

CSE 391: Web Programming Fundamentals

Today's schedule

Today:

- Keyboard events
- Mobile events
- Simple CSS animations
- Victoria's office hours once **again moved to Friday...**

Friday

- Classes and objects in JavaScript
- `this` keyword and `bind`
- **HW2 due**
- **HW3 assigned**
- Victoria has office hours 2:30 - 4pm

Other JavaScript events?

We've been doing a ton of JavaScript examples that involve `click` events...

Aren't there other types of events?

Other JavaScript events?

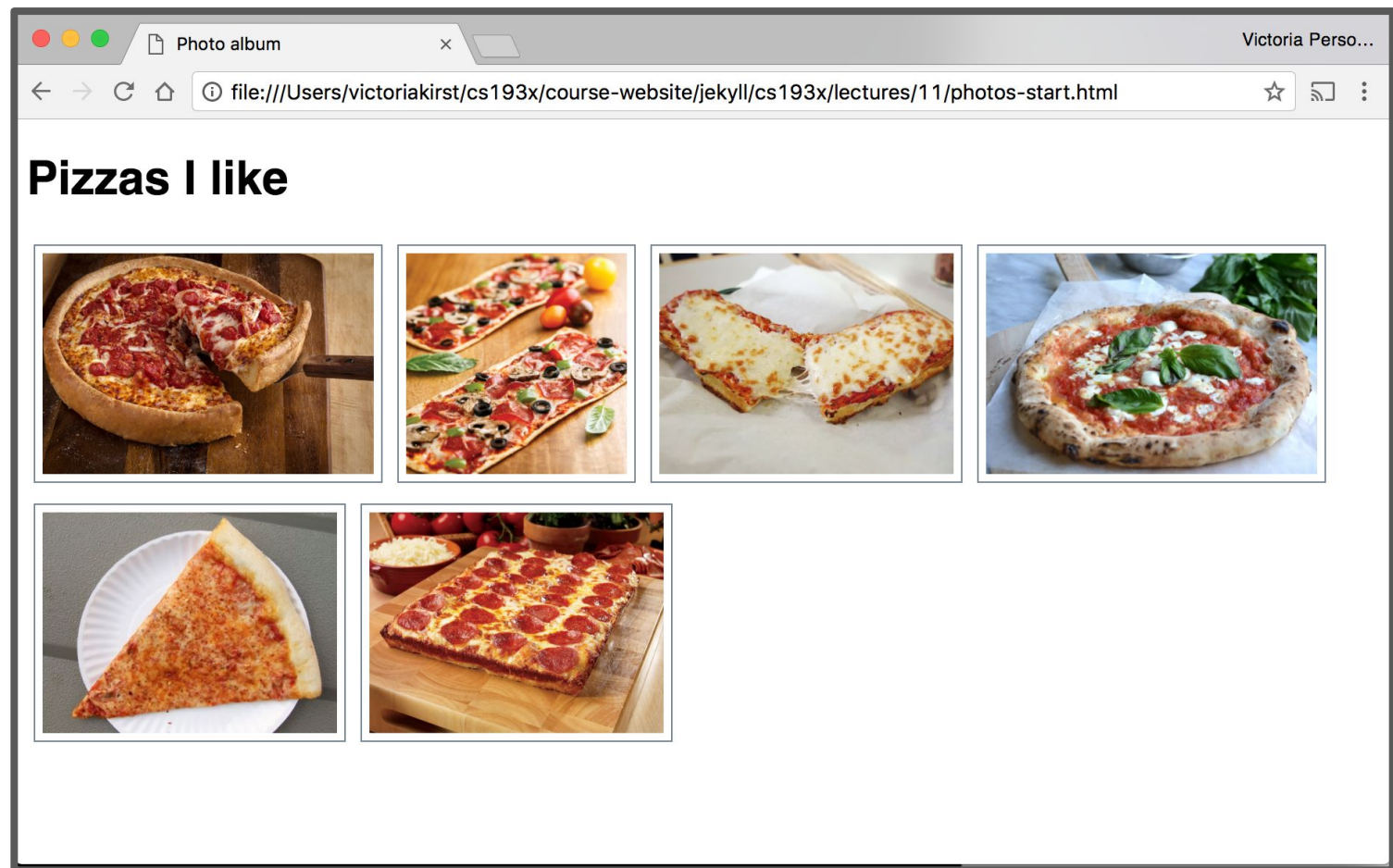
We've been doing a ton of JavaScript examples that involve `click` events...

Aren't there other types of events?

- Of course!
- Today we'll talk about:
 - **Keyboard events**
 - **Pointer / mobile events**
 - (possibly) **Animation events**

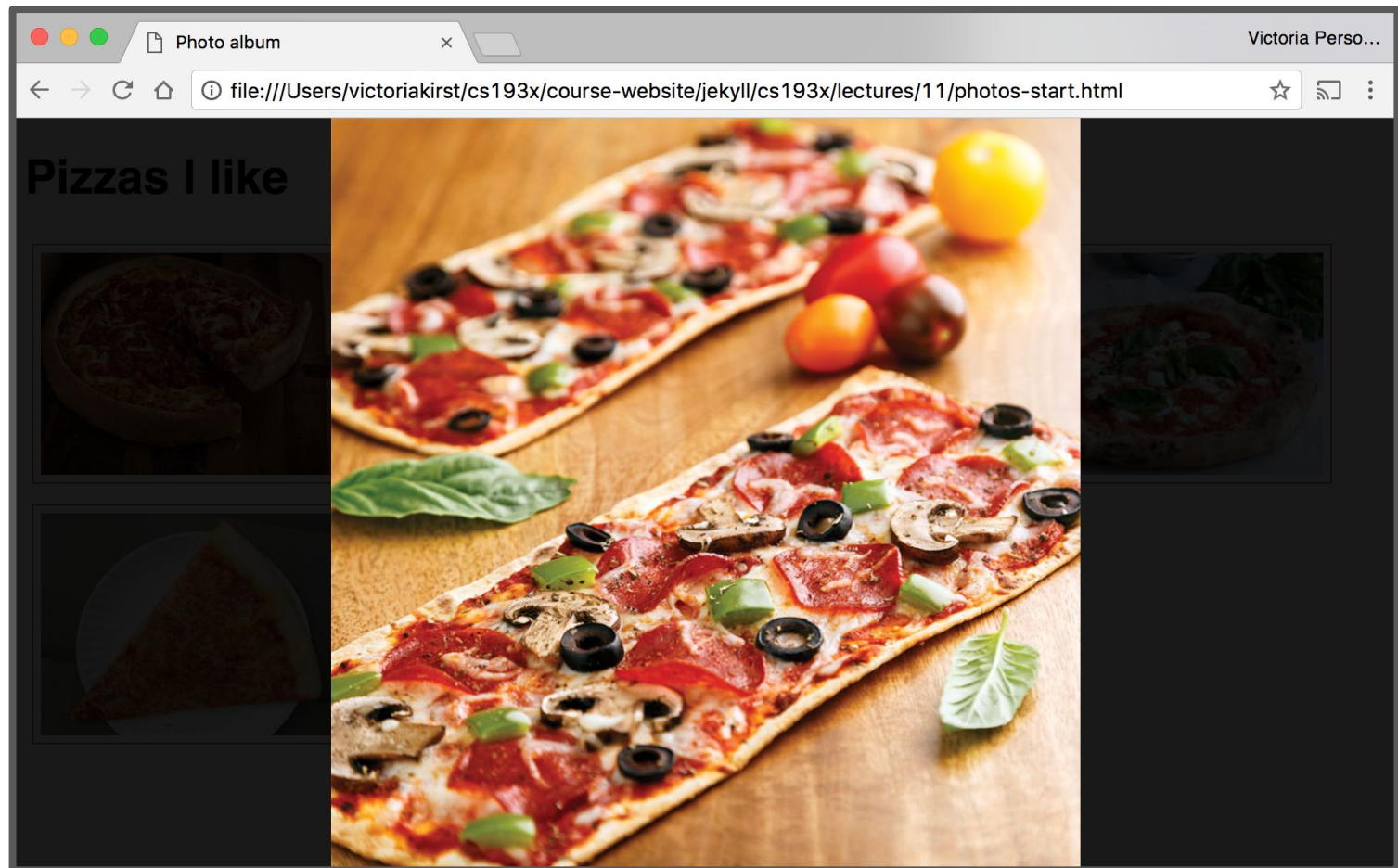
Example: Photo Album

We're going to add a few features to this photo album:



Example: Photo Album

We're going to add a few features to this photo album:



Code walkthrough:

[photo-start.html](#)

[photo.js](#)

[photo.css](#)

General setup

```
<body>
  <h1>Pizzas I like</h1>
  <section id="album-view">
  </section>

  <section id="modal-view" class="hidden">
  </section>
</body>
```

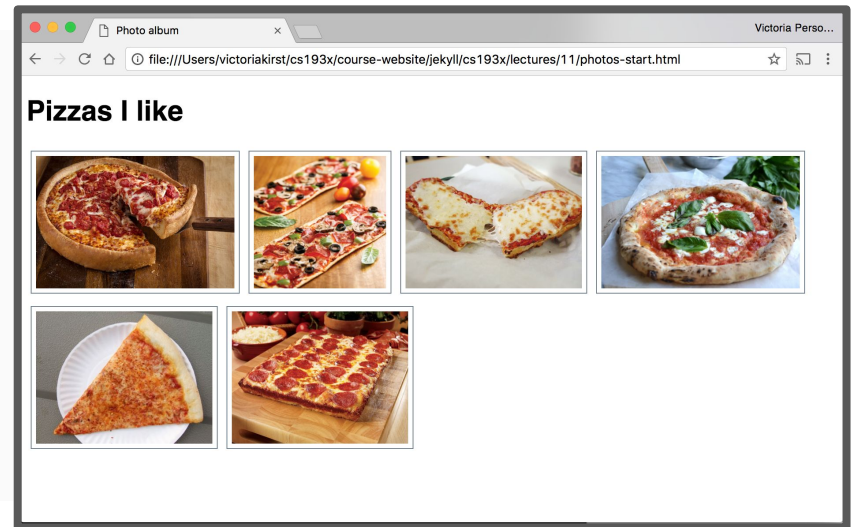
[photo.html](#) contains both "screens":

- The album view: Thumbnails of every photo
- The "[modal](#)" view: A single photo against a semi-transparent black background
 - Hidden by default

CSS: Album

[photo.css](#): The album view CSS is pretty straightforward:

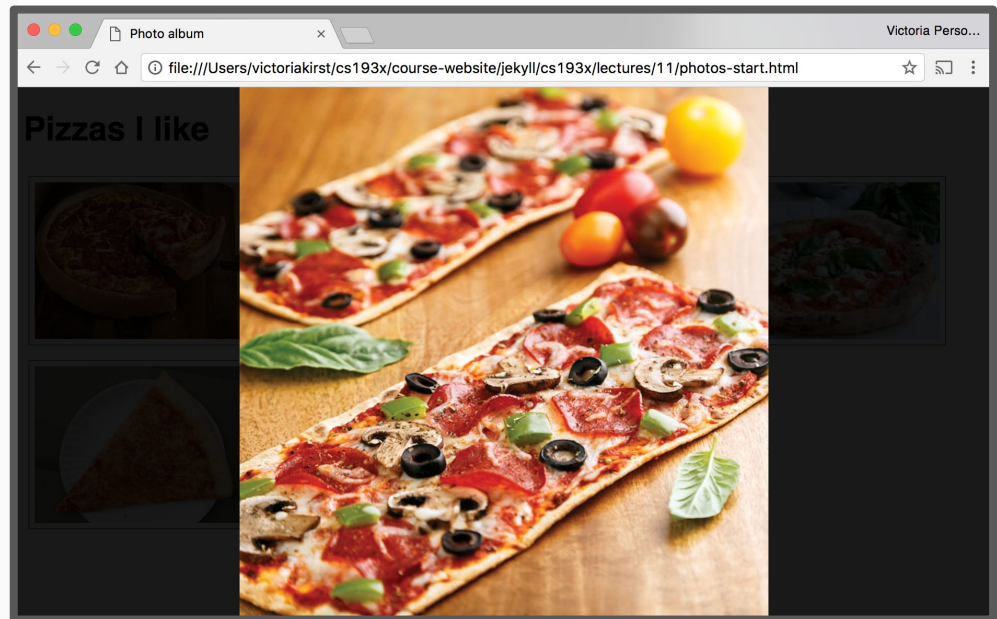
```
#album-view img {  
  border: 1px solid slategray;  
  margin: 5px;  
  padding: 5px;  
  height: 150px;  
}
```



CSS: Modal

Modal view is a little more involved, but all stuff we've learned:

```
#modal-view {  
  position: absolute;  
  top: 0;  
  left: 0;  
  height: 100vh;  
  width: 100vw;  
  
  background-color: rgba(0, 0, 0, 0.9);  
  z-index: 2;  
  
  display: flex;  
  justify-content: center;  
  align-items: center;  
}
```



CSS: Modal image

```
#modal-view img {  
  max-height: 100%;  
  max-width: 100%;  
}
```

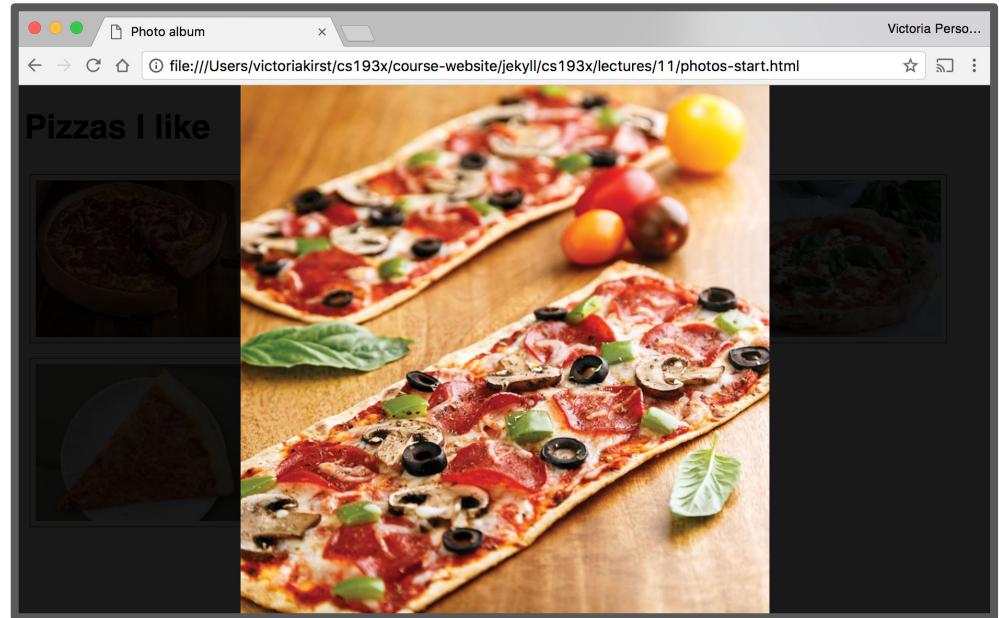


Image sizes are constrained to the height and width of the parent, `#modal-view` (whose height and width are set to the size of the viewport)

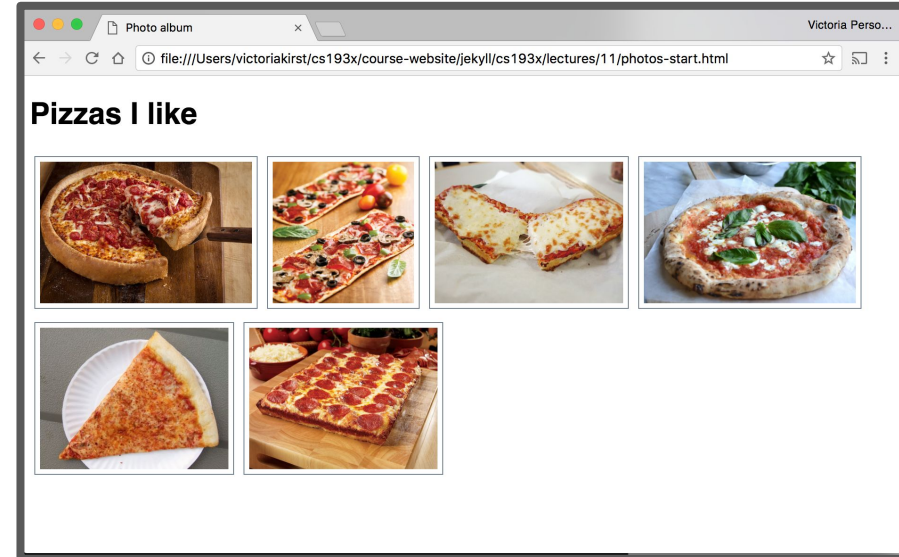
CSS: Hidden modal

```
<body>
  <h1>Pizzas I like</h1>
  <section id="album-view">

  </section>

  <section id="modal-view" class="hidden">
  </section>
</body>
```

```
#modal-view.hidden {
  display: none;
}
```



Even though both the album view and modal view are in the HTML, the modal view is set to `display: none;` so it does not show up.

Global List of Photos

```
<head>
  <meta charset="utf-8">
  <title>Photo album</title>
  <link rel="stylesheet" href="css/photo.css">
  <script src="js/photo-list.js" defer></script>
  <script src="js/photo.js" defer></script>
</head>
```

```
const PHOTO_LIST = [
  'images/deepdish.jpg',
  'images/flatbread.jpg',
  'images/frenchbread.jpg',
  'images/neapolitan.jpg',
  'images/nypizza.jpg',
  'images/squarepan.jpg'
];
```

[photo-list.js](#): There is a global array with the list of string photo sources called PHOTO_LIST.

Photo thumbnails

```
function createImage(src) {  
  const image = document.createElement('img');  
  image.src = src;  
  return image;  
}
```

```
const albumView = document.querySelector('#album-view');  
for (let i = 0; i < PHOTO_LIST.length; i++) {  
  const photoSrc = PHOTO_LIST[i];  
  const image = createImage(photoSrc);  
  image.addEventListener('click', onThumbnailClick);  
  albumView.appendChild(image);  
}
```

[photo.js](#): We populate the initial album view by looping over PHOTO_LIST and appending s to the #album-view.


Clicking a photo

```
function onThumbnailClick(event) {  
  const image = createImage(event.currentTarget.src);  
  modalView.appendChild(image);  
  modalView.classList.remove('hidden');  
}
```

When the user clicks a thumbnail:

- We create another `` tag with the same src
- We append this new `` to the `#modal-view`
- We unhide the `#modal-view`

Positioning the modal



```
function onThumbnailClick(event) {  
    const image = createImage(event.currentTarget.src);  
    modalView.style.top = window.pageYOffset + 'px';  
    modalView.appendChild(image);  
    modalView.classList.remove('hidden');  
}
```

We'll add another line of JavaScript to anchor our modal dialog to the top of the viewport, not the top of the screen:

```
modalView.style.top = window.pageYOffset + 'px';
```

(See [window.pageYOffset mdn](https://developer.mozilla.org/en-US/docs/Web/API/Window.pageYOffset))

Aside: style attribute

Every [HTMLElement](#) has a [style](#) attribute that lets you set a style directly on the element:

```
element.style.top = window.pageYOffset + 'px';
```

Generally **you should not use the style property**, as adding and removing classes via [classList](#) is a better way to change the style of an element via JavaScript

But when we are setting a CSS property based on JavaScript values, we must set the `style` attribute directly.

No scroll on page



```
function onThumbnailClick(event) {  
  const image = createImage(event.currentTarget.src);  
  document.body.classList.add('no-scroll');  
  modalView.style.top = window.pageYOffset + 'px';  
  modalView.appendChild(image);  
  modalView.classList.remove('hidden');  
}
```

```
.no-scroll {  
  overflow: hidden;  
}
```

And we'll also set `body { overflow: hidden; }` as a way to disable scroll on the page.

Closing the modal dialog

```
function onModalClick() {  
    document.body.classList.remove('no-scroll');  
    modalView.classList.add('hidden');  
    modalView.innerHTML = '';  
}
```

```
const modalView = document.querySelector('#modal-view');  
modalView.addEventListener('click', onModalClick);
```

When the user clicks the modal view:

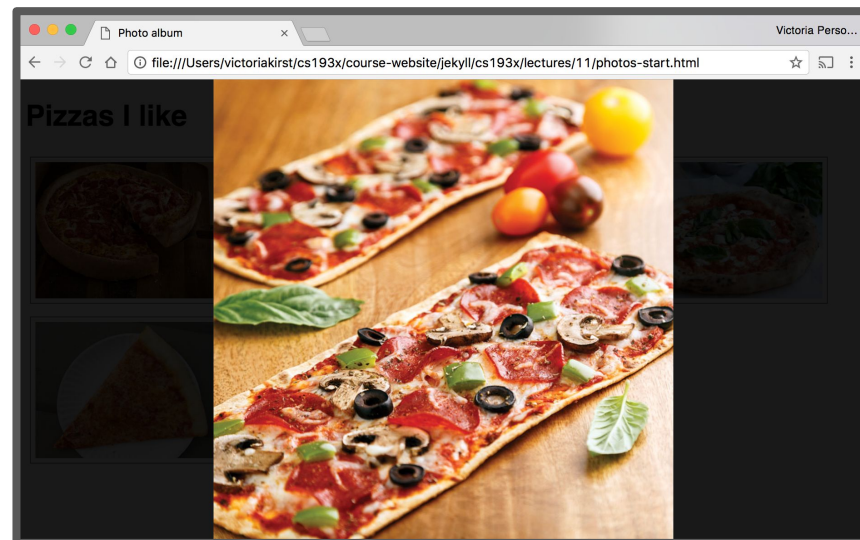
- We hide the modal view again
- We enable scroll on the page again
- We clear the image we appended to it by setting
 `innerHTML = ''`;

Adding keyboard navigation

Navigating photos

Let's add some keyboard events to navigate between photos in the Modal View:

- Left arrow: Show the "i - 1"th picture
- Right arrow: Show the "i + 1"th picture
- Escape key: Close dialog



How do we listen
to keyboard events?

Keyboard events

| Event name | Description |
|------------|--|
| keydown | Fires when any key is pressed. Continues firing if you hold down the key. (mdn) |
| keypress | Fires when any character key is pressed, such as a letter or number. Continues firing if you hold down the key. (mdn) |
| keyup | Fires when you stop pressing a key. (mdn) |

You can listen for keyboard events by adding the event listener to document:

```
document.addEventListener('keyup', onKeyUp);
```

KeyboardEvent.key

```
function onKeyUp(event) {  
    console.log('onKeyUp: ' + event.key);  
}  
document.addEventListener('keyup', onKeyUp);
```

Functions listening to a key-related event receive a parameter of [KeyboardEvent](#) type.

The KeyboardEvent object has a [key](#) property, which stores the string value of the key, such as "Escape"

- [List of key values](#)

Useful key values

| Key string value | Description |
|------------------|---------------------|
| "Escape" | The Escape key |
| "ArrowRight" | The right arrow key |
| "ArrowLeft" | The left arrow key |

Example: [key-events.html](#)

Let's finish the feature!

Finished result:
[photo-desktop-finished.html](#)

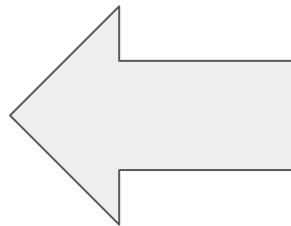
Mobile?

Keyboard events work well on desktop, but keyboard navigation doesn't work well for mobile.

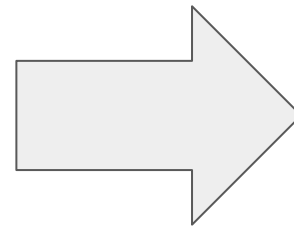


On your phone, you can usually navigate photo albums using **gestures**:

- **Left swipe** reveals the next photo
- **Right swipe** reveals the previous photo



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Mobile?

Keyboard events work well on desktop, but keyboard navigation doesn't work well for mobile.



On your phone, you can usually navigate photo albums using **gestures**:

- **Left swipe** reveals the next photo
- **Right swipe** reveals the previous photo

How do we implement the swipe gesture on the web?

Custom swipe events

- There are no gesture events in JavaScript (yet).
- That means there is no "Left Swipe" or "Right Swipe" event we can listen to. (Note that [drag](#) does not do what we want, nor does it work on mobile)

To get this behavior, we must implement it ourselves.

To do this, it's helpful to learn about a few more JS events:

- MouseEvent
- TouchEvent
- PointerEvent

MouseEvent

| Event name | Description |
|------------------|---|
| click | Fired when you click and release (mdn) |
| mousedown | Fired when you click down (mdn) |
| mouseup | Fired when when you release from clicking (mdn) |
| mousemove | Fired repeatedly as your mouse moves (mdn) |

***mousemove** only works on desktop, since there's no concept of a mouse on mobile.

TouchEvent

| Event name | Description |
|------------------|--|
| touchstart | Fired when you touch the screen (mdn) |
| touchend | Fired when you lift your finger off the screen (mdn) |
| touchmove | Fired repeatedly while you drag your finger on the screen (mdn) |
| touchcancel | Fired when a touch point is "disrupted" (e.g. if the browser isn't totally sure what happened) (mdn) |

***touchmove** only works on mobile ([example](#))

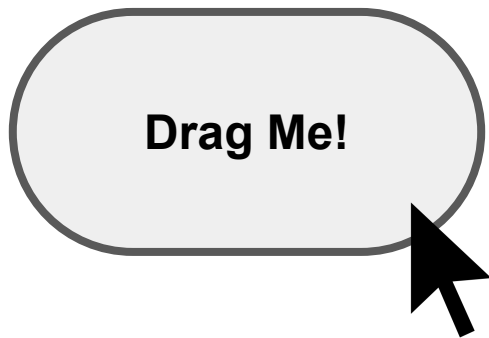
clientX and clientY

```
function onClick(event) {  
    console.log('x' + event.clientX);  
    console.log('y' + event.clientY);  
}  
element.addEventListener('click', onClick);
```

MouseEvents have a `clientX` and `clientY` :

- `clientX`: x-axis position relative to the left edge of the browser viewport
- `clientY`: y-axis position relative to the top edge of the browser viewport

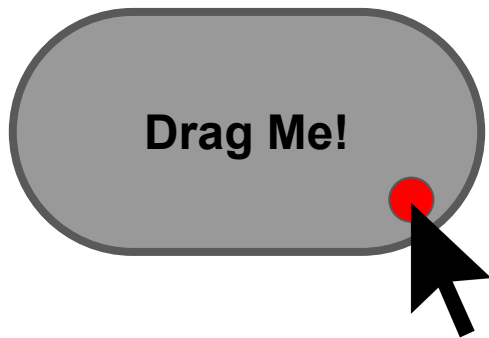
Implementing drag



When a user clicks down/touches
an element...

Implementing drag

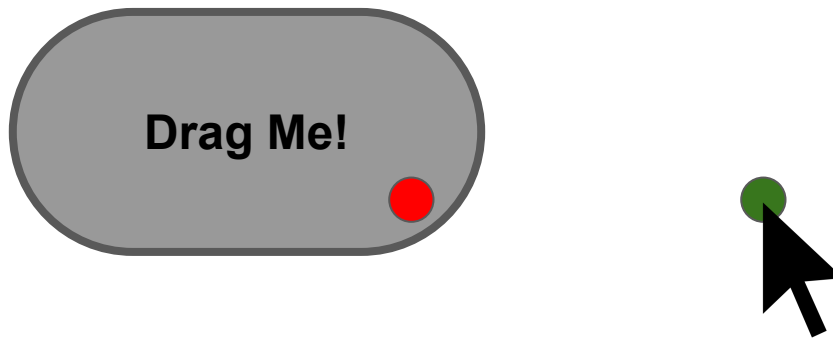
```
originX = 100;
```



Take note of the starting position.

Implementing drag

```
originX = 100;  
newX = 150;
```



Then on mousemove / touchmove, make note of the new mouse position

Implementing drag

```
originX = 100;  
newX = 150;
```



Move the element by the difference between the old and new positions.

Implementing drag



Then on release...

Implementing drag



... stop listening to mousemove /
touchmove.

Dragging on mobile and desktop

Wouldn't it be nice if we didn't have to listen to different events for mobile and desktop?

PointerEvent

PointerEvent: "pointer" events that work the same with for both mouse and touch

- Not to be confused with pointer-events CSS property (completely unrelated)
- **Note:** In this case, Mozilla's documentation on PointerEvent is not great.
 - [A Google blog post on PointerEvent](#)

PointerEvent inherits from MouseEvent, and therefore has clientX and clientY

PointerEvent

| Event name | Description |
|---------------------------------|--|
| <code>pointerdown</code> | Fired when a "pointer becomes active" (touch screen or click mouse down) (mdn) |
| <code>pointerup</code> | Fired when a pointer is no longer active (mdn) |
| <code>pointermove</code> | Fired repeatedly while the pointer moves (mouse move or touch drag) (mdn) |
| <code>pointercancel</code> | Fired when a pointer is "interrupted" (mdn) |

***pointermove** works on mobile and desktop!

... Except...

Our first controversial feature!

PointerEvent is **not** implemented on all browsers yet:

- Firefox implementation is [in progress](#)
- Safari outright opposes this API... [since 2012](#).

Argh!!! Does this mean we can't use it?

Polyfill library

A [polyfill library](#) is code that implements support for browsers that do not natively implement a web API.

Luckily there is a polyfill library for PointerEvent:

<https://github.com/jquery/PEP>

PointerEvent Polyfill

To use the [PEP polyfill library](#), we add this script tag to our HTML:

```
<script src="https://code.jquery.com/pep/0.4.1/pep.js"></script>
```

And we'll add need to add touch-action="none" to the area where we want PointerEvents to be recognized*:

```
<section id="photo-view" class="hidden" touch-action="none">  
</section>
```

*Technically what this is doing is it is telling the browser that we do not want the default touch behavior for children of this element, i.e. on a mobile phone, we don't want to recognize the usual "pinch to zoom" type of events because we will be intercepting them via PointerEvent. This is normally a [CSS property](#), but the [limitations of the polyfill library](#) requires this to be an HTML attribute instead.

Moving an element

We are going to use the [transform](#) CSS property to move the element we are dragging from its original position:

```
originX = 100;  
newX = 150;  
delta = newX - originX;
```



```
element.style.transform = 'translateX(' + delta + 'px)';
```

transform

[transform](#) is a strange but powerful CSS property that allow you to translate, rotate, scale, or skew an element.

| | |
|---|---|
| <code>transform: translate(<i>x</i>, <i>y</i>)</code> | Moves element relative to its natural position by <i>x</i> and <i>y</i> |
| <code>transform: translateX(<i>x</i>)</code> | Moves element relative to its natural position horizontally by <i>x</i> |
| <code>transform: translateY(<i>y</i>)</code> | Moves element relative to its natural position vertically by <i>y</i> |
| <code>transform: rotate(<i>deg</i>)</code> | Rotates the element clockwise by <i>deg</i> |
| <code>transform: rotate(10deg) translate(5px, 10px);</code> | Rotates an element 10 degrees clockwise, moves it 5px down, 10px right |

[Examples](#)

translate vs position

Can't you use relative or absolute positioning to get the same effect as translate? What's the difference?

- translate is much faster
- translate is optimized for animations

See comparison ([article](#)):

- [Absolute positioning](#) (click "10 more macbooks")
- [transform: translate](#) (click "10 more macbooks")

Finally, let's code!

preventDefault()

On desktop, there's a default behavior for dragging an image, which we need to disable with

[event.preventDefault\(\)](#):

```
function startDrag(event) {  
    event.preventDefault();  
}
```

setPointerCapture()

To listen to pointer events that occur when the pointer goes offscreen, call [setPointerCapture](#) on the target you want to keep tracking:

```
event.target.setPointerCapture(event.pointerId);
```

style attribute

Every [HTMLElement](#) also has a [style](#) attribute that lets you set a style directly on the element:

```
element.style.transform =  
    'translateX(' + value + ')';
```

Generally **you should not use the style property**, as adding and removing classes via [classList](#) is a better way to change the style of an element via JavaScript

But when we are dynamically calculating the value of a CSS property, we have to use the style attribute.

style attribute

The `style` attribute has **higher precedence** than any CSS property.

To undo a style set via the `style` attribute, you can set it to the empty string:

```
element.style.transform = '';
```

Now the element will be styled according to any rules in the CSS file(s).

(requestAnimationFrame)

(We are missing one key piece of getting smooth dragging motion, which is: [requestAnimationFrame](#))

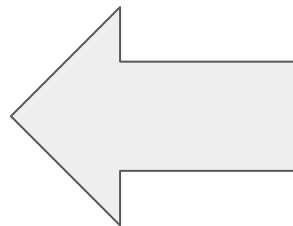
However, using requestAnimationFrame well requires us to know a little bit more about the JavaScript event loop. Functional programming also helps. We'll get there next week!)

CSS animations

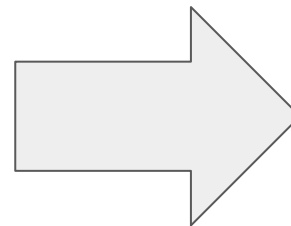
Softening the edges

Our photo album feels a little jerky still. We can make the UI feel a little smoother if we added some animations.

- The image should **slide in from the left** if we are going to the previous picture
- The image should **slide in from the right** if we are going to the next picture



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CSS animations syntax

```
@keyframes animation-name {  
  from {  
    CSS styles  
  }  
  to {  
    CSS styles  
  }  
}
```

[Examples](#)

Then set the following CSS property:

```
animation: animation-name duration;
```

Easier example: Fade in

```
#album-view img {  
  animation: fadein 0.5s;  
}
```

```
@keyframes fadein {  
  from {  
    opacity: 0;  
  }  
  to {  
    opacity: 1;  
  }  
}
```

Finished result:
[photo-mobile-finished.html](#)