Einführung in die Informatik für Games Engineering

Tutorials

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What do you remember from last week?

What do you remember from last week?

- How objects can behave in a physical way
- Different kind of light sources
- How to create a background
- Camera settings
- Prefabs

First Game – Spaceshooter 2,5D

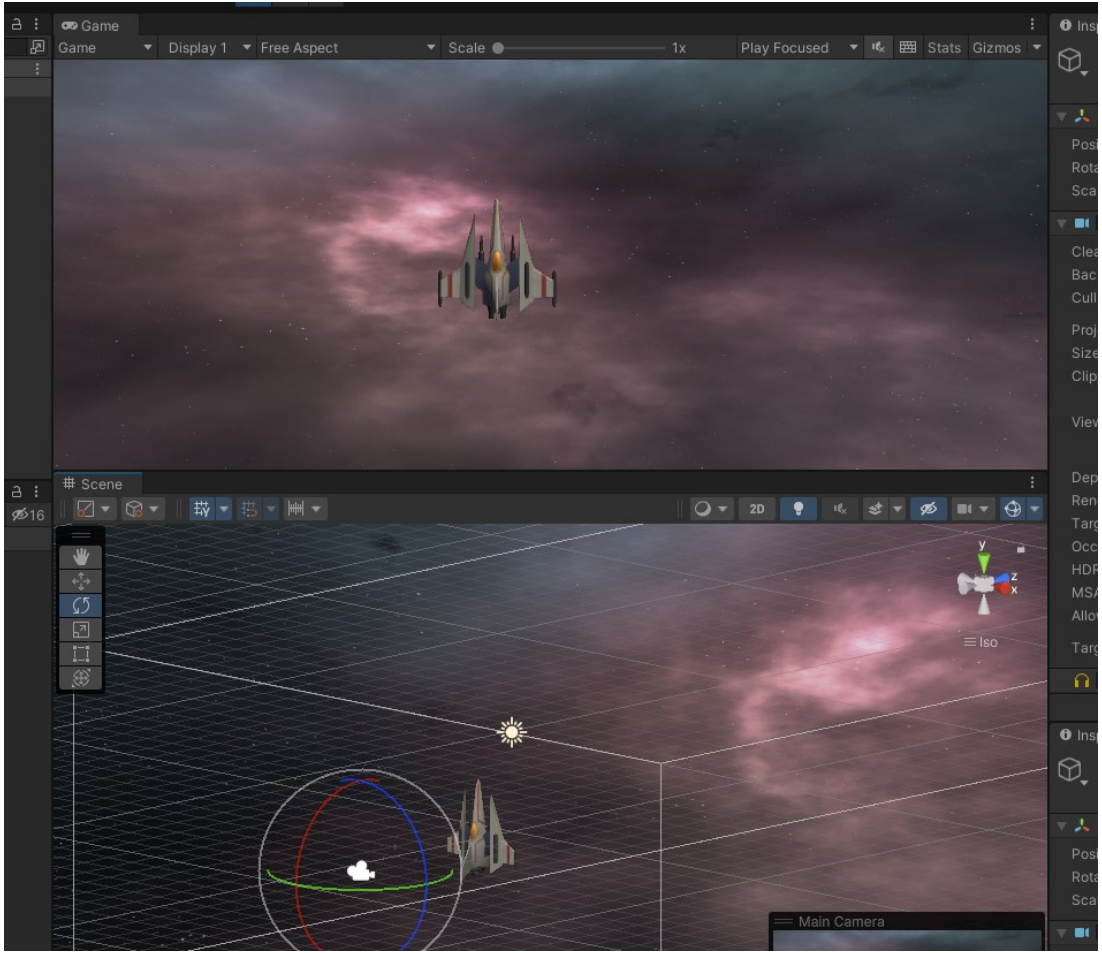
Use the scene you created last time

- with an orthographic camera
- A spaceship as model
- Suitable lighting
- A nice background

Installed IDE? Rider or VS Code or Visual Studio

Scene Setup

Something like this



In Unity you can edit and setup and layout everything of your world

What is missing?

Topic: Scripts

If you want to have
- Interaction with the user
- … or other game parts
- … or an AI
- … or game logic
- …

You need scripts!
In general, small text-based files representing your desired game behavior

In Unity3D the programming language C# is used and integrated in Unity3D game loop

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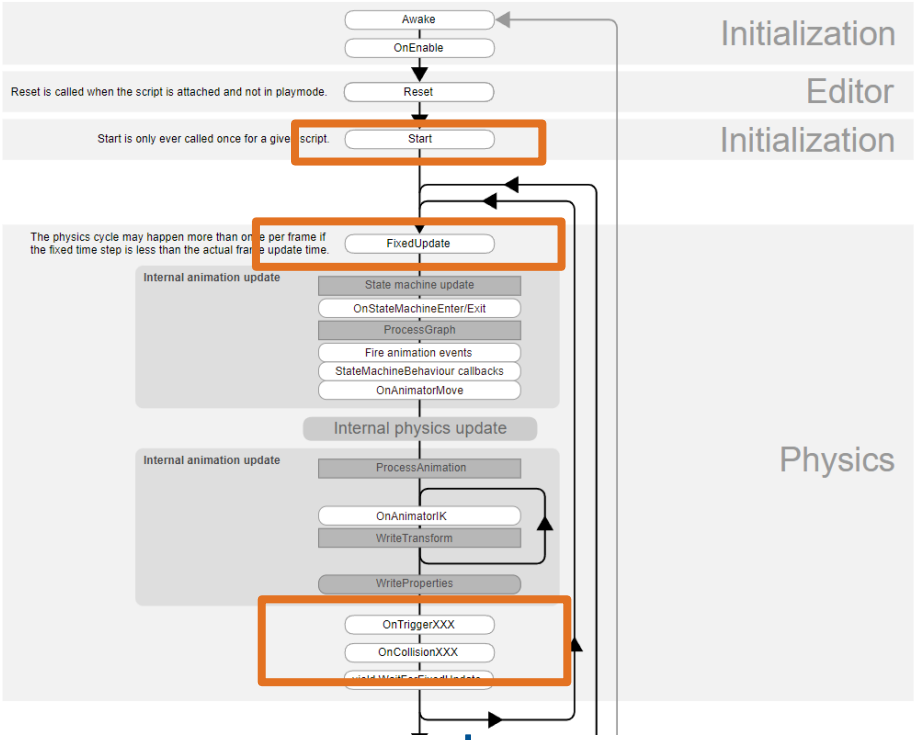
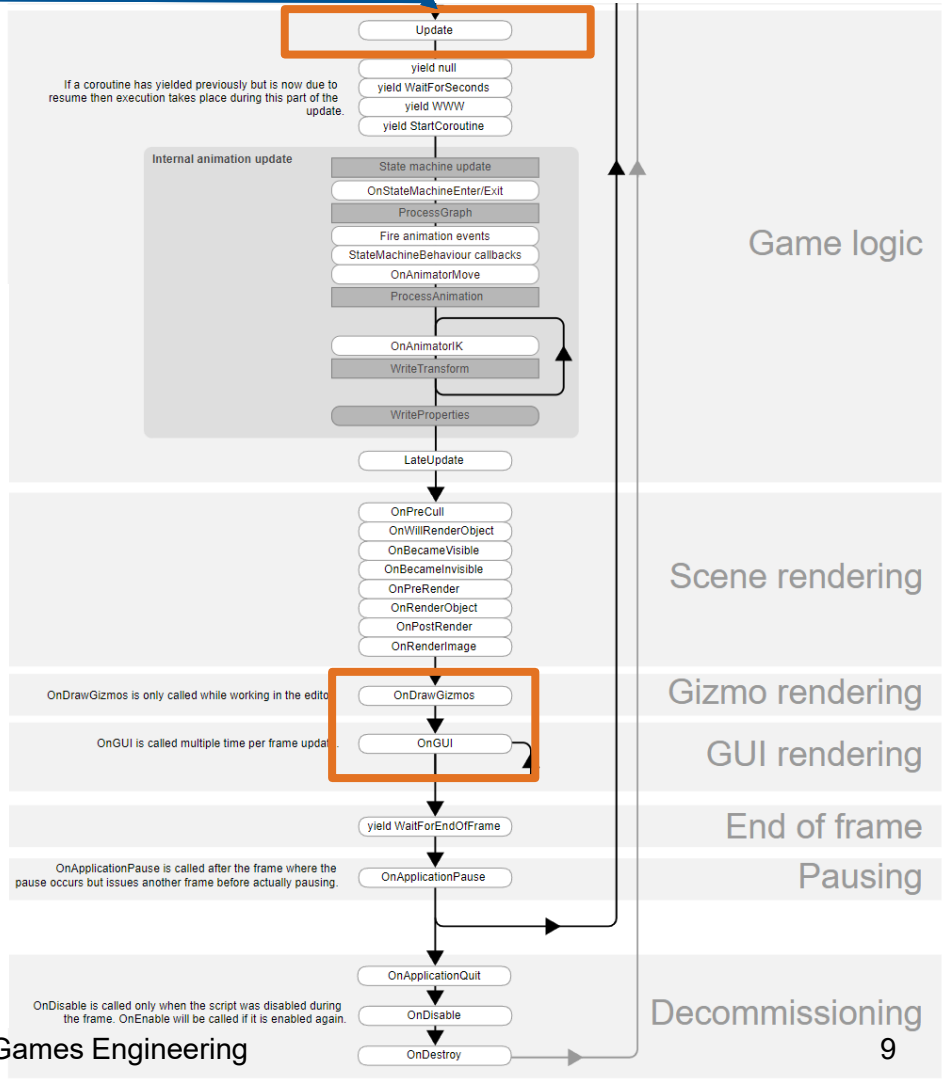
Topic: Scripts





Topic: Scripts

Unity3D has a very complex internal loop executed every frame
- Scripts can be used in different steps of this game loop
- Most important one you get to know today

In addition to behavior, you can also reveal variables (of your script class) to the Unity Editor
- You can “fine tune” the behavior (e.g. speed) using Unity Editor and not (only) inside your file

Topic: Scripts

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Topic: Scripts

Nice resources:

- https://blog.devgenius.io/unity-3d-c-scripting-cheatsheet-for-beginners-be6030b5a9ed
- https://docs.unity3d.com/Manual/ScriptingSection.html
- (older) https://learn.unity.com/tutorial/classes-5

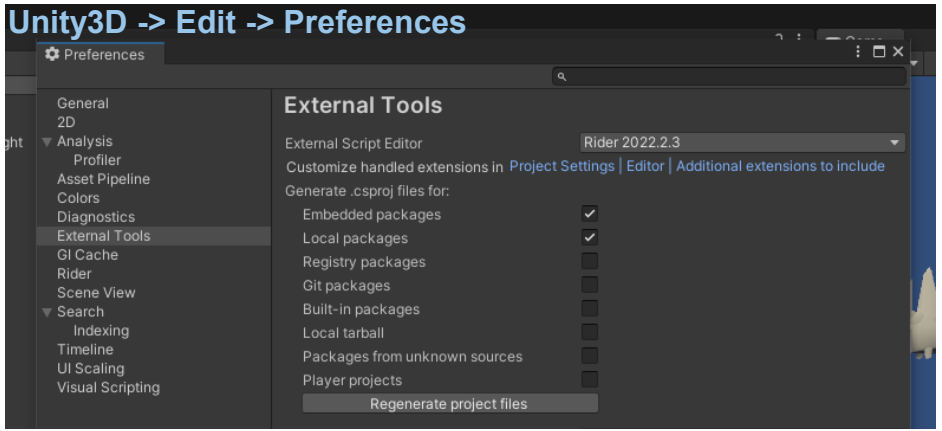
Topic: Scripts

For writing scripts you need to connect unity with your favorite IDE

- Like Rider (https://www.jetbrains.com/help/rider/Unity.html)
- VSCode (https://code.visualstudio.com/docs/other/unity)
- Visual Studio (https://learn.microsoft.com/de-de/visualstudio/gamedev/unity/get-started/getting-started-with-visual-studio-tools-for-unity)

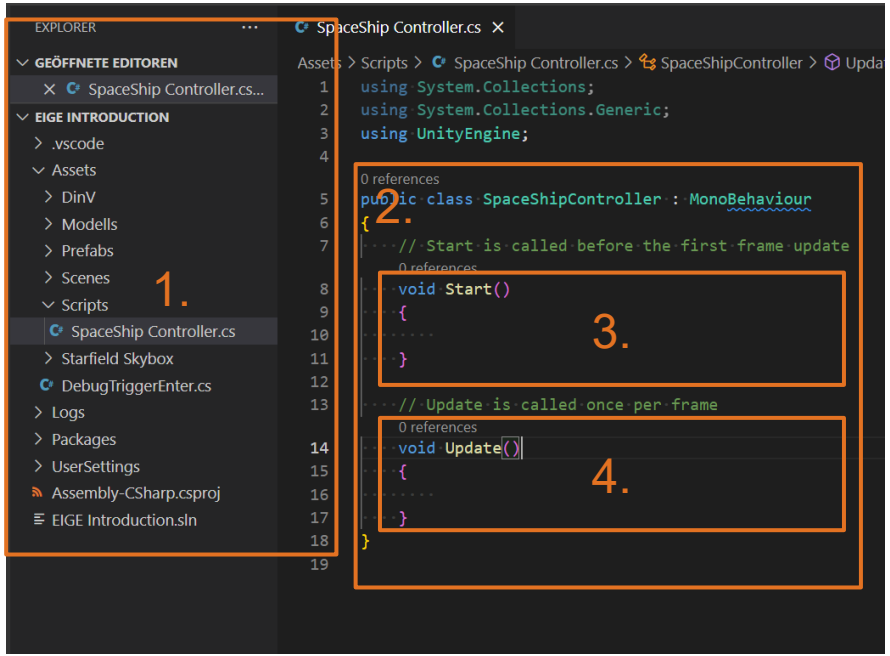
Why we use IDEs?

- Providing autocompletion (VERY helpful)
- Live debugging (MOST IMPORTANT)
- Error checking
- Project overview



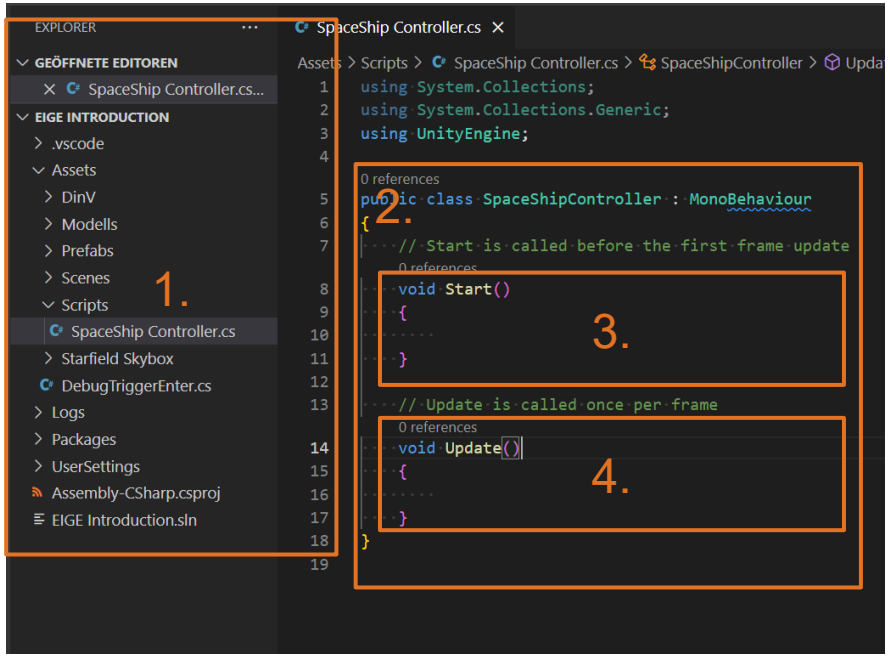
Topic: Scripts

1. Project Structure with all .cs (script) files, according your Unity Project Structure Assets/
2. Your Script Class
   - Always inherits MonoBehaviour
   - Can include all kinds of Unity Functions
     - Like Start, Awake, Update, FixedUpdate…
   - Public member variables are accessible in the inspector



Topic: Scripts

3. Start() function is called once if object is created
4. Update() is called every frame (depending on your current frame rate)



Spaceshooter – Scene Setup

With an orthographic camera objects does not change ins “perceived” size depending on the camera distance

- Use a scale factor on your game object (or imported model) to get a good size
- Use white as light color for your directional light
- Use a new material or drag ‘n drop the space ship texture on the model in your scene

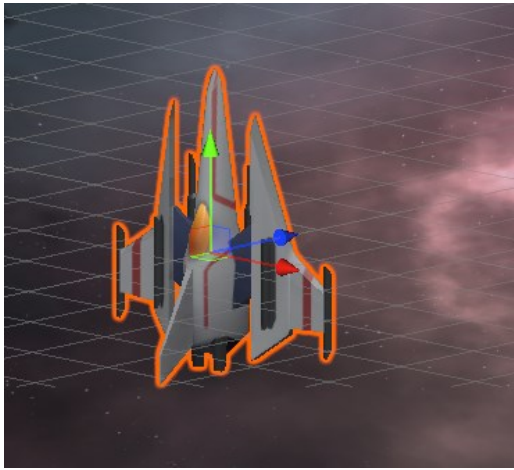
Spaceshooter – Make the spaceship fly

To make your spaceship fly (controlled by the user) we need to create our first script

- Create a new C# Script in your scripts folder (create it if necessary)
- Called “Player” (this will also be used as your class name)
- Add your new scripts to your Spaceship (will be our player in this game)
  - Drag ‘n drop or via “add component” in the inspector

How do you move your game objects in the Editor?

Spaceshooter – Make the spaceship fly



How do you move your game objects in the Editor?
-> Changing the Transformation (a Vector3) with **x**, **y**, **z** variables

#1 Change the values of the Transformation Component via your new script
http://docs.unity3d.com/ScriptReference/Transform.html

```
transform.Translate(Vector3.right * 0.01);
```

Where should this line be?

Spaceshooter – Make the spaceship fly

A better approach

- Using a variable to adjust your speed in unity

```
public float playerSpeed = 0.2;
```

- After saving you will see it directly in the inspector (unity3d)

Make your speed reacting to user Input

```
float amtToMove = Input.GetAxis("Horizontal") * playerSpeed * Time.deltaTime;
transform.Translate(Vector3.right * amtToMove);
```

Axis “Horizontal” is provided via Unity’s input system (by default, wasd, arrow key, joystick) for vertical and horizontal changes, values between -1, 0 +1

Spaceshooter – Make the spaceship fly

Now, your Player moves out of the screen when you press A or D, or the corresponding arrow keys.
-> But it just keeps going

Wait!

```
float amtToMove = Input.GetAxis("Horizontal") * playerSpeed * Time.deltaTime;
transform.Translate(Vector3.right * amtToMove);
```

Remove that part from your code, can you recognize a difference?

Spaceshooter – Make the spaceship fly

```
float amtToMove = Input.GetAxis("Horizontal") * playerSpeed * Time.deltaTime;
transform.Translate(Vector3.right * amtToMove);
```

Remove that part from your code, can you recognize a difference?

If not:
Each frame has a slightly (or sometimes larger) different duration (for computation) than the frame before.
deltaTime provides us with the exact amount of time since the last frame.
Result: the movement is calculated according the elapsed time, the spaceship is moved on slower FPS more than on faster ones

Spaceshooter – Make the spaceship fly

Now, your Player moves out of the screen when you press A or D, or the corresponding arrow keys.
-> But it just keeps going.

#2 To restrict it to your screen, you can implement a screen wrap.

Your game's space will be finite but unbounded: If the Player leaves one side of the screen it will immediately reappear on the opposite side. Get the Player's position with the Inspector and use the values at the edges of your screen as condition for reappearing on the opposite side.

Spaceshooter – Make the spaceship fly #2

What we need to check if spaceship is too far left or right?

What does too far left or right means?

Spaceshooter – Make the spaceship fly #2

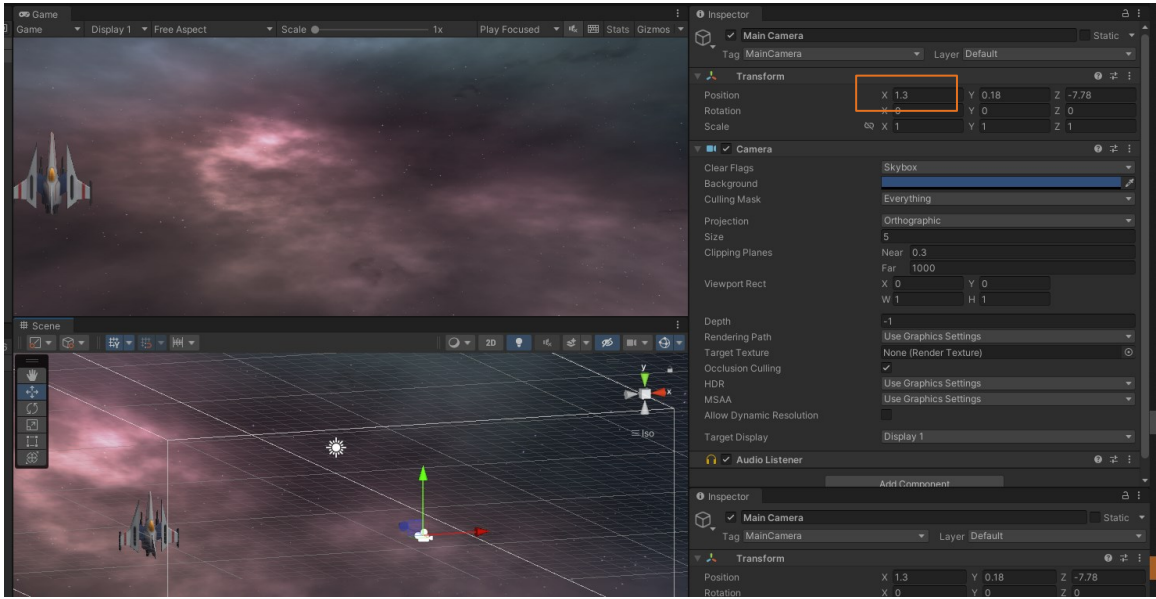
What we need to check if spaceship is too far left or right?

-> X value of our current Transformation

What does too far left or right means?

-> X is less or greater according to values checked via inspector.

Can be different depending on your game view size.



Spaceshooter – Make the spaceship fly #2

New programming concept:

```
if( condition ) { then; } else { otherwise do…; }
```

Spaceshooter – Make the spaceship fly #2

New programming concept:

if(condition) { then; } else { otherwise do…; }

```
// Screen wrap
if (transform.position.x < -7.4f)
{
  transform.position = new Vector3(7.4f, transform.position.y,
        transform.position.z); overwrite current x position with other side
}
else if (transform.position.x > 7.4f)
{
…
}
```

Spaceshooter – Make the spaceship fly #2

New programming concept:

if(condition) { then; } else { otherwise do…; }

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}
else if (transform.position.x > 7.4f)
{
…
}
```

Spaceshooter – A spaceship can shoot

#3 Create a small projectile (use a capsule) and create a projectile prefab

You can use a scale of 0.2, create a new material called “m_projectile” with green color

Add a rigidbody to your object and deselect "Gravity" and check "Is Kinematic" which will allow you to tell the Projectile how to move instead of being controlled by the physics engine

Create a new C# Script called “Projectile”

Make the projectile move upwards (y) similar to the player (but without Input)

```
// Move projectile (in Update Mehtod)
float amtToMove = projectileSpeed * Time.deltaTime;
transform.Translate(Vector3.up * amtToMove);
```

To adjust speed you can use a public variable again `public float projectileSpeed = 15;`

Save this as prefab and delete the scene object afterwards

Spaceshooter – A spaceship can shoot

#4 To avoid your projectiles flying endless in your world
You can destroy game objects (removed from the scene Hierarchy)

```
// Destroy projectile
if (transform.position.y > 6.4f)
{
     Destroy(gameObject);
}
```

Further reading: An easy, position independent way of destroying your GameObject as soon as it becomes "invisible" is adding your Destroy(gameObject) code to Unity's function "OnBecameInvisible" which is automatically called when your GameObject is no longer visible by any camera (http://docs.unity3d.com/ScriptReference/MonoBehaviour.OnBecameInvisible.html).

Spaceshooter – A spaceship can shoot

#5 Firing the Projectile

The projectile prefab acts as a template from which you can create new object instances (http://docs.unity3d.com/Manual/Prefabs.html)

Add to your Player script a new public variable (this time of type GameObject)

```
public GameObject projectilePrefab;
```

We can assign the projectile prefab to this field in the inspector (otherwise this will be null during play)

Spaceshooter – A spaceship can shoot #5

Again in your Player script

```
if (Input.GetKeyDown("space"))
{
        // Fire projectile
        Instantiate(projectilePrefab, transform.position,
                Quaternion.identity);
}
```

Quaternion: A really cool 4-Component vector to represent rotations! More later. Just use identity equal to rotation 0, 0, 0

Where does transform.position comes from?

Spaceshooter – A spaceship can shoot #5

Check it out in Unity3D

What did you see?

Spaceshooter – A spaceship can shoot #5

What did you see?

- Try `Input.GetKey("space")` and see the difference. Why is `Input.GetKeyDown` used here? (http://docs.unity3d.com/ScriptReference/Input.GetKey.html)
- When you check this in Unity, you will notice that there is a problem with the y position; the Projectile instantiates in the middle of the Player.

Additional Task (free work time during tuorial or at home)

#1 Changing the initial position of your projectile

Maybe
```
Vector3 position = new Vector3(transform.position.x, transform.position.y
        + (0.6f * transform.localScale.y),
        transform.position.z);
```

Further reading: The InputManager enables you to name an input and specify a key or button for it. You can access this by Input.GetButtonDown("yourName"). For more information check https://learn.unity.com/tutorial/getbutton-and-getkey.

#2 Adding sound

-> next page

Additional Task (free work time during tuorial or at home)

#2 Adding Sound

When fired, your Projectile should go along with some nice sound. You can use the sound file from moodle (www.moodle.tum.de/) or every other wav file you would like to hear.

- Create a folder named "Sounds".
- Drag and drop the wav file from your desktop into this folder.
- Select your ProjectilePrefab → Add Component → Audio → AudioSource.
- Drag your sound onto "Audio Clip".
- Make sure that "Play On Awake" is checked. Then the audio clip will be played as soon as the Projectile is instantiated.

Please present your final results next tutor session!