TypeScript Basics for Automation Testers – Day 3

Topic: Variables in TypeScript (Part 2 – Understanding Scopes, Re-declaration & Hoisting)

In the previous part, we learned about the three keywords used to declare variables in TypeScript — **var**, **let**, and **const**.
In this part, we'll understand **five aspects** that differentiate them clearly.

Five Aspects that Differentiate var, let, and const

1. Scope of the variable
2. Declaration or value assignment
3. Re-declaration
4. Re-initialization or re-assignment
5. Hoisting

---

1. Scope of the Variable

What does "scope" mean?

Scope means the *area where something is accessible or valid*.
Example: You can access your office Wi-Fi only inside the office premises — that's its **scope**.

In Java:

There are 3 types of scope:

1. **Local scope** – accessible only inside the method or block.
2. **Instance scope** – tied to an object (non-static).
3. **Static scope** – shared across all objects.

In TypeScript/JavaScript:

We only have 2 types of scope:

1. **Functional Scope**
2. **Block Scope**

Functional Scope

Meaning: Variables declared inside a function are accessible anywhere *within* that function.

Why? Because `var` keyword is function-scoped.

Example – var keyword

```
function varScope() {
    if (true) {
        var msg = "Hello Yogi";
        console.log(msg); // accessible inside the block
    }
    console.log(msg); // still accessible here (inside function)
}
varScope();
```

Practice Tip:
Try printing `msg` *outside* the function — it will throw an error because it's not accessible globally.

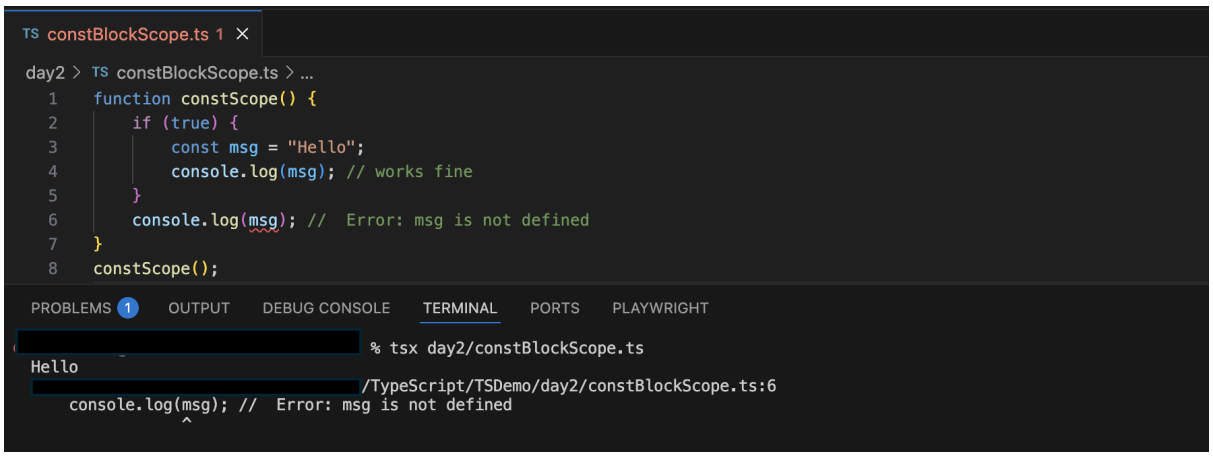
Block Scope

Meaning: A variable declared inside `{}` is only accessible within those braces (block).

`let` and `const` are **block scoped**, meaning they live and die inside the `{}` block where they are declared.

Example 1 – const (Block Scope)

```
function constScope() {
    if (true) {
        const msg = "Hello";
        console.log(msg); // works fine
    }
    console.log(msg); //  Error: msg is not defined
}
constScope();
```

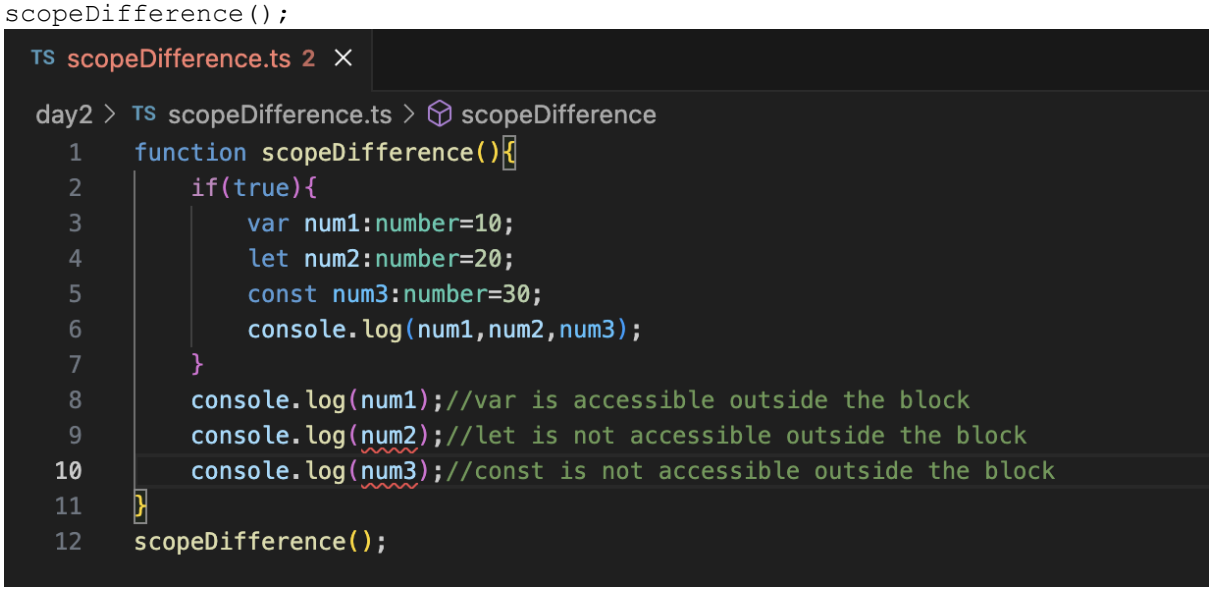


Example 2 – let (Block Scope)

```
function letScope() {
    for (let i: number = 0; i <= 10; i++) {
        console.log(i); // works fine
    }
    console.log(i); // Error: i is not defined
}
letScope();
```

Example 3 – Scope Difference

```
function scopeDifference() {
    if (true) {
        var num1 = 10;
        let num2 = 20;
        const num3 = 30;
        console.log(num1, num2, num3); // all accessible here
    }
    console.log(num1); //  works
    console.log(num2); //  Error
    console.log(num3); //  Error
}
scopeDifference();
```



---

2. Declaration / Value Assignment

Declaration means *introducing* something (creating a name),
Assignment means *giving a value* to it.

Example 1 – var

```
var variableName;
console.log(variableName); // undefined (declared but not initialized)
variableName = "Yogi";
console.log(variableName); // Yogi
```

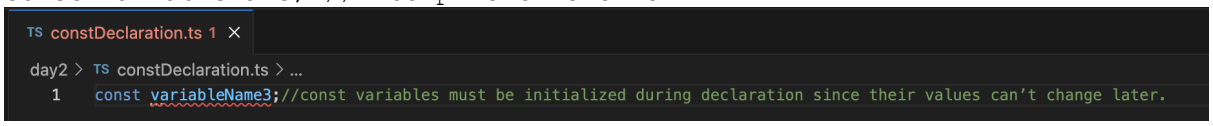
Note: If you don't specify a datatype, TypeScript assumes it as `any`.

Example 2 – let

```
let variableName;
console.log(variableName); // undefined
variableName = "Yogi";
console.log(variableName);
```

Example 3 – const

```
const variableName; //  Compile-time error
```



Explanation:
`const` variables must be initialized during declaration since their values can't change later.

---

3. Re-declaration

Meaning: Declaring something again with the same name.

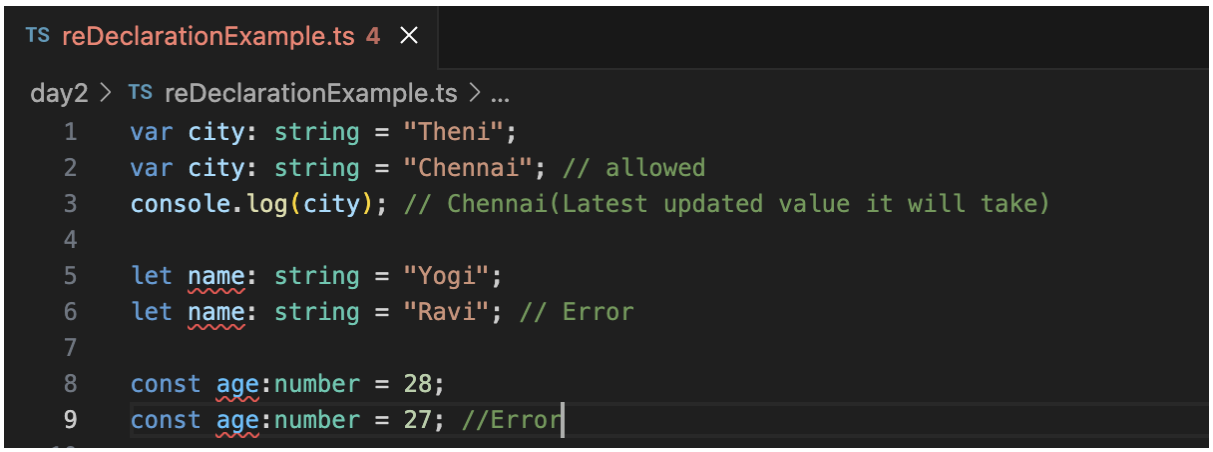
In programming: Declaring a variable with the same name again in the same scope.

- `var` → Allows re-declaration
- `let` and `const` → Do not allow re-declaration

Example

```
var city: string = "Theni";
var city: string = "Chennai"; // allowed
console.log(city); // Chennai

let name: string = "Yogi";
let name: string = "Ravi"; // Error
```



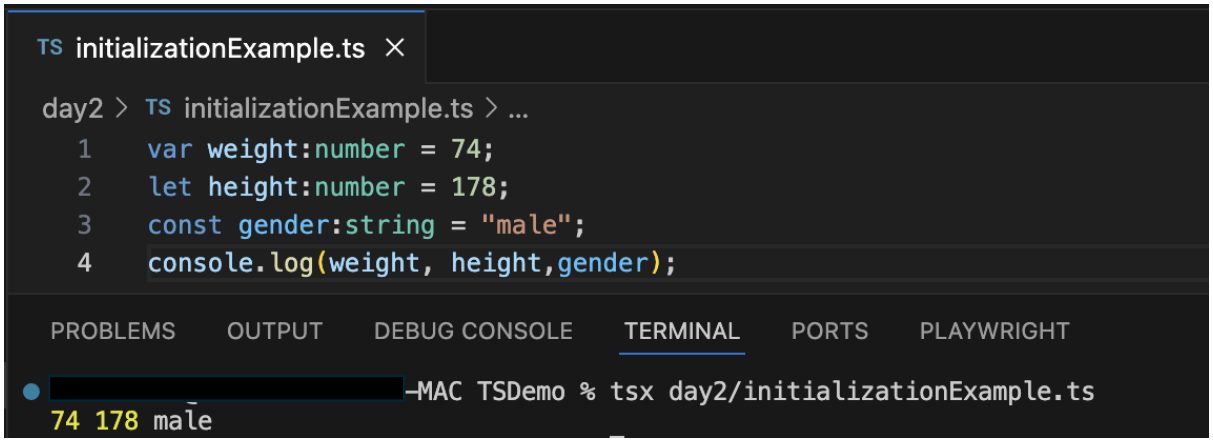
Reason: Allowing re-declaration breaks type safety — one of the main reasons we prefer `let` or `const`.

---

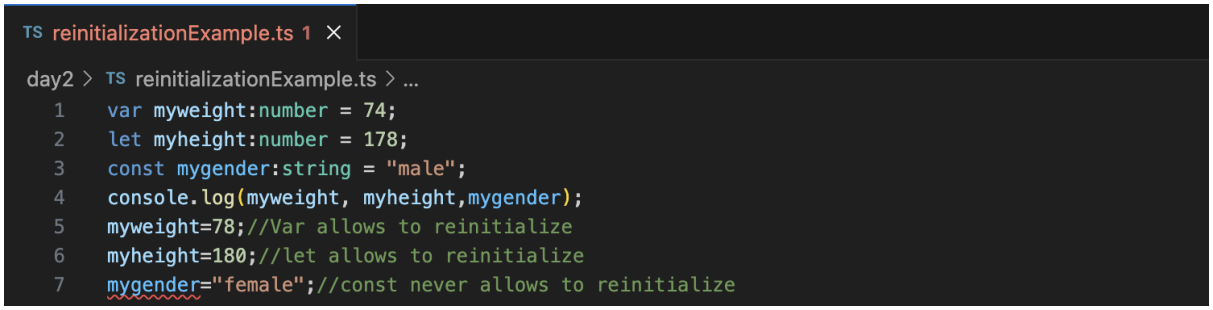
4. Re-initialization / Re-assignment

Meaning: Assigning a new value to an already declared variable.

Initialization:



Re-Initialization:



Example 1 – var

```
var name: string = "Yogi";
name = "Thangam"; // allowed
console.log(name); // Thangam
```

Example 2 – let

```
let name: string = "Yogi";
name = "Thangam"; // allowed
console.log(name);
```

Example 3 – const

```
const character: string = "Nallavan";
character = "Kettavan"; //  Error: Assignment to constant variable
```

Note: `const` values are constant — cannot be reassigned.

---

5. Hoisting

“Hoist” means *to lift up or raise*.

In programming:
Hoisting means *variable declarations are moved to the top of their scope before code execution.*

Example 1 – var

```
console.log(future); // undefined
var future: string = "surprise";
console.log(future);
```

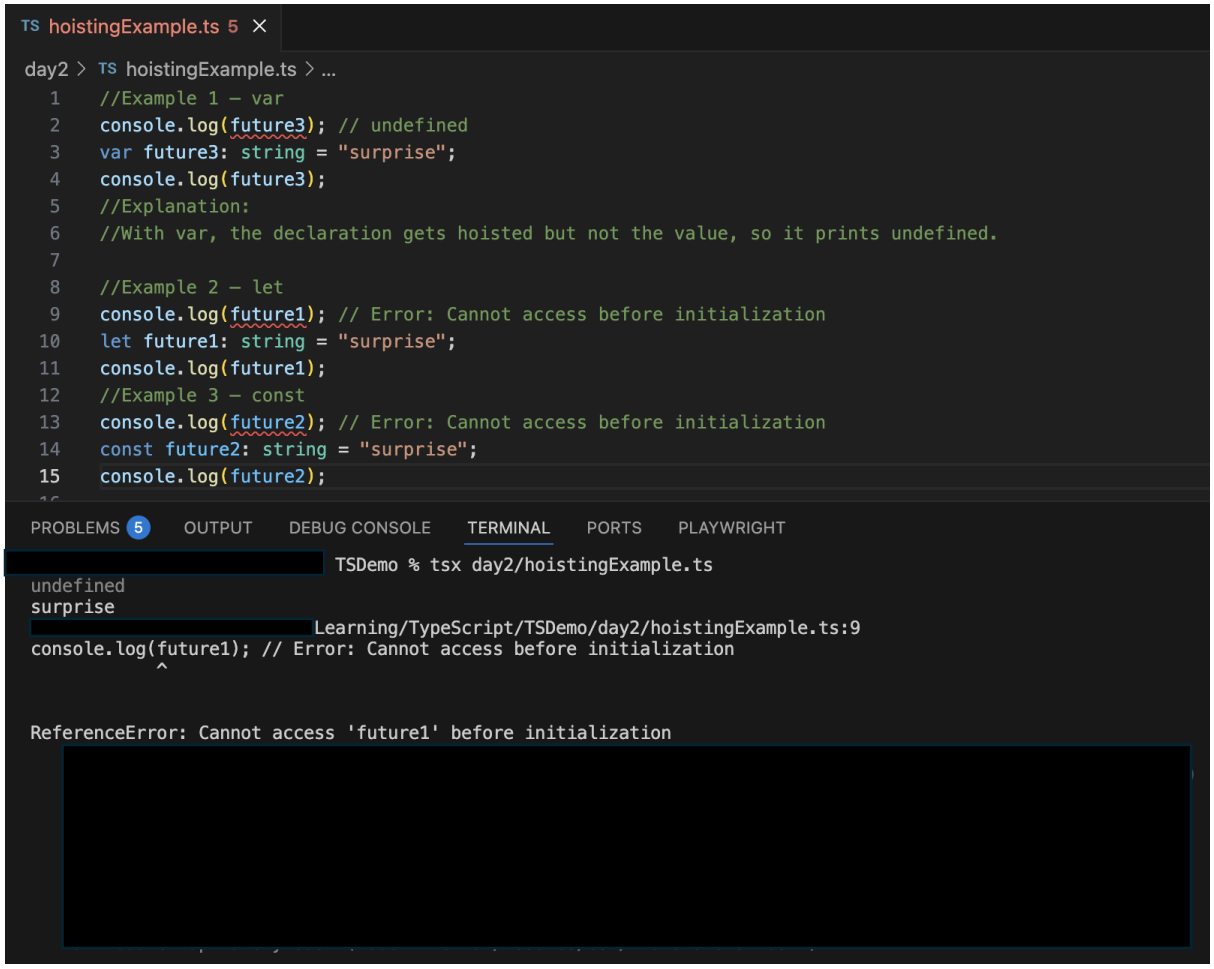
Explanation:
With `var`, the declaration gets hoisted but not the value, so it prints `undefined`.

Example 2 – let

```
console.log(future); // Error: Cannot access before initialization
let future: string = "surprise";
```

Example 3 – const

```
console.log(future); // Error: Cannot access before initialization
const future: string = "surprise";
```



Why avoid var?
Because of hoisting, it can create bugs — code may behave differently than expected.

Practice Summary

Keyword	Scope	Re-declare	Re-initialize	Must Initialize	Hoisted
var	Function	Yes	Yes	No	Yes (undefined)
let	Block	No	Yes	No	No
const	Block	No	No	Yes	No

Questions

1. What are the five aspects that differentiate var, let, and const?
2. Which keyword is function-scoped in TypeScript?
3. Why is var not recommended for modern TypeScript projects?
4. What is the main difference between block and function scope?
5. Which keywords allow re-initialization?
6. Which keyword must be initialized during declaration?
7. What is hoisting in TypeScript?

8. Why are let and const safer to use than var?

Answers

A1. The five aspects that differentiate `var`, `let`, and `const` are:

1. Scope of the variable
2. Declaration or value assignment
3. Re-declaration
4. Re-initialization (or re-assignment)
5. Hoisting

A2. `var` is **function-scoped** in TypeScript. It means the variable declared with `var` can be accessed anywhere inside the function, even outside blocks like `if` or `for`.

A3. `var` is not recommended because it has **function scope** and supports **re-declaration and hoisting**, which can cause unexpected behavior and make debugging harder.

A4. The main difference is:

- **Function Scope:** Variables can be accessed anywhere inside the function.
- **Block Scope:** Variables are accessible only within the block `{ }` where they are declared.

A5. Both `var` and `let` allow re-initialization (changing the value after declaration).
`const` does not allow re-initialization.

A6. `const` must be initialized at the time of declaration, otherwise TypeScript will throw a compile-time error.

A7. Hoisting means moving variable declarations to the top of their scope before code execution.
With `var`, this happens silently — undeclared variables return `undefined`.
With `let` and `const`, accessing variables before declaration causes a compile-time error.

A8. `let` and `const` are safer because they are **block-scoped**, prevent **accidental re-declaration**, and throw errors for **illegal access before initialization**, ensuring type safety and cleaner code.
