THE COMPLETE JAVASCRIPT COURSE

FROM ZERO TO EXPERT!

SECTION

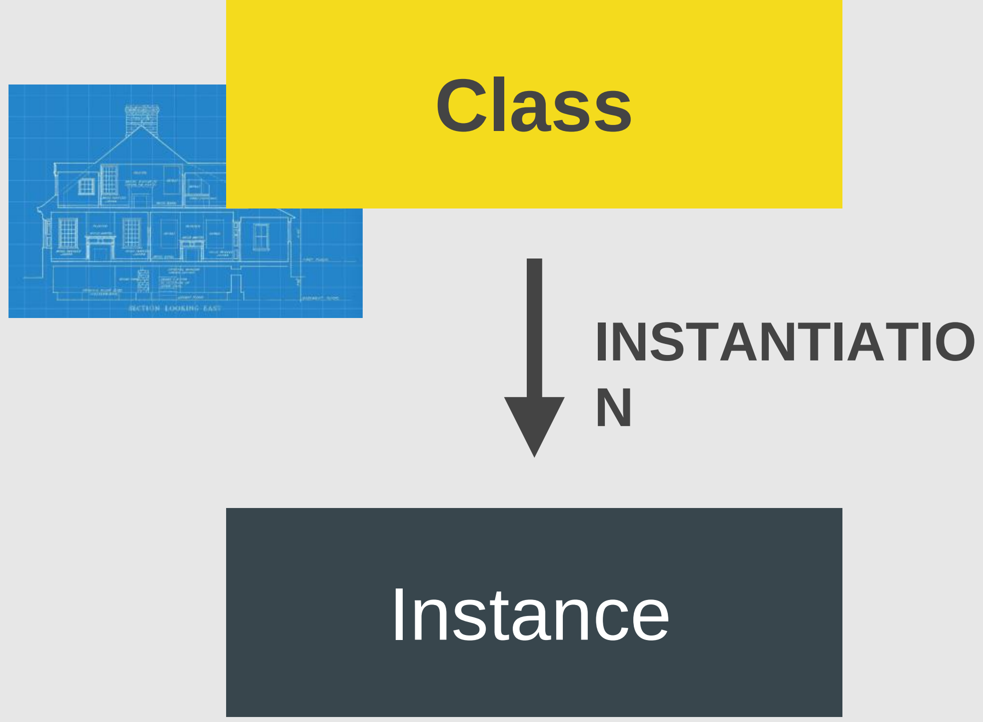
OBJECT ORIENTED PROGRAMMING (OOP) WITH JAVASCRIPT

LECTURE

OOP IN JAVASCRIPT

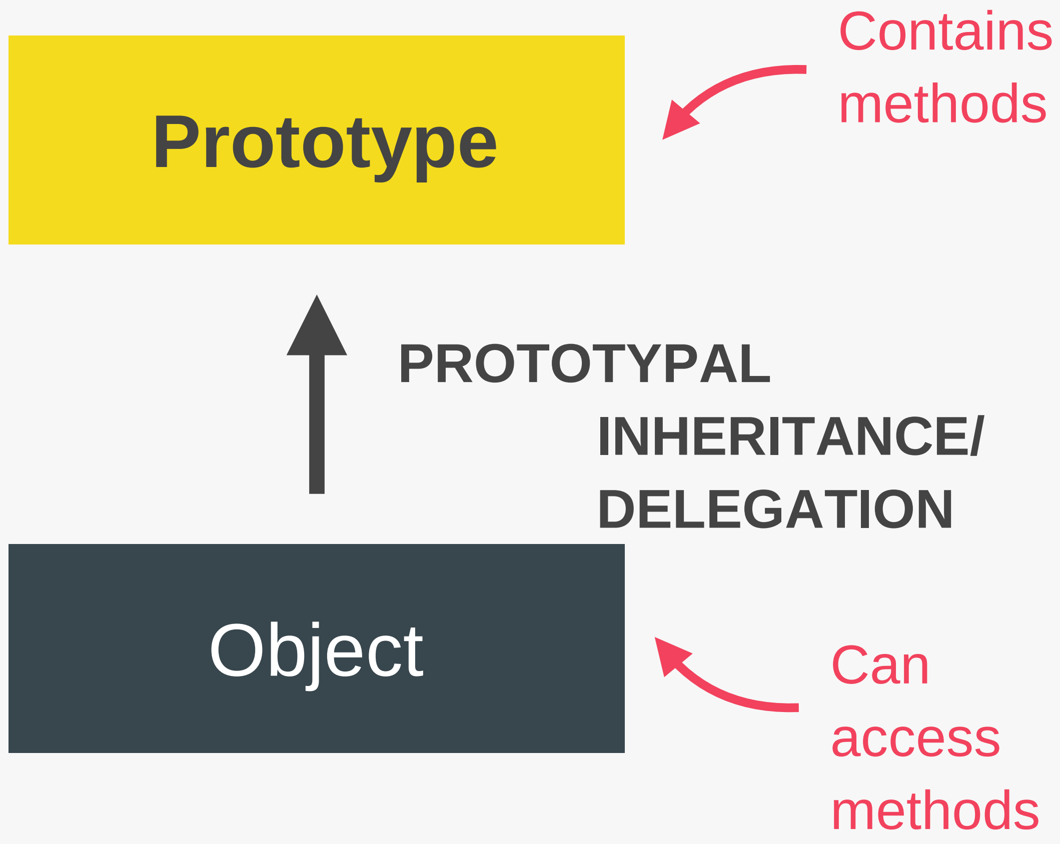
OOP IN JAVASCRIPT: PROTOTYPES

"CLASSICAL OOP": CLASSES



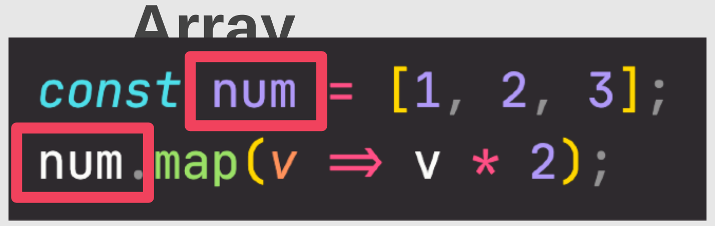
- Objects (instances) are **instantiated** from a class, which functions like a blueprint;
- Behavior (methods) is **copied** from class to all instances.

OOPIN JS: PROTOTYPES



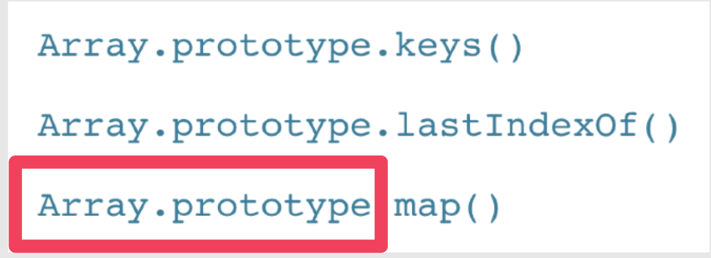
- Objects are **linked** to a prototype object,
- **Prototypal inheritance: The prototype contains methods (behavior) that are accessible to all objects linked to that prototype;**
- Behavior is **delegated** to the linked prototype object.

Example: Array



```
const num = [1, 2, 3];
num.map(v => v * 2);
```

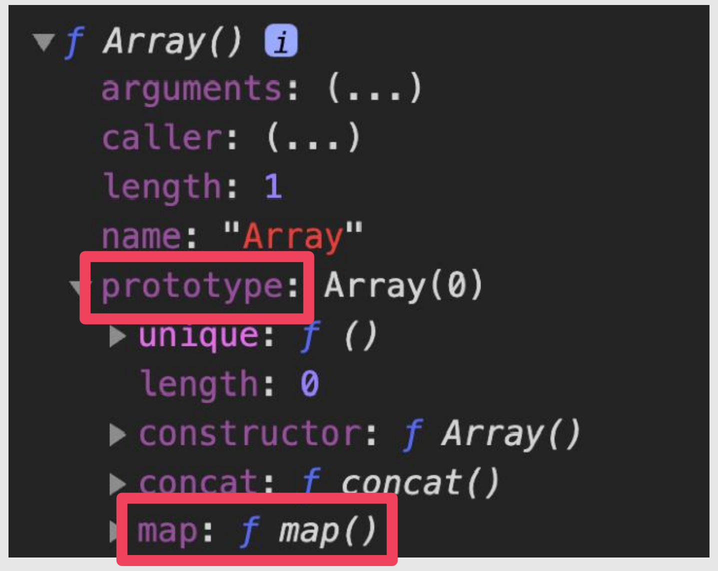
MDN web docs moz://a



```
Array.prototype.keys()
Array.prototype.lastIndexOf()
Array.prototype.map()
```

`Array.prototype` is the **prototype** of all array objects we create in JavaScript

Therefore, **all** arrays have access to the `map` method!



```
▼ f Array() i
    arguments: (...)
    caller: (...)
    length: 1
    name: "Array"
  ▼ prototype: Array(0)
    ▶ unique: f ()
      length: 0
    ▶ constructor: f Array()
    ▶ concat: f concat()
    ▶ map: f map()
```

3 WAYS OF IMPLEMENTING PROTOTYPAL INHERITANCE IN JS

> 🤔 *“How do we actually create prototypes? And how do we link objects to prototypes? How can we create new objects, without having classes?”*

1 Constructor functions

- Technique to create objects from a function;
- This is how built-in objects like Arrays, Maps or Sets are actually implemented.

2 ES6 Classes

- Modern alternative to constructor function syntax;
- “Syntactic sugar”: behind the scenes, ES6 classes work **exactly** like constructor functions;
- ES6 classes do **NOT** behave like classes in “classical OOP” (last lecture).

3 `Object.create()`

- The easiest and most straightforward way of linking an object to a prototype object.

☝ **The 4 pillars of OOP are still valid!**

- Abstraction
- Encapsulation
- Inheritance
- Polymorphism

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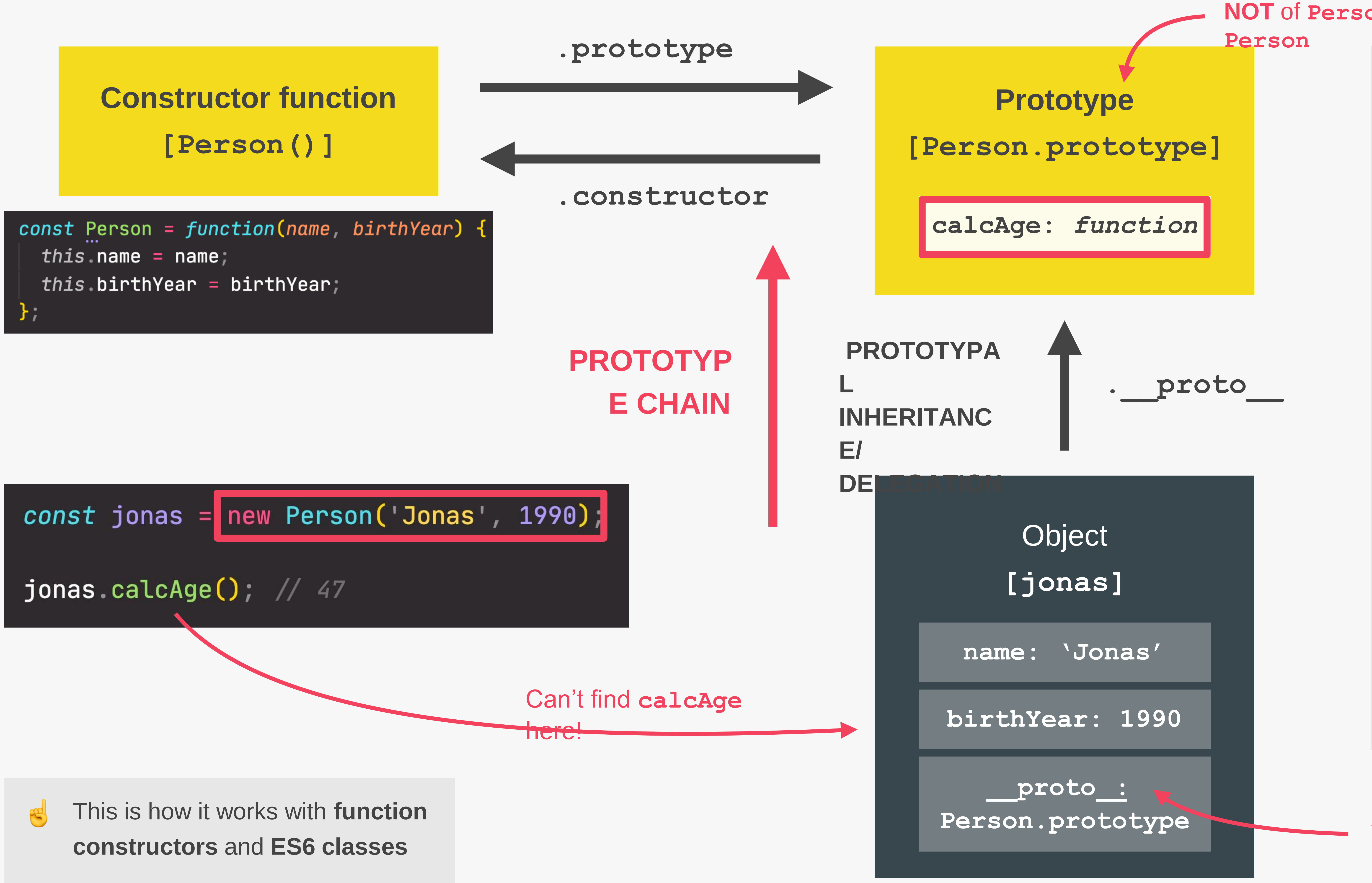
PROTOTYPAL INHERITANCE AND THE PROTOTYPE CHAIN

JS

HOW PROTOTYPAL INHERITANCE / DELEGATION WORKS



```
const Person = function(name, birthYear) {
  this.name = name;
  this.birthYear = birthYear;
};
```

```
const jonas = new Person('Jonas', 1990);

jonas.calcAge(); // 47
```

☝ This is how it works with **function constructors** and **ES6 classes**

🆕 **The new operator:**

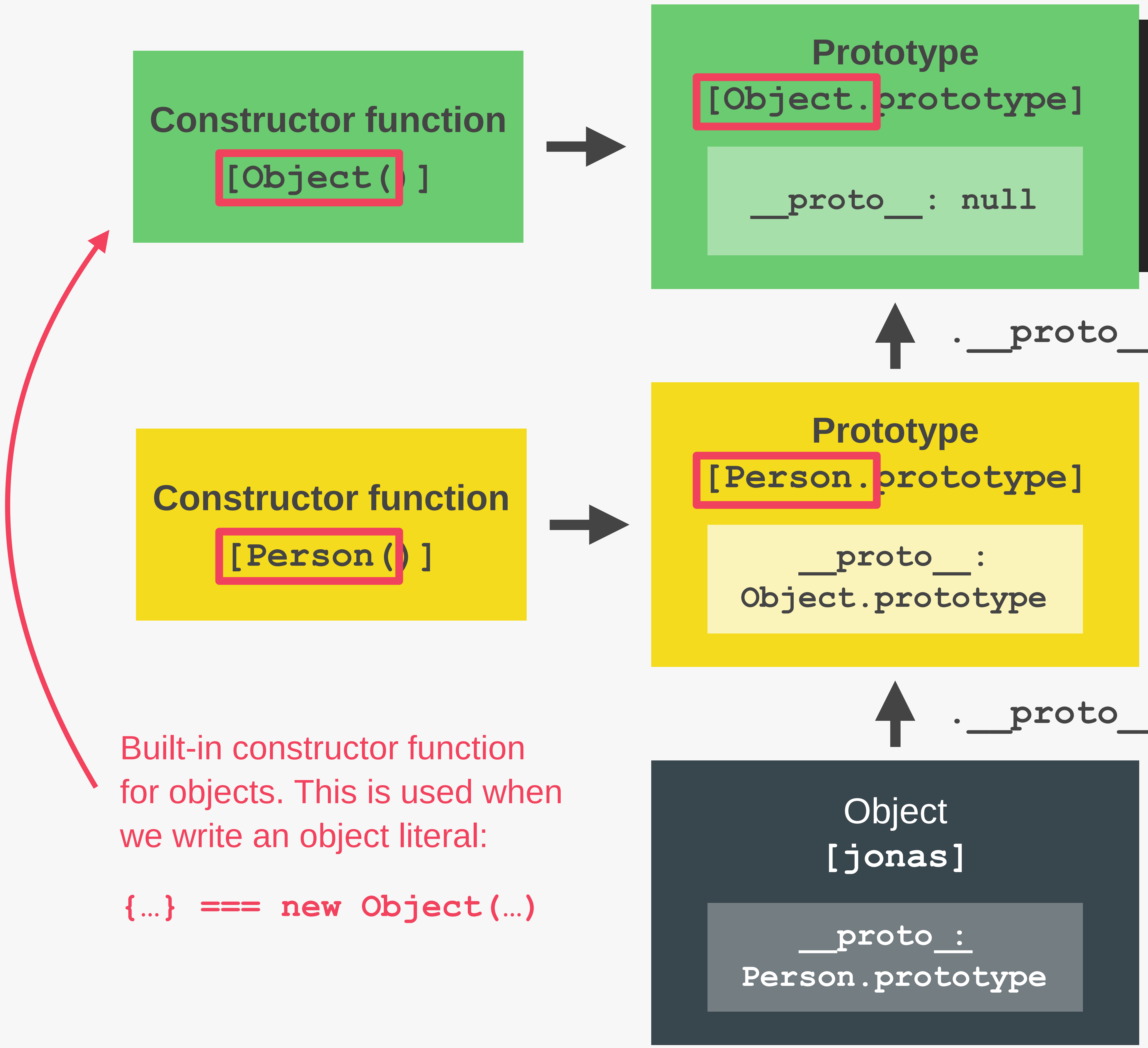
1 An empty object is created

2 `this` keyword in constructor function call is set to the new object

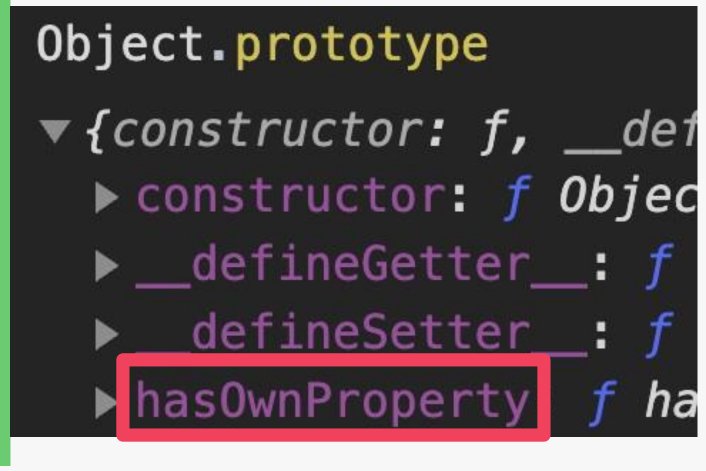
3 **The new object is linked (`__proto__` property) to the constructor function's prototype property**

4 The new object is returned from the constructor function call

THE PROTOTYPE CHAIN



null



```
Object.prototype
▼{constructor: f, __def
  ▶constructor: f Objec
  ▶__defineGetter__: f
  ▶__defineSetter__: f
  ▶hasOwnProperty  f ha
```

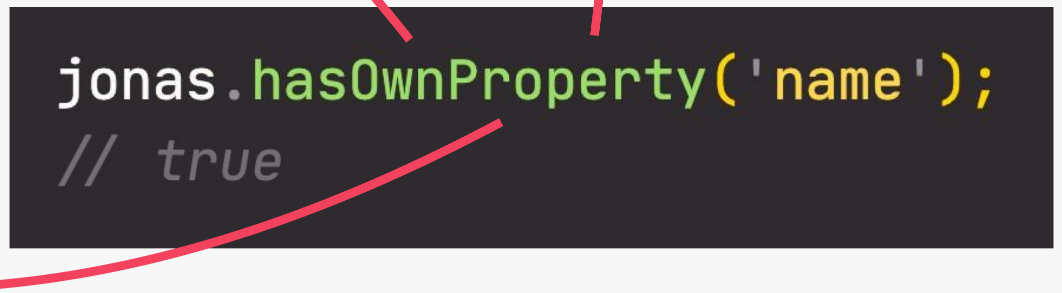
Built-in constructor function for objects. This is used when we write an object literal:

`{…} === new Object(…)`

This is an **OBJECT** itself! Remember, every object in JavaScript has a prototype!

Here it is!

Can’t find **`hasOwnProperty`** here!



```
jonas.hasOwnProperty('name');
// true
```

Can’t find **`hasOwnProperty`** here!

PROTOTYPE CHAIN

Series of links between objects, linked through prototypes

(Similar to the scope chain)

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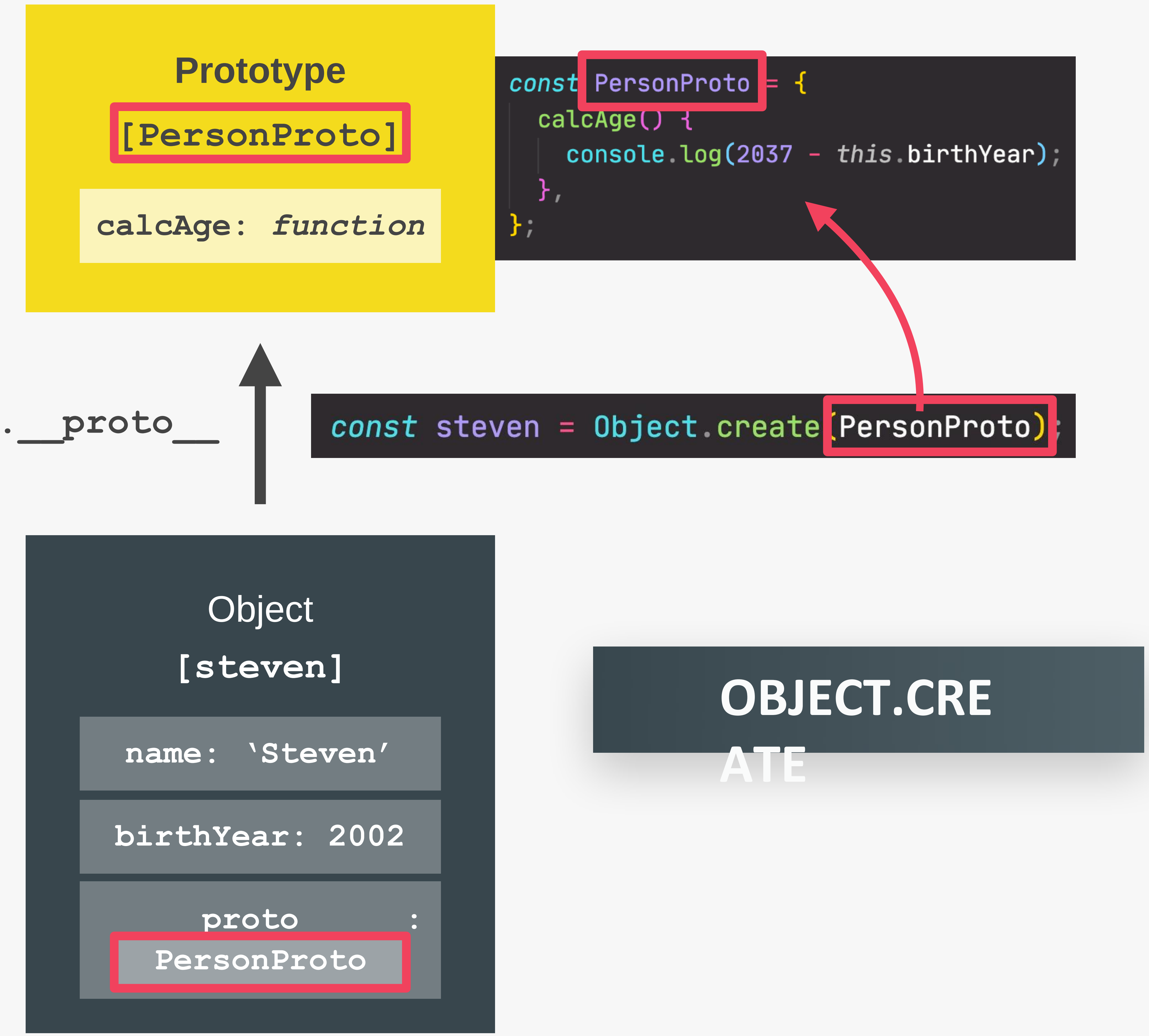
OBJECT.CREATE

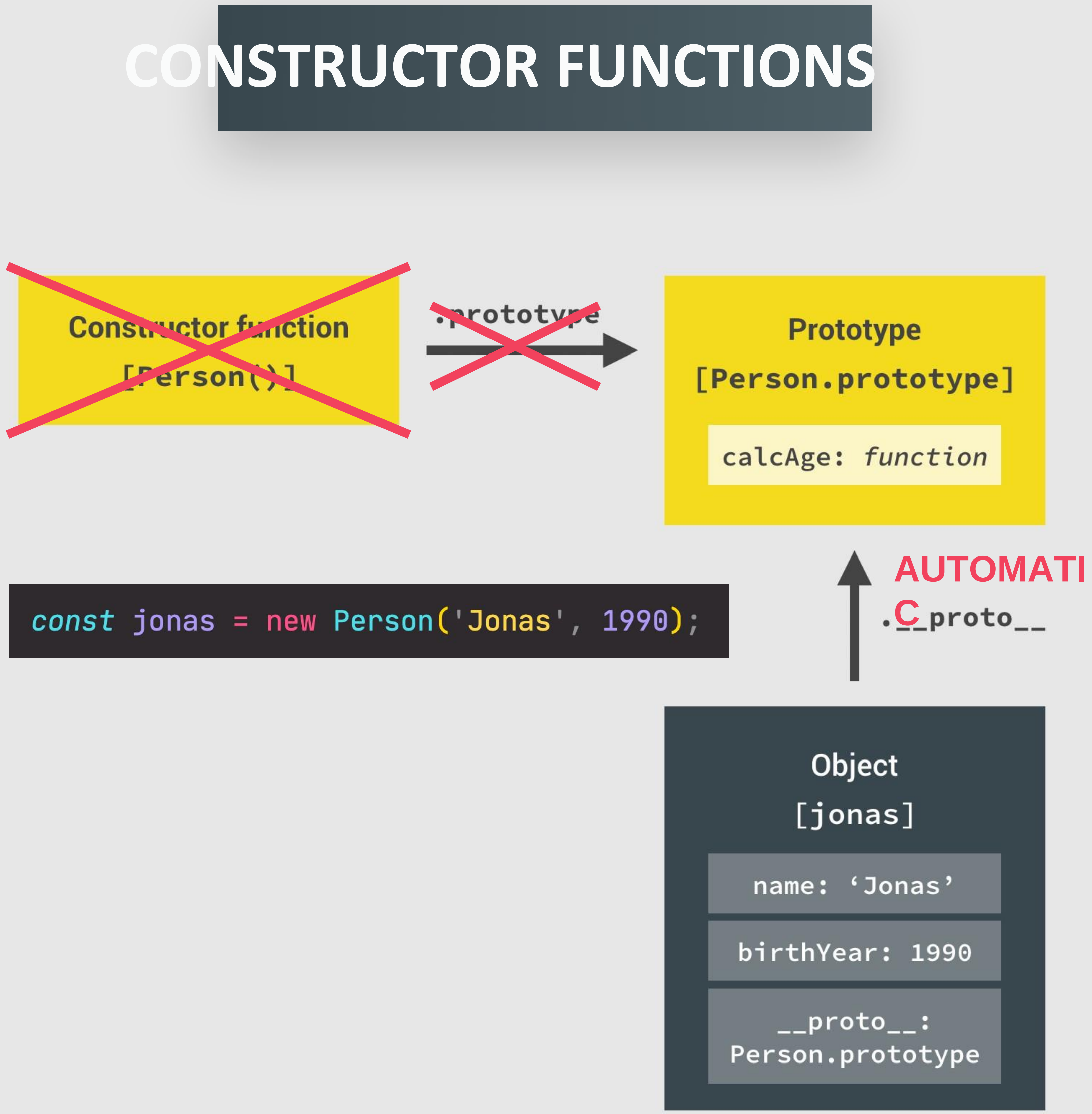
JS

HOW OBJECT CREATE WORKS



```
const PersonProto = {
  calcAge() {
    console.log(2037 - this.birthYear);
  },
};
```

```
const steven = Object.create(PersonProto);
```



```
const jonas = new Person('Jonas', 1990);
```

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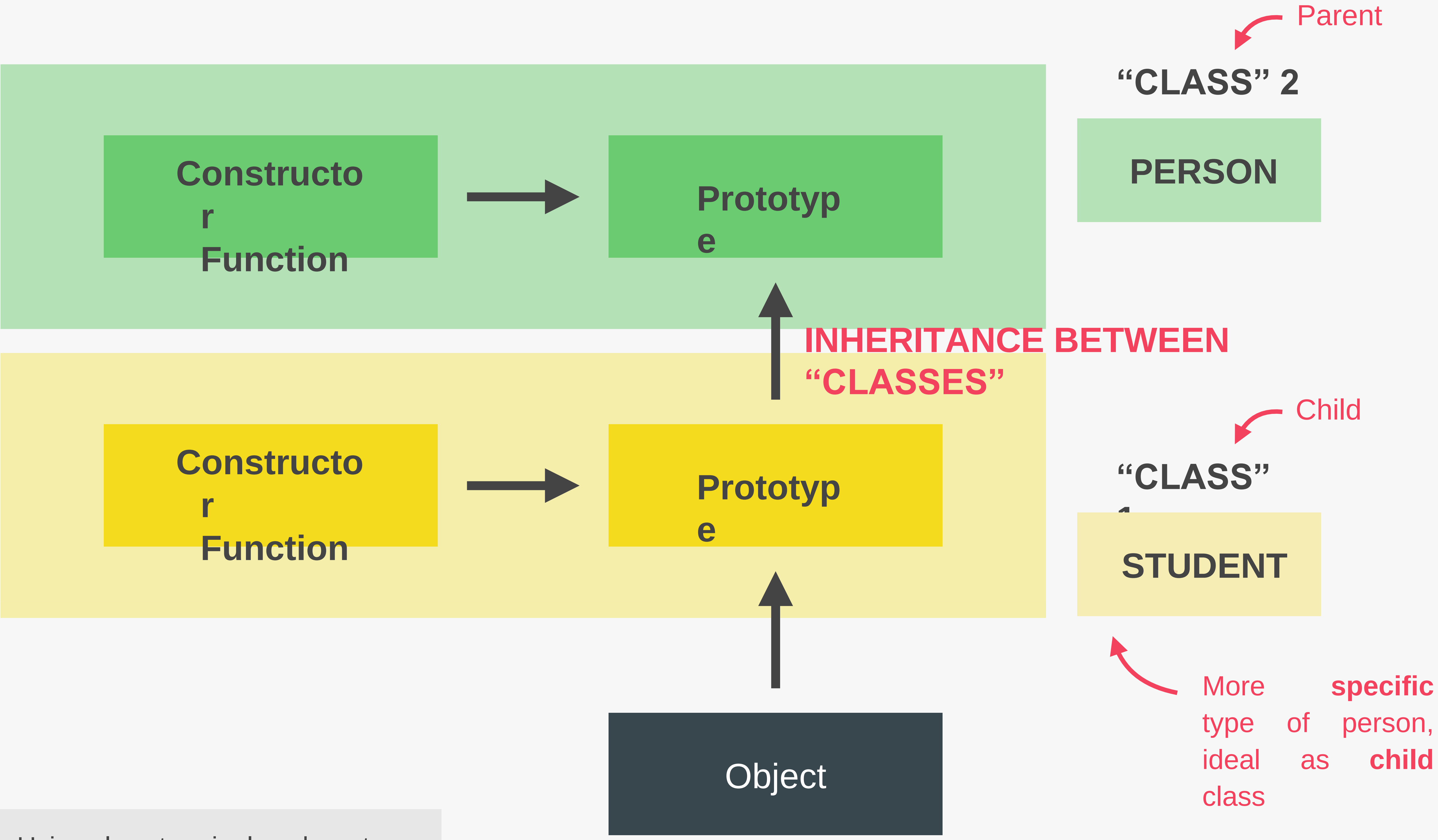
INHERITANCE BETWEEN "CLASSES": CONSTRUCTOR FUNCTIONS

JS

INHERITANCE BETWEEN “CLASSES”



Parent

“CLASS” 2

PERSON

Constructor Function

Prototype

INHERITANCE BETWEEN “CLASSES”

Child

“CLASS” 1

STUDENT

Constructor Function

Prototype

Object

More **specific** type of person, ideal as **child** class

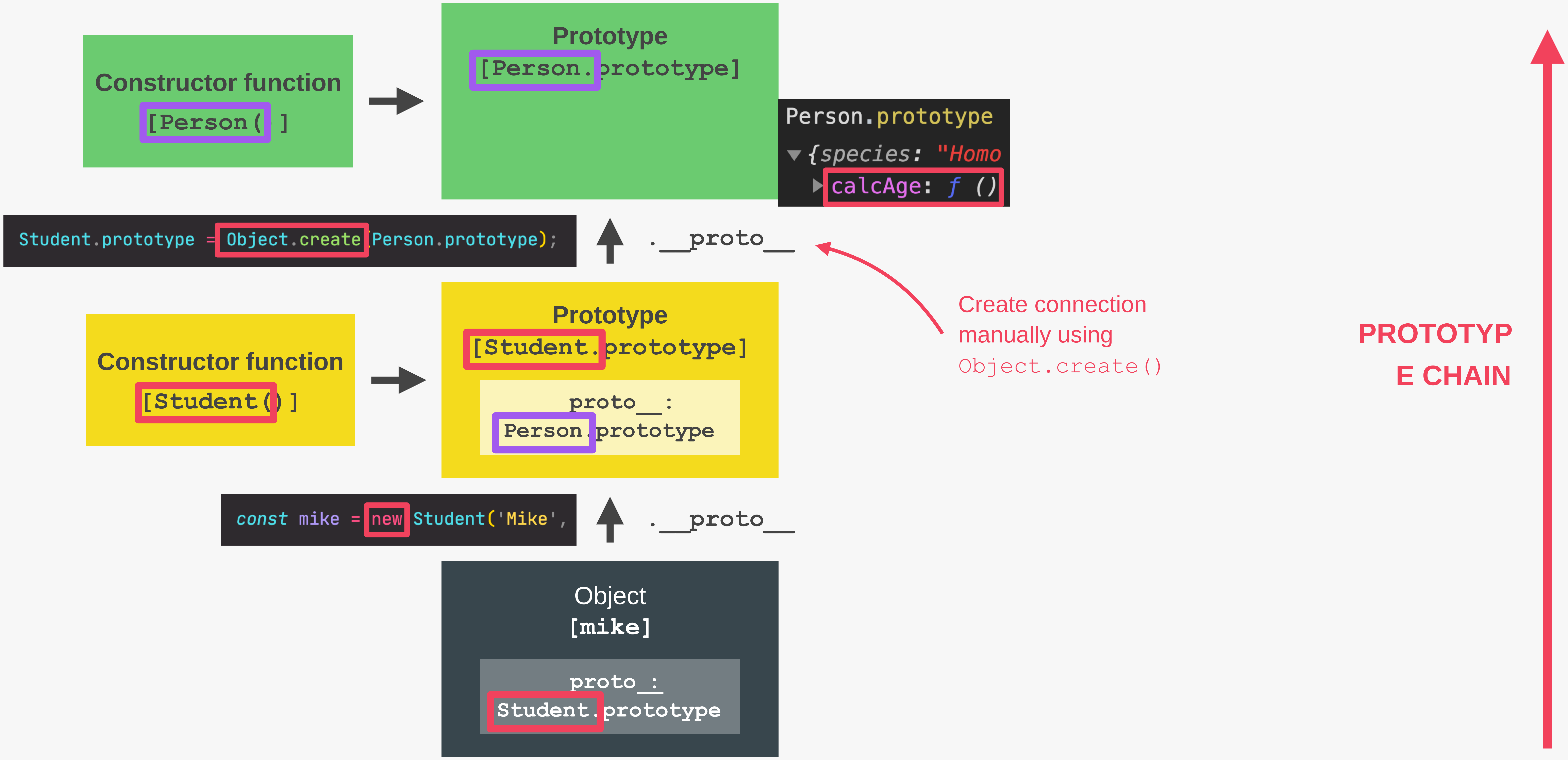
1 Constructor functions

2 ES6 Classes

3 `Object.create()`

☝️ Using class terminology here to make it easier to understand.

INHERITANCE BETWEEN “CLASSES”



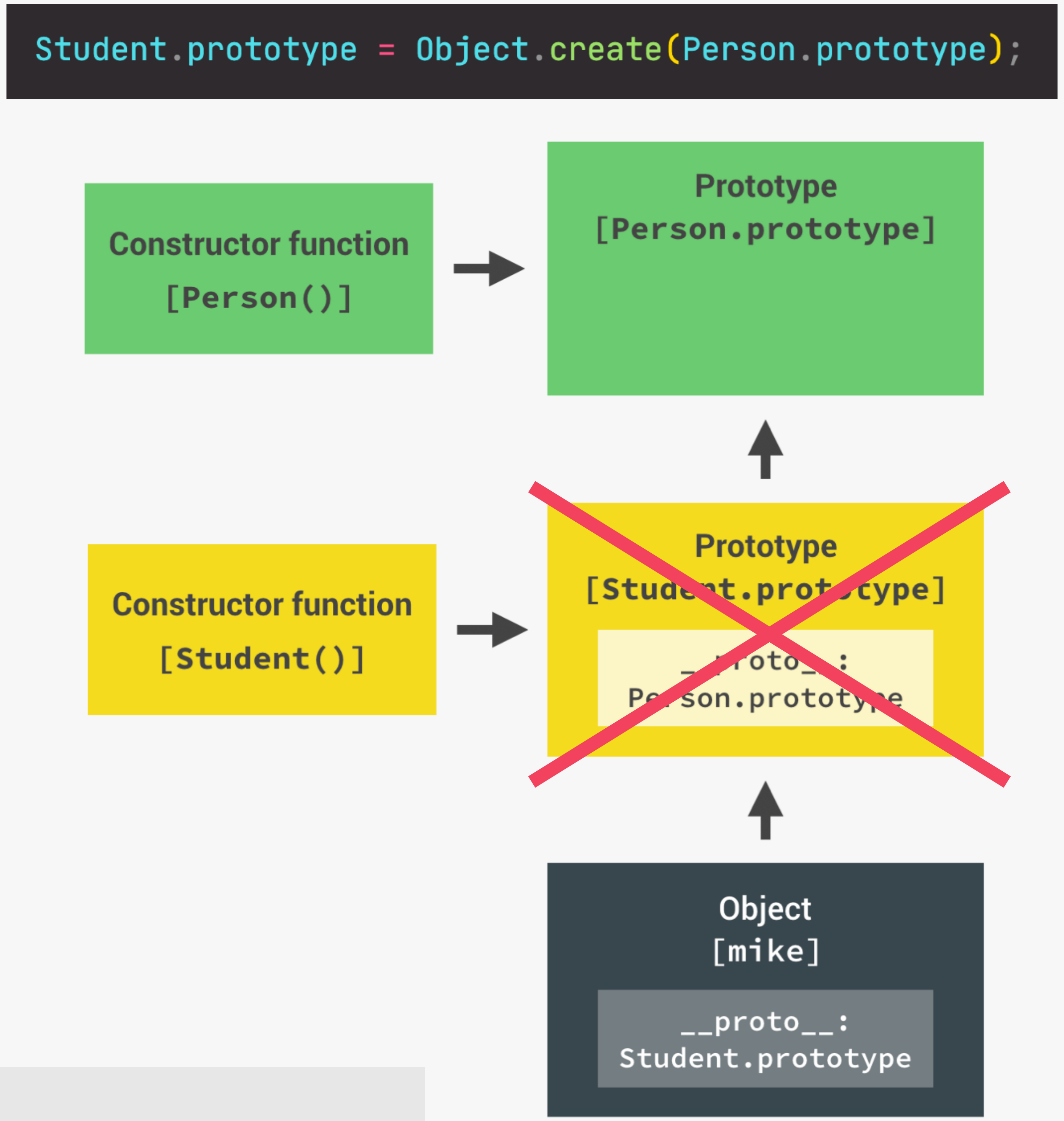
```
Person.prototype
▼{species: "Homo
 ▶calcAge: ƒ ()
```

```
Student.prototype = Object.create(Person.prototype);
```

```
const mike = new Student('Mike',
```

Create connection manually using `Object.create()`

INHERITANCE BETWEEN “CLASSES”



```
Student.prototype = Object.create(Person.prototype);
```

Constructor function
[Person()]

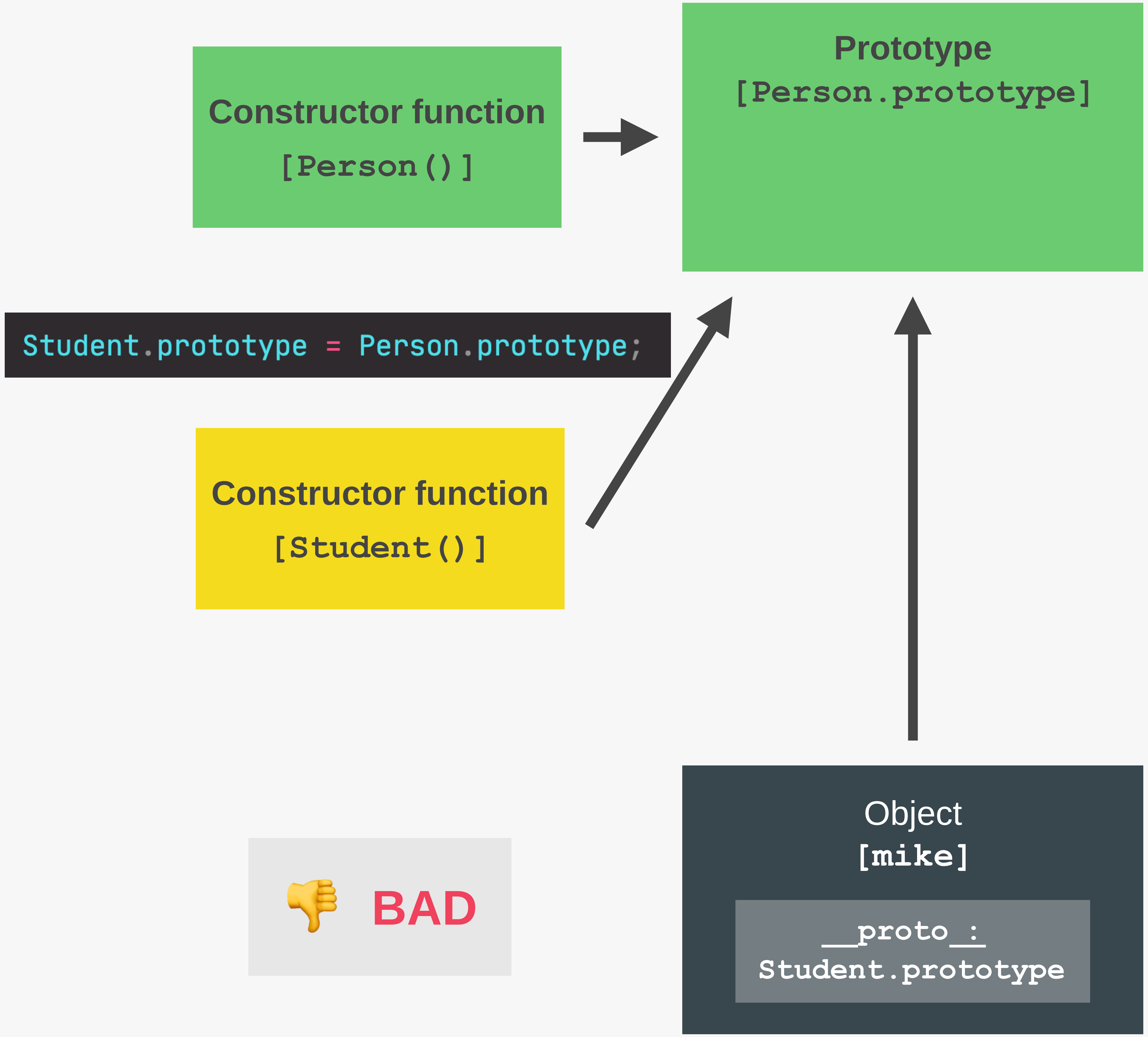
Prototype
[Person.prototype]

Constructor function
[Student()]

~~Prototype~~
~~[Student.prototype]~~
~~__proto__:~~
~~Person.prototype~~

Object
[mike]
__proto__:
Student.prototype

👍 GOOD



Constructor function
[Person()]

Prototype
[Person.prototype]

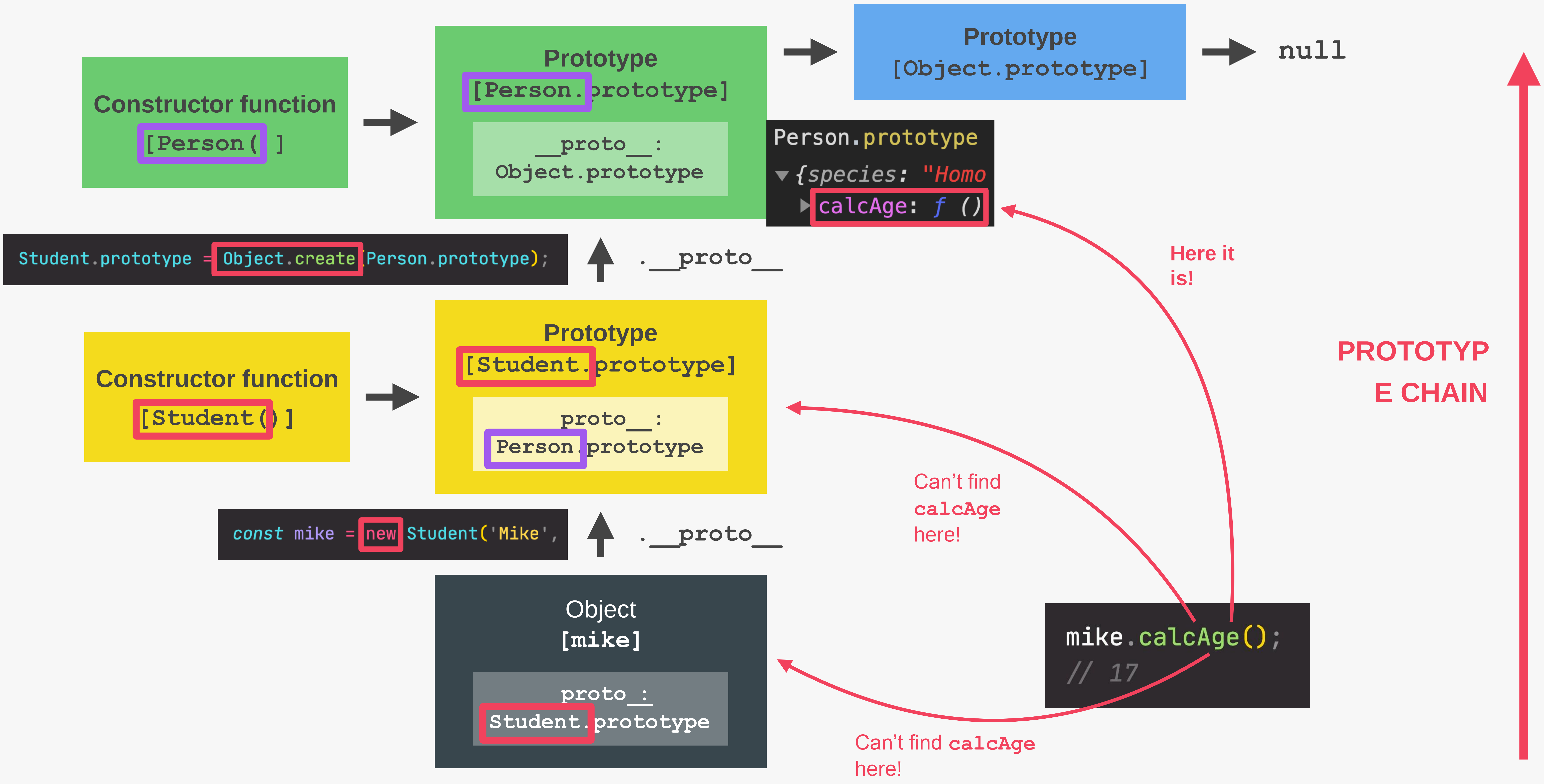
```
Student.prototype = Person.prototype;
```

Constructor function
[Student()]

Object
[mike]
__proto__:
Student.prototype

👎 BAD

INHERITANCE BETWEEN "CLASSES"



```
Person.prototype
▼{species: "Homo
 ▶calcAge: ƒ ()
```

```
Student.prototype = Object.create(Person.prototype);
```

```
const mike = new Student('Mike',
```

```
mike.calcAge();
// 17
```