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

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

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 }
```

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;
    }
}
```

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}`)
```

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 ...;
```

EXPORT EINER KLASSE

```
class User {
    constructor(n, p, e) {
        this._name = n;
        this._prename = p;
        this._email = e;
    }

    move() {
        console.log('1 step');
    }

    set name(n = 'no name') { this._name = n; }
    set prename(p) { this._prename = p; }
    set email(e) { this._email = e; }

    get name() { return this._name; }
    get prename() { return this._prename; }
    get email() { return this._email; }
}


export default User;
```

EXPORT EINER KLASSE

```
export class Male extends User {
    constructor(n, p, e) {
        super(n, p, e);
    }
    drink() {
        console.log('beer');
    }
}

export class Female extends User {
    constructor(n, p, e) {
        super(n, p, e);
    }
    dance() {
        console.log('jive');
    }
    move() {
        console.log('2 steps');
    }
}
```

IMPORT VON KLASSE

```
import User from './components/user.js';
import Male from './components/user.js';
import Female from './components/user.js';

let admin = new User('Joe');
log(admin.getName());

let ann = new Female('Doe', 'Ann', 'ann@doe.org');
log(ann.getPrename());

let john = new Male('Doe', 'John', 'john@doe.org')
log(john.getPrename());
```

EINBINDEN EINES MODULS

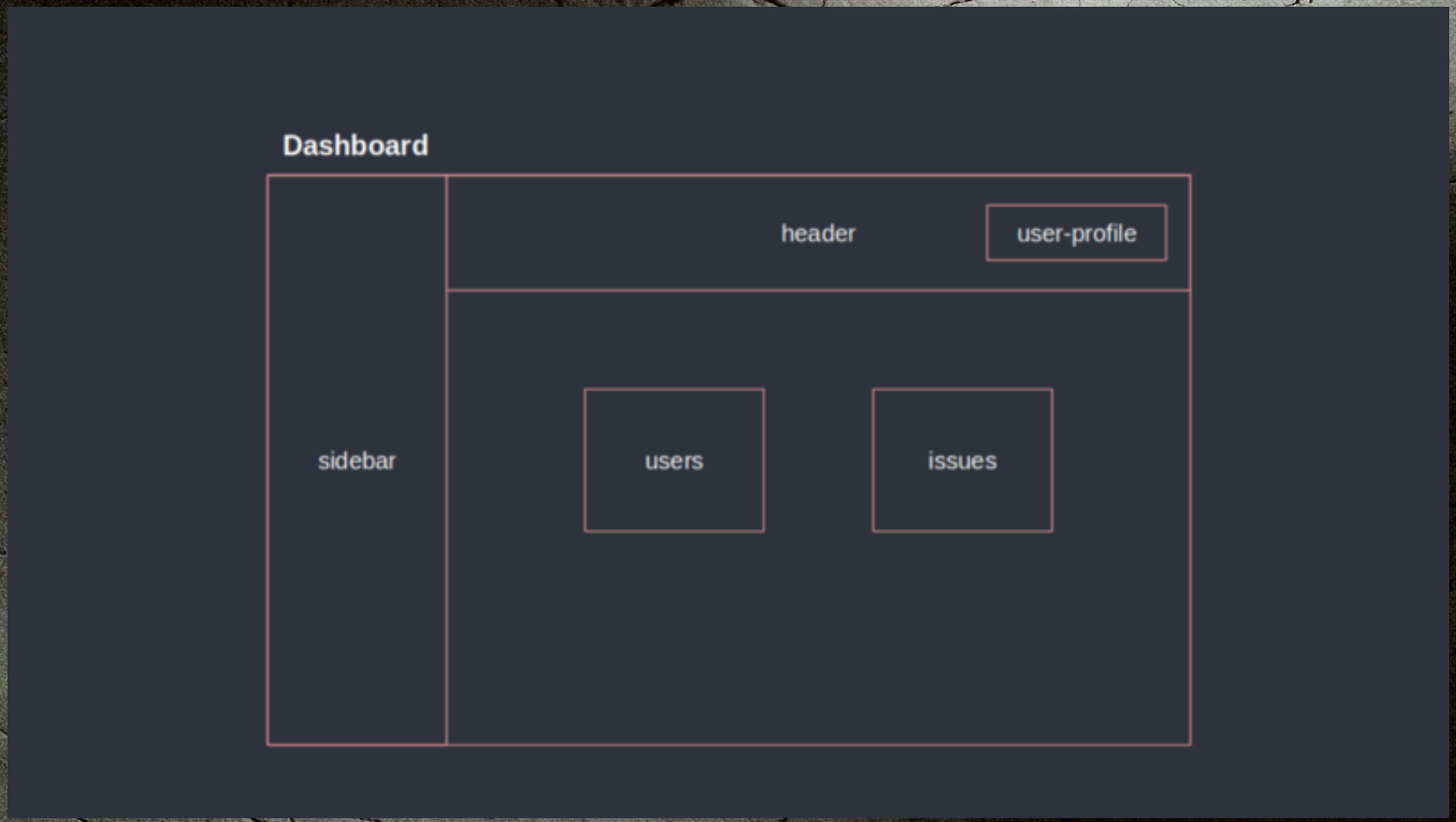
```
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-
scale=1.0">
    <meta http-equiv="X-UA-Compatible" content="ie=edge">
    <title>ES 6+ Modules</title>
</head>

<body>
    <nav>
    </nav>
    <script type="module" src="modules.js"></script>
</body>

</html>
```

EINE APPLIKATION MIT MODULEN ENTWERFEN


Dashboard
header
user-profile
sidebar
users
issues

SCHRITT 1 - ENTWURF

Ein guter Entwurf erspart Zeit und Schmerzen.
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 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() {
    // Creata 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}`);
}
```

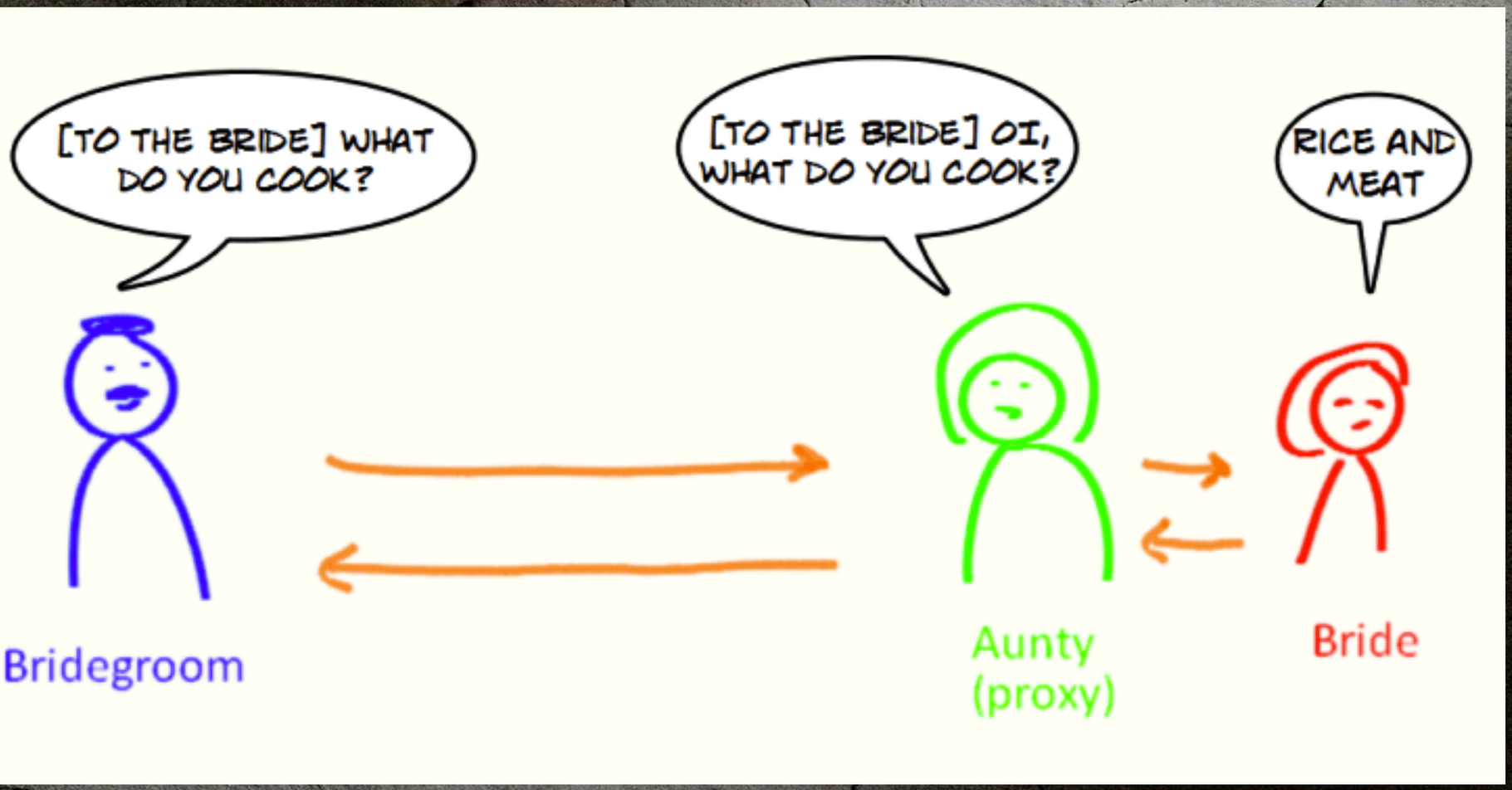
```
async function msg() {
  const [a, b, c] = await
Promise.all([who(), what(), where()]);

  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

PROXY (GRUNDPRINZIP) (STELLVERTRETER, VERMITTLER)

Original

```
let target = {
  x: 10,
  y: 20
}
```

offiziell: trap (engl.: Falle)

```
let handler = {
  get: (obj, prop) => 42
}
```

Falle stellen, besser:
Stellvertreter einrichten

```
target = new Proxy(target, handler)

target.x // 42
target.y // 42
```

Ab jetzt übernimmt
der Stellvertreter das Ergebnis!

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
```

Setze das nachfolgende Beispiel selbstständig um.

20 MINUTEN

"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: 'John',
  mediumHandle: '@jdoe',
  _favoriteRapper: 'Ann'
})

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

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

THOMAS BARRASSO

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.

DESTRUCTURING WITH OBJECTS

```
// old way
let tuple = {
    a: 3,
    b: 7,
    c: 6
};
let a = tuple.a;
let b = tuple.b;
let c = tuple.c;
log(a, b, c);

// Destructuring

let { x = 3, y = 7, z = 6 } = tuple;
```

DESTRUCTURING

```
const student = {
    firstname: 'Ann',
    lastname: 'Doe',
    country: 'UK'
};


({ firstname, lastname, country } = student); // Ann, Doe, UK

({ firstname, lastname } = student); // Ann, Doe
```

USING DIFFERENT NAMES AND DEFAULT VALUES

```
const person = {
    name: 'John Doe',
    country: 'US'
};

const {
    name: fullname,      <- setting an alias
    country: place,
    age: years = 25      <- a default value
} = person;


log(`I am ${fullname} from ${place} and I am ${years} years old.`);
-> I am John Doe from US and I am 25 years old.
```

Destrukturiere.

```
{prename:'john', 'name':doe, 'email':john@doe.org}
```

```
console.log(`Hello, my name is ${fullname}`);
console.log(`You can send me an Email to ${email}`);
console.log(`The best time would be ${bestTime}`);
```

10 MINUTEN

DESTRUCTURUNG WITH ARRAYS

```
const rgb = [255, 200, 0];
const [red, green, blue] = rgb;

log(`R: ${red}, G: ${green}, B: ${blue}`);
R: 255, G: 200, B: 0
```

SKIPPING ITEMS

```
const rgb = [200, 255, 100];

// Skip the first two items
const [ , , blue] = rgb;

log(`Blue: ${blue}`);
R: 200, G: undefined, B: 255
```

USING THE SPREAD OPERATOR

```
const rainbow = ['red', 'orange', 'yellow', 'green', 'blue',
'indigo', 'violet'];

// Assign the first and third items to red and yellow
// Assign the remaining items to otherColors using the spread operator (...)

const [red, , yellow, ...otherColors] = rainbow;


log(otherColors);
green,blue,indigo,violet
```

USING THE SPREAD OPERATOR AS FUNCTION ARGUMENT

```
function fn(a, b, c, d, ...args) {
    console.log('rest param:', a, b, args);
    console.log('number of expected args:', fn.length);
    console.log('number of additional args:', args.length);
}


fn(1, 2, 3, 4, 5, 6, 7, 8, 9, 0);

rest param:   1   2   5,6,7,8,9,0
number of expected args:   4
number of additional args: 6
```

Schreibe eine Funktion, die beliebig viele Zahlen addiert, die über ein Starndard- und Rest-Argument übergeben werden.

```
function add(a, ...rest){
    ...

    return result; // console.log(result)
}
```

20 MINUTEN

https://codeburst.io/es6-destructuring-the-complete-guide-7f842d08b98f

GLAD CHINDA

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()

- Neuer Datentyp:
  Symbol() erzeugt einen Wert vom Typ **`symbol`**

- Symbols sind immutable und immer **unique**

- Symbols können nicht implizit zu einem String konvertieren; deshalb **`symbol.toString()`**

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)
}
```

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

```
          01234
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)
}
```

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.