CS193X: Web Programming Fundamentals

Spring 2017

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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?

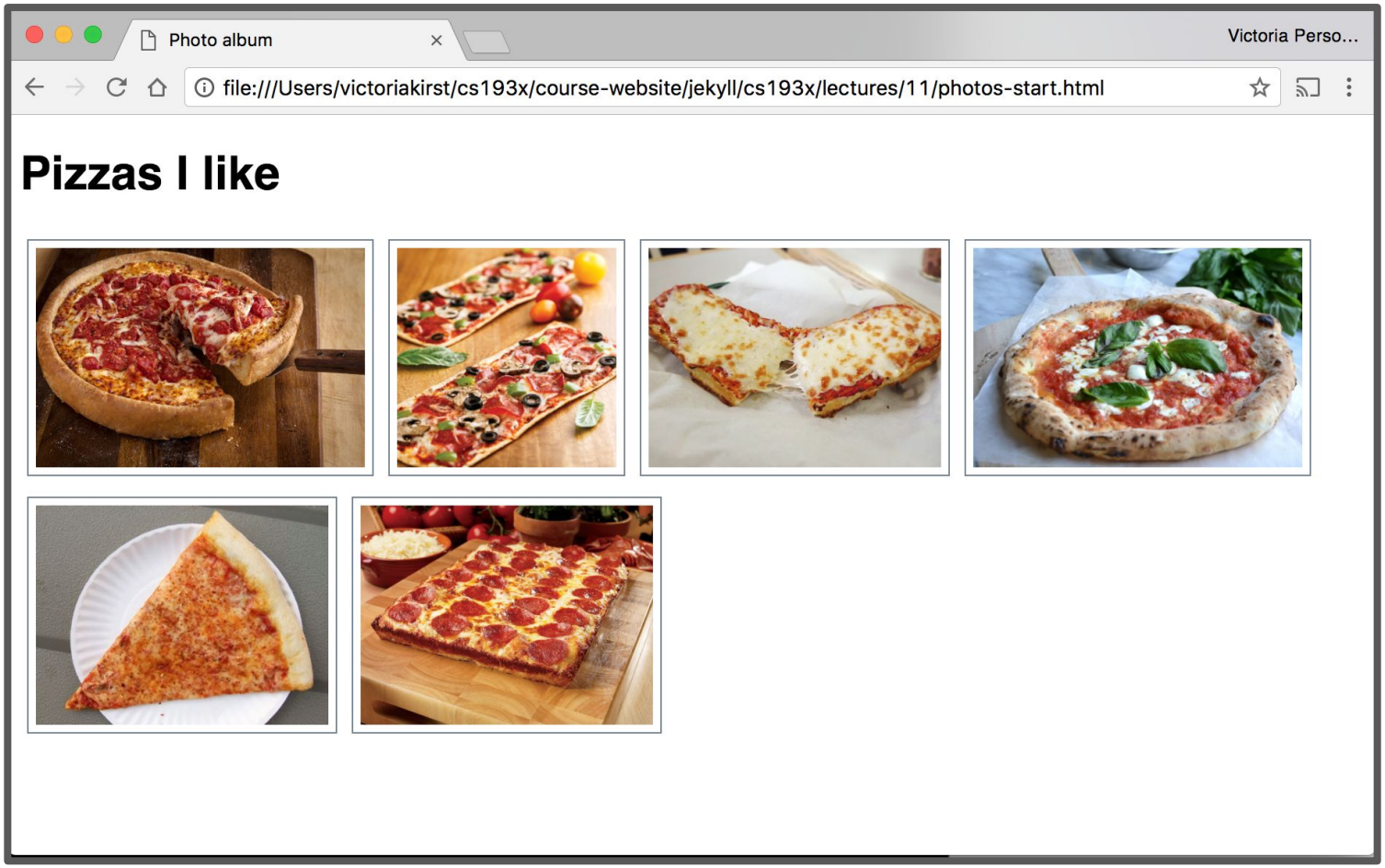
We've been doing a ton of JavaScript examples that involve `click` events...

Aren't there other types of events?

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

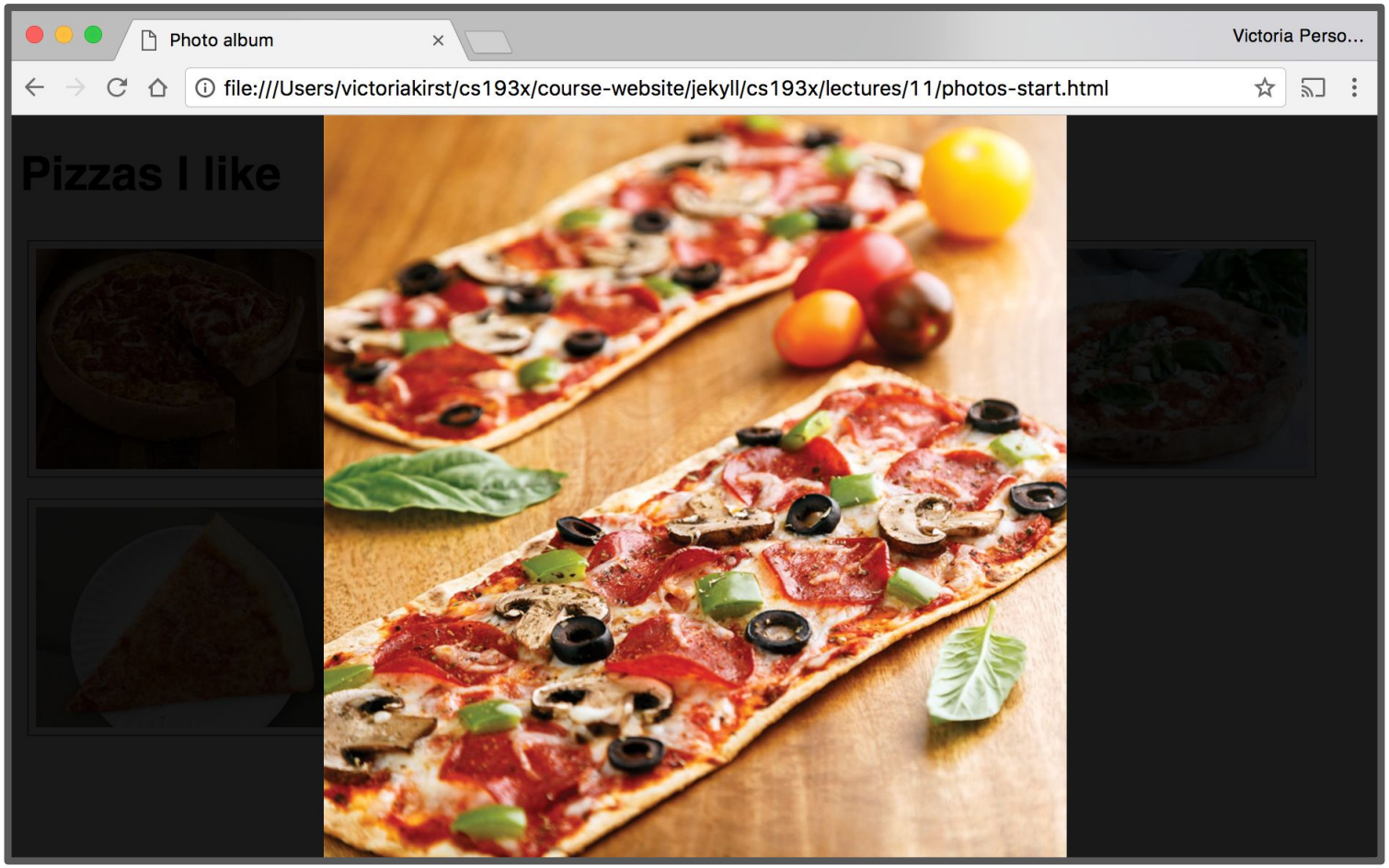
Example: Photo Album

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>
```

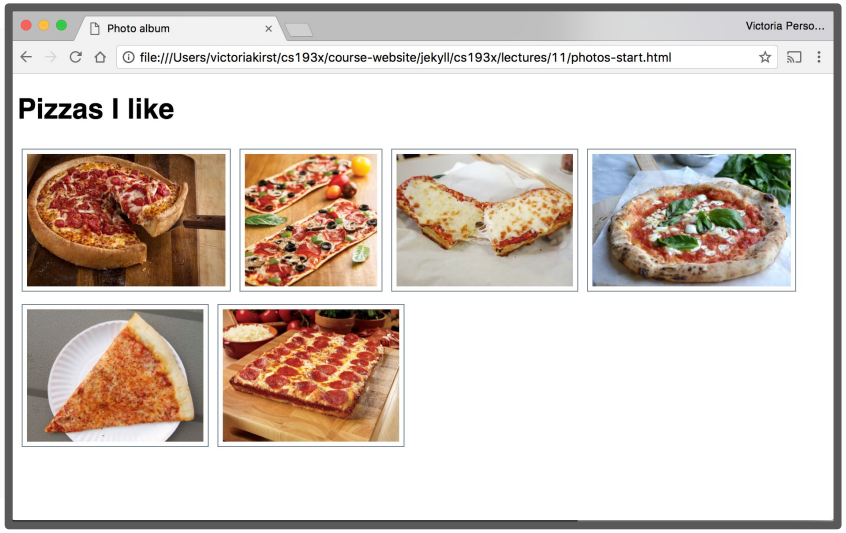
photo.html contains both "screens":

- 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:

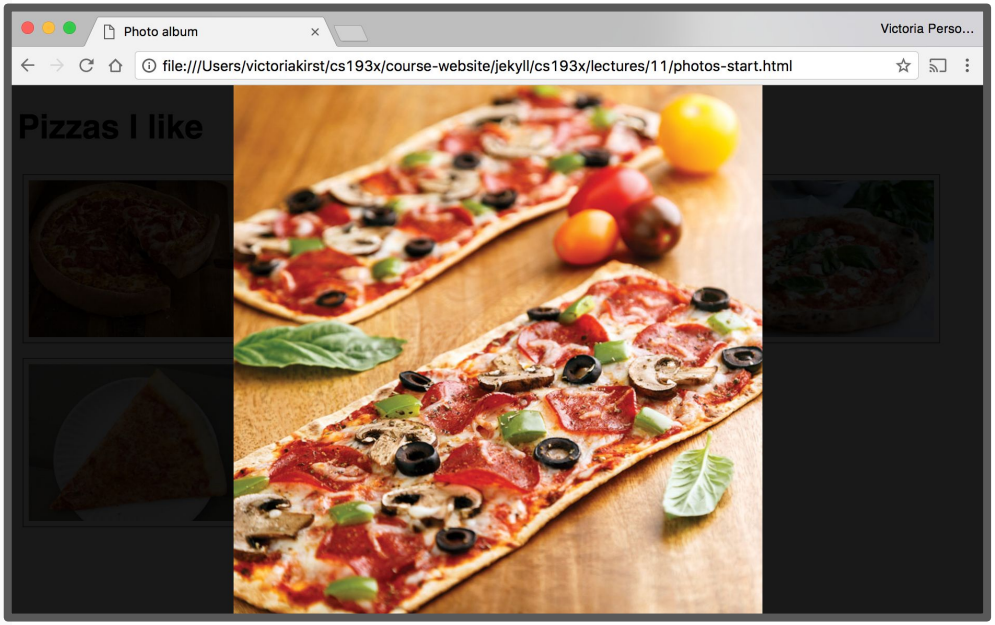
```
#album-view img {
  border: 1px solid slategray;
  margin: 5px;
  padding: 5px;
  height: 150px;
}
```



CSS: Modal

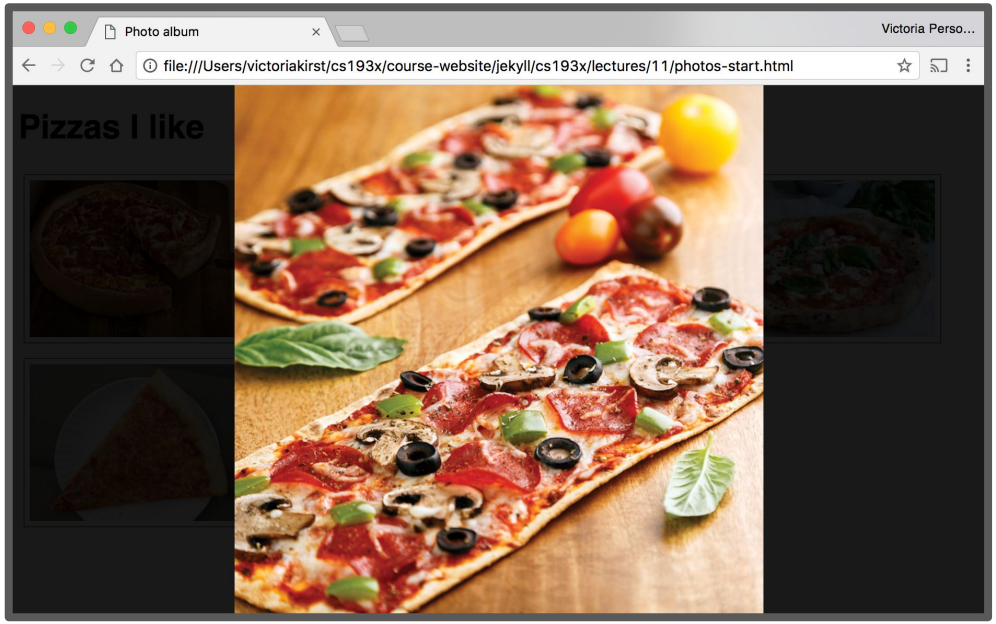
Modal view is a little more involved, but all stuff we've learned:

```
#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%;
}
```

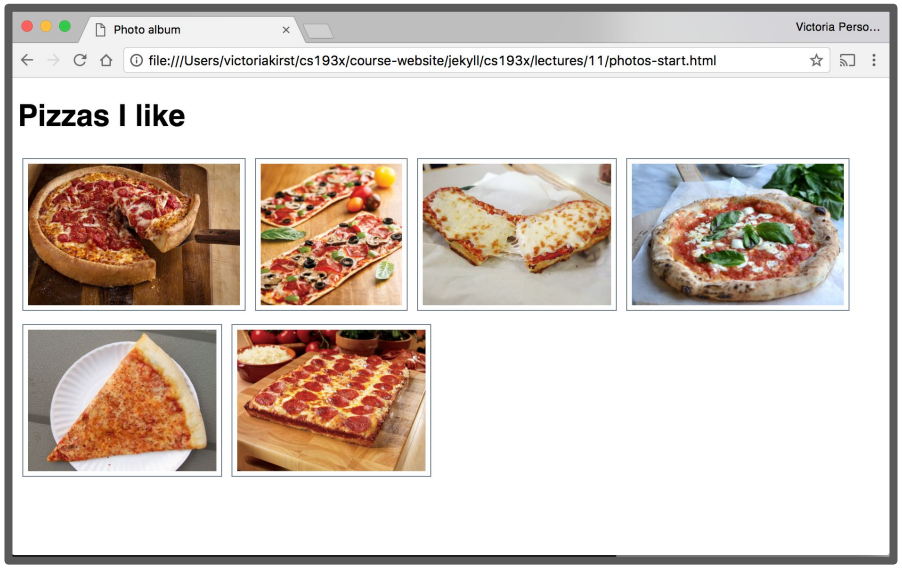


- Image sizes are constrained to the height and width of the parent, `#modal-view` (whose height and width are set to the size of the viewport)

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 model 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 `<img>`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 `<img>` tag with the same src
- We append this new `<img>` to the `#modal-view`
- We unhide the `#modal-view`

Closing the modal dialog

```
function onModalClick() {
  modalView.classList.add('hidden');
  modalView.innerHTML = '';
}
```

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

When the user clicks the modal view:

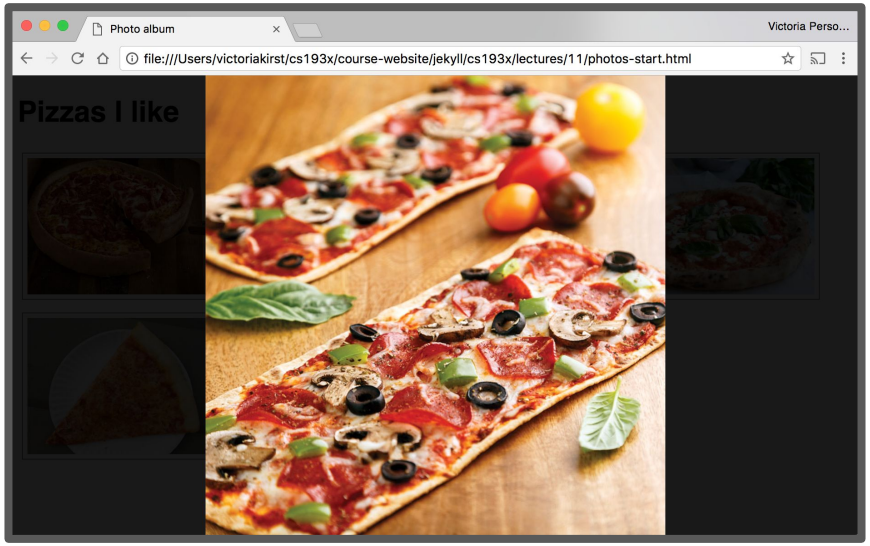
- We hide the modal view again
- We clear the image we appended to it by setting `innerHTML = '';`

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



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!

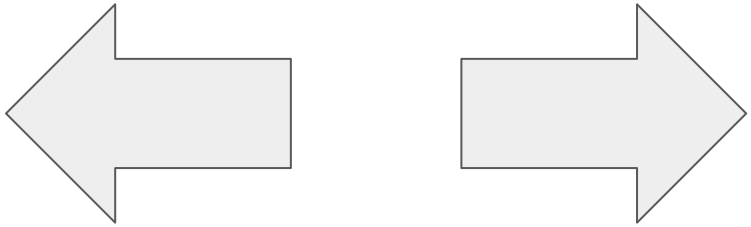
Finished result:
photo-desktop-finished.html

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



Next Previous

Mobile?

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

- **Left swipe** reveals the next photo
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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…

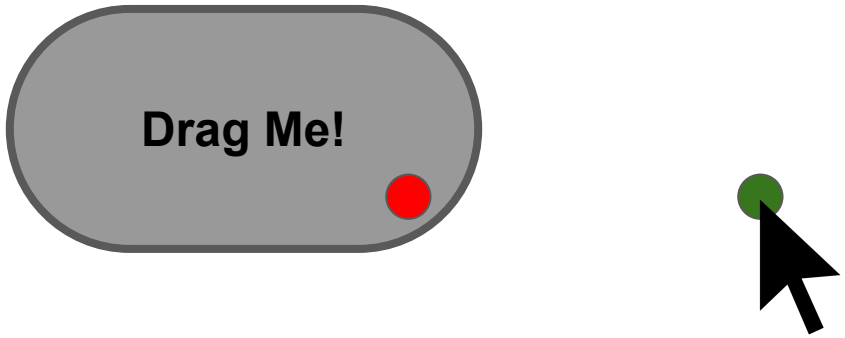
Implementing drag

```
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
`pointerdown`	Fired when a "pointer becomes active" (touch screen or click mouse down) (mdn)
`pointerup`	Fired when a pointer is no longer active (mdn)
`pointermove`	Fired repeatedly while the pointer moves (mouse move or touch drag) (mdn)
`pointercancel`	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.

`transform: translate(`***x***`, `***y***`)`	Moves element relative to its natural position by ***x*** and ***y***
`transform: translateX(`***x***`)`	Moves element relative to its natural position horizontally by ***x***
`transform: translateY(`***y***`)`	Moves element relative to its natural position vertically by ***y***
`transform: rotate(`***deg***`)`	Rotates the element clockwise by ***deg***
`transform: rotate(10deg) translate(5px, 10px);`	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();
```

`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).

CSS animations