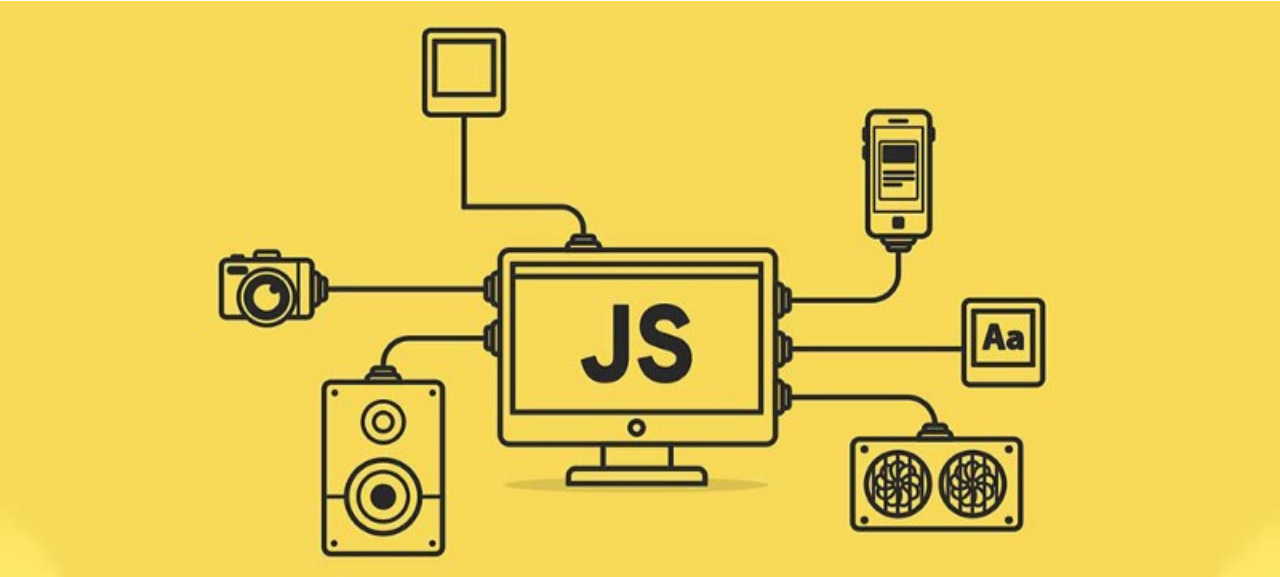
#001 JavaScript with Dimos: Variables and Constants

Hey there I am Dimos, a senior software engineer and software architect at arconsis. From time to time, I publish articles into the series "JavaScript with Dimos", where I am trying to analyze a JavaScript topic and to focus on the core concepts of JavaScript.



In the chapter "JavaScript's Grammar" we will take a look at JavaScript's basic grammar, variable declarations and data types.

Chapter's Posts Roadmap

- Variables and Constants (This article)
- Data Types

Today, in the first article of this chapter, we will explore JavaScript variables and constants, how to initialize and use them and their differences.

JavaScript Variables

A variable is just a container to **store** data and **hold** its value. For example we can use a variable to store a number, or a string:

```
var str = 'Hello!';
```

In above example, str is a variable we use to store a text.

Variable’s Declaration

It is essential to know how to declare variables in every programming language. The var, let, and const keywords are used to **declare** variables in JavaScript. There are some significant differences among them which we will analyze later in this tutorial.

```
var x = 1;
let y = 2;
const z = 3;
```

Variable’s Initialization

We can use the **assignment** operator = in order to initialize a variable and assign it a value. For example:

```
var num = 3;
let str = 'Hello!';
const isValid = true;
let str2;
str2 = 'Hey!';
```

In the above example, num was initialized with 3 as the initial value. As we can see, we can declare and initialize a variable at the same time (let str = 'Hello!';) or we can first declare it (let str2;) and then initialize it str2 = 'Hey!';.

JavaScript supports **multiple** variable declaration in a single sentence just like below:

```
let x = 1, y = 2, z = 3;
```

Variable’s Value Re-assignment

In JavaScript, it is possible to **mutate** the variable’s value, like below:

```
let x = 1;
console.log(x); // output 1
x = 2;
console.log(x); // output: 2
```

```
var y = 'Hello!';
console.log(y); // output: Hello!
y = 'Hey!';
console.log(y); // output: Hey!
```

JavaScript Constants

Similar to variables, we can declare **constants** in JavaScript. We can use const statement (was introduced in the ES6 version) to create constants. For example:

```
const x = 1;
```

Constants are similar to variables, apart from:

- declaration and initialization must take place at **same time**.
- **cannot** be re-assigned after initialization.

For example:

```
const x;  // Uncaught SyntaxError: missing = in const declaration
x = 1;
console.log(x);
```

```
const x = 1;
x = 3;  // Uncaught TypeError: invalid assignment to const 'x'
console.log(x);
```

> Be careful: Although we **cannot** mutate a constant (applies only to **primitive** values) we can still **mutate** (update, add, or remove) properties of an **object** declared by const. This is possible because the object declared by const is still pointing to the same object, even though its content has been changed.

```
const vehicle = { type : 'car'};
console.log(vehicle.type);  // output: "car"

vehicle.type = 'bike';
console.log(vehicle.type);  // output: "bike"
```

var statement

The var statement defines a **function-scoped** or **globally-scoped** variable (scopes will be discussed in next article). We can assign a value optionally, on variable declared by var. It does **not** support block-level scope, which means that a variable declared inside {…} (for example inside for or if statement) **cannot** be accessed outside the block, which potentially can lead to bugs.

```
var num = 1;
```

```
if (num === 1) {
   var num = 2;
   console.log(x); // output: 2
}

console.log(num); // output: 2
```

a) var is function-scoped

Function scope means that variables defined inside a function **cannot** be accessed from anywhere **outside** the function. For example:

```
function foo() {
   var x = 1;
   function baz() {
      var y = 2;
      console.log(x); // output: 1 (baz() can see outer scope)
      console.log(y); // output: 2
   }
   baz();
   console.log(x); // output: 1 (as x is in same function scope)
   console.log(y); // Uncaught ReferenceError: y is not defined
}

foo();
```

Another example:

```
var animal = 'dog';

function foo() {
   animal = 'cat';
   console.log(animal); // output: "cat"
}

console.log(animal); // output: "dog"
foo();
console.log(animal); // output:"cat"

// output: "dog", "cat", "cat"
```

b) var gets hoisted

The variables declared by var are processed before any code is executed in a process known as “**hoisting**” with undefined as initial value. If we declare a variable anywhere in the code using var, is the same as declaring it at the top. Hence a var can appear to be used **before** it’s declared, which is called

“**hoisting**”**.** In other words, the term “**hoisting**” means that all var and function declarations are “pulled” to the top of the code when the code is run.

```
animal = 'dog';
var animal;

// ...is equivalent (hoisting):

var animal;
animal = 'dog';

console.log(foo); // output: undefined
var foo = 1;
console.log(foo); // output: 1
```

Or another example:

```
function foo() {
  console.log(baz); // output: undefined
  var baz = 3;
  console.log(baz); // output: 3
}

// ...is equivalent (hoisting):

function foo() {
  var baz;
  console.log(baz); // output: undefined
  bar = 3;
  console.log(baz); // output: 3
}
```

> **Recommendation**: It’s best to declare variables always at the top of their scope, to be clear which is their scope.

c) var can be re-declared

Variables declared with var can be *re-declared* with a new value. For example:

```
var x = 1;
console.log(x); // output: 1
var x = 3;
console.log(x); // output: 3
```

d) var can be re-assigned

Variables declared by var can be *re-assigned* to a new value. For example:

```
var x = 1;
console.log(x); // output: 1
x = 3;
console.log(x); // output: 3
```

let statement

The let statement was introduced in the ES6 version. The let and the var statements have some similarities but their main difference is that let declares a **block-scoped** variable and although it can be reassigned it **cannot** be **re-declared**. Also compared to var statements, a variable declared using let will **not** be **hoisted**.

a) let is block-scoped

Unlike the var keyword, which defines a global or function-scoped variable, the let keyword allows us to define variables that are **block-scoped**. This means that variables are **limited** to the scope of the **block** statement or **expression** on which it is used, as well as in any nested **sub-blocks**.

```
let x = 3;

if (x === 3) {
   let x = 6;
   console.log(x); // output: 6
}

console.log(x); // output: 3
```

Another example:

```
function foo() {
   let x = 3;
   function baz() {
      let x = 6;  // different variable
      console.log(x);  // output: 6
   }
   baz();
   console.log(x);  // output: 3
}

foo();
console.log(x); // output: ReferenceError: x is not defined (defined in function scope, cannot be accessed outer)
```

b) let cannot be hoisted

The variables declared by let statement, **cannot** be hoisted and a ReferenceError is expected to be thrown, compared to variables declared by var. For example:

```
console.log(x); // Uncaught ReferenceError: can't access lexical declaration 'x' before initialization
let x = 1;
```

c) let cannot be re-declared

If we try to re-declare the same variable by let within the same function or same block, then a SyntaxError is expected to be thrown.For example:

```
if (true) {
   let x = 1;
   let x = 3; // Uncaught SyntaxError: redeclaration of let x
}
```

Or another example:

```
function foo() {
   let x = 3;
   let x = 6; // Uncaught SyntaxError: redeclaration of let x
}
foo();
```

Also if we combine var and let statements, then it is possible to get a SyntaxError, because var is hoisted to the top of the block. As we can see below, the variable declared by var , will introduce re-declaration of x , as is not block-scoped and will be “pulled” on top of the code because of the “hoisting”.

```
let x = 3;
{
   var x = 5; // Uncaught SyntaxError: redeclaration of let x, Previously declared
}
```

d) let can be re-assigned

Variables declared by let keyword can be re-assigned with a new value. For example:

```
let x = 1;
console.log(x); // output: 1
```

```
x = 3;
console.log(x); // output: 3
```

const statement

The const keyword and let keyword have a lot of similarities, as both are **blocked** scoped, **cannot** be hoisted and **cannot** be **re-declared**. The only difference is that variables declared by const **cannot** be **reassigned**. Hence, every const variable must be initialized with a value at the time of declaration.

a) const is block-scoped

The const statement allows us to define variables that are block-scoped. This means that variables are **limited** to the scope of the **block** statement or **expression** on which it is used, as well as in any contained **sub-blocks**.

```
const x = 3;
if (x === 3) {
   const x = 6;
   console.log(x); // output: 6
}
console.log(x); // output: 3
```

Or another example:

```
function foo() {
   const x = 3;
   function baz() {
      const x = 6;  // different variable
      console.log(x);  // output: 6
   }
   baz();
   console.log(x);  // output: 3
}

foo();
console.log(x); // output: ReferenceError: x is not defined (defined in function scope, cannot be accessed outer)
```

b) const cannot be hoisted

The variables declared by const statement, **cannot** be hoisted and a ReferenceError is expected to be thrown, compared to variables declared by var. For example:

```
console.log(x); // Uncaught ReferenceError: can't access lexical declaration 'x' before initialization

const x = 1;
```

c) const cannot be re-declared

If we try to re-declare the same variable by const within the same function or same block , then a SyntaxError is expected to be thrown. For example:

```
if (true) {
   const x = 1;
   const x = 3; // Uncaught SyntaxError: redeclaration of let x
}
```

Or another example:

```
function foo() {
   const x = 3;
   const x = 6; // Uncaught SyntaxError: redeclaration of let x
}
foo();
```

Also if we combine var and const statements, then it is possible to get a SyntaxError, because var is hoisted to the top of the block. As we can see below, the variable declared by var , will introduce re-declaration of x , as is not block-scoped and will be “pulled” on top of the code because of the “hoisting”.

```
const x = 3;
{
   var x = 5; // Uncaught SyntaxError: redeclaration of let x, Previously declared
}
```

d) const cannot be re-assigned

Variables declared by const keyword **cannot** be re-assigned with a new value and a TypeError is expected to be thrown. For example:

```
const x = 1;
console.log(x); // output: 1
x = 3;
console.log(x); // output: TypeError: invalid assignment to const 'x'
```

> Note: If we know that the variable’s value will not change, it’s preferable to use const instead of var or let.

Those are all we need to know about **variables** and **constants** declaration in JavaScript and their differences. Meanwhile, please feel free to post any questions, comments, or feedback in the comment section below.

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See you until next time!

References

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