

ECMA SCRIPT 6+

BLOCKSCOPE VARIABLEN UND KONSTANTEN

BLOCK SCOPE MIT LET

```
for (let i = 0; i < a.length; i++) {  
    let x = a[i];  
    ...  
}
```

```
let callbacks = [];
```

```
for (let i = 0; i <= 2; i++) {  
    callbacks[i] = () => i * 2;  
}
```

```
// callbacks[0]() === 0  
// callbacks[1]() === 2  
// callbacks[2]() === 4
```

BLOCK SCOPES MIT { ... }

```
{  
    function foo () { return 1 }           // foo() === 1  
    {  
        function foo () { return 2 }       // foo() === 2  
    }  
                                           // foo() === 1  
}
```

ECMAScript 5:

```
(function () {  
    var foo = function () { return 1; }  
    foo() === 1;  
    (function () {  
        var foo = function () { return 2; }  
        foo() === 2;  
    })();  
    foo() === 1;  
})();
```

CONST

```
const PI = 3.141593
```

```
PI > 3.0
```

ECMAScript 5:

```
Object.defineProperty(typeof global === "object" ? global : window, "PI", {  
  value:      3.141593,  
  enumerable: true,  
  writable:   false,  
  configurable: false  
})  
PI > 3.0;
```

THEMENBLOCK FUNKTIONEN

SPREAD- UND RESTOPERATOR

- Arrow Funktionen vs. Function-Funktionen
- Defaultparameter in Funktionen
- Funktionsparameter, Rest-Parameter

DEFAULT PARAMETER, REST- PARAMETER, SPREAD OPERATOR

DEFAULT PARAMETER

```
function f (x, y = 7, z = 42) {  
    return x + y + z  
}
```

```
function f(x){  
    let x = x || 42;  
}
```

```
f() // x=undefined, y=7; z=42
```

REST PARAMETER

```
function sum(...theArgs) {  
    return theArgs.reduce((previous, current) => {  
        return previous + current;  
    });  
}
```

```
console.log(sum(1, 2, 3));  
// expected output: 6
```

```
console.log(sum(1, 2, 3, 4));  
// expected output: 10
```

REST PARAMETER

- Rest Parameter bilden ein Array.
- Methoden wie sort, map, forEach oder pop können direkt angewendet werden.
- Das arguments Objekt ist kein echtes Array.
- Das arguments Objekt hat zusätzliche, spezielle Funktionalität (wie die calleeEigenschaft).

SPREAD OPERATOR

```
var params = [ "hello", true, 7 ]  
var other = [ 1, 2, ...params ] // [ 1, 2, "hello", true, 7 ]  
  
function f (x, y, ...a) {  
    return (x + y) * a.length    // f(1, 2, ...params) === 9  
}  
  
var str = "foo"  
var chars = [ ...str ]           // [ "f", "o", "o" ]
```

ARROW FUNCTIONS

$() \Rightarrow \{ \}$

ARROW FUNCTIONS

- Der Ausdruck einer Pfeilfunktion ist kürzer als ein Funktionsausdruck
- Kein eigenes this, arguments, super, oder new.target.
- Sie können nicht als/in Konstruktoren verwendet werden.

`(param1, param2, ..., paramN) => expression`

`// gleich zu: => { return expression; }`


```
(singleParam) => { statements }  
(oneParam, twoParam, ..., paramN) => { statements }
```

Klammern sind optional, wenn nur ein Parametername vorhanden ist:
`singleParam => { statements }`

Das ist also auch möglich:
`singleParam => returnStatement`

// Die Parameterliste für eine parameterlose Funktion
muss mit einem Klammernpaar geschrieben werden:

```
() => { statements }
```

Der Body kann eingeklammert werden, um ein Objektliteral zurück zu geben:

```
params => ({foo: bar})
```

Rest-Parameter und Default-Parameter:

```
(oneParam, oneParam, ...rest) => { statements }
```

```
(param1 = defaultValue) => { statements }
```

TEMPLATE LITERALS

- String interpolation
- Custom interpolation
- Raw string access

STRING INTERPOLATION

```
var customer = { name: "Foo" }  
  
var card = { amount: 7, product: "Bar", unitprice: 42 }  
  
var message = `Hello ${customer.name},  
want to buy ${card.amount} ${card.product} for  
a total of ${card.amount * card.unitprice} bucks`
```

CUSTOM INTERPOLATION

```
get ( `http://example.com/foo?bar=${bar + baz}&quux=${quux}` )
```

CLASSES

CLASSES

```
class MyClass {  
    constructor () {}  
  
    getProperty() {}  
    setProperty() {}  
}
```

CLASSES

```
class ChildClass extends parentClass {  
    constructor () {}  
  
    getProperty() {}  
    setProperty() {}  
}
```

KLASSEN, KONSTRUKTOR,

```
class Shape {  
  
    constructor (id, x, y) {  
        this.id = id. // property!  
        this.move(x, y)  
    }  
    move (x, y) {  
        this.x = x  
        this.y = y  
    }  
    getId () {}  
    setMove(){}  
}  
  
let myShape = new Shape('rect', 10, 10);
```

ECMAScript 5 – syntactic sugar: reduced | traditional

```
var Shape = function (id, x, y) {  
    this.id = id;  
    this.move(x, y);  
};  
Shape.prototype.move = function (x, y) {  
    this.x = x;  
    this.y = y;  
};
```

VERERBUNG, ELTERNKONSTRUKTOR

```
class Rectangle extends Shape {  
    constructor (id, x, y, width, height) {  
        super(id, x, y);  
        this.width = width;  
        this.height = height;  
    }  
}  
class Circle extends Shape {  
    constructor (id, x, y, radius) {  
        super(id, x, y);  
        this.radius = radius;  
    }  
}
```

DESTRUCTURING VON ARRAYS UND OBJEKTEN

DESTRUCTURING

- Die destrukturierende Zuweisung ermöglicht es, Daten aus Arrays oder Objekten zu extrahieren
- Die Syntax ist der Konstruktion von Array- und Objekt-Literalen nachempfunden.
- Destructuring ist "fail-soft", ähnlich wie Standardobjekte, die nach `foo["bar"]`, schauen, und ggf. nur ein `undefined` liefern.

OBJECT AND ARRAY MATCHING

```
var a, b, rest;  
[a, b] = [10, 20];
```

```
// a === 10  
// b === 20
```

```
[a, b, ...rest] = [10, 20, 30, 40, 50];
```

```
// a === 10  
// b === 20  
// rest === [30, 40, 50]
```

```
{ a, b } = { c: 10, d: 20 };
```

```
// a === 10  
// b === 20
```

OBJECT AND ARRAY MATCHING, DEFAULT VALUES

```
// Fail-soft destructuring  
var [a] = [];           // a === undefined;
```

```
// Fail-soft destructuring with defaults  
var [a = 1] = [];       // a === 1;
```


Destrukturierung in der Parameterliste:

```
var f = ([a, b] = [1, 2], {x: c} = {x: a + b}) => a + b + c;  
f(); // 6
```

SPREAD- UND RESTOPERATOR

- Destructuring von Arrays
- Destructuring von Objekten

MODULE

MODULE

- Language-level support for modules for component definition.
- Codifies patterns from popular JavaScript module loaders (AMD, CommonJS).
- Runtime behaviour defined by a host-defined default loader.
- Implicitly async model — no code executes until requested modules are available and processed.

MODULES

```
// Modul: lib/math.js
export function sum(x, y) {
  return x + y;
}
export var pi = 3.141593;
```

```
// app.js
import * as math from "lib/math";
alert("2π = " + math.sum(math.pi, math.pi));
```

```
// otherApp.js
import {sum, pi} from "lib/math";
alert("2π = " + sum(pi, pi));
```

VERSCHIEDENE EXPORT MÖGLICHKEITEN

```
export { name1, name2, ..., nameN };  
export function FunctionName(){...}
```

```
export class ClassName {...}  
export default class ClassName {...}
```

```
...
```

```
export * from ...;  
export { name1, name2, ..., nameN } from ...;  
export { import1 as name1, import2 as name2, ..., nameN } from  
...;  
export { default } from ...;
```

EINE APPLIKATION MIT MODULEN ENTWERFEN

Dashboard



SCHRITT 1 - ENTWURF

Ein guter Entwurf erspart viel Zeit und Kopfschmerzen. Ein Entwurf muss nicht perfekt sein, er sollte aber die Richtung weisen.

Entwurf für eine Softwarearchitektur:

Components: `users.js`, `user-profile.js`, `issues.js`

Layouts: `header.js`, `sidebar.js`

Dashboard: `dashboard.js`

Alle Komponenten werden in `dashboard.js` geladen. Das Dashboard wird dann über `index.js` initiiert.

SCHRITT 1 - ENTWURF

Das Layout brauchen wir nur einmal, zum Beispiel als statisches Template. Der Inhalt darin mag sich ändern, aber die Sidebar und der Header werden gleich bleiben.

Der Komponenten Ordner ist für allgemeine Komponenten, die wiederverwendbar sind oder sein sollen.

SCHRITT 2 - ORDNERSTRUKTUR

```
root
|- dashboard
|   |- dashboard.js
|
|- components
|   |- issues.js
|   |- user.js
|   |- userprofile.js
|
|- layouts
|   |- header.js
|   |- sidebar.js
|
|- snippets
|   |- user-data.html | .jade | .ejs
|- index.html
|- index.js ( entry point )
```

SCHRITT 3 – IMPLEMENTATION

Komponenten bauen: Jede Komponente ist eine Klasse
Eine Methode zeigt das Laden einer Komponente an.

```
class Users {  
  loadUsers() {  
    console.log('Users component is loaded...')  
  }  
  buildHtml(){  
    // load Data  
    // load template  
    // merge both and return  
  }  
}  
export { Users };
```

SCHRITT 3 – IMPLEMENTATION

```
import { UserProfile } from '../components/users-profile.js';

class Header {
  loadHeader() {
    // Create a new instance
    const userProfile = new UserProfile();

    // Invoke the method (component)
    userProfile.loadUserProfile();

    // Output loading status
    console.log('Header component is loaded...')
  }
}

export { Header };
```

SCHRITT 3 – IMPLEMENTATION

```
// From component folder
import { Users } from '../components/users.js';
import { Issues } from '../components/issues.js';

// From layout folder
import { Header } from '../layouts/header.js';
import { Sidebar } from '../layouts/sidebar.js';

class Dashboard {
  loadDashboard(){

    // Create new instances
    const users = new Users();
    const issues = new Issues();
    const header = new Header();
    const sidebar = new Sidebar();

    function addToDashboard(users.buildHtml(), '#user-layout-id'){ ... }

    console.log('Dashboard component is loaded');
  }
}

export { Dashboard }
```

SCHRITT 3 – IMPLEMENTATION

```
// index.js:  
  
import { Dashboard } from './dashboard/dashboard.js';  
  
const dashboard = new Dashboard();  
dashboard.loadDashboard();
```

<https://www.freecodecamp.org/news/how-to-use-es6-modules-and-why-theyre-important-a9b20b480773/>

PROMISES

FETCH() (PROMISES ANWENDEN)

```
fetch('data.json')
  .then(function (response) {
    if (response.ok)
      return response.json();
    else
      throw new Error('Daten konnten nicht geladen werden');
  })
  .then(function (json) {
    // Hier Code zum Abarbeiten der Daten
  })
  .catch(function (err) {
    // Hier Fehlerbehandlung
  });

// fetch basiert auf Promises
```

PROMISES VERSTEHEN

Stell dir vor, du bist ein Kind. Deine Mutter verspricht dir, dass sie dir nächste Woche ein neues Telefon schenkt.

Du weißt jetzt nicht genau, ob du das Telefon bis nächste Woche wirklich bekommst. Deine Mutter kann es dir schenken, sie kann es aber auch lassen, wenn sie mit Dir nicht zufrieden ist.

Das ist ein **promise**.

Ein **promise** hat 3 Zustände:

Pending: Du weißt nicht, ob du das Handy bekommst.

Fulfilled: Deine Mutter ist zufrieden, sie kauft und bringt dir das neue Handy.

Rejected: Deine Mutter ist nicht zufrieden und besorgt dir kein neues Handy.

CREATING A PROMISE (ES6)

```
const isMomHappy = true;

// Promise
const willIGetNewPhone = new Promise(
  (resolve, reject) => {
    if (isMomHappy) {
      const phone = {
        brand: 'Samsung',
        color: 'black'
      };
      resolve(phone);
    } else {
      const reason = new Error('mom is not happy');
      reject(reason);
    }
  }
);
```

CONSUMING A PROMISE

```
// call our promise
const askMom = function () {
    willIGetNewPhone
        .then(showOff)
        .then(fulfilled => console.log(fulfilled))
        .catch(error => console.log(error.message));
};

askMom();
```

CHAINING PROMISES

- Promises are chainable.
- Let's say, you, the kid, promises your friend that you will show them the new phone when your mom buy you one.

CHAINING PROMISES

```
// 2nd promise
```

```
const showOff = function (phone) {  
  const message = 'Hey friend, I have a new ' +  
    phone.color + ' ' + phone.brand + ' phone';  
  return Promise.resolve(message);  
};
```

CALL YOUR PROMISES

```
var askMom = function () {  
  willIGetNewPhone  
    .then(showOff) // chain it here  
    .then(function (fulfilled) {  
      console.log(fulfilled);  
      // output: 'Hey friend, I have a new black Samsung  
phone.'  
    })  
    .catch(function (error) {  
      // oops, mom don't buy it  
      console.log(error.message);  
      // output: 'mom is not happy'  
    });  
};
```


CREATING A PROMISE (ES7)

```
const isMomHappy = true;

// Promise
const willIGetNewPhone = new Promise(
  (resolve, reject) => {
    if (isMomHappy) {
      const phone = {
        brand: 'Samsung',
        color: 'black'
      };
      resolve(phone);
    } else {
      const reason = new Error('mom is not happy');
      reject(reason);
    }
  }
);
```

CHAINING PROMISES

```
// 2nd promise
```

```
async function showOff(phone) {  
  return new Promise(  
    (resolve, reject) => {  
      var message = 'Hey friend, I have a new ' +  
        phone.color + ' ' + phone.brand + ' phone';  
  
      resolve(message);  
    }  
  );  
};
```

CALL YOUR PROMISES

```
async function askMom() {  
  try {  
    console.log('before asking Mom');  
  
    let phone = await willIGetNewPhone;  
    let message = await showOff(phone);  
  
    console.log(message);  
    console.log('after asking mom');  
  }  
  catch (error) {  
    console.log(error.message);  
  }  
}
```

<https://scotch.io/tutorials/javascript-promises-for-dummies>

ES7: ASYNC/AWAIT

```
function scaryClown() {  
  return new Promise(resolve => {  
    setTimeout(() => {  
      resolve('🤡');  
    }, 2000);  
  });  
}
```

```
async function msg() {  
  const msg = await scaryClown();  
  console.log('Message:', msg);  
}
```

```
msg(); // Message: 🤡 <-- after 2 seconds
```

ES7: ASYNC/AWAIT

```
function who() {  
  return new Promise(resolve =>  
  {  
    setTimeout(() => {  
      resolve('😄');  
    }, 200);  
  });  
}
```

```
function what() {  
  return new Promise(resolve =>  
  {  
    setTimeout(() => {  
      resolve('lurks');  
    }, 300);  
  });  
}
```

```
function where() {  
  return new Promise(resolve =>  
  {  
    setTimeout(() => {  
      resolve('in the shadows');  
    }, 500);  
  });  
}
```

```
async function msg() {  
  const a = await who();  
  const b = await what();  
  const c = await where();  
  
  console.log(`${a} ${b} ${c}`);  
}
```

```
msg(); // 😄 lurks in the  
shadows <-- after 1 second
```

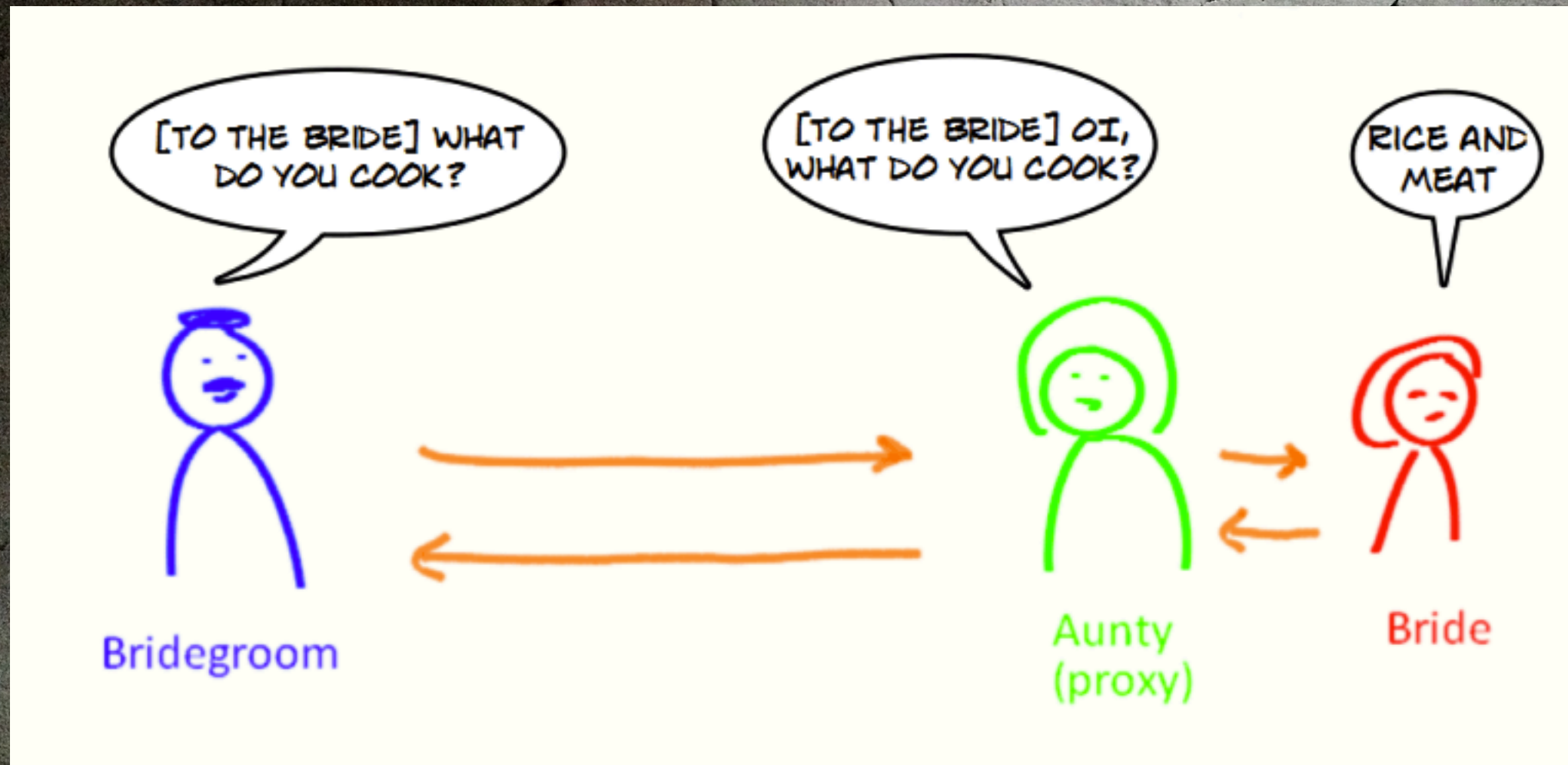
ES7: ASYNC/AWAIT

```
async function msg() {  
  const a = await who();  
  const b = await what();  
  const c = await where();  
  
  console.log(`${a} ${b} ${c}`);  
}
```

```
async function msg() {  
  const [a, b, c] = await  
  Promise.all([who(), what(), where()]);  
  
  console.log(`${a} ${b} ${c}`);  
}  
  
msg(); // 😊 lurks in the shadows <--  
after 1 second
```

<https://alligator.io/js/async-functions/>

PROXIES



QUELLE: [HTTPS://DZONE.COM/ARTICLES/SCALA-PROXY-DESIGN-PATTERN](https://dzone.com/articles/scala-proxy-design-pattern)

PROXY (GRUNDPRINZIP) (STELLVERTRETER, VERMITTLER)

The diagram illustrates the Proxy pattern implementation with the following code and annotations:

```
let target = {  
  x: 10,  
  y: 20  
}  
  
let handler = {  
  get: (obj, prop) => 42  
}  
  
target = new Proxy(target, handler)  
  
target.x // 42  
target.y // 42
```

Original (points to the original `target` object)

offiziell: trap (engl.: Falle) (points to the `get` method in the handler)

Falle stellen, besser: Stellvertreter einrichten (points to the `new Proxy` call)

Ab jetzt übernimmt der Stellvertreter das Ergebnis! (points to the final output)

PROXY TRAPS

```
handler.get  
handler.set  
handler.has  
handler.apply  
handler.construct  
handler.ownKeys  
handler.deleteProperty  
handler.defineProperty  
handler.isExtensible  
handler.preventExtensions  
handler.getPrototypeOf  
handler.setPrototypeOf  
handler.getOwnPropertyDescriptor
```

"PRIVATE" - VERSTECKEN VON EIGENSCHAFTEN MIT PROXIES

```
const hide = (target, prefix = '_') => new Proxy(target, {  
  has: (obj, prop) => ( !prop.startsWith(prefix) && prop in obj ),  
  ownKeys: (obj) => Reflect.ownKeys(obj)  
    .filter(prop => (typeof prop !== "string" || !prop.startsWith(prefix))),  
  get: (obj, prop, rec) => (prop in rec) ? obj[prop] : undefined  
})
```

"PRIVATE" - VERSTECKEN VON EIGENSCHAFTEN MIT PROXIES

```
let userData = hide({  
  firstName: 'Tom',  
  mediumHandle: '@tbarrasso',  
  _favoriteRapper: 'Drake'  
})
```

```
userData._favoriteRapper // undefined  
( '_favoriteRapper' in userData) // false  
Object.keys(userData) // ['firstName', 'mediumHandle']
```

<https://blog.bitsrc.io/a-practical-guide-to-es6-proxy-229079c3c2f0>

DEFINITIV BESTER ARTIKEL!



NEUE METHODEN FÜR STANDARDOBJEKTE IN ES2015

NEUE ARRAY METHODEN

ARRAY METHODS

Array

- .from()**
- .isArray()**
- .of()**

Array.prototype

- .concat()**
- .copyWithin()**
- .entries()**
- .every()**
- .fill()**
- .filter()**
- .find()**
- .findIndex()**
- .flat()**
- .flatMap()**
- .forEach()**
- .includes()**
- .indexOf()**

- .join()**
- .keys()**
- .lastIndexOf()**
- .map()**
- .pop()**
- .push()**
- .reduce()**
- .reduceRight()**
- .reverse()**
- .shift()**
- .slice()**
- .some()**
- .sort()**
- .splice()**
- .toLocaleString()**
- .toSource()**
- .toString()**
- .unshift()**
- .values()**

OBJECT TO ARRAY

```
const arrayLikeObject = { length:2, 0:'a', 1:'b' };

for (const x of arrayLikeObject) {           // TypeError
  console.log(x);
}

const arr = Array.from(arrayLikeObject);
for (const x of arr) {                       // OK, iterable
  console.log(x);
}

// Output:
// a
// b
```

MAP()

```
const spanElements = document.querySelectorAll('span.name');

const names1 = Array.prototype.map.call(
  spanElements,
  s => s.textContent
);

// Array.from():
const names2 = Array.from(spanElements, s => s.textContent);
```

ARRAY CREATING

```
Array.of(item_0, item_1, ...)
```

creates an Array whose elements are item_0, item_1, etc.

ARRAY.FIND(), ARRAY.FINDINDEX()

```
let arr = [ 1, 3, 4, 2 ]  
  
arr.find(x => x > 3)      // 4  
arr.findIndex(x => x > 3) // 2
```

ECMAScript 5

```
var arr = [ 1, 3, 4, 2 ]  
arr.filter( function (x) { return x > 3; } )[0]; // 4
```

TYPED ARRAYS

```
// create a TypedArray with a size in bytes
const typedArray1 = new Int8Array(8);
typedArray1[0] = 32;

const typedArray2 = new Int8Array(typedArray1);
typedArray2[1] = 42;

console.log(typedArray1);
// expected output: Int8Array [32, 0, 0, 0, 0, 0, 0, 0]

console.log(typedArray2);
// expected output: Int8Array [32, 42, 0, 0, 0, 0, 0, 0]
```


TYPED ARRAYS

```
Int8Array();  
Uint8Array();  
Uint8ClampedArray();  
Int16Array();  
Uint16Array();  
Int32Array();  
Uint32Array();  
Float32Array();  
Float64Array();  
BigInt64Array();  
BigUint64Array();
```

NEUE METHODEN VON OBJECT

NEW OBJECT METHOD

Object

- **assign()**
- create()
- defineProperties()
- defineProperty()
- entries()
- freeze()
- fromEntries()
- getOwnPropertyDescriptor()
- getOwnPropertyDescriptors()
- getOwnPropertyNames()
- getOwnPropertySymbols()
- getPrototypeOf()
- is()
- isExtensible()
- isFrozen()
- isSealed()
- keys()

- preventExtensions()
- seal()
- setPrototypeOf()
- values()

Object.prototype

- __defineGetter__()
- __defineSetter__()
- __lookupGetter__()
- __lookupSetter__()
- hasOwnProperty()
- isPrototypeOf()
- propertyIsEnumerable()
- toLocaleString()
- toSource()
- toString()
- valueOf()
- watch()

ENHANCED OBJECT PROPERTIES

```
let dest = { quux: 0 },  
    src1 = { foo: 1, bar: 2 },  
    src2 = { foo: 3, baz: 4 };
```

`Object.assign(dest, src1, src2)`

```
// dest.quux === 0;  
// dest.foo === 3;  
// dest.bar === 2;  
// dest.baz === 4
```

ECMAScript 5

```
var dest = { quux: 0 };  
var src1 = { foo: 1, bar: 2 };  
var src2 = { foo: 3, baz: 4 };
```

```
Object.keys(src1).forEach(function(k) { dest[k] = src1[k]; });  
Object.keys(src2).forEach(function(k) { dest[k] = src2[k]; });
```

```
dest.quux === 0; dest.foo === 3; dest.bar === 2; dest.baz === 4;
```

ENHANCED OBJECT PROPERTIES

```
let x = 0, y = 0;  
let obj = { x, y };
```

ECMAScript 5

```
var x = 0, y = 0;  
var obj = { x: x, y: y };
```

COMPUTED PROPERTY NAMES

```
let obj = {  
  foo: "bar",  
  ["baz" + quux()]: 42  
}
```

```
ECMAScript 5  
var obj = {  
  foo: "bar"  
};  
obj[ "baz" + quux() ] = 42;
```

METHOD PROPERTIES

```
obj = {  
    foo (a, b) { ... },  
    bar (x, y) { ... },  
    *quux (x, y) { ... }  
}
```

ECMAScript 5

```
obj = {  
    foo: function (a, b) {  
        ...  
    },  
    bar: function (x, y) {  
        ...  
    },  
    // quux: no equivalent in ES5  
};
```

NEUE METHODEN VON STRING, NUMBER, MATH

STRING METHODS

String

- .fromCharCode()
- .fromCodePoint()
- .raw()

String.prototype

- .anchor()
- .big()
- .blink()
- .bold()
- .charAt()
- .charCodeAt()
- .codePointAt()
- .concat()
- .endsWith()**
- .fixed()
- .fontcolor()
- .fontsize()
- .includes()**
- .indexOf()
- .italics()
- .lastIndexOf()
- .link()
- .localeCompare()
- .match()
- .matchAll()
- .normalize()

- .padEnd()
- .padStart()
- .repeat()**
- .replace()
- .search()
- .slice()
- .small()
- .split()
- .startsWith()**
- .strike()
- .sub()
- .substr()
- .substring()
- .sup()
- .toLocaleLowerCase()
- .toLocaleUpperCase()
- .toLowerCase()
- .toSource()
- .toString()
- .toUpperCase()
- .trim()
- .trimRight()
- .trimLeft()
- .valueOf()

NEUE STRING METHODEN

```
      0 1 2 3 4
let str='hello';

str.startsWith("ello", 1) // true   startet ab Position 1 mit ello
str.endsWith("hell", 4)  // true   endet mit 'hell' mit Länge 4
str.includes("ell")      // true   enthält 'ello'
str.includes("ell", 1)   // true   enthält 'ell' ab Position 1
str.includes("ell", 2)   // false  enthält 'ell' ab Position 2
```

```
ECMAScript 5
"hello".indexOf("ello")    === 1;           // true
"hello".indexOf("hell")    === (4 - "hell".length); // true
"hello".indexOf("ell")     !== -1;          // true
"hello".indexOf("ell", 1)  !== -1;          // true
"hello".indexOf("ell", 2)  !== -1;          // false
```

NUMBER TYPE CHECKING

```
Number.isNaN(42) === false  
Number.isNaN(NaN) === true
```

```
Number.isFinite(Infinity) === false  
Number.isFinite(-Infinity) === false  
Number.isFinite(NaN) === false  
Number.isFinite(123) === true
```

```
ECMAScript 5  
var isNaN = function (n) {  
    return n !== n;  
};  
var isFinite = function (v) {  
    return (typeof v === "number" && !isNaN(v) && v !== Infinity && v !==  
    -Infinity);  
};
```

NUMBER SAFETY CHECKING

```
Number.isSafeInteger(42) === true  
Number.isSafeInteger(9007199254740992) === false
```

ECMAScript 5 – syntactic sugar: reduced | traditional

```
function isSafeInteger (n) {  
    return (  
        typeof n === 'number'  
        && Math.round(n) === n  
        && -(Math.pow(2, 53) - 1) <= n  
        && n <= (Math.pow(2, 53) - 1)  
    );  
}
```

STANDARD EPSILON FÜR GENAUEREN FLIEßKOMMA VERGLEICH

```
0.1 + 0.2 === 0.3 // false
```

```
Math.abs((0.1 + 0.2) - 0.3) < Number.EPSILON // true
```

TRUNC

Ganzzahlermittlung:

```
Math.trunc(42.7)    // 42  
Math.trunc( 0.1)    //  0  
Math.trunc(-0.1)    // -0
```

```
ECMAScript 5  
function mathTrunc (x) {  
    return (x < 0 ? Math.ceil(x) : Math.floor(x));  
}
```

NUMBER SIGN DETERMINATION

Vorzeichenbestimmung:

```
Math.sign(7)      // 1
Math.sign(0)      // 0
Math.sign(-0)     // -0
Math.sign(-7)     // -1
Math.sign(NaN)    // NaN
```

```
ECMAScript 5
function mathSign (x) {
    return (
        (x === 0 || isNaN(x)) ? x : (x > 0 ? 1 : -1)
    );
}
```

GENERATOREN

GENERATOREN

- Generatorfunction und Generatorobject
- yield-Keyword und next-Methode

GENERATOR FUNCTION

```
function* range (start, end, step) {  
  while (start < end) {  
    yield start           // yield -> Ertrag  
    start += step  
  }  
}
```

```
for (let i of range(0, 10, 2)) {  
  console.log(i)         // 0, 2, 4, 6, 8  
}
```

```
ECMAScript 5  
function range (start, end, step) {  
  var list = [];  
  while (start < end) {  
    list.push(start);  
    start += step;  
  }  
  return list;  
}  
  
var r = range(0, 10, 2);  
for (var i = 0; i < r.length; i++) {  
  console.log(r[i]); // 0, 2, 4, 6, 8  
}
```

GENERATOR, YIELD UND NEXT()

```
function* foo(index) {  
  while (index < 2) {  
    yield index++;  
  }  
}
```

```
const iterator = foo(0);
```

```
console.log(iterator.next().value);    // expected output: 0  
console.log(iterator.next().value);    // expected output: 1
```

GENERATOR FUNCTION MIT ITERATOR

```
let fibonacci = {  
  *[Symbol.iterator]() {  
    let previous = 0, current = 1  
    for (;;) {  
      [ previous, current ] = [ current, previous + current ];  
      yield current;  
    }  
  }  
}  
  
for (let n of fibonacci) {  
  if (n > 1000)  
    break  
  console.log(n)  
}
```

SYMBOLS

SYMBOL

```
const symbol1 = Symbol();  
const symbol2 = Symbol(42);  
const symbol3 = Symbol('foo');  
  
console.log(typeof symbol1);  
// expected output: "symbol"  
  
console.log(symbol3.toString());  
// expected output: "Symbol(foo)"  
  
console.log(Symbol('foo') === Symbol('foo'));  
// expected output: false
```

SYMBOL()

- The Symbol() function returns a value of type symbol
- Static properties that expose several members of built-in objects
- Static methods that expose the global symbol registry
- Resembles a built-in object class but is incomplete as a constructor because it does not support the syntax "new Symbol()"
- Every symbol value returned from Symbol() is unique.

SYMBOL

Properties

Symbol

- .asyncIterator
- .hasInstance
- .isConcatSpreadable
- .iterator
- .match
- .matchAll
- .prototype
- .prototype.description
- .replace
- .search
- .species
- .split
- .toPrimitive
- .toStringTag
- .unscopables

Methods

Symbol

- .for()
- .keyFor()

Symbol.prototype

- .toSource()
- .toString()
- .valueOf()

[SYMBOL.ITERATOR]

```
const iterable1 = new Object();

iterable1[Symbol.iterator] = function* () {
  yield 1;
  yield 2;
  yield 3;
};

console.log(...iterable1); // expected output: Array [1, 2, 3]
```

ITERATOREN

FOR ... OF

```
let fibonacci = {  
  [Symbol.iterator]() {  
    let pre = 0, cur = 1  
    return {  
      next () {  
        [ pre, cur ] = [ cur, pre + cur ]  
        return { done: false, value: cur }  
      }  
    }  
  }  
}  
  
for (let n of fibonacci) {  
  if (n > 1000)  
    break  
  console.log(n)  
}
```

SPREAD- UND RESTOPERATOR

- for-of-Schleife
- Bildung und Einsatz von Iteratoren

MAP/SET,
WEAKMAP/WEAKSET

SET()

```
let s = new Set();  
s.add("hello").add("goodbye").add("hello");  
  
// s.size === 2  
// s.has("hello") ===  
true  
  
for (let key of s.values()) {           // insertion order!!!  
    console.log(key);  
}
```

MAP()

```
let m = new Map();  
let s = Symbol();  
  
m.set("hello", 42);           // m.get(s) === 34  
m.set(s, 34)                  // m.size === 2  
  
for (let [ key, val ] of m.entries()) {  
    console.log(key + " = " + val);  
}
```

WEAKSET, WEAKMAP()

```
let isMarked = new WeakSet();

export class Node {
  constructor (id) { this.id = id }
  mark        ()    { isMarked.add(this) }
  unmark      ()    { isMarked.delete(this) }
  marked      ()    { return isMarked.has(this) }
}

let foo = new Node("foo") // JSON.stringify(foo) === '{"id":"foo"}'

foo.mark()               // JSON.stringify(foo) === '{"id":"foo"}'
                        // isMarked.has(foo)      === true

foo = null               // remove only reference to foo
                        // isMarked.has(foo)      === false
```


WEAKSET, WEAKMAP()

```
let attachedData = new WeakMap()

export class Node {
  constructor (id) { this.id = id }
  set data (data) { attachedData.set(this, data) }
  get data () { return attachedData.get(this) }
}

let foo = new Node("foo") // JSON.stringify(foo) === '{"id":"foo"}'

foo.data = "bar" // foo.data === "bar"
// JSON.stringify(foo) === '{"id":"foo"}'
// attachedData.has(foo) === true

foo = null // remove only reference to foo
// attachedData.has(foo) === false
```

REFLECTIONS

REFLECT

```
let obj = { a: 1 }
```

```
Object.defineProperty(obj, "b", { value: 2 })
```

```
obj[Symbol("c")] = 3
```

```
console.log(Reflect.ownKeys(obj))           // [ "a", "b", Symbol(c) ]
```

REFLECT

Reflect.apply()

Ruft eine Zielfunktion mit Argumenten auf, die Argumente werden im Parameter args angegeben. Siehe auch `Function.prototype.apply()`.

Reflect.construct()

Der new operator als Funktion. Equivalent zu `new target(...args)`. Bietet die optionale Möglichkeit, einen anderen Prototyp anzugeben.

Reflect.defineProperty()

Ähnlich zu `Object.defineProperty()`. Gibt einen Boolean zurück.

Reflect.deleteProperty()

Der delete operator als Funktion. Ähnlich zu dem Aufruf `delete target[name]`.

Reflect.get()

Eine Funktion, die den Wert von Eigenschaften/Properties zurückgibt.

Reflect.getOwnPropertyDescriptor()

Ähnlich zu `Object.getOwnPropertyDescriptor()`. Gibt einen Eigenschaftsdeskriptor der angegebenen Eigenschaft, oder undefined zurück.

Reflect.getPrototypeOf()

Gleich wie `Object.getPrototypeOf()`.

REFLECT

Reflect.has()

Der in operator als Funktion. Gibt einen booleschen Wert zurück, der angibt, ob eine eigene oder geerbte Eigenschaft vorhanden ist.

Reflect.isExtensible()

Gleich wie `Object.isExtensible()`.

Reflect.ownKeys()

Gibt ein Array der eigenen (nicht geerbten) Eigenschaftsschlüssel des Zielobjekts zurück.

Reflect.preventExtensions()

Ähnlich zu `Object.preventExtensions()`. Gibt einen Boolean zurück.

Reflect.set()

Eine Funktion, die den Eigenschaften/Properties Werte zuweist. Gibt einen Booleanzurück, der true ist, wenn die Zuweisung erfolgreich verlief.

Reflect.setPrototypeOf()

Eine Funktion, die den Prototyp eines Objekts festlegt.