loaded all resources (images, styles etc)
  - **beforeunload/unload** – when the user is leaving the page

# [DOMContentLoaded]

- The DOMContentLoaded event happens on the document object
- We must use addEventListener() to catch it:

```
<script>
  function ready() {
    alert("DOM is ready");

    // image is not yet loaded (unless was cached), so the size is 0x0
    alert(`Image size: ${img.offsetWidth}x${img.offsetHeight}`);
  }

  document.addEventListener("DOMContentLoaded", ready);
</script>


```

- In the example the DOMContentLoaded handler runs when the document is loaded, not waiting for the page load. So alert shows a size of zero.

# [DOMContentLoaded and Scripts]

- When the browser initially loads HTML and comes across a `<script>...</script>` in the text, it must execute the script before continuing building the DOM
- So DOMContentLoaded may only happen after all such scripts are executed
- External scripts (with `src`) also put DOM building to pause while the script is loading
- However, external scripts with **async** or **defer** attributes tell the browser to continue processing without waiting for the scripts, and run them when they finish loading
  - So the user can see the page before scripts finish loading, good for performance

	async	defer
Order	Scripts with async execute in the load-first order. Their document order doesn't matter – which loads first runs first.	Scripts with defer always execute in the document order (as they go in the document).
DOMContentLoaded	Scripts with async may load and execute while the document has not yet been fully downloaded.	Scripts with defer execute after the document is loaded and parsed (they wait if needed), right before DOMContentLoaded.

## [window onload]

- The **load** event on the window object triggers when the whole page is loaded including styles, images and other resources
- The example below correctly shows image sizes, because window.onload waits for all images:

```
<script>
    window.onload = function () { alert("Page loaded");

        // image is loaded at this time
        alert(`Image size: ${img.offsetWidth}x${img.offsetHeight}`);
    };
</script>

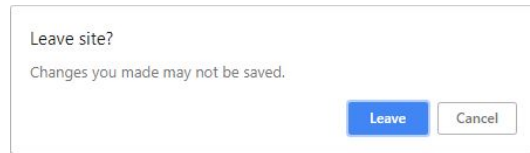

```

# [window unload]

- When a visitor leaves the page, the **unload** event triggers on window
  - We can do there actions that don't involve a delay, like closing popup windows
  - But we can't cancel the transition to another page
- For that we should use another event – **onbeforeunload**
  - In this event you can ask the user for additional confirmation before leaving the page
  - Some browsers disable this feature, because certain webmasters abused this event handler by showing misleading and hackish messages
- Try it by running the following code:

```
<script>
  window.onbeforeunload = function () {
    return "There are unsaved changes. Leave now?";
  };
</script>

<a href="http://example.com">Leave for EXAMPLE.COM</a>
```



# [Resource Loading Events]

- The browser allows to track the loading of external resources – scripts, images, iframes and so on
- There are two events for it:
  - **onload** – successful load
  - **onerror** – an error occurred



## [Loading a Script]

- Let's say we need to call a function that resides in an external script
- We can load it dynamically, like this:

```
// Load the jquery script
let script = document.createElement("script"); script.src =
"https://code.jquery.com/jquery-3.3.1.js";
document.head.append(script);

alert($); // Uncaught reference error
```

- We need to wait until the script loads, and only then we can call it
- The main helper is the **load** event - it triggers after the script was loaded and executed

# [Loading a Script]

→ In **onload** we can use script variables, run functions etc:

```
let script = document.createElement("script"); script.src =  
"https://code.jquery.com/jquery-3.3.1.js";  
document.head.append(script);  
  
script.onload = function () {  
    // The script creates a helper function "$" alert($);  
}
```

→ Errors that occur during the loading of the script can be tracked on **error** event

→ For instance, let's request a script that doesn't exist:

```
script = document.createElement("script");  
script.src = "https://example.com/404.js"; // no such script  
document.head.append(script);  
  
script.onerror = function () {  
    alert("Error loading " + this.src); // Error loading  
    https://example.com/404.js  
};
```

## [Exercise (21)]

- Normally, images are loaded when they are created
- So when we add <img> to the page, the user does not see the picture immediately
- To show an image immediately, we can create it “in advance”, like this:

```
let img = new Image();  
img.src = 'my.jpg';
```

- The browser starts loading the image and remembers it in the cache
- Later, when the same image appears in the document, it shows up immediately
- Create a function **preloadImages(sources, callback)** that loads all images from the array sources and, when ready, runs callback
- For instance, this will show an alert after the images are loaded:

```
function loaded() { alert("Images loaded")  
}  
preloadImages(["1.jpg", "2.jpg", "3.jpg"], loaded);
```

## [Exercise (21)]

→ Use the following code to test your function:

```
function preloadImages(sources, callback) {  
    /* your code */  
}  
  
// ----- The test -----  
let sources = [  
    "https://en.js.cx/images-load/1.jpg",  
    "https://en.js.cx/images-load/2.jpg",  
    "https://en.js.cx/images-load/3.jpg"  
];  
  
// add random characters to prevent browser caching  
for (let i = 0; i < sources.length; i++) {  
    sources[i] += '?' + Math.random();  
}
```

```
// for each image, let's create another img with  
the same src and check that we have its width  
immediately  
function testLoaded() {  
    let widthSum = 0;  
    for (let i = 0; i < sources.length; i++) {  
        let img = document.createElement('img');  
        img.src = sources[i];  
        widthSum += img.width;  
    }  
    alert(widthSum);  
}  
  
// every image is 100x100, the total width  
should be 300  
preloadImages(sources, testLoaded);
```

# [Form Properties and Methods]

- Forms and control elements, such as `<input>` have a lot of special properties and events
- Working with forms can be much more convenient if we know them
- Document forms are members of the special collection **document.forms**
- That's a **named collection**: we can use both the name and the number to get the form:
  - `document.forms.my` – the form with name “my”
  - `document.forms[0]` – the first form in the document
- Any element in a form is available in the named collection **form.elements**

# [Form Properties and Methods]

→ For example:

```
<form name="myform">
  <input name="one" value="1">
  <input name="two" value="2">
</form>

<script>
  // get the form
  let form = document.forms.myform;

  // get the element
  let elem = form.elements.one;

  alert(elem.value); // 1
</script>
```

→ There's a shorter notation: we can access the element as form[index/name]

→ e.g., instead of form.elements.one we can write form.one

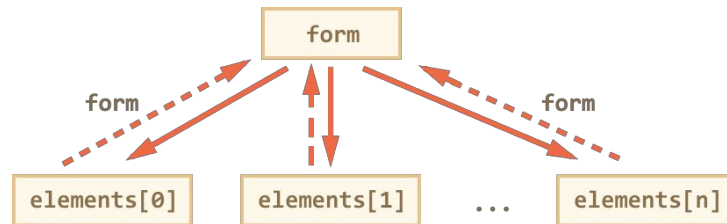
## [Backreference: element.form]

- For any element, the form is available as **element.form**
- So a form references all elements, and elements reference the form
- For example:

```
<form id="form1">
  <input type="text" name="login">
</form>

<script>
  // form -> element
  let login = form1.login;

  // element -> form  alert(login.form); //
  HTMLFormElement
</script>
```

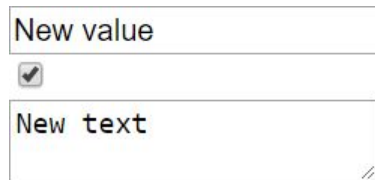


# [Input and Textarea]

→ Normally, we can access the value as `input.value` or `input.checked` for checkboxes

```
<form>
  <input type="text" id="txt1"><br />
  <input type="checkbox" id="chk1" /><br />
  <textarea id="area1"></textarea><br />
</form>

<script>
  txt1.value = "New value";  chk1.checked =
    true;  area1.value = "New text";
</script>
```



New value

☒

New text



# [Select and Options]

- A `<select>` element has 3 important properties:
  - **`select.options`** – the collection of `<option>` elements
  - **`select.value`** – the value of the chosen option
  - **`select.selectedIndex`** – the number of the selected option
- So we have three ways to set the value of a `<select>`:
  1. Find the needed `<option>` and set `option.selected` to true
  2. Set `select.value` to the value
  3. Set `select.selectedIndex` to the number of the option
- The first way is the most obvious, but (2) and (3) are usually more convenient

# [Select and Options]

→ Here is an example:

```
<select id="select">
  <option value="apple">Apple</option>
  <option value="pear">Pear</option>
  <option value="banana">Banana</option>
</select>

<script>
  // all three lines do the same thing
  select.options[2].selected = true;
  select.selectedIndex = 2;
  select.value = "banana";
</script>
```

Banana ▼

# [Select with Multiple Choice]

- Unlike most other controls, **<select multiple>** allows multiple choice
- In that case we need to walk over select.options to get all selected values:

```
<select id="genres" multiple>
  <option value="blues" selected>Blues</option>
  <option value="rock" selected>Rock</option>
  <option value="classic">Classic</option>
</select>

<script>
  // get all selected values from multi-select
  let selected = Array.from(genres.options)
    .filter(option => option.selected)
    .map(option => option.value);

  alert(selected); // blues,rock
</script>
```

## [Creating a New Option]

- In the specification of the option element, there's a nice short syntax to create <option> elements:

```
option = new Option(text, value, defaultSelected, selected);
```

- text – the text inside the option
  - value – the option value
  - defaultSelected – if true, then selected attribute is created
  - selected – if true, then the option is selected
- Call the select.options.add() method to add the new option
  - For instance:

```
let option = new Option("Text", "value", true, true);  
// creates <option value="value" selected>Text</option>  
  
select.options.add(option);
```

# [Option Properties]

- Option elements have additional properties:
  - **selected** – is the option selected
  - **index** – the number of the option among the others in its <select>
  - **text** – the text content of the option (seen by what the visitor)

## [Exercise (22)]

→ There's a `<select>`:

```
let option = new Option("Text", "value");  
// creates <option value="value">Text</option>  
  
let option = new Option("Text", "value", true, true);  
// creates <option value="value" selected>Text</option>
```

→ Use JavaScript to:

- Show the value and the text of the selected option
- Add an option: `<option value="classic">Classic</option>`
- Make it selected

# [Focus Events]

- The **focus** event is called when an element receives a focus
  - This occurs when the user either clicks on it or uses the Tab key on the keyboard
- Focusing generally means: “prepare to accept the data here”, so that’s when we can run code to initialize or load something
- The **blur** event is called when an element loses the focus
  - This occurs when the user clicks somewhere else or presses Tab to go to the next form field
- Losing the focus generally means: “the data has been entered”, so we can run code to check it or even to save it to the server and so on

# [Focus Events]

- Let's use the focus events for validation of an input field
- In the example below:
  - The blur handler checks if the field the email is entered, and if not – shows an error.
  - The focus handler hides the error message (on blur it will be checked again)

```
<style>
  .invalid {
    border-color: red;
  }
  #error {
    color: red;
  }
</style>
```

```
Your email please: <input type="email" id="input">
<span id="error" hidden>Please enter a valid
email</span><br/>
<button>Send</button>
```



# [Focus Events]

```
<script>
  input.onblur = function () {
    if (!input.value.includes('@')) { // not email
      input.classList.add("invalid");
      error.hidden = false;
    }
  };

  input.onfocus = function () {
    if (this.classList.contains("invalid")) {
      // remove the "error" indication, because
      the user wants to re-enter something
      this.classList.remove("invalid");
      error.hidden = true;
    }
  };
</script>
```

Your email please:  Please enter a valid email

## [Methods focus/blur]

- Methods **elem.focus()** and **elem.blur()** set/unset the focus on the element
- For instance, let's make the visitor unable to leave the input if the value is invalid:

```
input.onblur = function () {  
    if (!input.value.includes('@')) { // not email  
        input.classList.add("invalid"); error.hidden = false;  
  
        // put the focus back input.focus();  
    }  
    else {  
        this.classList.remove("invalid"); error.hidden = true;  
    }  
};
```

- Note that we can't "prevent losing focus" by calling `event.preventDefault()` in `onblur`, because `onblur` works *after* the element lost the focus

## [Allow Focusing on Any Element]

- Many elements do not support focusing by default
- focus/blur support is guaranteed for elements that a visitor can interact with
  - `<button>`, `<input>`, `<select>`, `<a>`, etc.
- On the other hand, elements that exist to format something such as `<div>`, `<span>`, `<table>` are unfocusable by default
  - The method `elem.focus()` doesn't work on them, and focus/blur events are never triggered
- This can be changed using HTML-attribute **tabindex**
  - Any element supports focusing if it has `tabindex`
- `tabindex` specifies the order number of the element when Tab is used to move between elements
  - If we have two elements, the first has `tabindex="1"`, and the second has `tabindex="2"`, then pressing Tab while in the first element – moves us to the second one

# [Allow Focusing on Any Element]

- tabindex has two special values:
  - tabindex="0" makes the element the last one
  - tabindex="-1" means that Tab should ignore that element

```
<style>
  li {
    cursor: pointer;
  }
  :focus {
    outline: 1px dashed green;
  }
</style>
```

Click the first item and press Tab. Keep track of the order.

```
<ul>
  <li tabindex="1">One</li>
  <li tabindex="0">Zero</li>
  <li tabindex="2">Two</li>
  <li tabindex="-1">Minus one</li>
</ul>
```

Click the first item and press Tab. Keep track of the order.

- One
- Zero
- Two
- Minus one

- Normally, <li> does not support focusing, but tabindex full enables it, along with events and styling

## [Exercise (23)]

- Create a `<div>` that turns into `<textarea>` when clicked
- The textarea allows to edit the text in the `<div>`
- When the textarea loses focus, it turns back into `<div>`, and its content becomes the HTML in `<div>`s

Click the div to edit.  
Blur saves the result.

Some text

Click the div to edit.  
Blur saves the result.

Now in edit mode

- Start with the code on the following slide

## [Exercise (23)]

```
<style>
  /* Make the div and the textarea the same size */
  .view, .edit { height: 150px; width: 400px;
    font-family: arial;
    font-size: 14px;
  }
  .view {
    border: 1px solid black; padding: 2px;
  }
  .edit {
    display: block;
    border: 2px solid blue; padding: 1px;
  }
  ul {
    padding: 0;
  }
</style>
```

```
<ul>
  <li>Click the div to edit.</li>
  <li>Blur saves the result.</li>
</ul>

<div id="view" class="view">Some text</div>

<script>
  // ...your code...
  // Note: <textarea> should have class="edit"
</script>
```

## [Change Event]

- The **change** event triggers when the element has finished changing
- For text inputs that means that the event occurs when it loses focus
- For other elements: select, input type=checkbox/radio it triggers right after the selection changes
- In the following example when we move the focus from the text field, for instance, click on a button – there will be a change event:

```
<input type="text" onchange="alert(this.value)">  
<input type="button" value="Button">
```

# [Input Event]

- The **input** event triggers every time a value is modified
- Unlike keyboard events it works on any value change, even those that do not involve keyboard actions: pasting with a mouse or using speech recognition
- The input event occurs after the value is modified, so we can't use `event.preventDefault()` there – it's just too late, there would be no effect

```
<input type="text" onchange="alert(this.value)">  
<input type="button" value="Button">
```

test      oninput: test



## [Exercise (24)]

- Create an interface that allows to enter a sum of bank deposit and percentage, then calculates how much it will be after given periods of time
- Any input change should be processed immediately
- The formula is:

```
// initial: the initial money sum
// interest: e.g. 0.05 means 5% per year
// years: how many years to wait
let result = Math.round(initial * (1 + interest * years));
```
- Start with the HTML on the next slides

Deposit calculator.

Initial deposit

How many months?

Interest per year?

**Was:** **Becomes:**

10000 10500



## [Exercise (24)]

```
<!DOCTYPE html>
<html>

<head>
  <meta charset="utf-8">
  <style>
    td select, td input {
      width: 150px;
    }

    #diagram td {
      vertical-align: bottom;
      text-align: center; padding:
      10px;
    }

    #diagram div {
      margin: auto;
    }
  </style>
</head>
```

## [Exercise (24)]

```
<body>
  Deposit calculator.
  <form name="calculator">
    <table>
      <tr>
        <td>Initial deposit</td>
        <td>
          <input name="money" type="number" value="10000" required>
        </td>
      </tr>
      <tr>
        <td>How many months?</td>
        <td>
          <select name="months">
            <option value="3">3 (minimum)</option>
            <option value="6">6 (half-year)</option>
            <option value="12" selected>12 (one year)</option>
            <option value="18">18 (1.5 years)</option>
            <option value="24">24 (2 years)</option>
            <option value="30">30 (2.5 years)</option>
            <option value="36">36 (3 years)</option>
            <option value="60">60 (5 years)</option>
          </select>
        </td>
      </tr>
      <tr>
        <td>Interest per year?</td>
        <td>
          <input name="interest" type="number" value="5"
            required>
        </td>
      </tr>
    </table>
  </form>
```

## [Exercise (24)]

```

                                <table id="diagram">
    <tr>
      <th>Was:</th>
      <th>Becomes:</th>
    </tr>
    <tr>
      <th id="money-before"></th>
      <th id="money-after"></th>
    </tr>
    <tr>
      <td>
        <div style="background: red;width:40px;height:100px"></div>
      </td>
      <td>
        <div style="background: green;width:40px;height:0" id="height-after"></div>
      </td>
    </tr>
  </table>

  <script>
    let form = document.forms.calculator;
    // your code
  </script>
</body>
</html>

```

# [Form Submission]

- There are two main ways to submit a form:
  - The first – to click `<input type="submit">` or `<input type="image">`
  - The second – press Enter on an input field
- The **submit** event triggers when the form is submitted
- It is usually used to validate the form before sending it to the server
- The submit handler can check the data, and if there are errors, show them and call `event.preventDefault()`, then the form won't be sent to the server

# [Form Submission]

→ Here is an example:

```
<form id="form" method="get">
  Enter your name: <input type="text" id="name" name="name"/><br />
  Enter your age: <input type="number" id="age" name="age" /><br />
  <input type="submit" value="Submit">
</form>

<script>
  form.onsubmit = function (event) {
    let name = document.getElementById("name").value;
    if (!name) {
      alert("You must enter your first name");
      event.preventDefault();
      return;
    }
    let age = Number(document.getElementById("age").value); if (age <
    0 || age > 120) {
      alert("Age must be between 0 and 120");
      event.preventDefault();
      return;
    }
  }
</script>
```

Enter your name:

Enter your age:

# [Form Submission]

- To submit a form to the server manually, we can call **form.submit()**
- Then the submit event is not generated
  - It is assumed that if the programmer calls form.submit(), then the script already did all related processing
- Sometimes that's used to manually create and send a form, like this:

```
googleSearch.onclick = function () {  
  let form = document.createElement("form");  
  form.action = "https://google.com/search";  
  form.method = "GET";  
  
  form.innerHTML = '<input name="q" value="test">';  
  
  // the form must be in the document to submit it  
  document.body.append(form);  
  
  form.submit();  
};
```

## [ Control questions ]

1. How can we detect which key was pressed?
2. What event is triggered when page DOM is ready?
3. How can we set a select-element value?
4. What event react to input-element changes?
5. How can we process form-element on its submit?



# [ Materials ]

Core materials:

<https://learn.javascript.ru/introduction-browser-events>

<https://learn.javascript.ru/event-details>

Additional materials:

<https://developer.mozilla.org/ru/docs/Web/Events>

<https://learn.javascript.ru/event-bubbling>

Video materials:

<https://www.youtube.com/watch?v=8cV4ZvHXQL4>