INLS 672
Web Development 2

JavaScript Basics

UNC
SCHOOL OF INFORMATION
AND LIBRARY SCIENCE

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Part 1: JavaScript Overview

Part 2: Language Concepts

Part 3: DOM Events

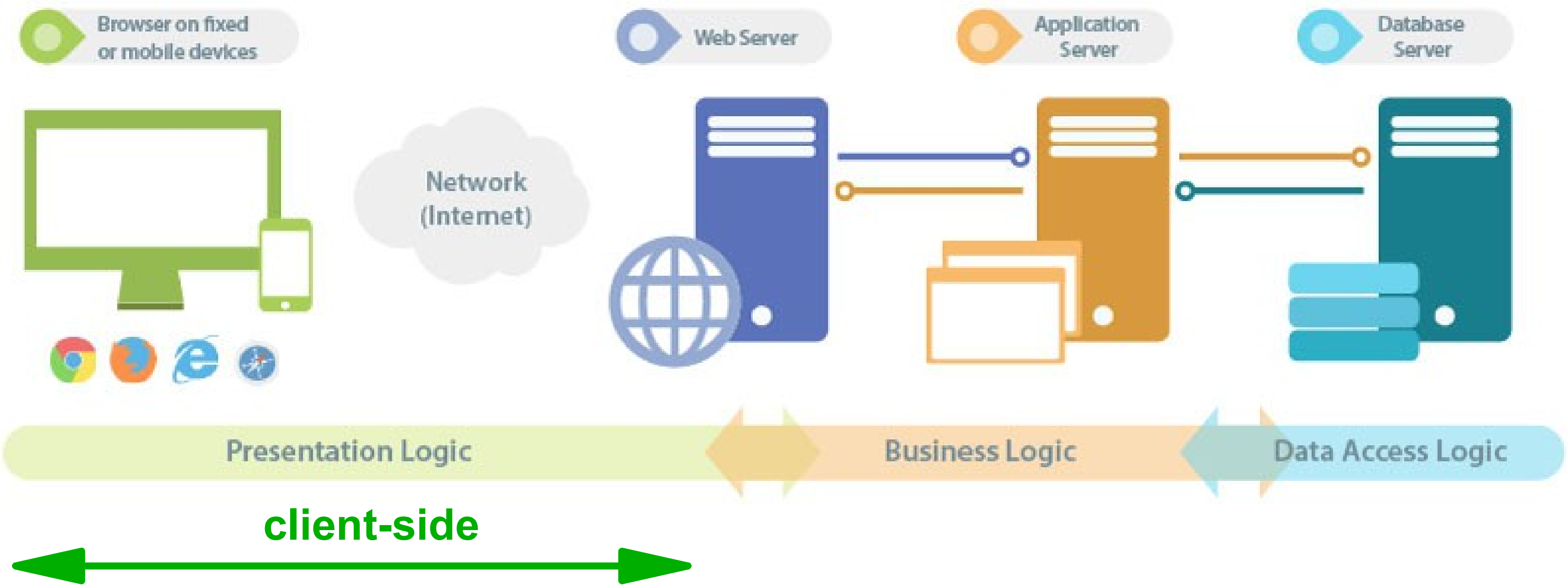
What is JavaScript and how is it used?

JavaScript is a scripting language for building interactive and complex experiences on the web, such as responding to user interactions and updating dynamic content on a page.

Anything involving how a web page should behave when an event occurs is what JavaScript is used for. Some examples....

- Slideshows: Suzie Wolf Photography, Art Wolfe
- Form validation: awwwards Contact Us
- Calculators: Google calculator, PX to EM conversion
- Graphs: COVID-19 US Cases, Financial Times Markets Data
- Google Maps

JavaScript Runs in the Browser



JavaScript is a client-side scripting language

- Scripts are embedded/referenced in a web page, and executed when a page is loaded, or in response to a user action
- It is NOT the same as the Java programming language
- Java is compiled (and much faster); JavaScript is interpreted
- TIOBE Programming Index

JavaScript – Getting Started

Tutorials

- w3schools: JavaScript Tutorial
- MDN Web Docs: JavaScript
- Codecademy, Coursera

Programming References (intermediate)

- Robust Client-Side JavaScript: A Developer's Guide
- Eloquent JavaScript
- JavaScript for Web Designers

Plenty of free JavaScript available, but...

- Need to understand the free stuff before you can use it
- Free JavaScript is not necessarily good JavaScript
- Check the dates on the web sites, demos, and examples

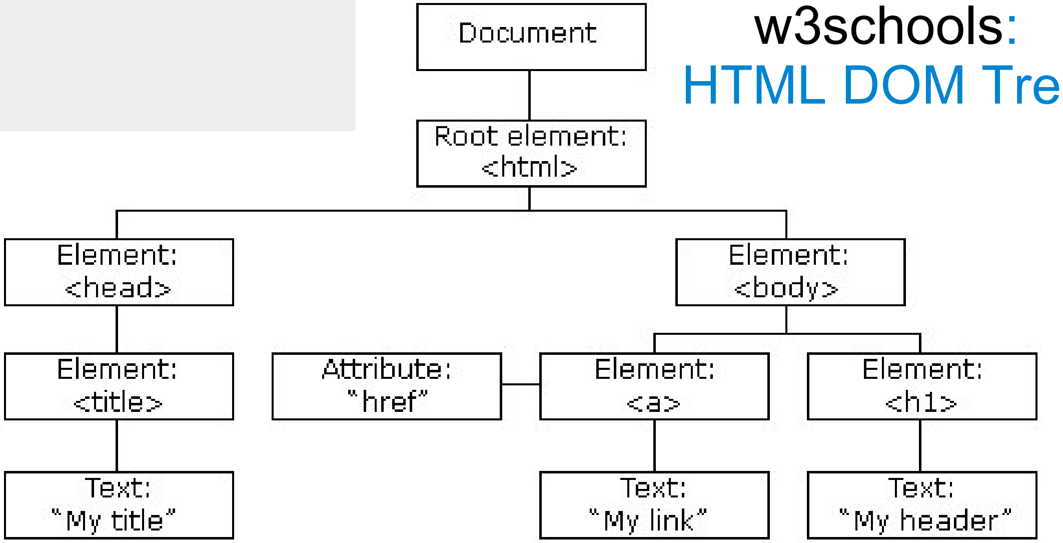
ECMAScript is a standard that forms the basis of JavaScript

JavaScript supports interaction by manipulating the Document Object Model (DOM)

Every HTML document has an underlying representation called the Document Object Model, where everything in your HTML document is represented as a node.

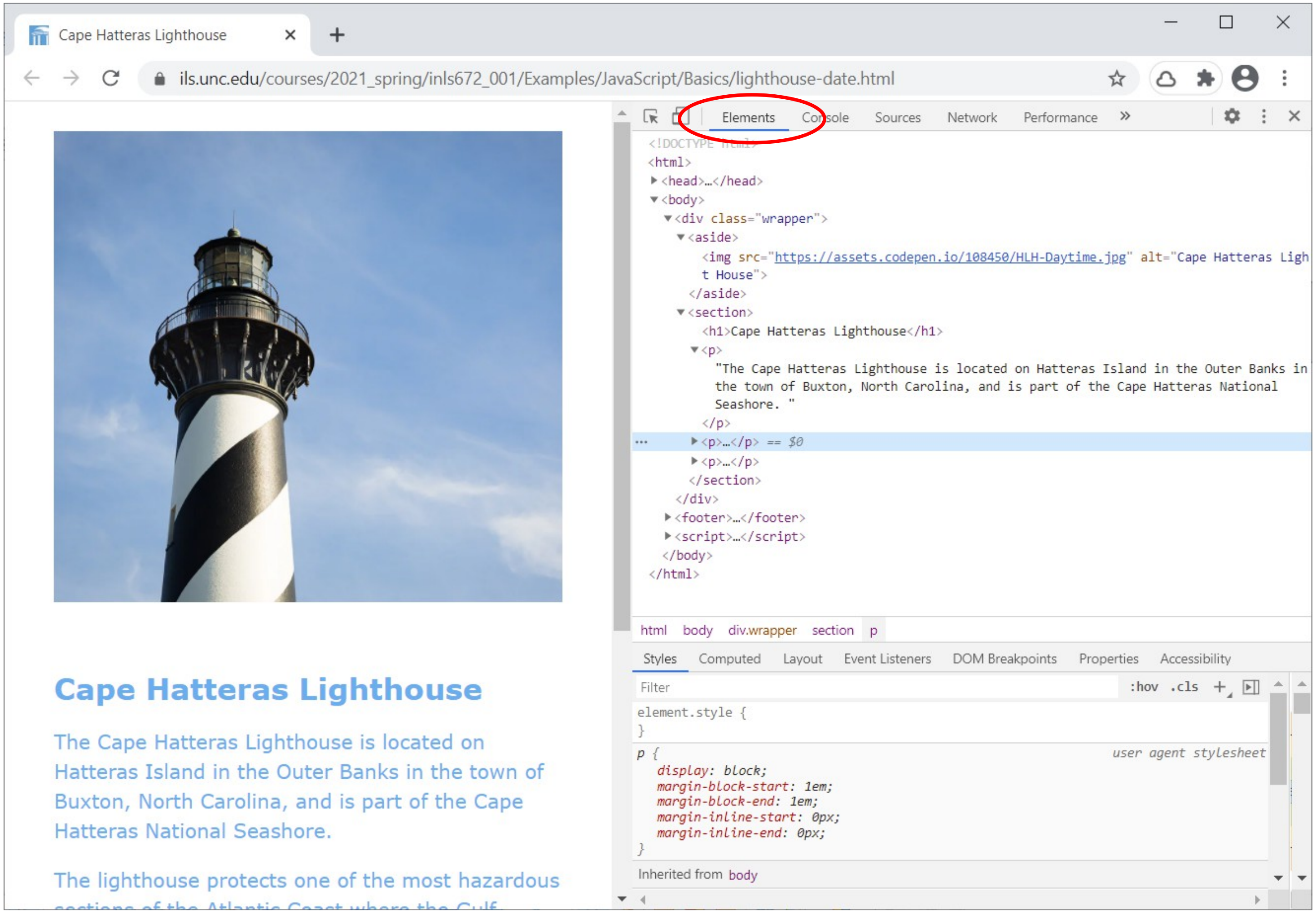
HTML Document

```
<html>
   <head>
      <title>My title</title>
   </head>
   <body>
      <a href="http://mylink.com”>My link</a>
      <h1>My header</h1>
   </body>
</html>
```



w3schools: HTML DOM Tree

Viewing the DOM for a web page



Cape Hatteras Lighthouse

The Cape Hatteras Lighthouse is located on Hatteras Island in the Outer Banks in the town of Buxton, North Carolina, and is part of the Cape Hatteras National Seashore.

The lighthouse protects one of the most hazardous

```
<!DOCTYPE html>
<html>
 ▶<head>…</head>
 ▼<body>
   ▼<div class="wrapper">
     ▼<aside>
        <img src="https://assets.codepen.io/108450/HLH-Daytime.jpg" alt="Cape Hatteras Ligh
        t House">
      </aside>
     ▼<section>
        <h1>Cape Hatteras Lighthouse</h1>
       ▼<p>
          "The Cape Hatteras Lighthouse is located on Hatteras Island in the Outer Banks in
          the town of Buxton, North Carolina, and is part of the Cape Hatteras National
          Seashore. "
        </p>
...    ▶<p>…</p> == $0
       ▶<p>…</p>
      </section>
    </div>
   ▶<footer>…</footer>
   ▶<script>…</script>
  </body>
</html>
```

```
element.style {
}
p {                                                  user agent stylesheet
  display: block;
  margin-block-start: 1em;
  margin-block-end: 1em;
  margin-inline-start: 0px;
  margin-inline-end: 0px;
}
Inherited from body
```

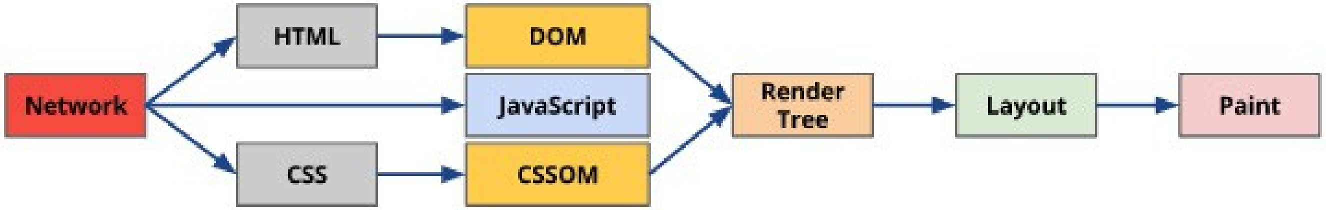
Open the Inspector, and select the Elements tab (default view)

lighthouse-date.html

How browsers process a web page

Your browser is an application that performs many tasks

- Creates a model of a page (DOM and CSSOM)
- Uses a rendering engine to render and lay out your web page based on the HTML document and CSS style rules
- Calls the JavaScript interpreter to run JavaScript code



You have to tell the browser where the JavaScript is located using `<script>` tags

- Tags tell the browser that there is some JavaScript code to run, which it then hands over to the JavaScript interpreter.
- When the interpreter is done, control returns back to the render task

Google Web Fundamentals: Constructing the Object Model

How to include JavaScript in a web page

Two ways

- Embed JavaScript code within your page by delimiting with `<script></script>` tags.

  Similar to embedding CSS with `<style></style>` tags.
- Put JavaScript in a separate file
  - Use `<script>` tags with a `src` attribute that specifies the file
  - Example: `<script src="myJavaScript.js"></script>`

Where to place your `<script></script>` tags?

- Recommendation: at the end of your web page, before `</body>` tag
- Reduces rendering delays and may improve performance

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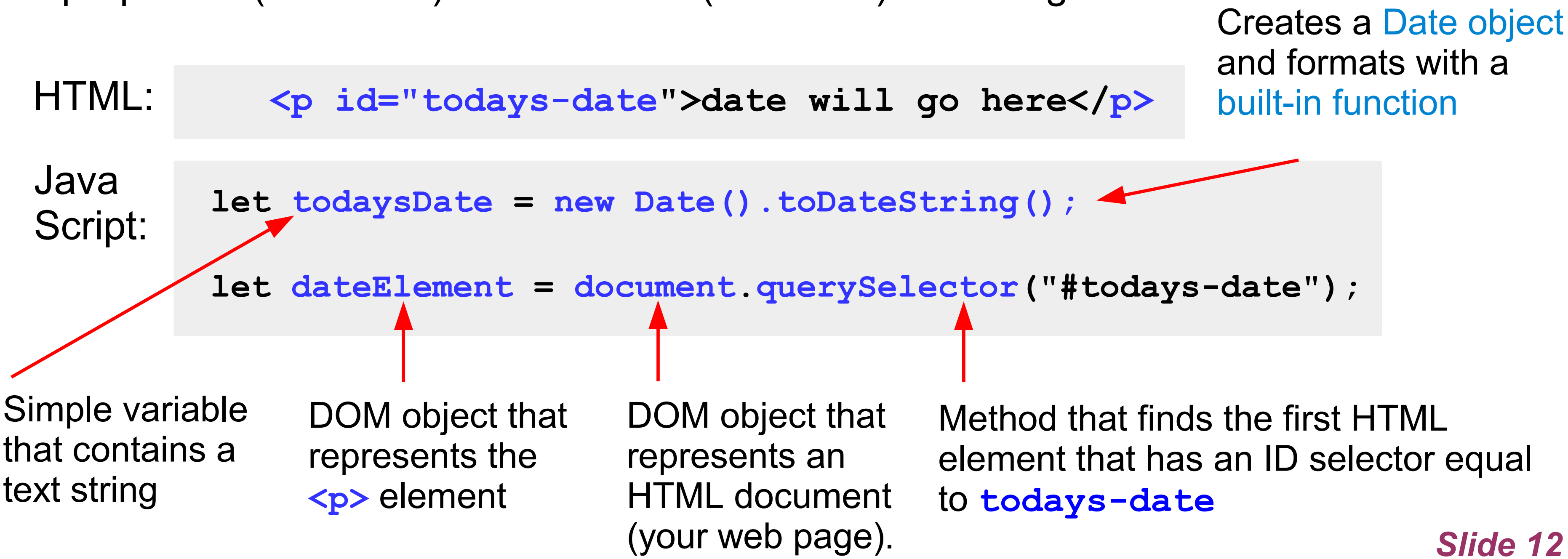
JavaScript Language Concepts

- Objects, variables, and data types
  - Object often represent elements in the Document Object Model (DOM)
  - Variables serve as containers for values
  - Values have a data type: number, string, boolean, DOM element
- Statements: separated by semi-colon (recommended, not required)
- Operators
  - Arithmetic: +, -, *, /, ++, –, %
  - Comparison: ==, !=, >, <, >=, <=
  - Logical: AND (&&), OR (||), and NOT (!)
- Conditionals: if/else statements to evaluate true/false conditions
- Iteration: repeatedly executing statements in a loop
- Functions: built-in or user-defined
- Events: actions that can be detected with JavaScript
  - Clicking buttons, mouse hover, input changes, page loading

JavaScript Objects and Variables

Every programming language uses variables to manage and manipulate data. Many languages also represent information as objects.

- Variables are used to contain information that your script uses , e.g., numbers, text, results of a calculation, or a reference to a DOM element
- The browser stores the values of your variables
- Variables are often declared using the `let` keyword
- Objects are often used to represent more complex kinds of information. They have properties (attributes) and methods (functions) to manage them.



Creates a Date object and formats with a built-in function

HTML:

```
<p id="todays-date">date will go here</p>
```

Java Script:

```
let todaysDate = new Date().toDateString();

let dateElement = document.querySelector("#todays-date");
```

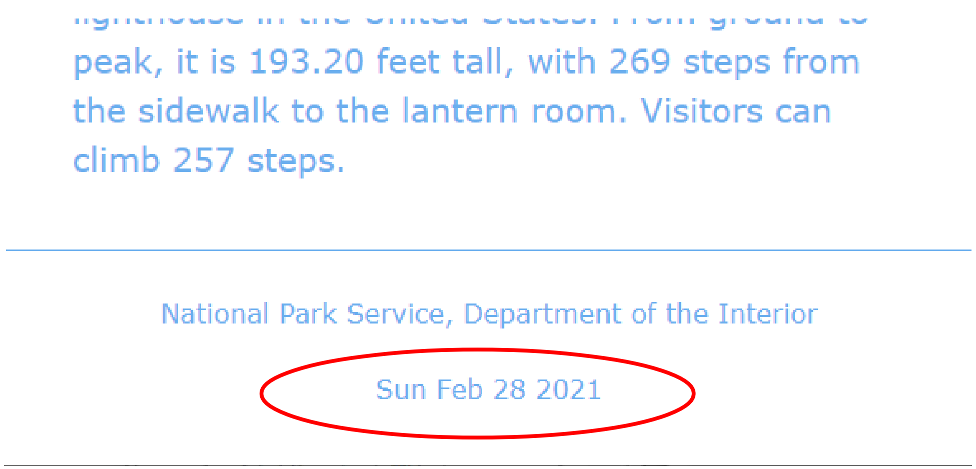
Simple variable that contains a text string

DOM object that represents the `<p>` element

DOM object that represents an HTML document (your web page).

Method that finds the first HTML element that has an ID selector equal to `todays-date`

JavaScript Variables and Modifying Content



lighthouse in the United States. From ground to peak, it is 193.20 feet tall, with 269 steps from the sidewalk to the lantern room. Visitors can climb 257 steps.

National Park Service, Department of the Interior

Sun Feb 28 2021

- `todaysDate` contains the value of the current date
- `querySelector` returns an element with the specified selector
- `dateElement` references the `<p>` element with ID selector, “todays-date”
- `textContent` is a property that represents the content of an HTML element (in this case, <p>)
- Assigning `todaysDate` to `textContent`, changes the `<p>` contents

```
   ...
   <p id="todays-date">date will go here</p>
   <script>
     let todaysDate = new Date().toDateString();
     let dateElement = document.querySelector("#todays-date");
     dateElement.textContent = todaysDate;
   </script>
 </body>
```

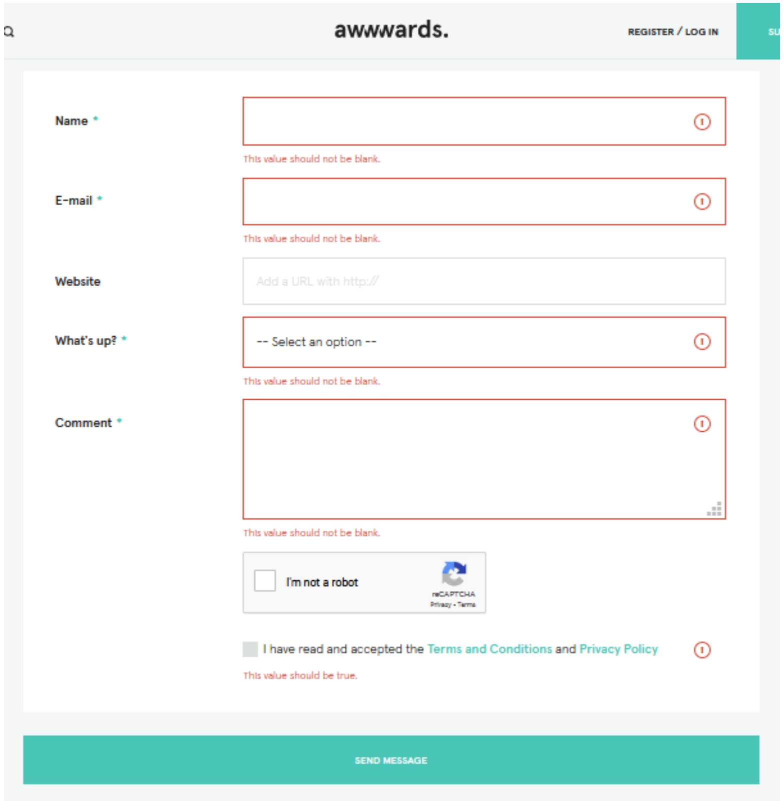
Before script runs

After script runs

```
<p id="todays-date">Sun Feb 28 2021</p>
```

lighthouse-date.html

Using JavaScript to Modify Content and Style



awwwards.

REGISTER / LOG IN

Name *

This value should not be blank.

E-mail *

This value should not be blank.

Website

Add a URL with http://

What's up? *

-- Select an option --

This value should not be blank.

Comment *

This value should not be blank.

□ I'm not a robot

reCAPTCHA
Privacy - Terms

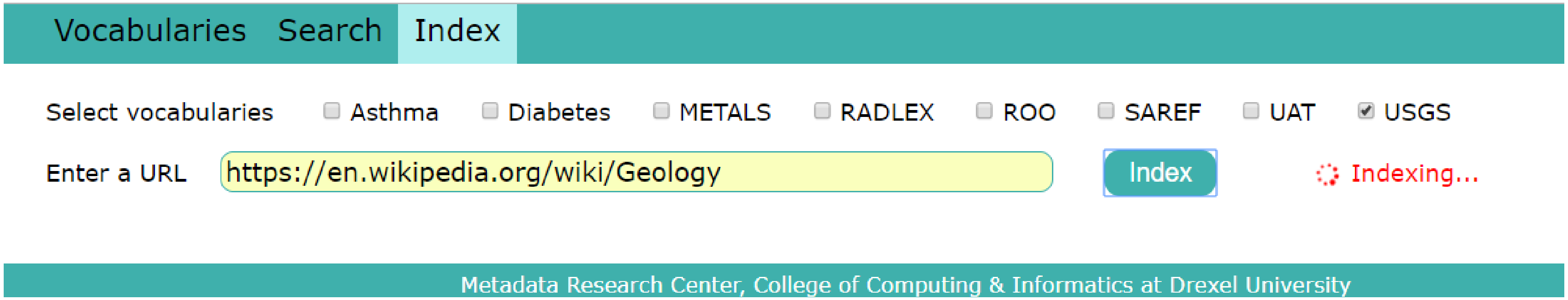
□ I have read and accepted the Terms and Conditions and Privacy Policy

This value should be true.

SEND MESSAGE

Common scenarios

- Provide error messages for invalid form inputs
- Provide user feedback on long running tasks



Vocabularies Search Index

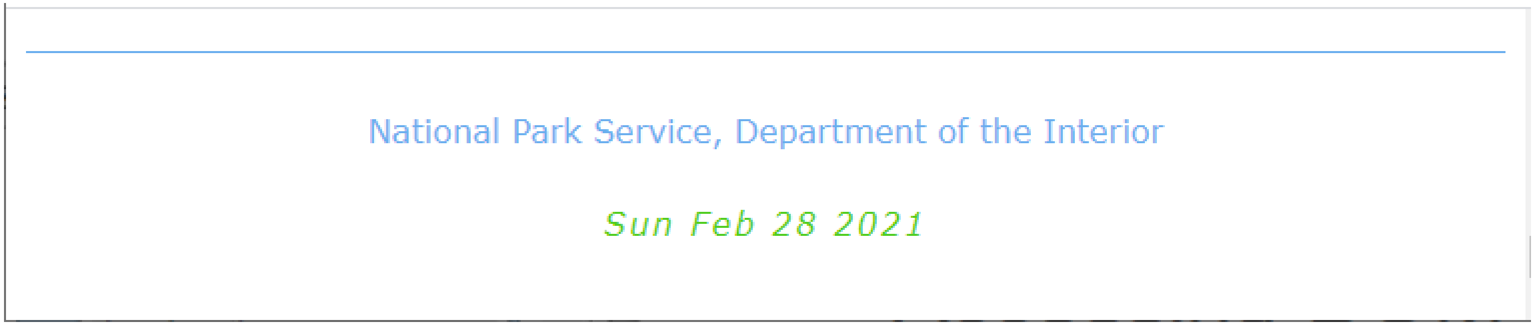
Select vocabularies □ Asthma □ Diabetes □ METALS □ RADLEX □ ROO □ SAREF □ UAT ☑ USGS

Enter a URL https://en.wikipedia.org/wiki/Geology Index Indexing...

Metadata Research Center, College of Computing & Informatics at Drexel University

Accessing DOM to Modify Style

How to change the style of HTML elements



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```
<p id="todays-date"></p>
<script>
   let todaysDate = new Date().toDateString();
   let dateElement = document.querySelector("#todays-date");
   dateElement.textContent = todaysDate;
   dateElement.style.color="limegreen";
   dateElement.style.fontStyle="italic";
   dateElement.style.letterSpacing=".1em";
</script>
```

Change the specified
CSS property for **`dateElement`**

w3schools: HTML DOM Style Object

lighthouse-date-modify-style.html

JavaScript methods that do the same thing

So far, the examples have used the `querySelector` method to obtain a reference to an HTML DOM element, and then saved it in a variable so that it can be modified.

```
<p id="todays-date">date will go here</p>

<script>
   let todaysDate = new Date();
   let dateElement = document.querySelector("#todays-date");
   dateElement.textContent = todaysDate;
</script>
```

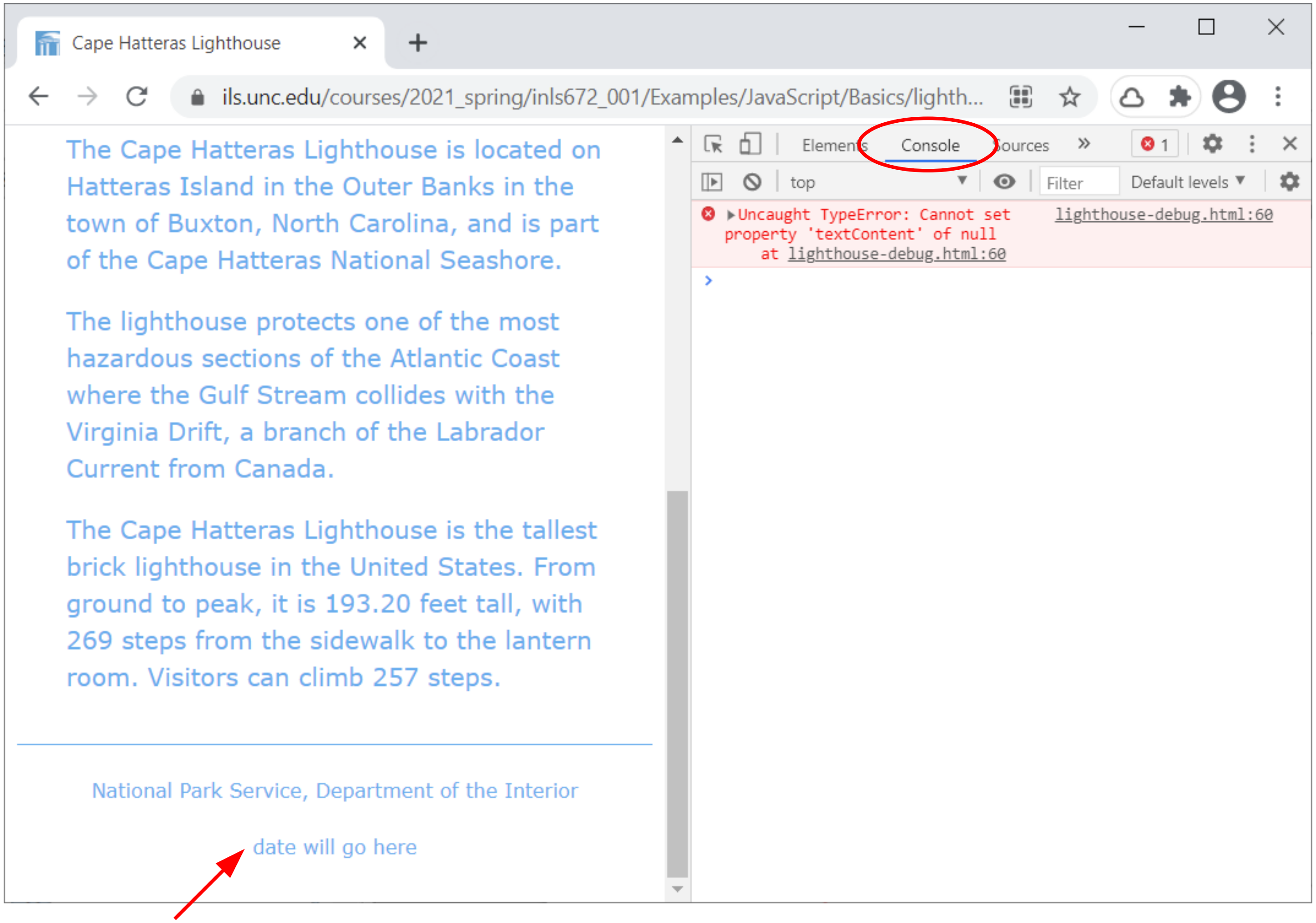
There is another JavaScript method, `getDocumentElementById`, that does the same thing, and you will often see this method used in examples and documentation.

```
<p id="todays-date">date will go here</p>

<script>
   let todaysDate = new Date();
   let dateElement = document.getDocumentElementById("todays-date");
   dateElement.textContent = todaysDate;
</script>
```

Reference: w3Schools HTML DOM querySelector() method

Finding and Fixing JavaScript Problems


Cape Hatteras Lighthouse
ils.unc.edu/courses/2021_spring/inls672_001/Examples/JavaScript/Basics/ligth...
Elements
Console
Sources
top
Filter
Default levels

The Cape Hatteras Lighthouse is located on Hatteras Island in the Outer Banks in the town of Buxton, North Carolina, and is part of the Cape Hatteras National Seashore.

The lighthouse protects one of the most hazardous sections of the Atlantic Coast where the Gulf Stream collides with the Virginia Drift, a branch of the Labrador Current from Canada.

The Cape Hatteras Lighthouse is the tallest brick lighthouse in the United States. From ground to peak, it is 193.20 feet tall, with 269 steps from the sidewalk to the lantern room. Visitors can climb 257 steps.

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date will go here

```
Uncaught TypeError: Cannot set property 'textContent' of null    lighthouse-debug.html:60
    at lighthouse-debug.html:60
```

Problem: no date displayed, just the placeholder text

Open the Inspector, and select the Console tab

lighthouse-debug.html

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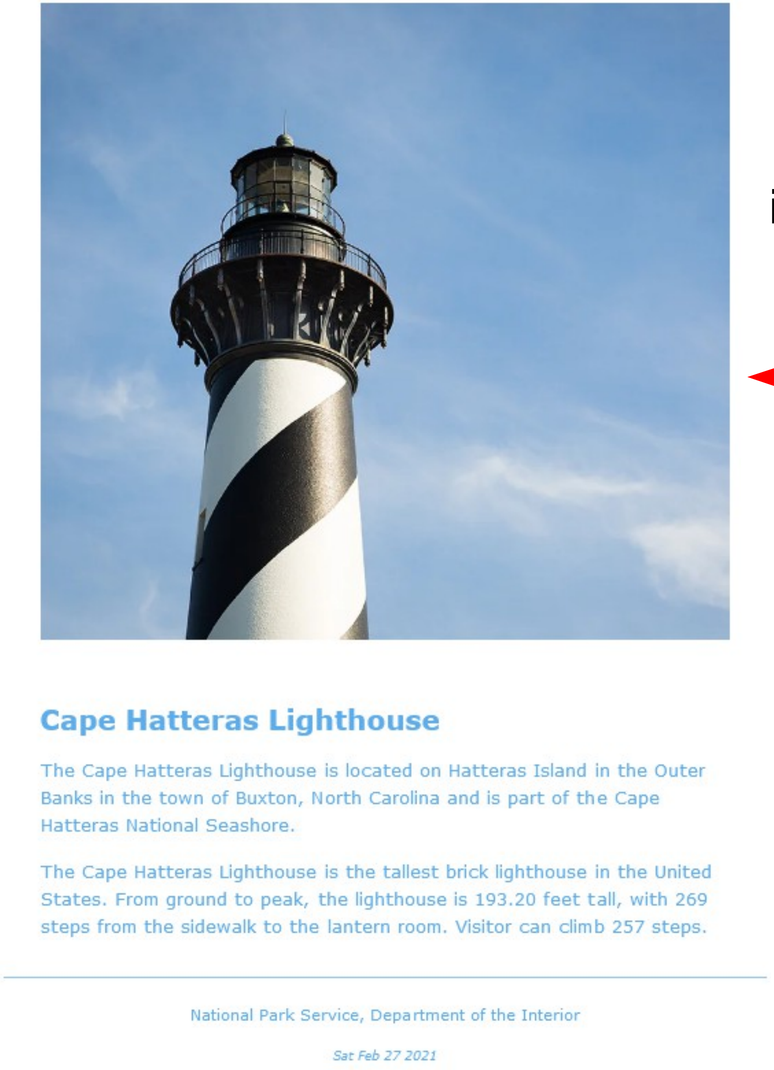
HTML DOM Events

- DOM events allow users to interact with your web page.
- A JavaScript function can be executed when an event occurs
  - Button is clicked
  - Cursor over an element
  - Form input field is changed
  - Web page is loaded
- Events are typically “bound” to a JavaScript function: browser 'listens' for an event, and when it occurs, a function is called to handle the event
  - w3schools: JavaScript HTML DOM EventListener
- Complete list of HTML DOM Events
  - Different types: mouse, keyboard, frame, form, media, touch

DOM Click Event to Change Theme Properties: Image and Colors



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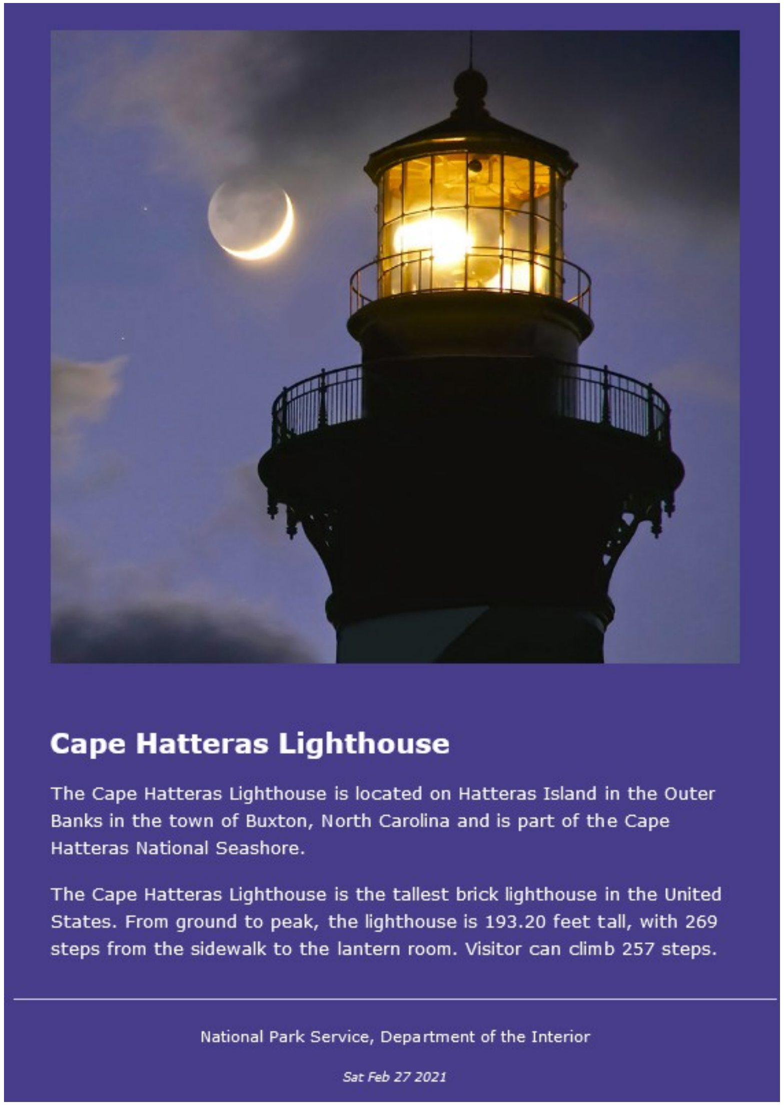
Click image to change theme



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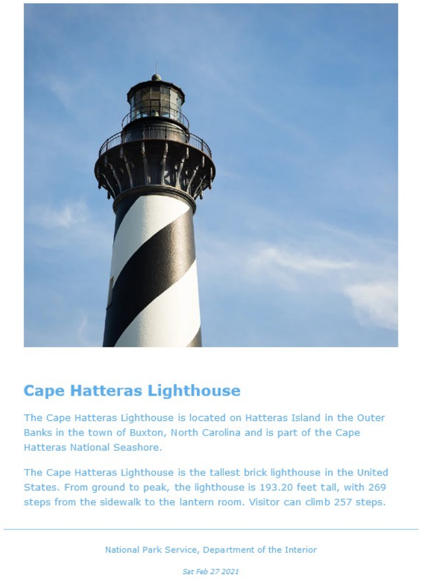
theme-change.html

DOM Click Event to Change Theme Properties



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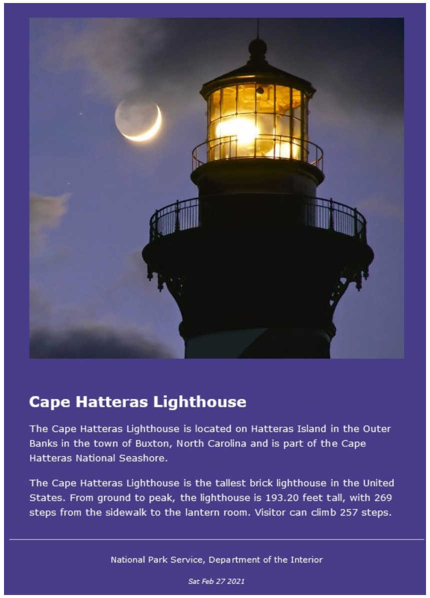

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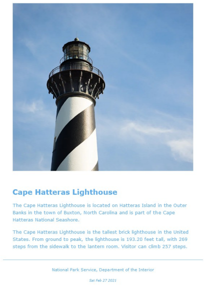
2 theme properties are changed when you click an image:

- Images toggle between daytime and nighttime lighthouse views
- Background and foreground (text) colors toggle between light and dark.
  Initial values for these colors are defined by CSS custom properties (variables)

```
:root {
   --bg-color: white;     /* default 'light' background color */
   --text-color: #5dadec; /* default 'light' foreground (text) color */  }
```

theme-change.html

Changing Themes: How this works



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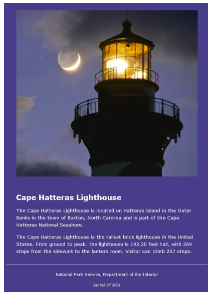

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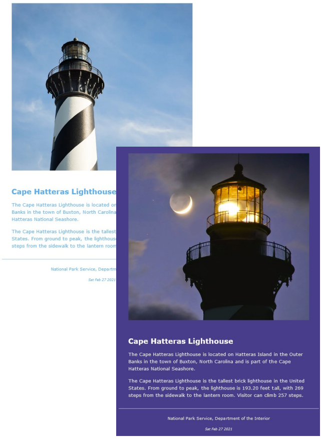
- Since the `<img>` source and `<body>` element colors change, we need to create variables that reference these DOM objects, so we can change their attributes.
- Add a 'click' event listener to the lighthouse image since this is how we want to trigger the theme change. Specify the function, `changeTheme`, that will be called to make the changes.

```
// When an image is clicked, toggle theme
let lighthouse = document.querySelector('img');
let body = document.querySelector('body');
lighthouse.addEventListener('click', changeTheme);


function changeTheme()  {
   // If the 'light' image is currently displayed, change theme to 'dark'
   if (lighthouse.src.match(".../HLH-Daytime.jpg"))  {
      lighthouse.src = ".../HLH-Nighttime.jpg";
      document.documentElement.style.setProperty('--bg-color', 'darkslateblue');
      document.documentElement.style.setProperty('--text-color', 'white');   }
   else {  // Change 'dark' to 'light' theme
      lighthouse.src = “.../HLH-Daytime.jpg";
      document.documentElement.style.setProperty('--bg-color', 'white');
      document.documentElement.style.setProperty('--text-color', '#5dadec');  }
}
```

theme-change.html

Changing Themes: How this works



Cape Hatteras Lighthouse

The Cape Hatteras Lighthouse is located on
Banks in the town of Buxton, North Carolina
Hatteras National Seashore.

The Cape Hatteras Lighthouse is the tallest
States. From ground to peak, the lighthouse
steps from the sidewalk to the lantern room

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Cape Hatteras Lighthouse

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- `changeTheme` determines which theme is currently displayed by checking the `src` attribute of the image. If it is the daytime image then switch to the light theme; otherwise, switch to dark.
- Change the colors by changing the values of the CSS variables – these are properties of the style sheet, so you can use the `document.documentElement.style.setProperty()` method to change colors

```
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let lighthouse = document.querySelector('img');
let body = document.querySelector('body');
lighthouse.addEventListener('click', changeTheme);

function changeTheme()  {
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   if (lighthouse.src.match(".../HLH-Daytime.jpg"))  {
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      document.documentElement.style.setProperty('--bg-color', 'darkslateblue');
      document.documentElement.style.setProperty('--text-color', 'white');   }
   else {  // Change 'dark' to 'light' theme
      lighthouse.src = “.../HLH-Daytime.jpg";
      document.documentElement.style.setProperty('--bg-color', 'white');
      document.documentElement.style.setProperty('--text-color', '#5dadec');  }
}
```

theme-change.html

Changing Themes is an example of a Toggle Pattern

Toggle pattern behaves like a light switch: the switch is either on or off, and its state changes when you flip the switch up or down.

Applying the toggle pattern to an HTML element on your web page allows you to change how the element is displayed when the user clicks it. Very generally, the steps include:

- Identify the element whose attributes are toggled when clicked
- Identify the attributes that will change when the user clicks the element. Initially the attributes are in state A, and after the click, the attributes are in state B.
- Associate a click event with the element, and specify a function to be called when the element is clicked.
    - If the user clicks the element while it is in state A, change it to state B
    - If the user clicks the element while it is in state B, change it to state A