Pass-by-value, Pass-by-reference

Overview

```
/*
  - Primitive vs. complex types

  - Variable assignment

  - Passing values into functions

  - Equality operators and PBV/PBR

  - Arrays and .slice
*/
```

Primitive/complex values

```
/* primitive values in JS:
        - string
        - number
        - boolean
        - undefined
        - null
  - ES6 symbols (not covered in this course)

complex values in JS:
        - objects (including arrays)
        - functions
 */
```

York
New York

Primitive/complex observed behavior

```
1   /* strings are primitive values */
2   let britishCity = 'York';
3   let americanCity = britishCity;
4
5   americanCity = 'New ' + americanCity;
6
7   console.log(britishCity);
8   console.log(americanCity);
9
10
11
12
13
14
```

[New, York]
[New, York]

Primitive/complex observed behavior

```
1   /* arrays are complex values */
2   let britishCity = ['York'];
3   let americanCity = britishCity;
4
5   americanCity.unshift('New');
6
7   console.log(britishCity);
8   console.log(americanCity);
9
10
11
12
13
14
```

Primitive/complex observed behavior

```
1   /* why do primitive values and complex values behave differently? */
2
3   /* you'll be able to answer that question at the end of this lesson! */
4
5
6
7
8
9
10
11
12
13
14
```

30
31

Assignment: primitive values

```
1   /* when you assign a primitive value to a variable, the variable 'stores'
2      a copy of that value */
3
4   let first = 20; // first stores the value 20
5   first = 30; // first now stores a new value, 30
6
7   let second = 30; // second stores its own copy of 30
8   second++; // second now stores a new value, 31
9
10  console.log(first);
11  console.log(second);
12
13
14
```

Variable		Value
first	→	30
second	→	31

20
21

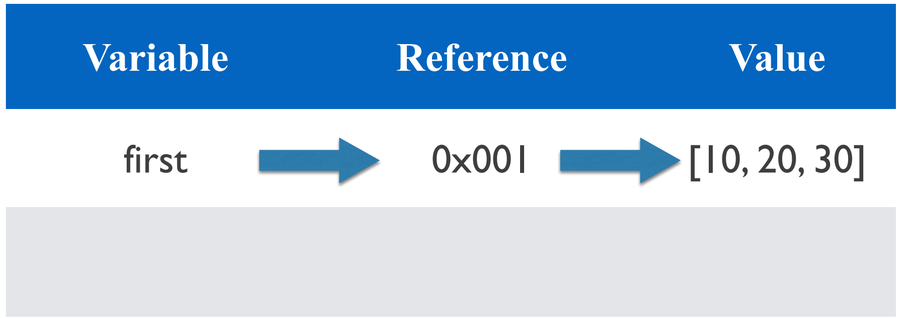
Assignment: primitive values

```
1   let first = 20; // first stores the value 20
2   second = first; // second stores its own copy of the value 20
3
4   second++; // has no effect on the value stored in first!
5
6   console.log(first);
7   console.log(second);
8
9
10
11
12
13
14
```

[10, 20, 30]

Assignment: complex values

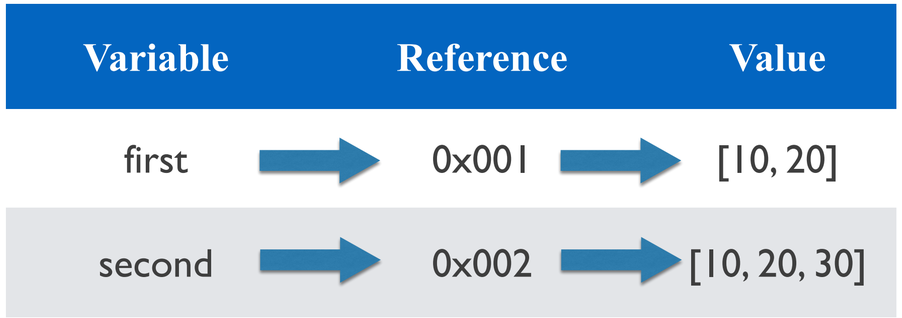
```
1   /* when you assign a complex value to a variable, the variable DOES NOT
2      store a copy of the value */
3
4   /* instead, the variable stores a reference in memory; the reference
5      points to the value */
6
7   let first = [10, 20]; // first stores a reference to [10, 20]
8   first.push(30); // first still stores the same reference
9
10  console.log(first);
11
12
13
14
```



[10, 20]
[10, 20, 30]

Assignment: complex values

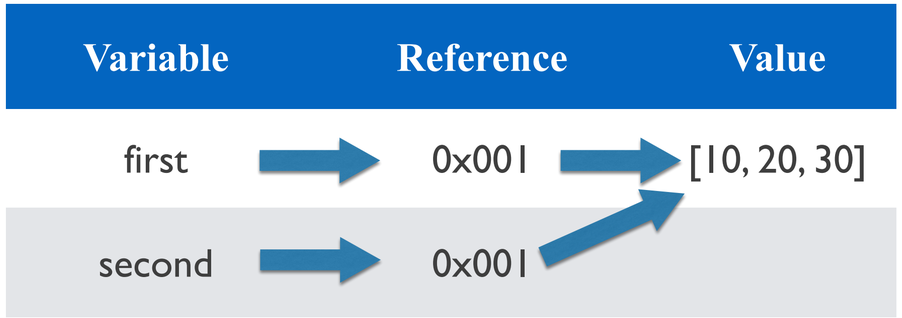
```
1   let first = [10, 20];
2
3   let second = [10, 20]; // second stores a new reference to a new array
4
5   /* since first and second reference different arrays, pushing a value into
6      second will not affect the array referenced by first */
7   second.push(30);
8
9   console.log(first);
10  console.log(second);
11
12
13
14
```



[10, 20, 30]
[10, 20, 30]

Assignment: complex values

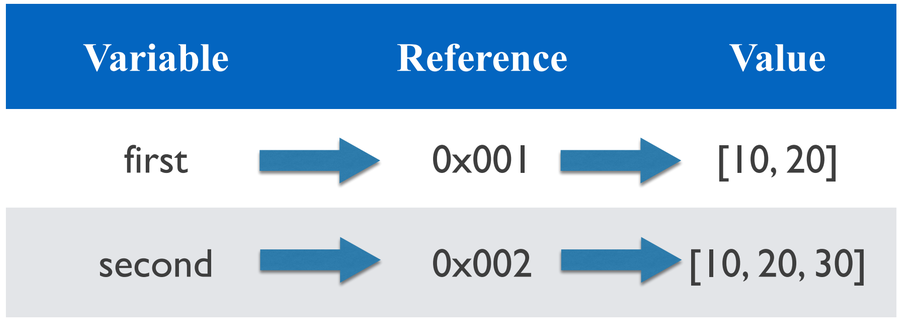
```
1   let first = [10, 20];
2
3   let second = first; /* second now stores a copy of the REFERENCE that was
4   originally stored in first */
5
6   /* first and second share the same reference to the same array! */
7   second.push(30);
8
9   console.log(first);
10  console.log(second);
11
12
13
14
```



[10, 20]
[10, 20, 30]

Assignment: complex values

```
1   let first = [10, 20];
2
3   let second = first.slice(); // slice creates a new array!
4
5   second.push(30); // first and second reference different arrays
6
7   console.log(first);
8   console.log(second);
9
10
11
12
13
14
```



Passing primitive values

```
1   let myNum = 10;
2
3   function adds20(num) {
4     num += 20;
5     return num;
6   }
7
8   let returnedNum = adds20(myNum);
9
10  console.log(myNum);
11  console.log(returnedNum);
12
13
14
```

[10, 20]
[10, 20]

Passing complex values

```
let myArray = [10];

function pushes20(array) {
  array.push(20);
  return array;
}

let returnedArray = pushes20(myArray);

console.log(myArray);
console.log(returnedArray);
```

false

Equality operator and PBV/PBR

```
1   // === will compare complex values by reference, not by value!
2
3   let array1 = [1, 2, 3];
4   let array2 = [1, 2, 3];
5
6   console.log(array1 === array2);
7
8
9
10
11
12
13
14
```

true

Equality operator and PBV/PBR

```
1   // === will compare complex values by reference, not by value!
2
3   let array1 = [1, 2, 3];
4   let array2 = array1; // array1 and array2 share the same reference
5
6   console.log(array1 === array2);
7
8
9
10
11
12
13
14
```

[1, [2, 3]]
false

Arrays and .slice

```
1   /* we showed earlier that .slice creates a copy of an array */
2
3   let array1 = [1, [2, 3]];
4   let array2 = array1.slice();
5
6   console.log(array2);
7   console.log(array1 === array2);
8
9
10
11
12
13
14
```

[2, 3, 4]
true

Arrays and .slice

```
1   /* if an array has a complex value as an element, only the reference
2      to that complex value is copied into the new array */
3
4   /* that's why we say slice makes a "shallow" copy of an array; it doesn't
5      make new copies of any complex values stored inside the array */
6
7   let array1 = [1, [2, 3]];
8   let array2 = array1.slice();
9
10  array1[1].push(4);
11  console.log(array2[1]);
12
13  console.log(array1[1] === array2[1]);
14
```

Recap

```
/*
  - Primitive vs. complex types

  - Variable assignment

  - Passing values into functions

  - Equality operators and PBV/PBR

  - Arrays and .slice
*/
```