

(eXtreme) Game Development with Phaser



Let's start with the basics

? gamedev... anyone? ?

Game loop

```
while (true) {  
    /* Update all game objects */  
    updateScreen();  
}
```

Game loop #2

```
while (true) {  
    for (const gameObject of gameObjects) {  
        gameObject.update();  
    }  
    updateScreen();  
}
```

Game loop #3

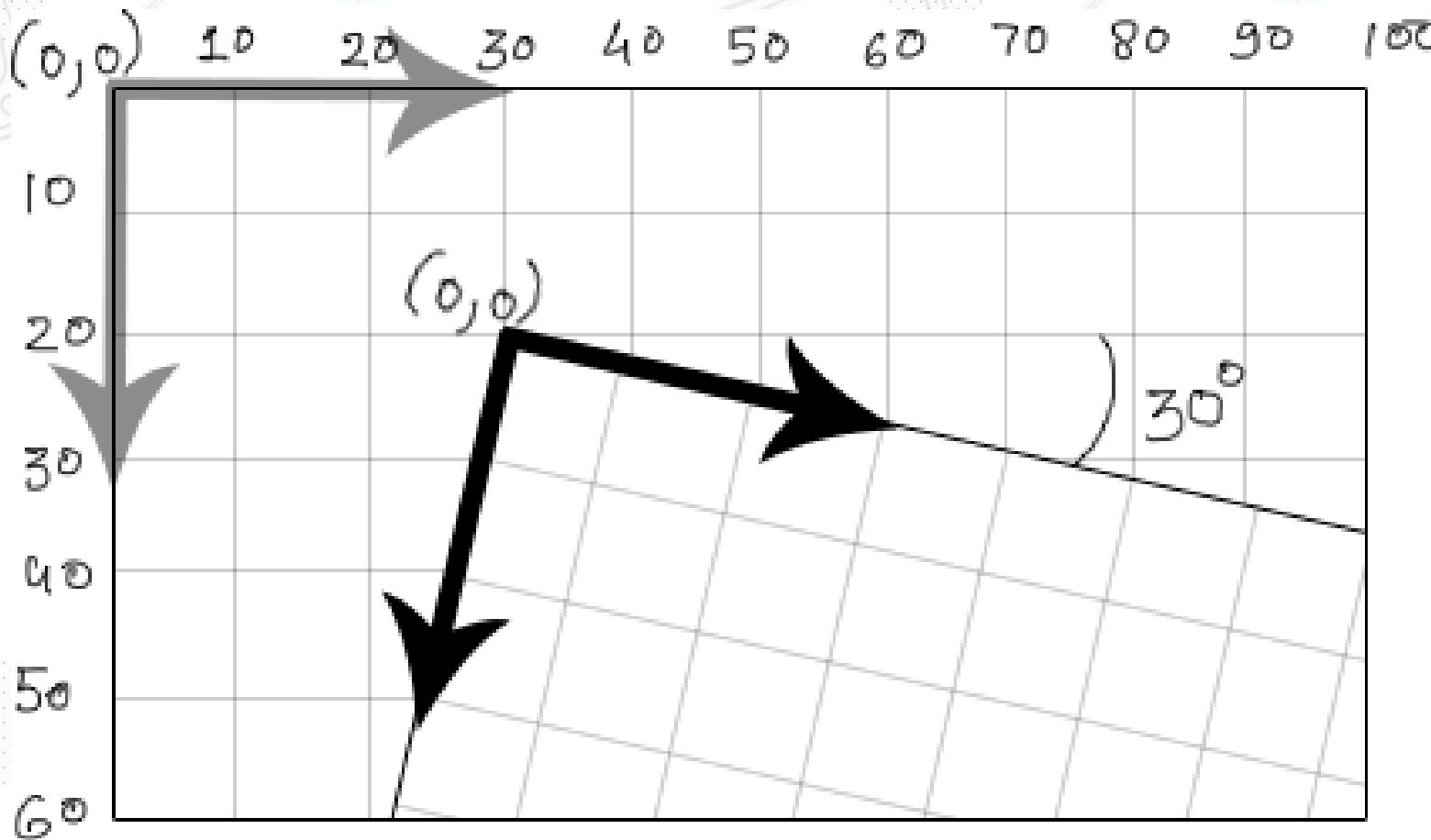
```
function updateGame() {  
    for (const gameObject of gameObjects) {  
        gameObject.update();  
    }  
    updateCanvas();  
    requestAnimationFrame(updateGame);  
}  
  
requestAnimationFrame(updateGame);
```

Updating objects

=

Changing rotation, position, scale!

Game = cartesian plane



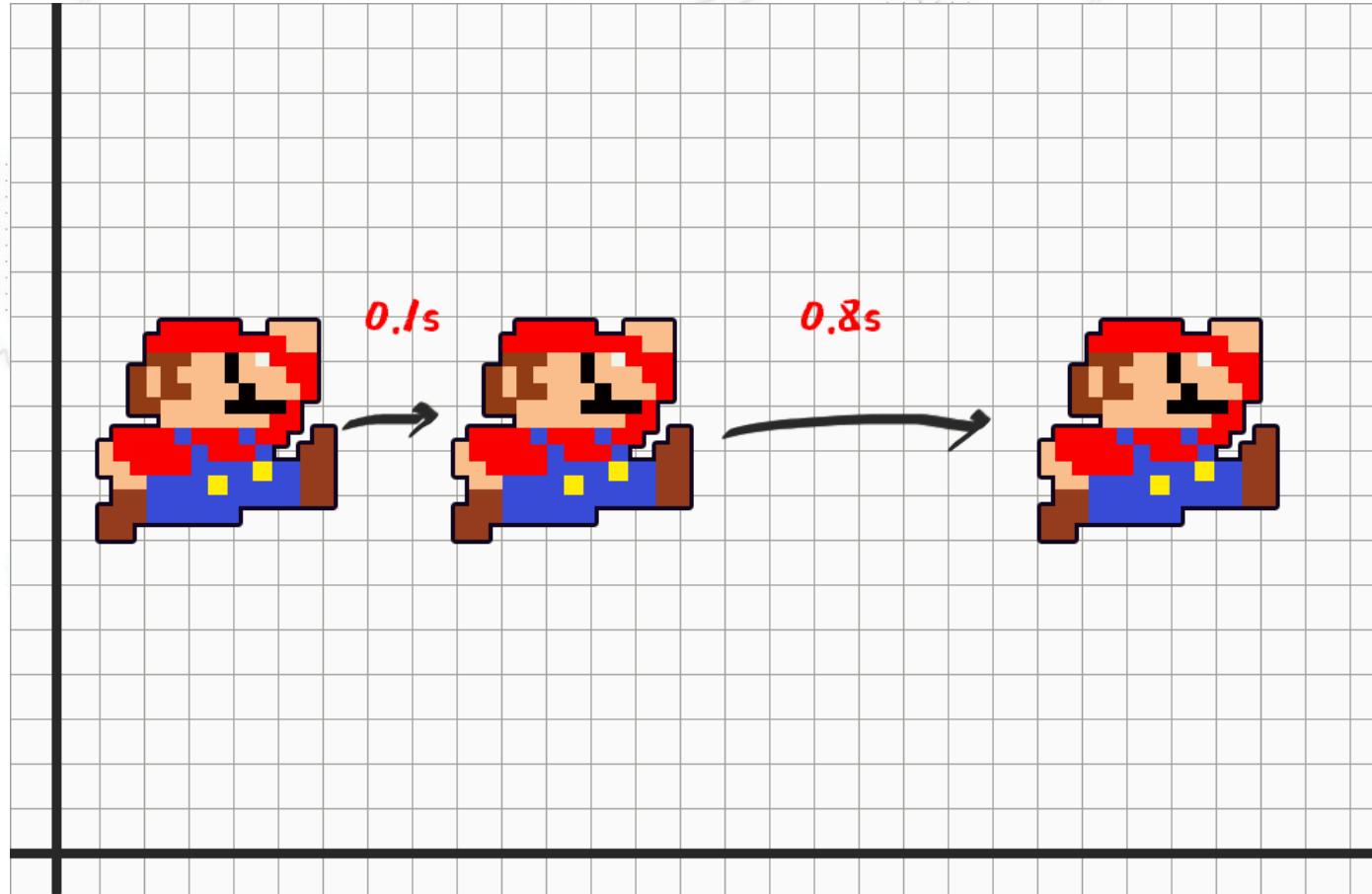
Game = stop-motion movie



0.001666666666666667
seconds

**BUT... what if the game runs
slower?**

We have to compensate!



Delta time in Game Loop

```
let lastTime = Date.now();
function updateGame() {
    const currentTime = Date.now();
    const deltaTime = currentTime - lastTime;
    lastTime = currentTime;

    for (const gameObject of gameObjects) {
        gameObject.update(deltaTime);
    }
    /* Update screen */
}
```

Frame rate independent movement

```
function update(deltaTime) {  
    const speed = 100; // pixels per second  
    const distance = speed * deltaTime / 1000;  
    this.x += distance;  
}
```

Who does all of this stuff?

- Calculating delta time
- Updating game objects
- Rendering the screen
- Handling user input
- Loading assets
- Audio
- ...

We need a game engine

Let's use Phaser!

Why Phaser?

- Easy to learn
- Open source
- It's Javascript
- It's fun!

Basic concepts

- Scenes
- Game Objects & Factory
- Loader
- Physics

Scenes

A scene is a container for all the game objects. It can be a menu, a level, a game over screen, etc.

Example:

Super Mario Bros has a scene for the title screen, a scene for each level, and a scene for the game over screen.

Scenes

```
class MyScene extends Phaser.Scene
{
    constructor () {
        super('MyScene');
    }
    preload () { /* Load assets */ }
    create () { /* Create game objects */ }
    update (time, delta) { /* update them. */ }
}
```

Scenes registration

```
const config = {  
    type: Phaser.AUTO,  
    width: 800,  
    height: 600,  
    // Scene must be registered here  
    scene: [MyScene]  
};  
const game = new Phaser.Game(config);
```

Game Object

A game object is an entity that can be placed in a scene. It can be a sprite, a text, a group, an audio, etc.

They are implemented as classes inheriting from `Phaser.GameObject` and can be created using the **factory**.

Factory

Inside a scene, you can create game objects using the factory, invoking `this.add`.

```
create() {  
    this.add.text(100, 100, 'Hello, Phaser!');  
    this.add.sprite(400, 300, 'player');  
    this.add.audio('music');  
}
```

Loader

To be able to use assets in your game, you need to load them first. You can do this in the `preload` method of a scene.

```
preload() {  
    /* choosing a symbolic name for the asset */  
    this.load.image('player', 'assets/player.png');  
}  
...  
/* later in the create method */  
this.add.sprite(400, 300, 'player');
```

Inputs #1

```
create() {  
    this.spaceKey = this.input.keyboard.addKey(  
        Phaser.Input.Keyboard.KeyCodes.SPACE  
    );  
}  
  
update() {  
    if (this.spaceKey.isDown) {  
        /* ... do stuff ... */  
    }  
}
```

Inputs #2

```
create() {
    this.spaceKey = this.input.keyboard.addKey(
        Phaser.Input.Keyboard.KeyCodes.SPACE
    );

    this.spaceKey.on('down', () => {
        /* ... do stuff ... */
    });
}
```

Physics

Arcade vs ~~Matter~~

Arcade Physics

```
const config = {
  ...
  physics: {
    default: 'arcade',
  },
  ...
};

this.player = this.physics.add.sprite(400, 300, 'player');

/* ... */
this.player.body.setVelocityX(100);
```

Collisions

```
this.player = this.physics.add.sprite(400, 300, 'player');
this.ground = this.physics.add.staticImage(400, 568, 'ground');
this.ground.setImmovable(true);
this.ground.body.allowGravity = false;

this.physics.add.collider(this.player, this.ground, () => {
  console.log('Player hit the ground!');
});
```



Workshop time!

Let's make PONG!

PONG Rules

- Two players (WASD and Arrow keys)
- Each player has a paddle
- A ball bounces between the paddles
- Every time the ball hits a paddle, it speeds up
- If the ball hits the wall behind a player, the other player scores
- First player to reach 5 points wins

Scan me



<https://progm.github.io/extreme-game-development-phaser/>

Useful links

- Phaser 3 Docs

<https://newdocs.phaser.io/docs/3.85.2>

- Phaser Debugger

<https://chromewebstore.google.com/detail/phaser-debugger/aigiefhkiaiihlploginlonehdafjljd>

- Phaser Examples

<https://labs.phaser.io/>

Part 2: XP and Video Game Industry...



A sad story.

Most articles are 10~20 years old

- Most Games Programmers Dont Grok Object Orientation
- Post Mortem: Space Station Manager
- Extreme Game Development: Right on Time, Every Time
- ExtremeGameDev

Cultural problems

- Many non-technical people involved
(70-80% of the team)
- Crunch time
- Competition & bad management
- (Historically) No interest for long-time maintenance

Technical problems

- A lot of proprietary / licensed / obscure software
- No standardization (lack of tooling)
- Game programmers are **very** performance oriented
(the 16.6ms problem)
- Hard to test player experience
- *You're testing the engine, not the game*



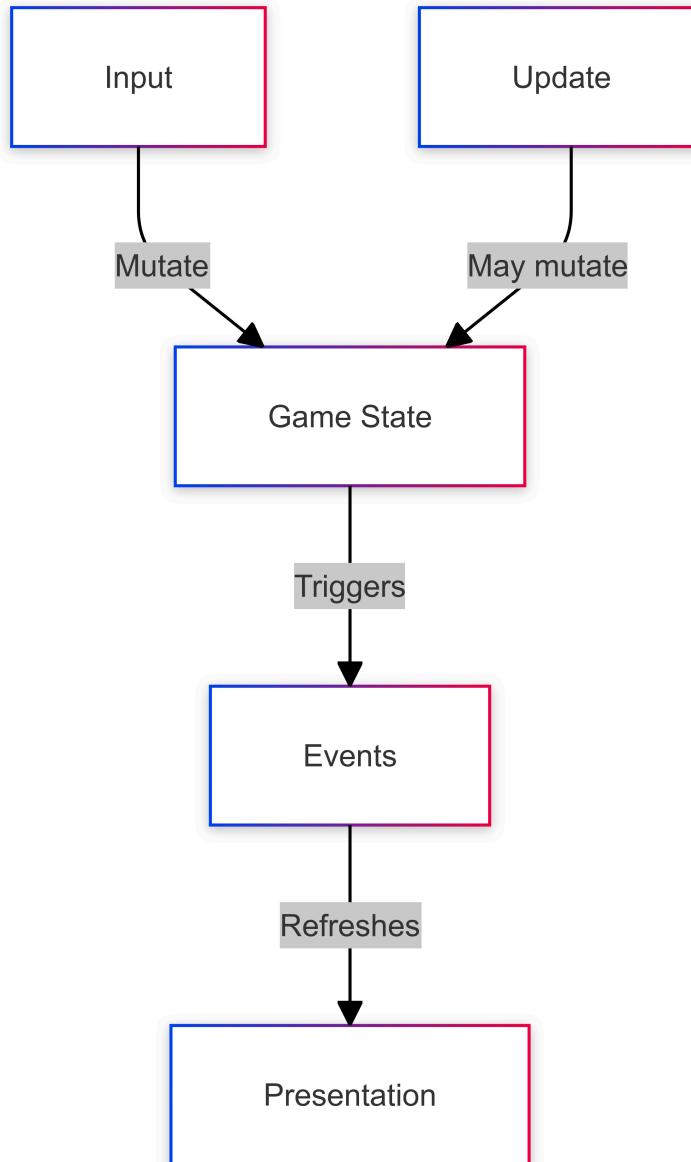
But... it's possible!

Separation of concerns

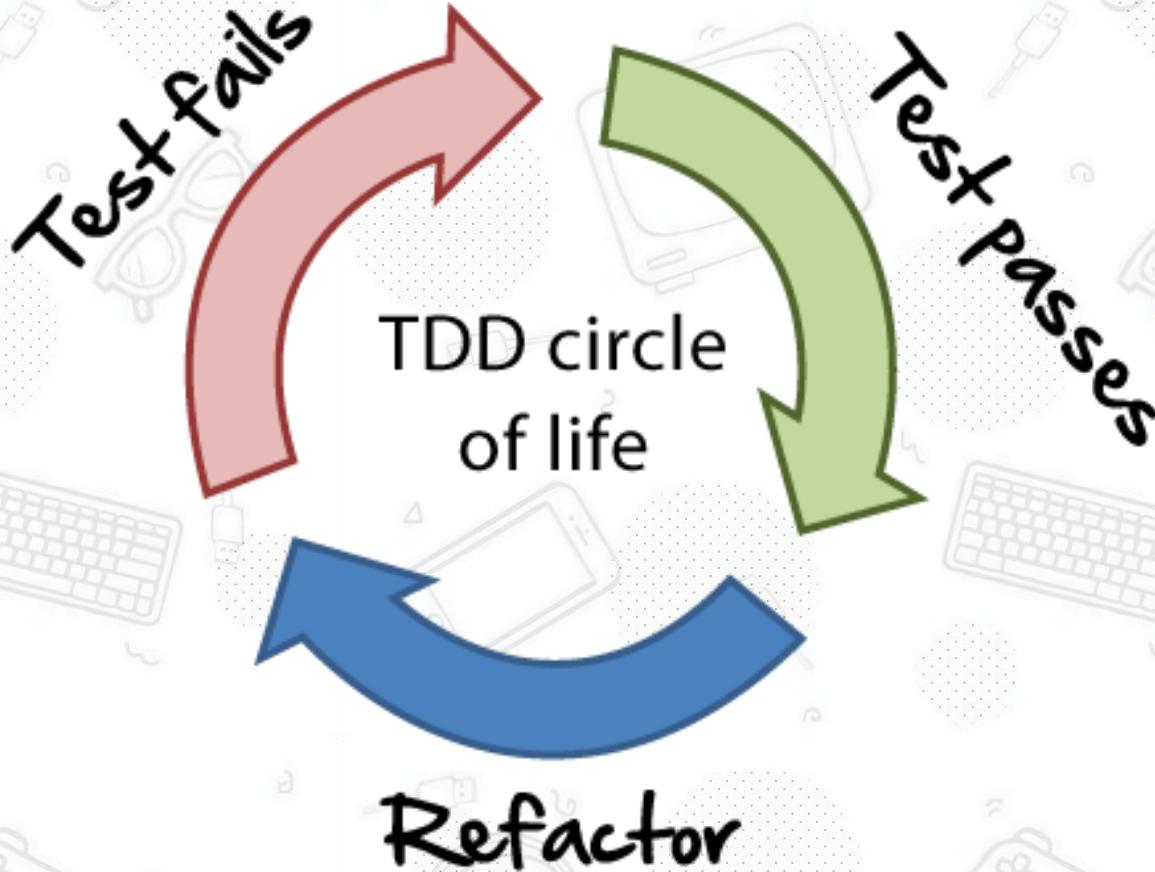
- Game state
- Presentation
- Input handling

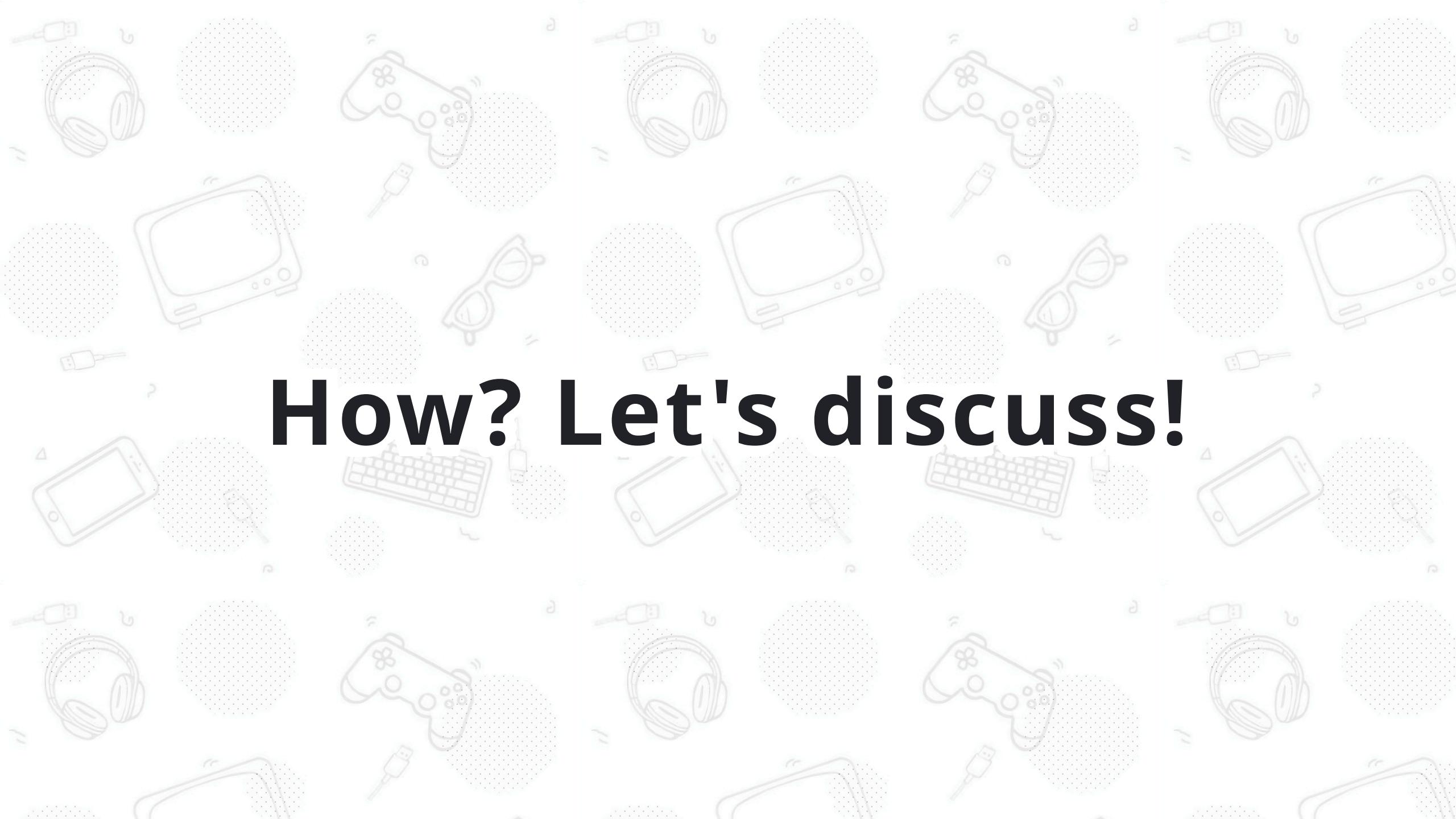
What is a game state?

- The current score
- The position of the ball
- The position of the paddles
- The speed of the ball
- The direction of the ball



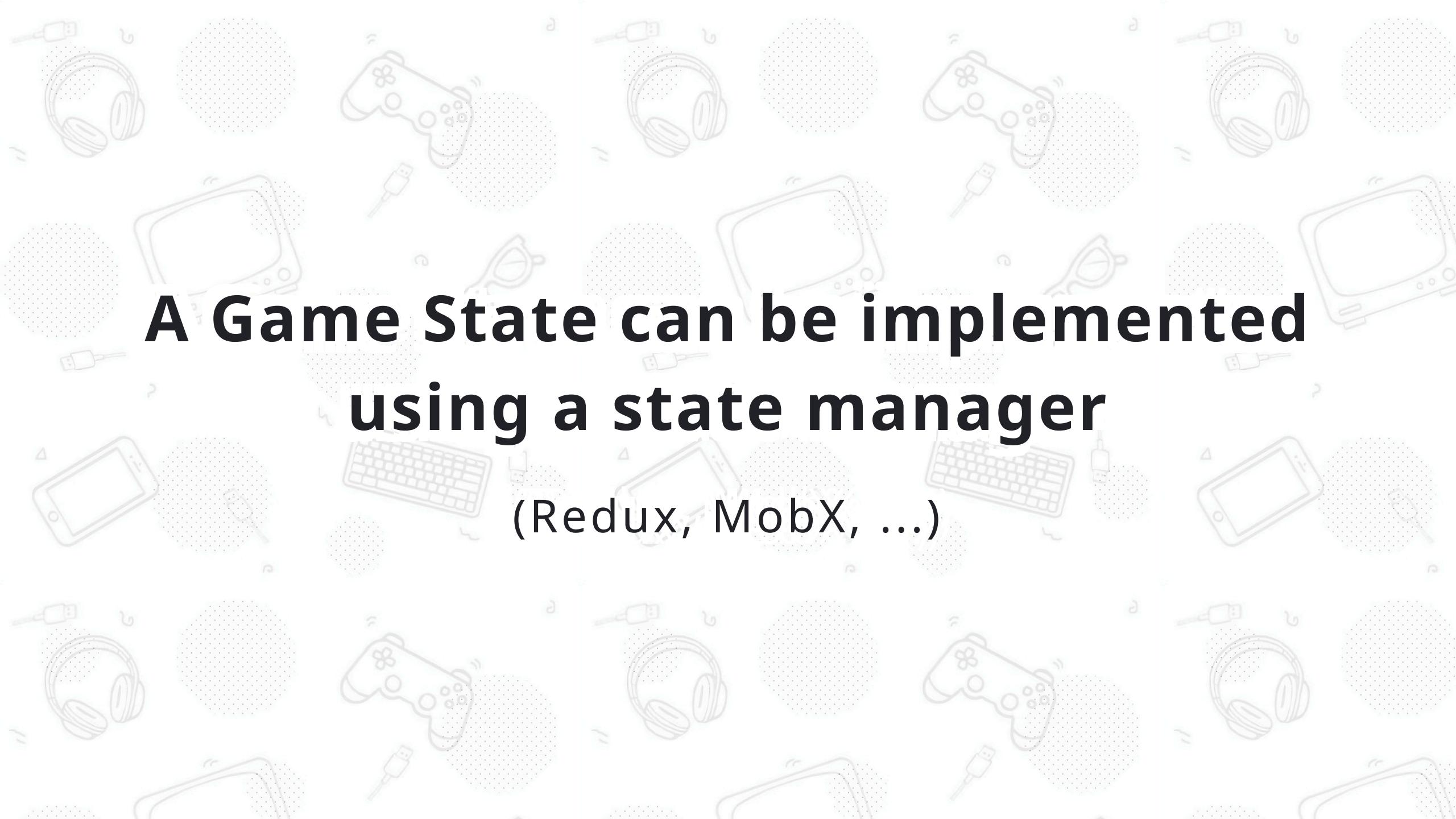
Let's *TDD* the Game State!





How? Let's discuss!

Technicalities



A Game State can be implemented using a state manager

(Redux, MobX, ...)

MobX Setup

- `npm install mobx`

GameState.js

```
class GameState {  
    score = 0;  
    ball = { x: 400, y: 300, speed: 5, direction: { x: 1, y: 1 } };  
  
    constructor() {  
        makeAutoObservable(this, {  
            score: observable,  
            ball: observable,  
            updateBall: action,  
        });  
    }  
  
    updateBall() {  
        this.ball.x += this.ball.speed * this.ball.direction.x;  
        this.ball.y += this.ball.speed * this.ball.direction.y;  
    }  
}
```

Build system tuning

```
import esbuildServe from "esbuild-serve";
import inlineImage from "esbuild-plugin-inline-image";

esbuildServe(
{
  ...
  define: { "process.env.NODE_ENV": "\"development\"", },
  ...
},
{ root: "public", port: 8080 },
);
```

Vitest setup

- `npm install vitest`

vite.config.js

```
/// <reference types="vitest" />
import { defineConfig } from 'vite'

export default defineConfig({
  test: { globals: true, },
})
```

GameState.test.js

```
import { test } from 'vitest';

import GameState from './GameState';

test('GameState should update ball position', () => {
  const gameState = new GameState();
  gameState.updateBall();
  expect(gameState.ball.x).toBe(405);
  expect(gameState.ball.y).toBe(305);
});
```



Let's start!

Extra: E2E testing

<https://elfgames.com/2019/06/25/automated-testing-in-video-games-a-case-study/>

Questions?



Thank you!