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## Callable entities in ECMAScript 6

Labels: [dev](#), [esnext](#), [javascript](#)

**Update 2013-11-28:** There won't be generator arrow functions in ECMAScript 6 ([details](#)).

In ECMAScript 5, one creates all callable entities via functions. ECMAScript 6 has more constructs for doing so. This blog post describes them.

### 1. The status quo: ECMAScript 5

In ECMAScript 5, functions do triple duty:

- As normal functions: you can directly call functions.
- As methods: you can assign a function to the property of an object and call it as a method, via that object.
- As constructors: you can invoke functions as constructors, via the new operator.

The three main problems with this approach are:

1. It confuses people.
2. You can use a function the wrong way, e.g. call a constructor or a method as a normal function.
3. Functions used as normal functions shadow the `this` of surrounding constructors or methods [1]. That's because `this` is always *dynamic* (provided by each function call), but should be *lexical* in this case, like normal variables that are resolved via surrounding scopes if they are not declared within a function.

Let's first look at ECMAScript 6's callable entities and then at how they help with these problems.

### 2. ECMAScript 6's callable entities

The following subsections explain ECMAScript 6's callable entities and what ECMAScript 5 constructs and patterns they correspond to. If you are confused about the difference between a function expression and a function declaration, consult [3].

#### 2.1. Function expression → arrow function

In ECMAScript 5, a function used as a normal function inside a constructor or a method shadows `this`:

```
function GuiComponent() { // constructor
  var that = this;
  var domNode = ...;
  domNode.addEventListener('click', function () {
    console.log('CLICK');
    that.handleClick(); // `this` is shadowed
  });
}
```

ECMAScript 6 has *arrow functions* [2] that have a more compact syntax and don't have their own `this`, their `this` is lexical:

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```
function GuiComponent() { // constructor
  var domNode = ...;
  domNode.addEventListener('click', () => {
    console.log('CLICK');
    this.handleClick(); // `this` not shadowed
  });
}
```

### 2.2. Function declaration → const + arrow function

In ECMAScript 5, you have function declarations for normal functions:

```
function foo(arg1, arg2) {
  ...
}
```

In ECMAScript 6, you'll const-declare an arrow function:

```
const foo = (arg1, arg2) => {
  ...
};
```

The problem with function declarations is that they shadow this inside methods and constructors.

But they also have two advantages: First, a function object created by a function declaration always gets a meaningful name, which is useful for debugging. However, ECMAScript 6 engines will probably also assign names to arrow functions, at least in standard scenarios such as the one above.

Second, function declarations are *hoisted* (moved to the beginning of the current scope). That allows you to call them before they appear in the source code. Here, more discipline is required in ECMAScript 6 and source code will sometimes not look as nice (depending on your taste). However, one important case of calling methods and normal functions that appear later does not change: calling them from other methods and functions (after the callees have been evaluated!).

Ironically, not using function declarations may make things less confusing for newcomers, because they won't need to understand the difference between function expressions and function declarations [3]. In ECMAScript 5, I'm often seeing code like this, using a function expression instead of a function declaration (even though the latter is considered best practice):

```
var foo = function (arg1, arg2) {
  ...
};
```

### 2.3. IIFE → block + let

ECMAScript 5 does not have block-scoped variables. In order to simulate blocks, you use the IIFE [1] pattern:

```
(function () { // open IIFE
  var tmp = ...;
  ...
})(); // close IIFE
```

In ECMAScript 6, you can simply use a block and a let variable declaration:

```
{ // open block
  let tmp = ...;
  ...
} // close block
```

### 2.4. Function in object literal → concise method syntax

In ECMAScript 5, you define a method inside an object literal by providing a property value via a function expression:

```
var obj = {
  myMethod: function (arg1, arg2) {
```

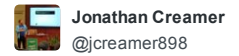
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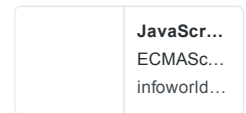
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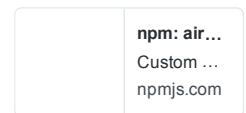
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```
...  
}  
};
```

In ECMAScript 6, you get more compact syntax for defining a method (internally, the result is the same):

```
let obj = {  
  myMethod(arg1, arg2) {  
    ...  
  }  
};
```

## 2.5. Constructor → class

In ECMAScript 5, you use constructors. Which becomes clumsy if you want to define sub-constructors:

```
// Super-constructor  
function Point(x, y) {  
  this.x = x;  
  this.y = y;  
}  
Point.prototype.toString = function () {  
  return '('+this.x+', '+this.y+')';  
};  
  
// Sub-constructor  
function ColorPoint(x, y, color) {  
  Point.call(this, x, y);  
  this.color = color;  
}  
ColorPoint.prototype = Object.create(Point.prototype);  
ColorPoint.prototype.constructor = ColorPoint;  
ColorPoint.prototype.toString = function () {  
  return this.color+ ' '+Point.prototype.toString.call(this);  
};
```

In ECMAScript 6, you use classes [4] (which have the same method definition syntax as ECMAScript 6 object literals):

```
// Super-class  
class Point {  
  constructor(x, y) {  
    this.x = x;  
    this.y = y;  
  }  
  toString() {  
    return '('+this.x+', '+this.y+')';  
  }  
}  
  
// Sub-class  
class ColorPoint extends Point {  
  constructor(x, y, color) {  
    super(x, y); // same as super.constructor(x, y)  
    this.color = color;  
  }  
  toString() {  
    return this.color+ ' '+super();  
  }  
}
```

## 2.6. New in ECMAScript 6: generator functions and generator methods

One construct is completely new in ECMAScript 6: generators [5]. You can create one via a generator function declaration:

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```
function *generatorFunction(arg1, arg2) {  
    ...  
}
```

Or via a generator method definition (which can also be used in classes):

```
let obj = {  
    *generatorMethod() {  
        ...  
    }  
};
```

Generator functions are an unfortunate mix of the old and the new. Like function declarations, they have dynamic this. And there are no generator function expressions.

In my opinion, a better choice would be to replace generator function declarations with generator arrow functions. Or at least to additionally introduce the latter, with an asterisk somewhere. For example:

```
const generatorFunction = (arg1, arg2) =>* {  
    ...  
};
```

Alas, this idea has been explicitly **rejected** for ECMAScript 6, due to syntactic issues.

### 3. Avoiding function expressions

There are two cases where you may think you need old-school function expressions with dynamic this. This section shows you that you don't.

#### 3.1. Functions with this as an implicit parameter

Some libraries use this as an implicit parameter:

```
var $button = $('#myButton');  
$button.on('click', function () {  
    this.classList.toggle('clicked');  
});
```

If you are using such a library, you have no choice but to use function expressions. If you are considering using this pattern for your own library then know that you don't have to. You can always introduce an explicit parameter, instead:

```
var $button = $('#myButton');  
$button.on('click', target => {  
    target.classList.toggle('clicked');  
});
```

As an added benefit, the this of the surrounding scope remains accessible.

#### 3.2. Adding methods to an object

To add a method to an existing object in ECMAScript 5, you use a function expression:

```
MyClass.prototype.foo = function (arg1, arg2) {  
    ...  
};
```

In ECMAScript 6, you can use Object.assign() and a method definition inside an object literal:

```
Object.assign(MyClass.prototype, {  
    foo(arg1, arg2) {  
        ...  
    }  
});
```

### 4. Conclusion

The large amount of callable entities in ECMAScript 6 can be a bit overwhelming at first. But they do help with the three problems of using functions for everything (#1 confusing, #2 can be used incorrectly, #3 dynamic this where you don't want it):

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1. The clear separation of concerns makes things less confusing, especially for newcomers: classes replace constructors, blocks replace IIFEs, the keyword function does not appear when you define a method, etc.
2. ECMAScript 6 prevents some incorrect uses of functions, but not many: you will get an exception if you invoke a class as a function. Calling extracted methods as functions remains a problem.
3. Arrow functions eliminate the pitfall of inadvertently shadowing this.

## 5. References

- [1] [JavaScript variable scoping and its pitfalls](#)
- [2] [ECMAScript.next: arrow functions and method definitions](#)
- [3] [Expressions versus statements in JavaScript](#)
- [4] [ECMAScript.next: classes](#)
- [5] [Iterators and generators in ECMAScript 6](#)

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Wil Moore III • 3 years ago

Wasn't Object.mixin dropped from ES6?

<https://github.com/rwaldron/tc...>

Has it been brought back?

^ | v • Reply • Share

Axel Rauschmayer Mod → Wil Moore III • 3 years ago

Not it hasn't, I just hadn't updated the blog post, yet. Fixed now, thanks.

^ | v • Reply • Share

Donald Pipowitch • 3 years ago

Thank you for the article. Could you please explain me "3.2 Adding methods to an object" a little bit further? Is this just a different syntax or are there technical differences? The "this" isn't dynamic here or am I wrong? It always refers to the current instance which invokes the method (in ES5 and ES6).

^ | v • Reply • Share

avi tshuva • 3 years ago

Very good article. It put some of the features i already read about in a refreshing light.

One comment: i would not give up the usage of "function" for normal functions because i like the "hoisting" feature - it let me write a more readable code sometimes.

Saying this, it is clear that i have no problem (yet, at least) with the generator's syntax. Must admit i never used it yet.

^ | v • Reply • Share



Kuba • 3 years ago

Thanks for that article. I have two questions:

1. You said that blocks are to replace immediately invoked function expressions. But how do they work? Are they, like for example catch block, pushing a new object in front of the scope chain of the active context? If so, I think that in one aspect IIFE are better - they can import variables from the wrapping scope making them local to the called functions (and, as we know, avoiding deep scope chain traversing is considered to be a good practice). Is this also possible with ES6 blocks?

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this also possible with ES6 blocks ?

2. You also said that function declarations are considered to be the best practice, or at least to be a better solution than function expressions. Can you tell why do you think so? Because I find myself using always FEs (because I think hoisting can be rather tricky than helpful and see no reasons for desired usage of it... Also FEs looks to me somehow nicer) and though I know all the differences between them (or at least I think I know) still don't know why FDs are considered to be a better solution.

Thanks in advance.

^ | v • Reply • Share ›



**Kuba** → Kuba • 3 years ago

Well, about the first question... I just thought that we can just declare a block-scoped variable and assign to it a value of some outer-scoped variable and the effect will be pretty much the same as importing it... So we can pretend that this question was not asked at all :)

^ | v • Reply • Share ›

**Axel Rauschmayer** Mod → Kuba • 3 years ago

Yes, exactly!

Question 2: Then you are well prepared for ES6. The blog post mentions two advantages that function declarations have over function expressions (after "But they also have two advantages: ...").

^ | v • Reply • Share ›



**Kuba** → Axel Rauschmayer • 3 years ago

Thank you very much for that quick response. I though that there were some other advantages than those you mentioned in the text (as I said I am not really convinced to desired usage of hoisting, I think that it breaks code readability, especially for some JS freshmen who are not aware of it and don't know what it is caused by. But that's only my opinion. And about naming - well, if one needed to, they could always name a function expression too) which make JS programmers to generally consider FDs as a better solution (or just a better practice). For now I think it depends on the programmer which one they want to use, of course if they are aware what are the consequences of using it.

Thanks for the response again and have a nice day.

^ | v • Reply • Share ›

**John Eric Torres Orolfo** • 3 years ago

oooooh very informative

^ | v • Reply • Share ›

**rwaldron** • 3 years ago

Nice coverage :)

^ | v • Reply • Share ›

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