

Game programming

Lecture 1: Introduction and concepts..

By Dr. Rokia Abdein

Game programmer vs. game developer.

- Game development is the overall process of a video game production (from initial concept to distribution), whereas game programming is one part of game development — specifically software development, which involves writing the code that drives a video game.
- Game programming, a subset of game development, is the software development of video games.
- Game programming refers to the **code that brings a video or computer game to life**.

Game programmer vs. game developer.

- Essentially, a game programmer writes the code that brings a video game to life. They work closely with producers and other departments (e.g. game designers, game artists, Sound, etc) to translate the project's vision into a fully functioning, playable game.
- They could be responsible for anything from **dictating the speed** at which your character runs and **how high they jump** to **how many enemies appear** and when and **how they react** when attacked.



Game programmer vs. game developer.

- Using **coding languages** like C#, C++, Python, and HTML5, a game programmer brings imaginative ideas to life. An idea turned into a visually stunning, challenging, and enjoyable game with code for **multiple platforms**, such as computers, gaming consoles (PS5, Xbox, Nintendo), mobile phones, and tablets.

Is game development a good career?

- One of the most important factor that appeal people to specific field is to earn money.
- Entertainment industry make more money than the education industry.
- The entertainment industry often generates more revenue than the education industry for several reasons. First, entertainment products such as movies, music, and video games have a broad appeal and can be easily marketed to large audiences, leading to higher sales and profits.
- Additionally, the entertainment industry is driven by consumer demand and can adapt quickly to changing trends and technologies, allowing it to capitalize on new opportunities and maintain its profitability.

Reasons to Invest in the Entertainment Industry

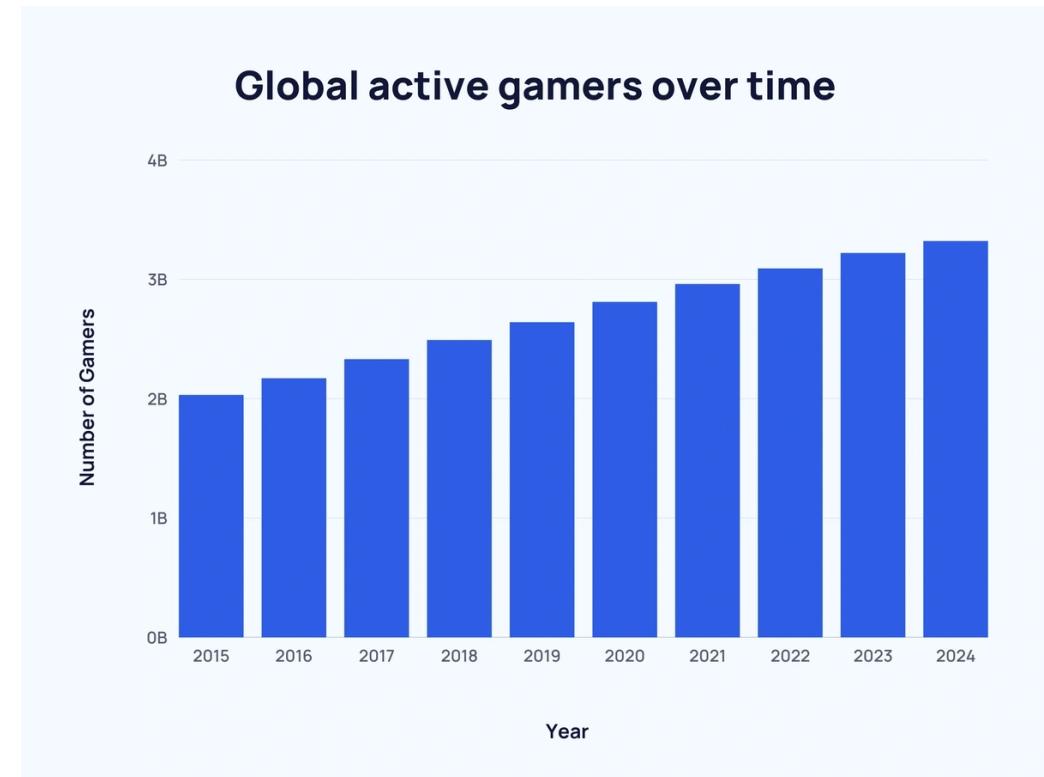
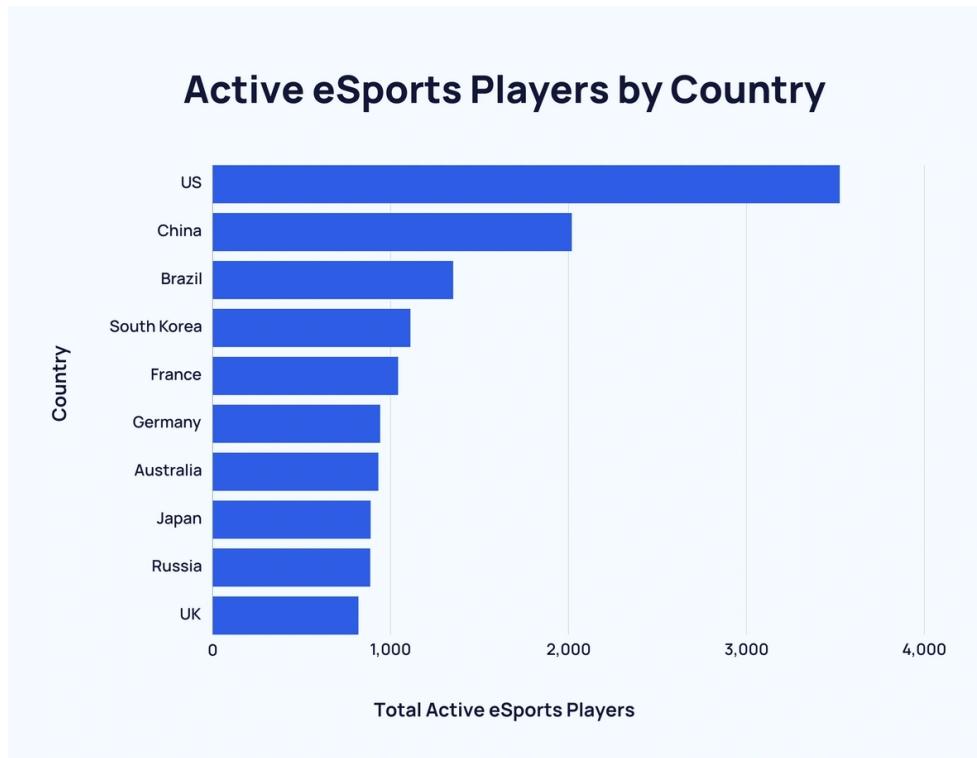
- The gaming industry has experienced tremendous growth in recent years. In the United States alone, the video game market is estimated to be worth \$95.45 billion as of 2023. The number of worldwide gamers is also set to rise to about 2.8 billion by 2027, and revenue from video games are projected to reach \$304.70 billion.
- Millions of new players splashed out on games and consoles during COVID-19 lockdowns. Some players said gaming during the pandemic helped with their mental health.
- The first reason is **The Profits Are Massive!**

Reasons to Invest in the Entertainment Industry

- Demand for developers in the gaming industry has increased by 50% in a couple of years. The gaming industry's expansion has exploded as the internet and web applications become increasingly integrated into our daily lives. Yes, imagine a day without the internet! Products from gaming companies are coming to our smartphones and computers, where we spend more and more time.
- Working in the gaming industry can be one of the lucrative career options in 2024. Games that people play every day need to be built, updated, and maintained by someone. As a result of their high salaries, game developers are in high demand all over the world. Many people, particularly gamers, find the career path of game development appealing.
- **Attractive and has high demand!**

How Many Gamers Are There In 2024?

- According to the latest data, there are approximately 3.32 billion active video gamers worldwide. That figure has risen by well over 1 billion in just eight years.



Here are the top six reasons given for playing video games as of February 2021:

Reason	Share of Respondents	Number of Gamers (Global)
Unwind, relax, and decompress	66%	2.04 billion
Fill time while taking a break, waiting, or commuting	52%	1.61 billion
Escape and be highly entertained	51%	1.58 billion
Spend time by myself	48%	1.48 billion
Solve a problem, use my brain, and think logically	37%	1.14 billion
Be comforted by something familiar	32%	0.99 billion

Game playing is also profitable..!!

. Livestream

If you're good at gaming or if you have an entertaining personality, you can make money livestreaming yourself playing.

You might be wondering, Why would anyone want to watch me play, and why would anyone want to pay me to play? There are a number of reasons people like to watch other people play video games:

- To pick up tips from someone who is a more advanced player
- To witness exceptional gameplay
- To listen to someone who offers entertaining narration as they play
- To connect with others in the gaming community who are watching

Game playing is also profitable..!!

. Livestream

You'll also need a suitable platform for livestreaming. Some of your best options include:

Twitch (owned by Amazon)

YouTube Gaming

Facebook Gaming

DLive

Top Skills Required for Careers in Game Development

- To be a successful video game developer, one must know analytical and creative skills.
- Many developers have soft skills like problem-solving, time management, communication, storytelling, and working for a team.
- Likewise, Math, physics, software engineering, and programming (in languages like C++, Java, and C#, among others) are examples of hard skills.

Proven Factors That Make Your Games Success!

1. Localization

Localization is the process of adapting a game to the local culture and language of the target audience. It's a critical factor that can make or break the success of a game.

2. Genre

The genre of a game can significantly impact its success in. Certain genres are more popular than others, and understanding the preferences of gamers can help game developers cater to their needs. For example, PUBG Mobile is a battle royale game that has become very popular in the world. The game's action-packed gameplay and intense combat appeal to gamers' love for action games.



Proven Factors That Make Your Games Success!

3. Platform

Choosing the right platform to publish a game in is crucial. Mobile gaming is very popular in some countries such as China, with over 60% of gamers playing on their phones. However, PC gaming is also popular, especially among hardcore gamers. An example of a game that has successfully targeted both mobile and PC gamers is League of Legends. The game is available on both platforms, which helped it become one of the most popular games in the country.



Proven Factors That Make Your Games Success!

4. Pricing

Pricing is a significant factor that can impact the success of a game. Gamers in some countries are price-sensitive, and offering games that provide value for money is essential.

The popular mobile games in many African countries are free to download but offers in-app purchases. This pricing strategy allowed the game to reach a wider audience while still generating revenue.

With some apps, you can buy additional content or services within the app. We call these "in-app purchases." Here are some examples of in-app purchases:

A sword that gives you more power in a game.

A key that unlocks more features of an app.

Virtual currency that can be used for purchases.

Proven Factors That Make Your Games Success!

5. Marketing

Marketing is crucial in getting the word out about a game in many countries. Social media is prevalent, and platforms like Facebook and Instagram can be effective in reaching potential players.

6. Community

Building a community around a game can help create a sense of belonging among gamers. This can include social media groups, forums, and in-game chat features. The game's social features allow players to interact with each other, which helps build a sense of community among players.

Proven Factors That Make Your Games Success!

7. Uniqueness

A proper study of the target market of your game is required to place your game in a niche that is new or even if not, has a unique calling to entice players.

8. Technical Requirements

The technical requirements of a game can impact its success. Many gamers may not have the latest hardware or internet speeds, so optimizing the game for lower-end devices and slower connections is crucial.

Proven Factors That Make Your Games Success!

In conclusion, success in the gaming market depends on several factors, from localization and genre to pricing and marketing. Understanding the preferences and habits of gamers is crucial in creating a game that resonates with them. By taking into account these seven factors, game developers can increase their chances of success in growing gaming market.

How To Create Your Own Video Game?

1. Write out your idea

- Before jumping into the actual game development process, you'll need an idea of what you want to build. Consider the central concept behind your game and the genre that your game fits in. Some popular genres include puzzles, endless runners, racing, arcade games, comedy, horror, role-playing games, visual novels. You should limit your game's scope to a particular genre to avoid too much complexity that may slow development.



How To Create Your Own Video Game?



1. Write out your idea

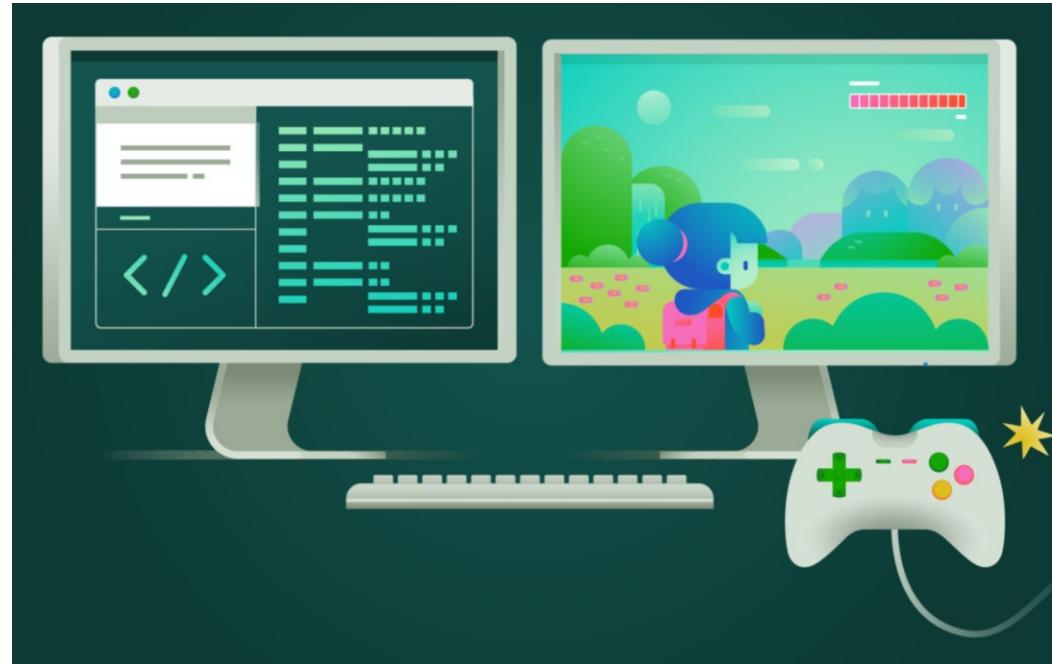
- Now that you have a game idea and genre, think of the characters that people will interact with when playing your game. Use your imagination to create different characters that fit your game and genre. Some of the common characters include animals, aliens, and cartoons in human form.
- Next, think of the environment in your game. Consider the scenes, colors, and backgrounds you'll need to support your gameplay. These factors should also align with your selected genre. For instance, [Temple Run](#), an endless runner game, features a road with numerous obstacles that gamers are expected to avoid to achieve different milestones.

How To Create Your Own Video Game?

2. Design the game

In this step, you need to develop your game idea further by writing down your main concepts, features, and mechanics. Your design document should **describe how the game works, the players, themes, art styles, and interactions.**

You should make rough sketches of your characters and the game environment, including scenes and backgrounds, to get a rough idea of how these components will come together to form a game.



How To Create Your Own Video Game?

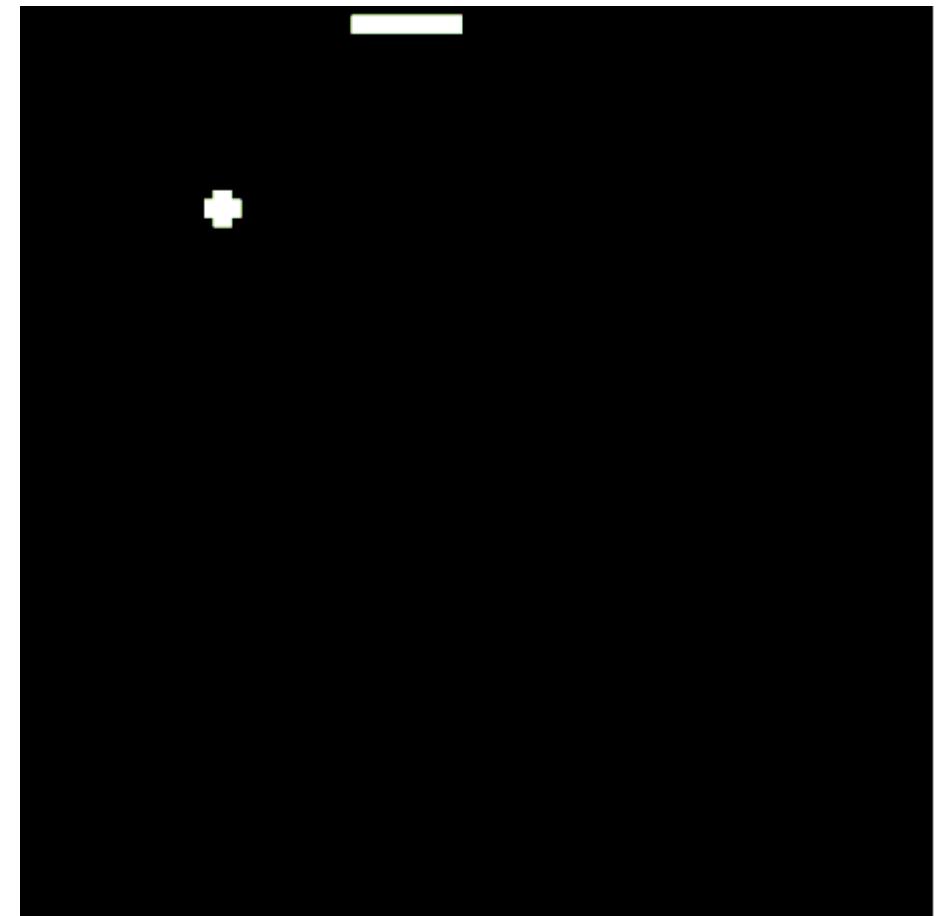
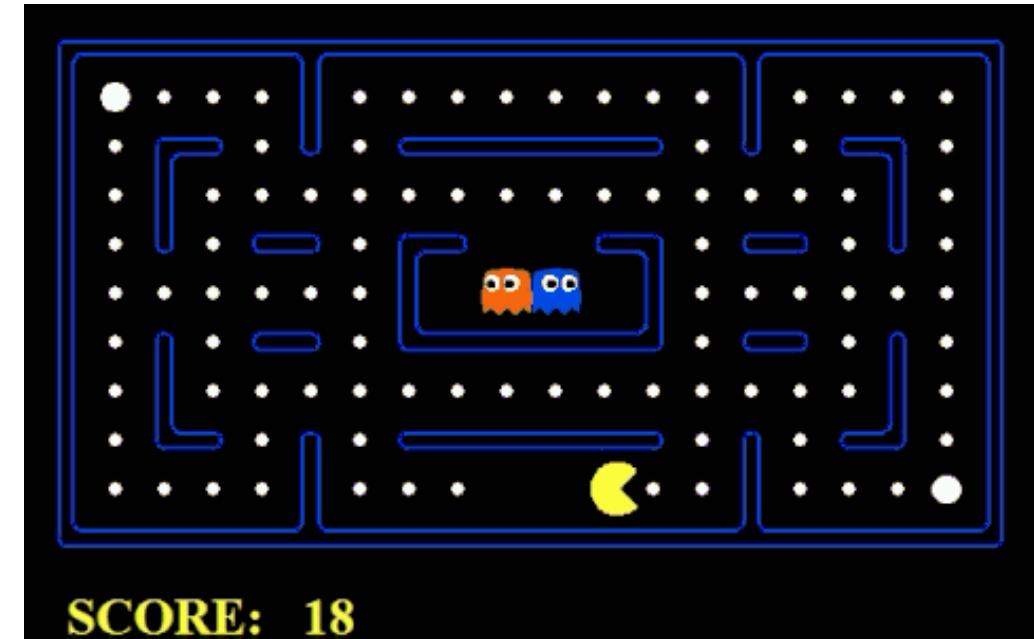
2. Design the game

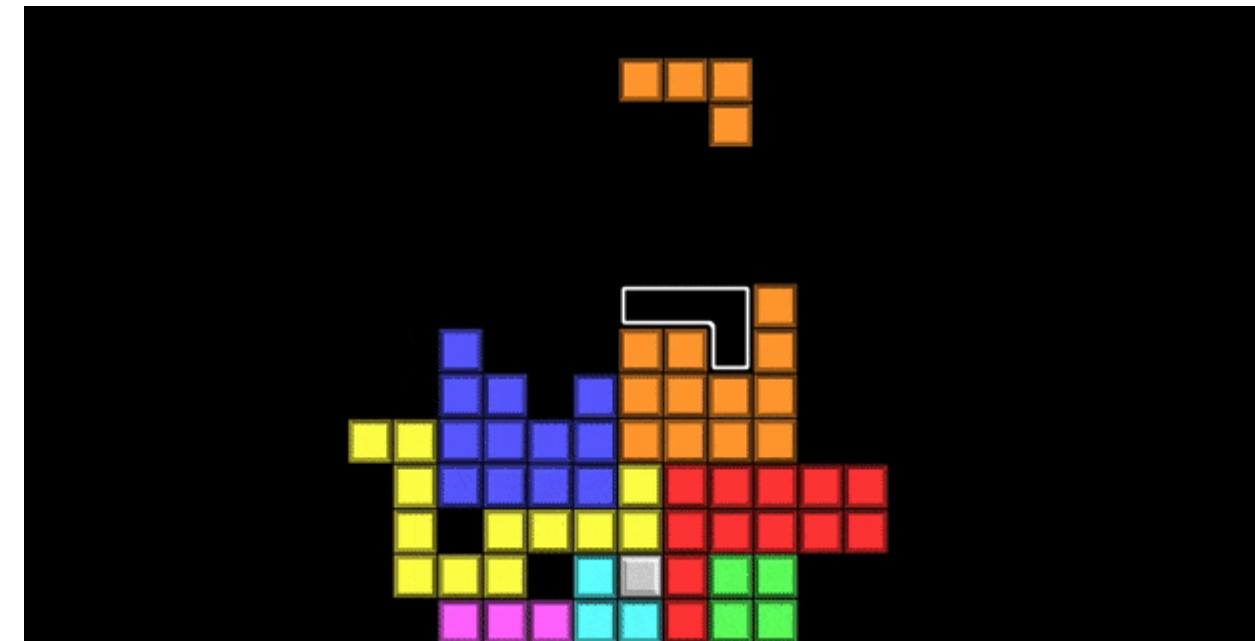
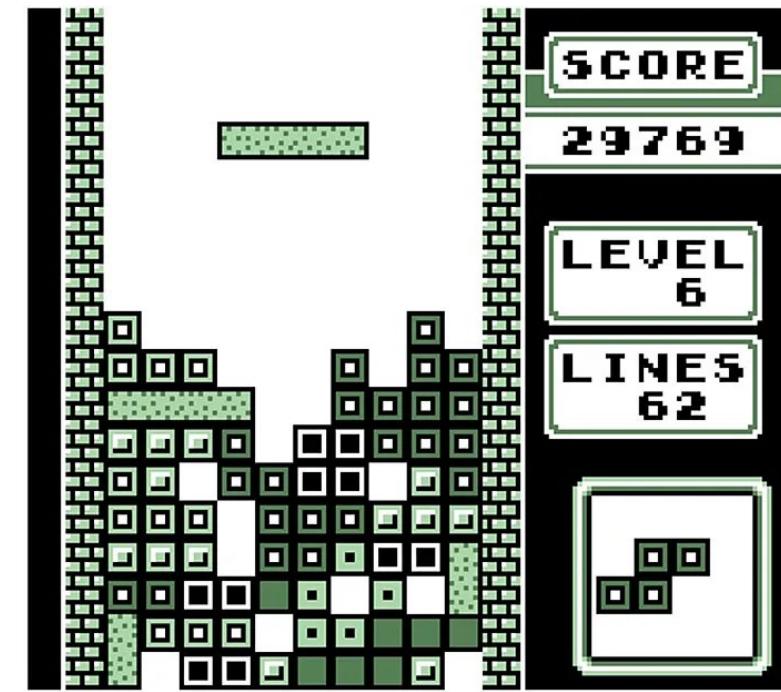
This is also the perfect time to assess the viability of the game idea. You can perform more research and, if need be, add extra features to your game to make it more interesting.

At this point, you can share your game design with friends and family. Their feedback can help you improve your game design.



How old electronic games look like in computer and mobile platforms..





How To Create Your Own Video Game?

3. Choose the right game development software

Once you're done with the idea generation and game design, you'll want to choose the appropriate game development software.

Game engines are responsible for the heavy lifting of your project. They perform complex tasks such as memory management, collision detection, sound management, and graphic rendering, allowing you to focus on the game itself.

Here are the top game engines that you might consider.



wikiHow to Make Computer Games

How To Create Your Own Video Game?

Unity is among the most popular game engines that allow you to create cross-platform games (iOS, Android, Microsoft Windows, Mac, and console). Many developers, especially newcomers, prefer Unity because of its simple interface and flat learning curve.

Unity's top features include:

- **Easy workflow.** Unity provides a simple workflow that allows <https://unity.com/> developers to assemble scenes as well as perform other game-related tasks.
- **Quality game creation.** Unity has dedicated graphics, sound, and physics engines that allow you to create complex and simple games easily.
- **Reusable assets.** Unity helps you cut game development time by providing assets such as characters, scenes, and other graphics on its Asset Store.



How To Create Your Own Video Game?

- **Broad community.** A large number of developers use Unity for game development, and often give advice for other developers who get stuck. There are also numerous tutorials online for both Unity and its programming language, C++.
- Unity is available for free for those earning less than \$100,000 annually. In case you wish to access more functionalities, you will need to pay an annual fee of \$1,800 and \$399 for Unity Pro and Unity Plus, respectively.



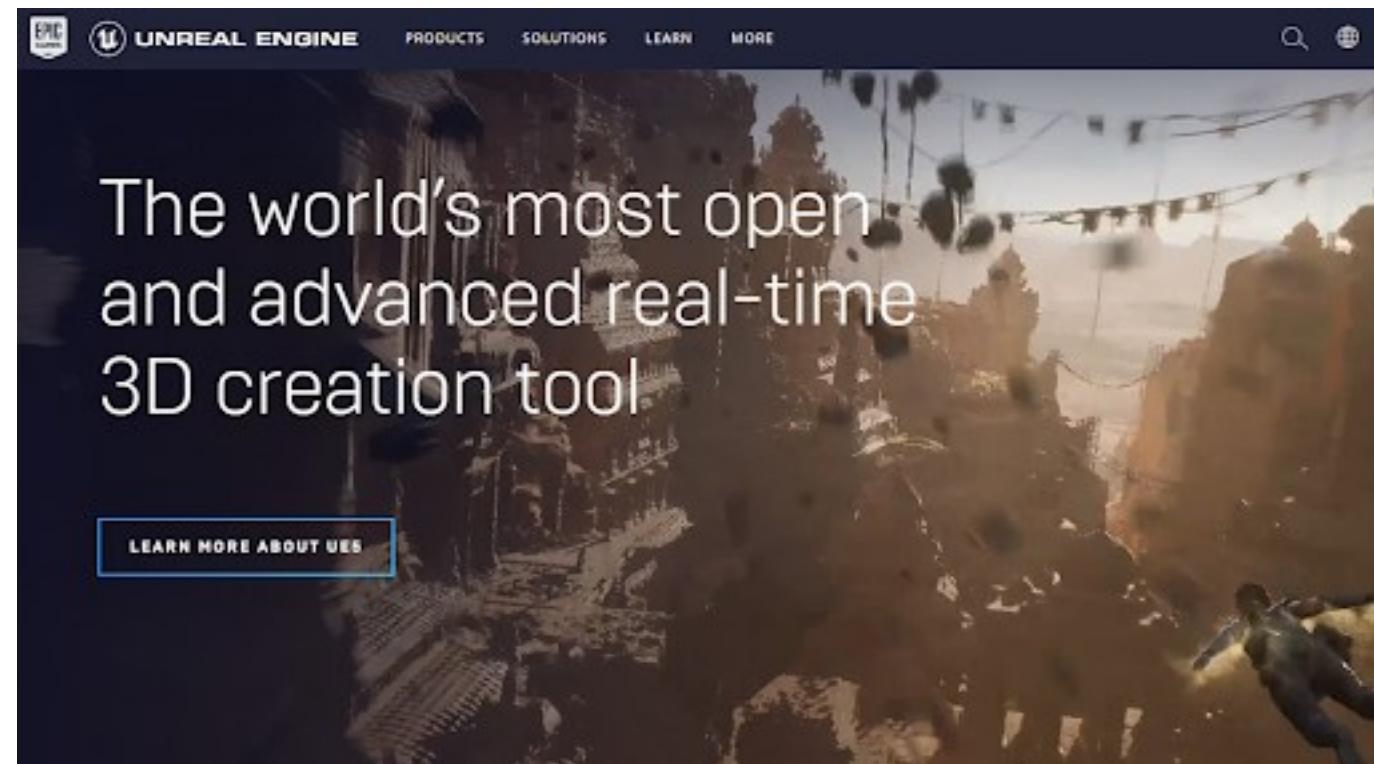
<https://unity.com/>

How To Create Your Own Video Game?

Unreal Engine is considered by many the best game engine for rendering complex graphics. You can use Unreal Engine to create games for mobile, console (Playstation, Nintendo, and Xbox), PC, AR, and VR.

The top features of Unreal Engine include:

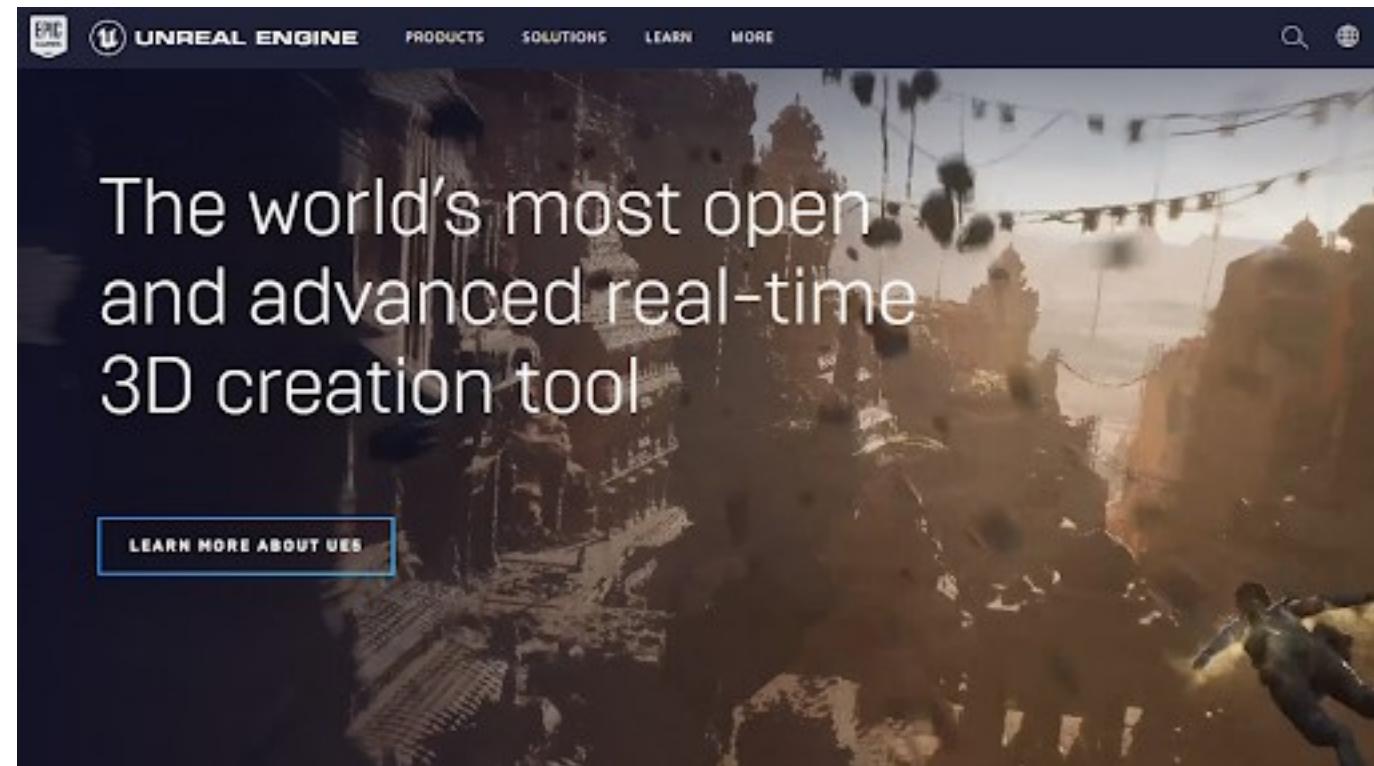
- **An enhanced integration.** Unreal provides the different tools and algorithms required to develop a complete game.
- **Animation.** Unreal Engine supports numerous animations that you use to improve the quality of your video game.



<https://www.unrealengine.com/en-US>

How To Create Your Own Video Game?

- **Game testing.** Unreal Engine features a robust multiplayer framework that you can use to test your game across different operating systems.
- **Availability of assets.** You can find high-quality plugins and assets on the Unreal Engine marketplace that you can use to accelerate your game development.
- Unreal Engine is free to use. However, you will need to pay a 5% loyalty fee when the revenues from your application pass \$1,000,000.



<https://www.unrealengine.com/en-US>

How To Create Your Own Video Game?

[Phaser](#) is a free and open-source game development software that allows you to build HTML5 and JavaScript games for mobile and desktop browsers.

Phaser is lightweight and includes the following features.

- **Animation.** Phaser provides different types of animations that you can use to bring action to your game. You can also import animations from other applications, including Unity.



<https://phaser.io/>

How To Create Your Own Video Game?

- **Physics and particle engine.** Phaser provides engines that allow you to easily add features such as rain, explosions, and fire to your video game.
- **Plugin system.** You can add more features to your development environment by downloading and installing the numerous plugins supported by Phaser.
- **Developer focused.** Phaser responds quickly to bug reports which facilitates a conducive development environment.

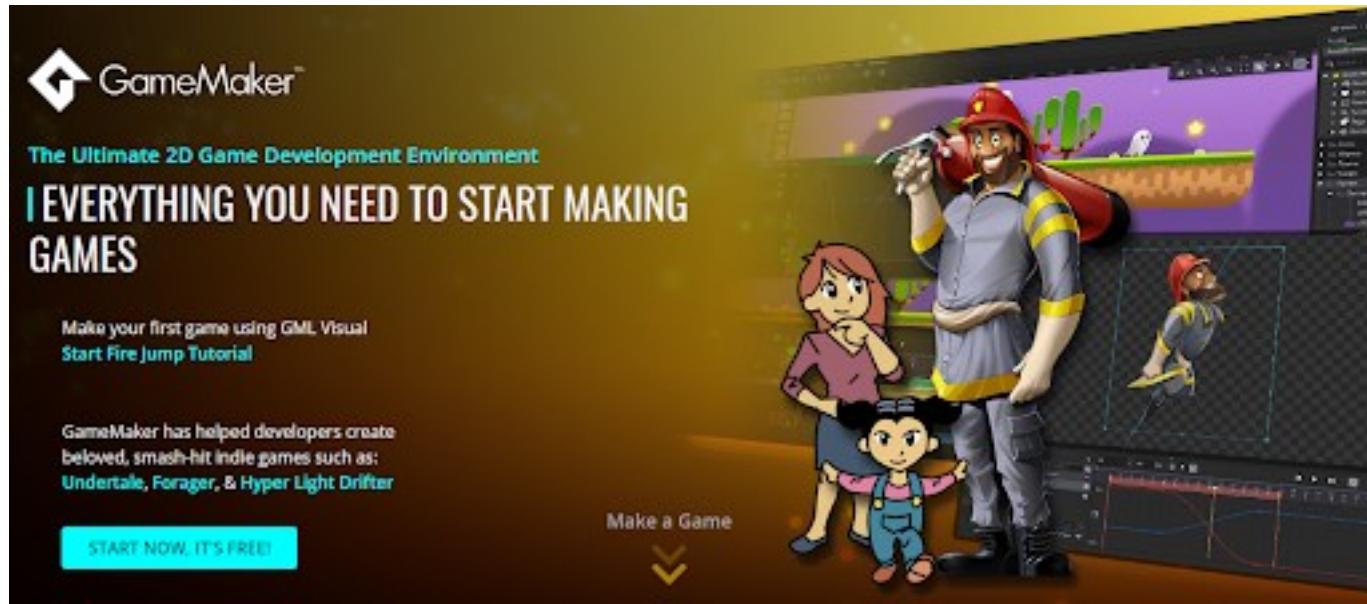


<https://phaser.io/>

How To Create Your Own Video Game?

GameMaker Studio allows you to create fun and action-packed 2D games. It's commonly used by educators, indie game developers, and professional game development studios to build cross-platform games. GameMaker Studio has the following features.

- **Flexible workspace.** You can rearrange the GameMaker workspace to fit your project's needs which can boost productivity.
- **Drag-and-drop editor.** As a beginner, you can also use GameMaker's editor to customize objects and characters, which will help improve your game's appeal.



[https://gamer.io/en](https://gammer.io/en)

How To Create Your Own Video Game?

- **Active development.** GameMaker releases updates and new features regularly, which you can use in your application.
- You can download and use GameMaker Studio for free.

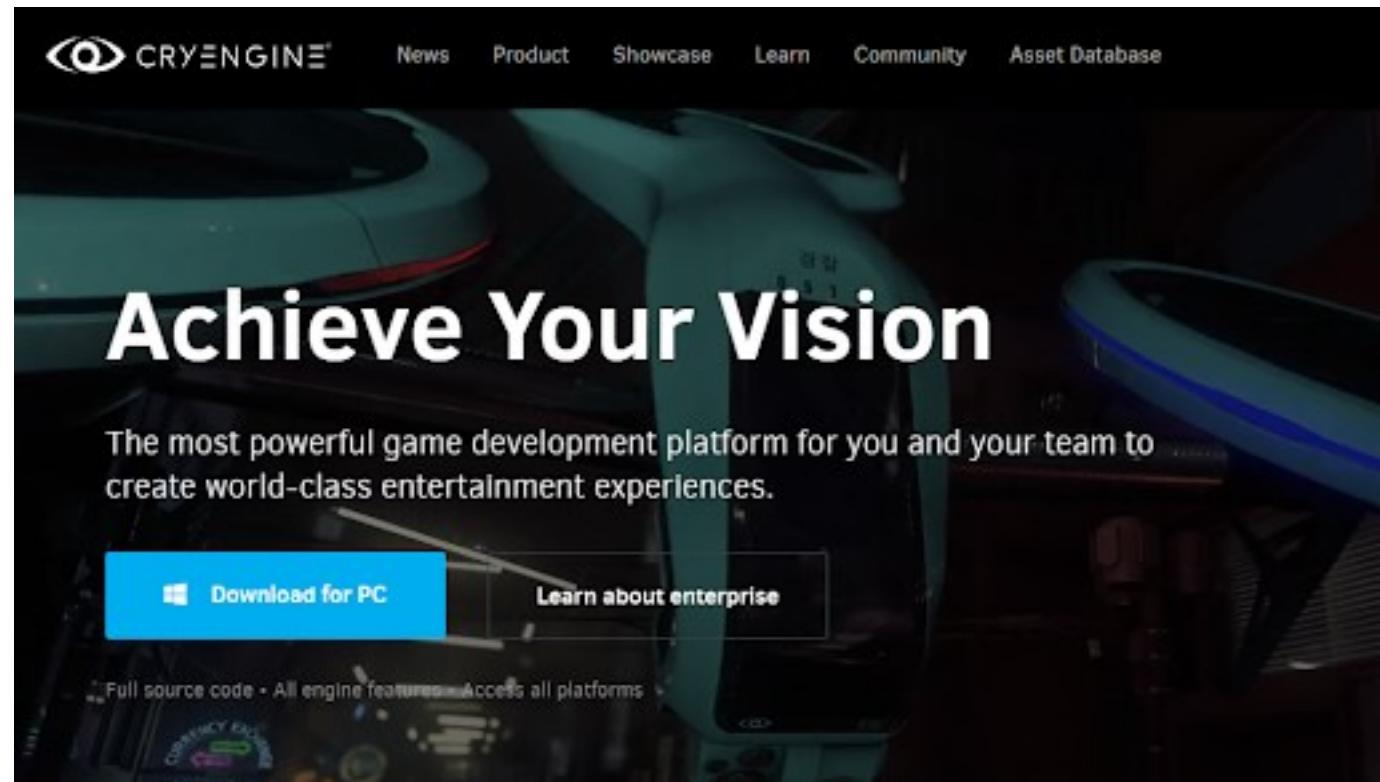


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How To Create Your Own Video Game?

CryEngine provides development tools that enable you to build quality video games. CryEngine has the following features:

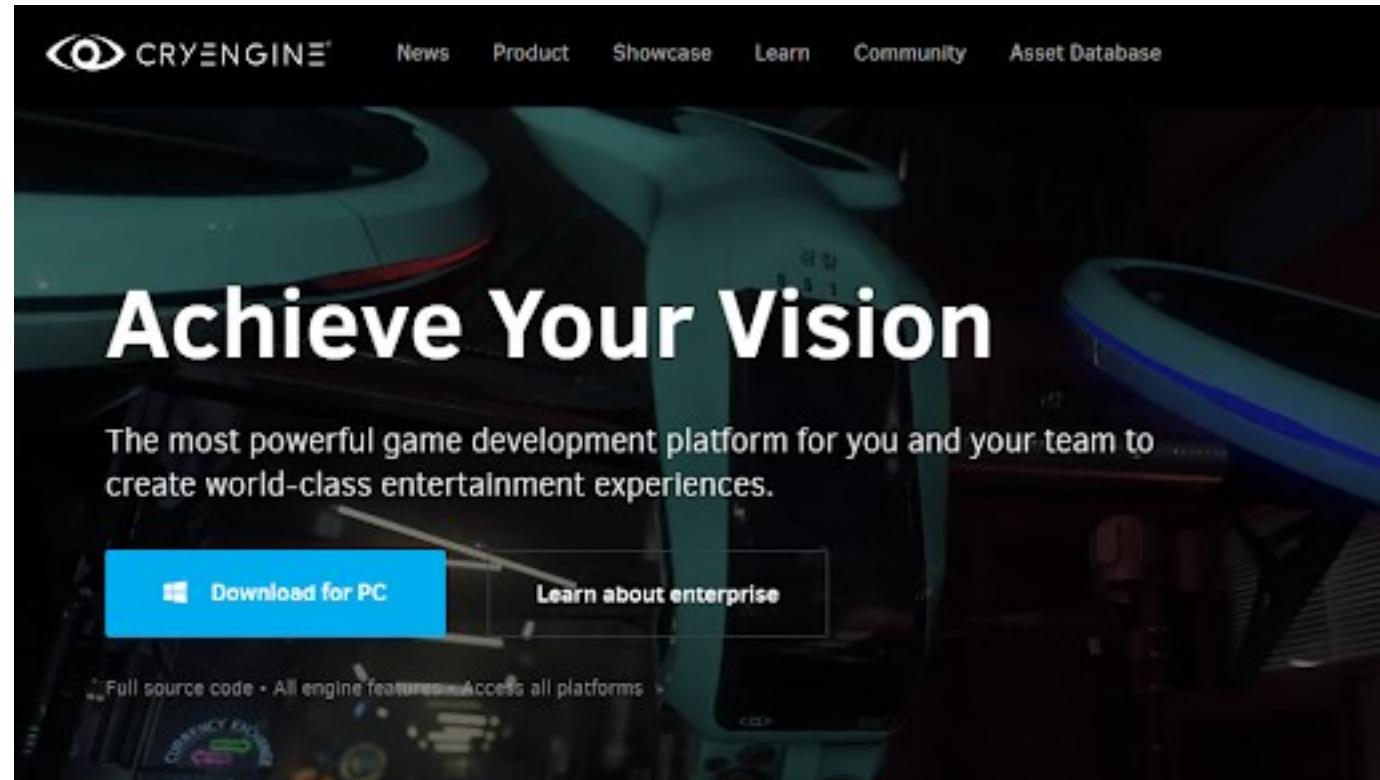
- **Cross-platform support.** You can use CryEngine to develop games for mobile, computer, and console devices. Cross-platform capabilities allow you to target a broad audience.
- **Artificial intelligence.** CryEngine uses artificial intelligence to add more interactivity to video games. This allows you to implement specific actions or events in your game easily.



<https://www.cryengine.com/>

How To Create Your Own Video Game?

- **3D visualization.** CryEngine allows you to build powerful 3D games and deploy them on different devices.
- CryEngine is also available for free. However, you must pay a 5% loyalty fee when you ship your project.



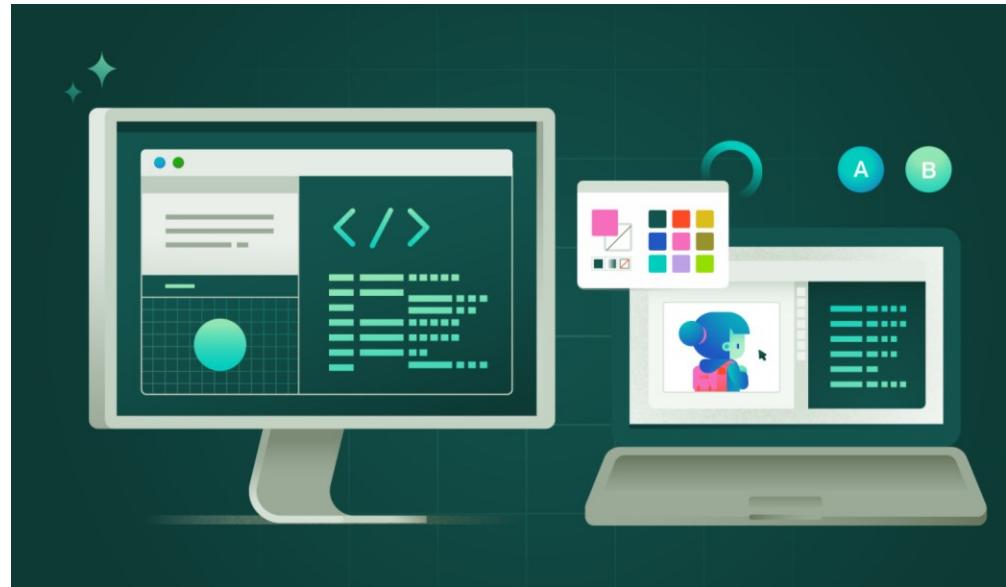
<https://www.cryengine.com/>

How To Create Your Own Video Game?

3. Start with the basics

After downloading your preferred gaming engine and setting up your development environment, you can start programming the video game.

At this step, only focus on the basic features needed by your game to run. You can add more complex features in subsequent updates. If you find certain concepts challenging to implement, don't be afraid to look for help. There are a number of developer communities on the internet that can be amazing resources.



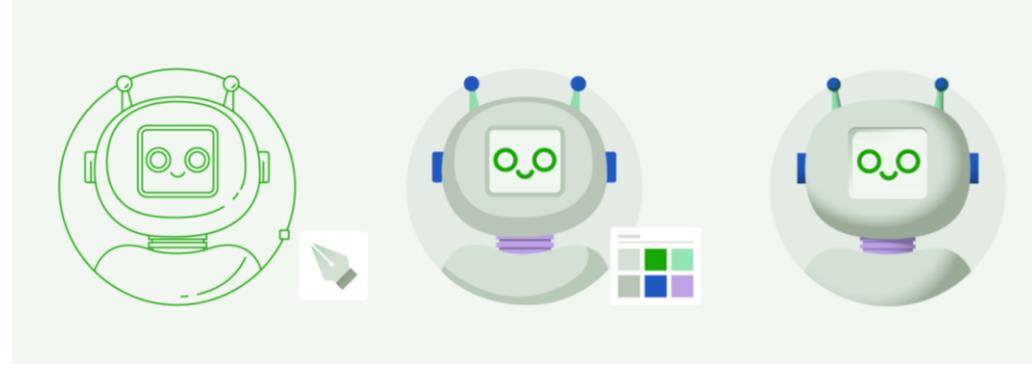
How To Create Your Own Video Game?

4. Design the characters

Once you understand your gameplay, it's time to design the characters that users will interact with.

At this stage, start with simple characters that you can improve later. For instance, you may use objects or shapes to symbolize your main characters. You can later replace these objects with the final designs. This strategy can help reduce your workload and even eliminate stress and pressure.

You can also save time by purchasing characters from different online graphic stores or hiring designers to do the job for you.



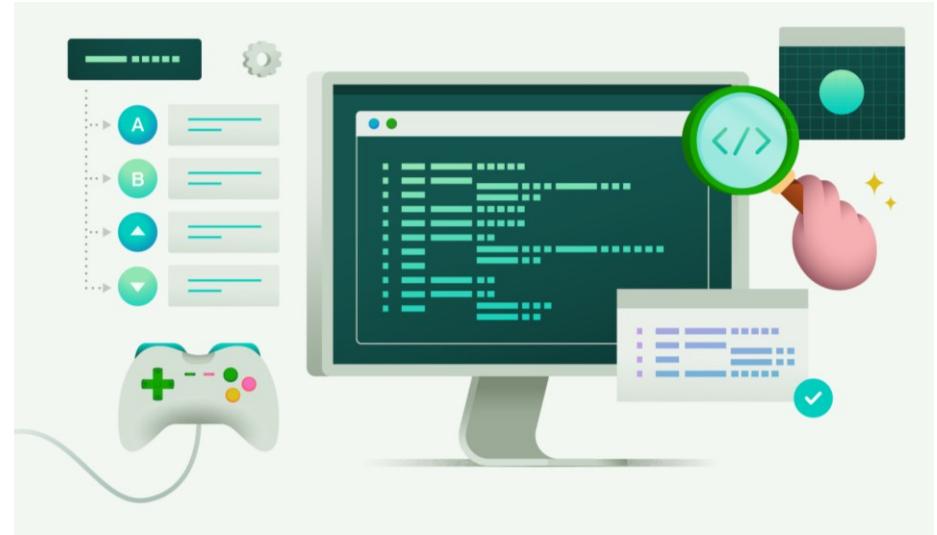
How To Create Your Own Video Game?

4. Test your game

Testing is an essential part of video game creation. It allows you to ensure that your game works as intended. Before releasing your video game, you should subject it to intensive testing.

Look for bugs by performing actions that average users will not do. Invite your friends and family to test the game and ask for feedback.

You can also send the game to experts and ask for their professional opinion. Remember to write detailed test reports of your video game's performance. You can use these bug reports for future improvement.



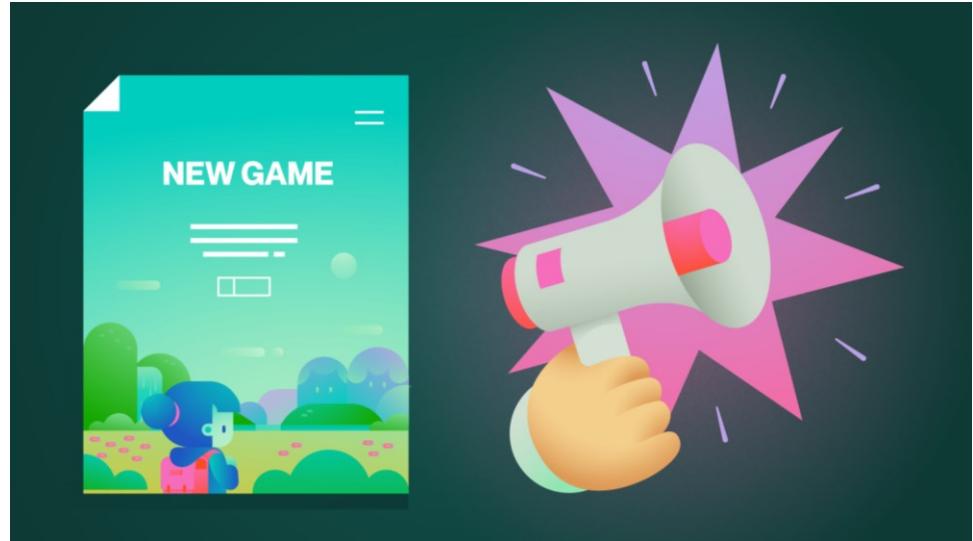
How To Create Your Own Video Game?

4. Market the game

Now that the game is developed, you should consider how best to market it to your intended audience. Here are some marketing strategies you can use to market your video game.

Embrace social media marketing. You can use social media platforms such as Facebook, Twitter, Tiktok, and Instagram to promote the game. These social media accounts are also the best place for user engagement. For instance, you can answer questions relating to your game and provide game updates.

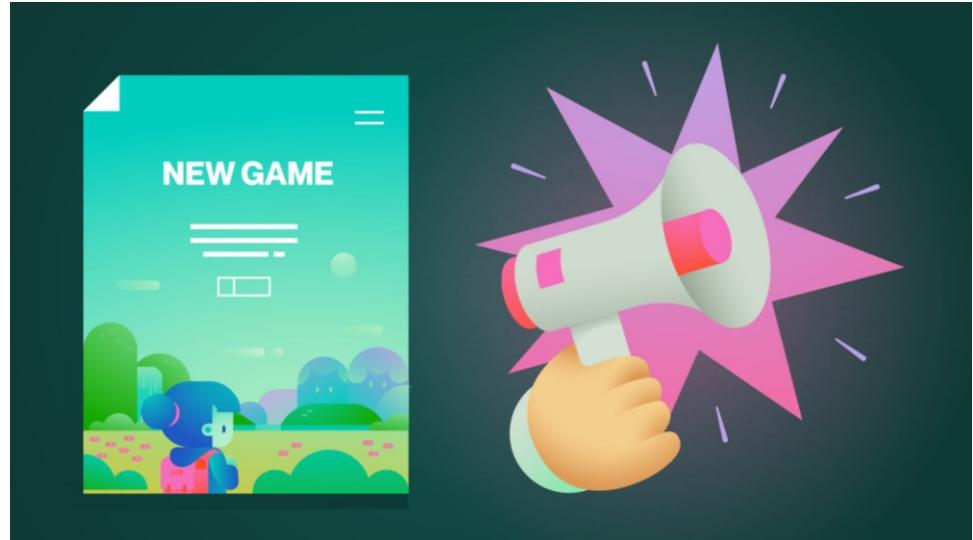
Use existing platforms or marketplaces. If you created a mobile video game, consider distributing it via Google Play and the Apple App Store. These app markets receive significant traffic and can improve your app's visibility.



How To Create Your Own Video Game?

4. Market the game

- **Use influencers.** You can also promote your video game by partnering with Influencers. Influencers usually have already established fan bases on social platforms and can, therefore, boost your marketing.
- **Create a dedicated website.** You should create a website and use it to market your video game. Investing in search engine optimization can help direct traffic searchers to your site which you can then convince to try out your game.



Hardware..

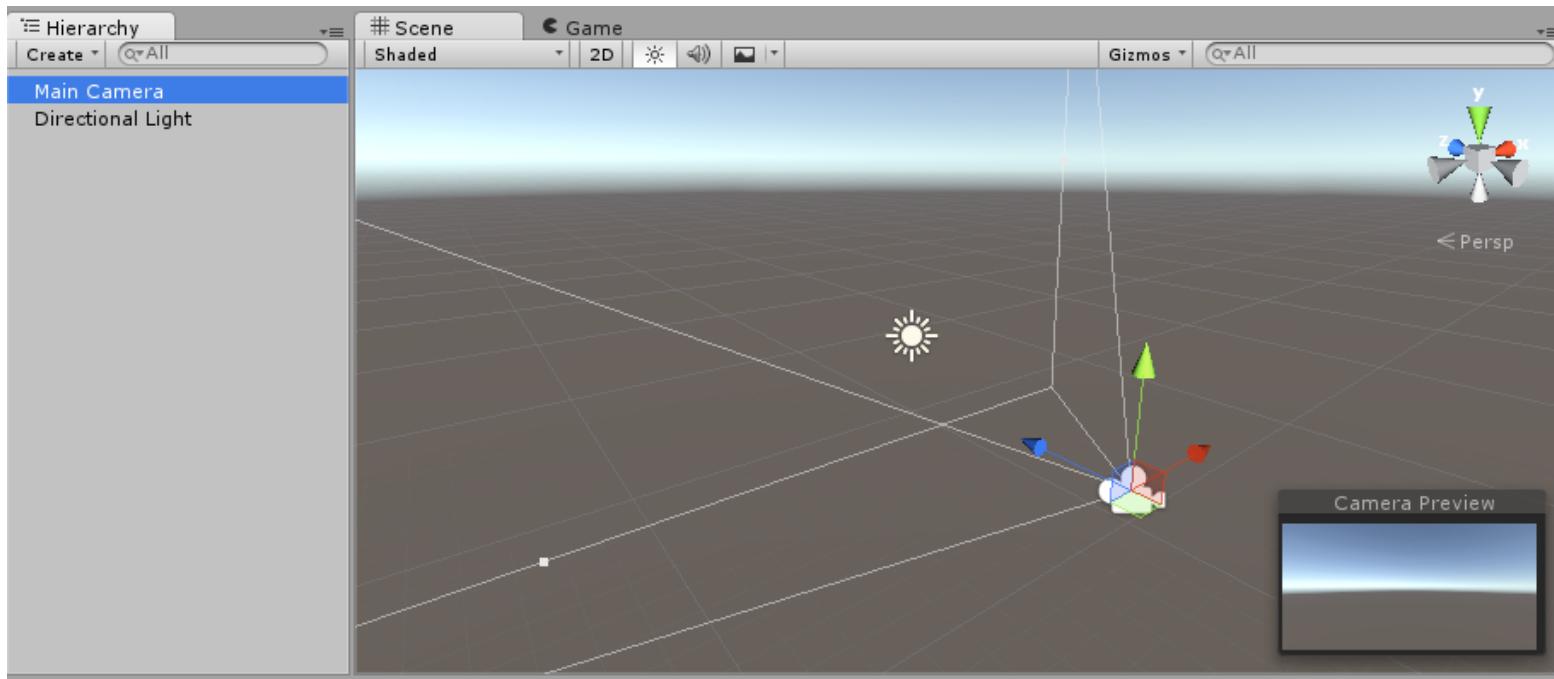
- **What's the difference between GPUs and CPUs?**
- A CPU, or central processing unit, is a hardware component that is the core computational unit in a server. It handles all types of computing tasks required for the operating system and applications to run.
- The GPU is a processor that is made up of many smaller and more specialized cores. By working together, the cores deliver massive performance when a processing task can be divided up across many cores at the same time (or in parallel). While GPUs were initially created to handle graphics rendering tasks in gaming and animation, their uses now extend far beyond that such as AI.



Concepts ..

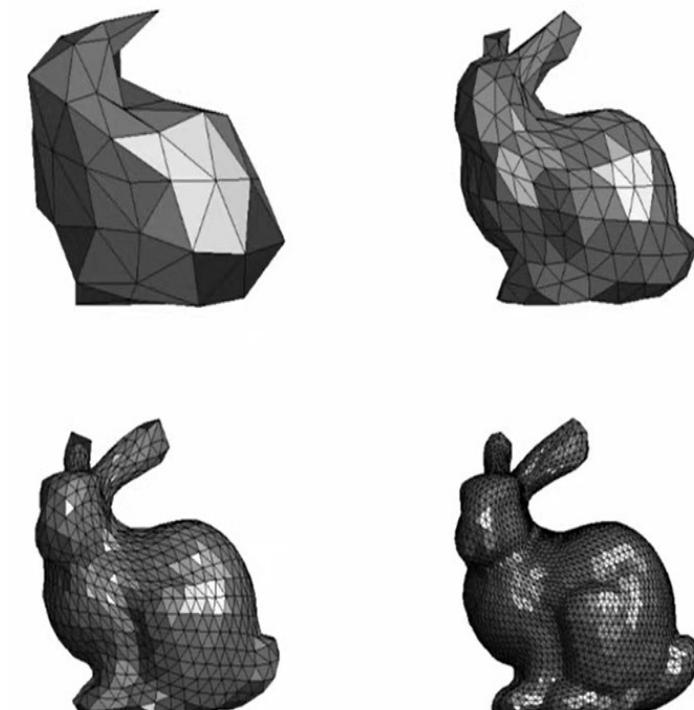
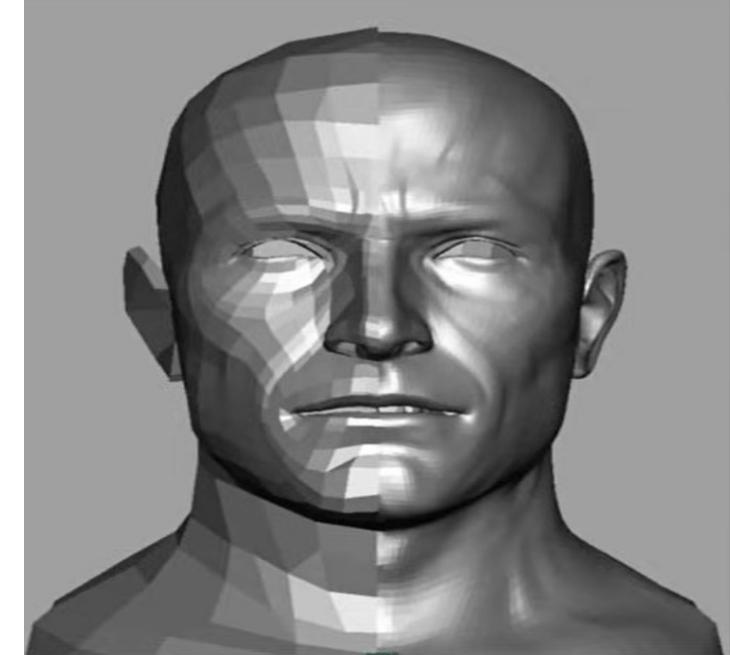
What is scene?

- Scenes contain the objects of your game. They can be used to create a main menu, individual levels, and anything else. Think of each unique Scene file as a unique level. In each Scene, you will place your environments, obstacles, and decorations, essentially designing and building your game in pieces.

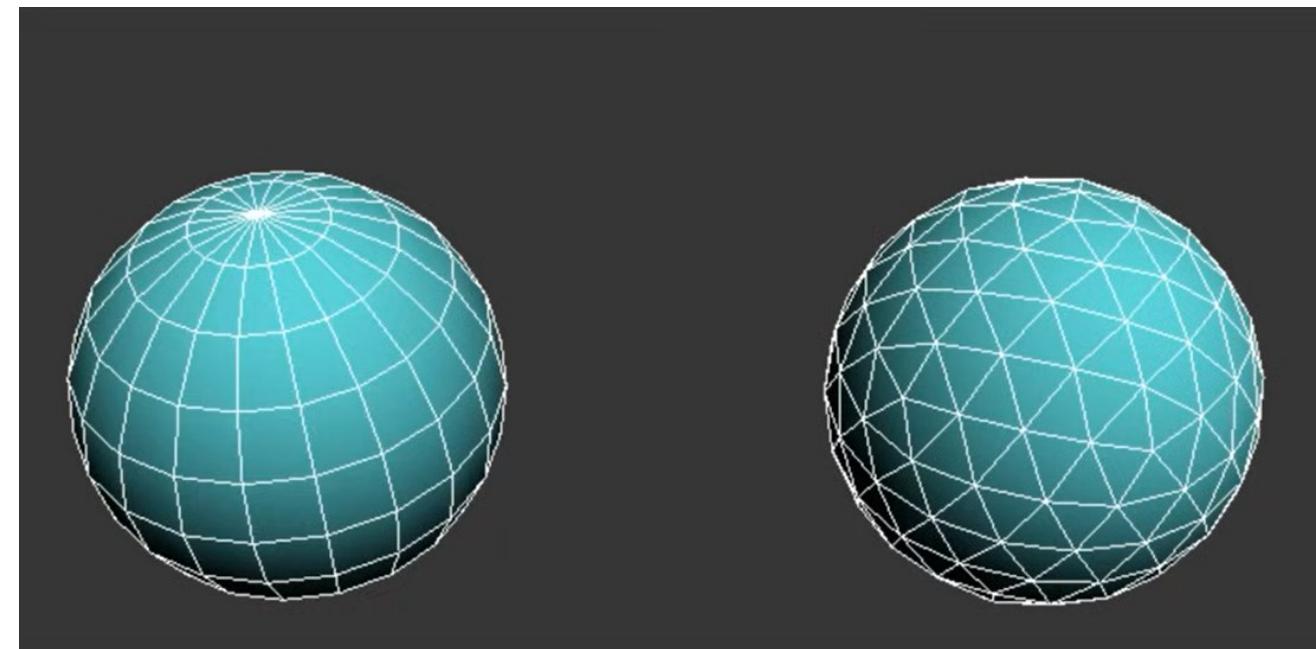


Triangles and quads in graphics..

- Triangles are used in game engines due to their simplicity and efficiency with modern GPUs, and flexibility in representing complex 3D models.
- All 3D models are made up of triangles or squares (quads).
- Quads are polygons used in 3D modeling that have four vertices and four edges. They are an essential component used in computer graphics to specify the geometry and surfaces of three-dimensional objects.
- The more shapes you have, the more detailed your object becomes.



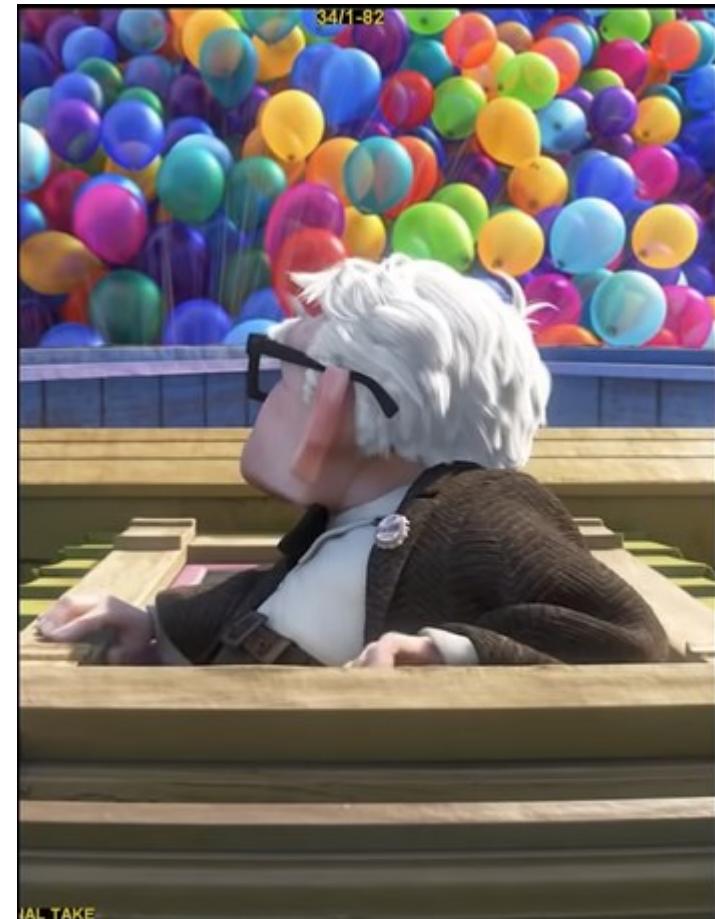
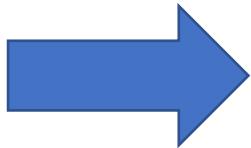
Triangles and quads in graphics..



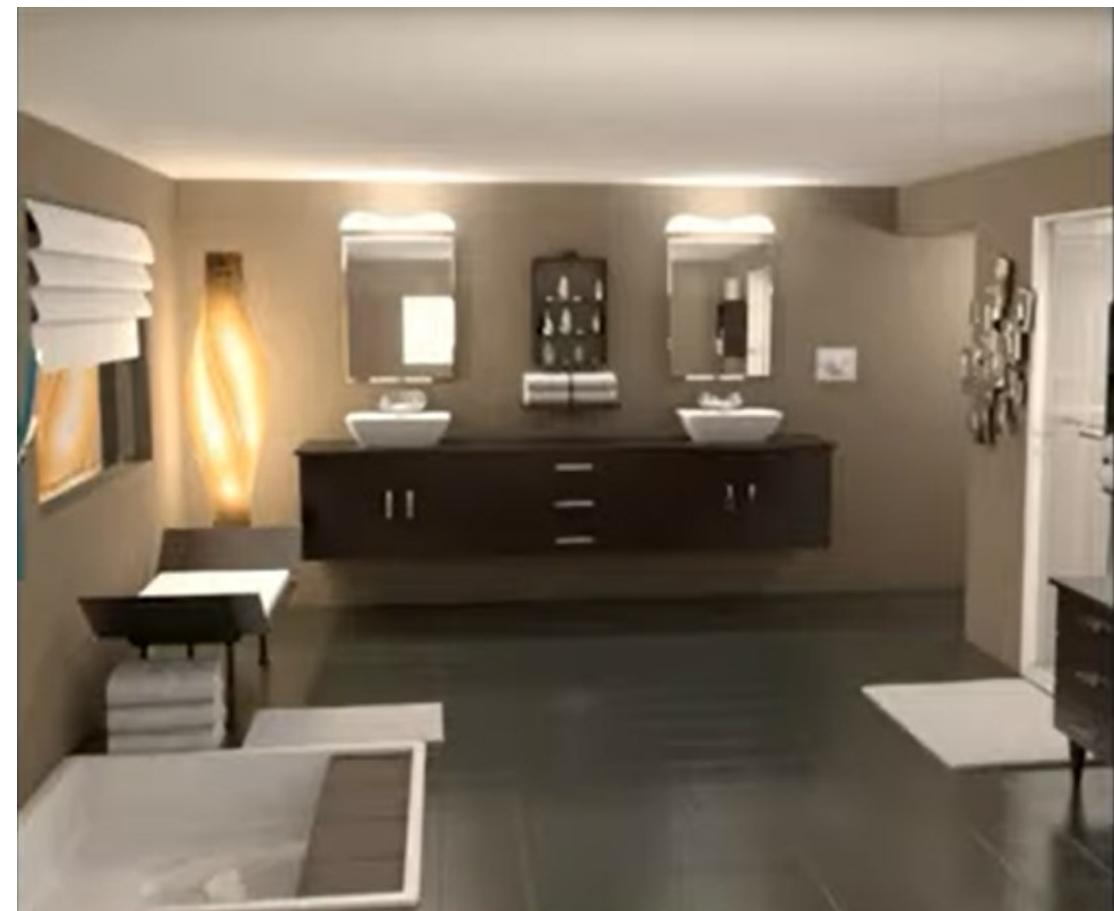
What is rendering..

- **Rendering** is the process of turning a 3D model or animation into a 2D image or video. The computer takes all the information about the 3D model and applies the lighting and materials to turn it into a final image or video that we can watch on our screens.
- Rendering in animation is an essential process that brings the 3D models and scenes to life. It is a complex procedure that involves the **calculation of various visual effects**, including lighting, shadows, reflections, and texture. The final output of rendering is the image or video sequence that contains all the visual information of the scene.
- Rendering is a **time-consuming process** that requires significant computing power. The more complex the scene and the higher the quality required, the longer it takes to render. High-quality animations with many frames can take days, weeks, or even months to render on a single machine.

What is rendering?



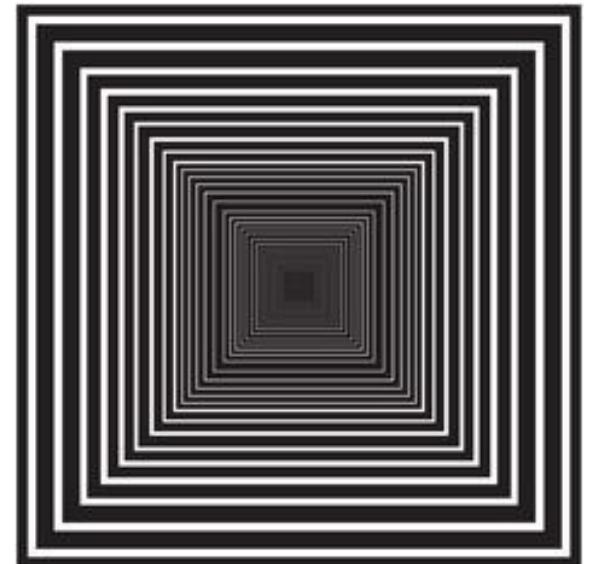
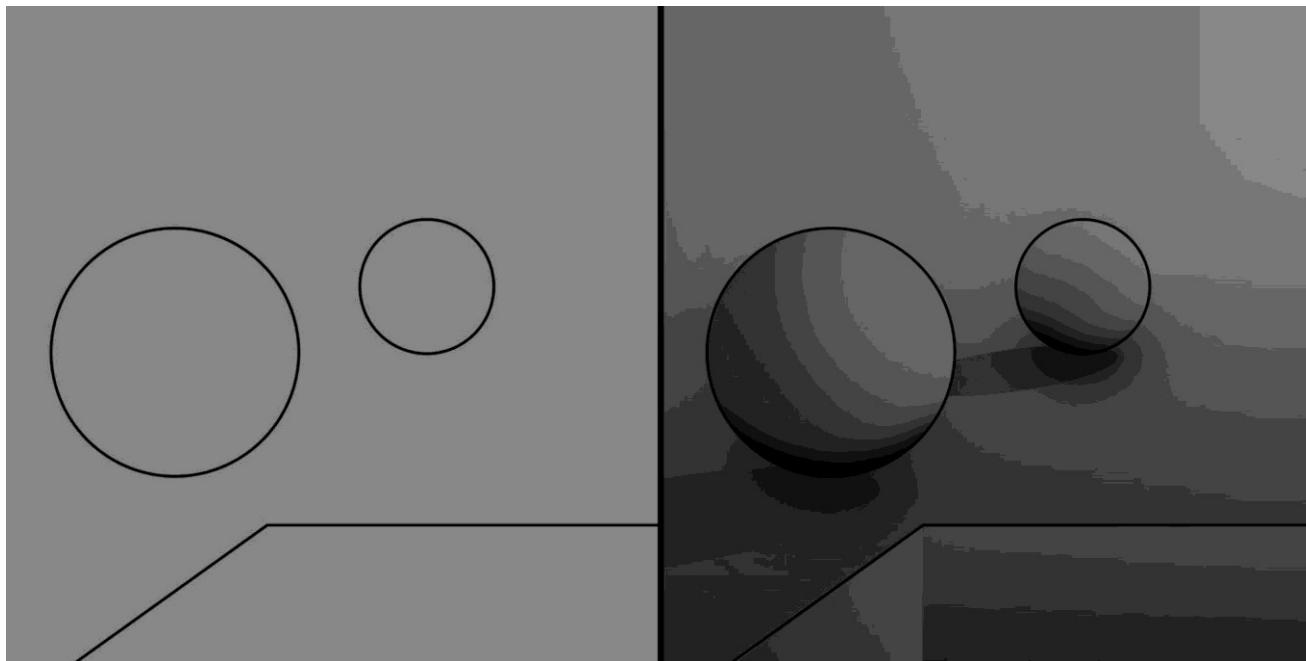
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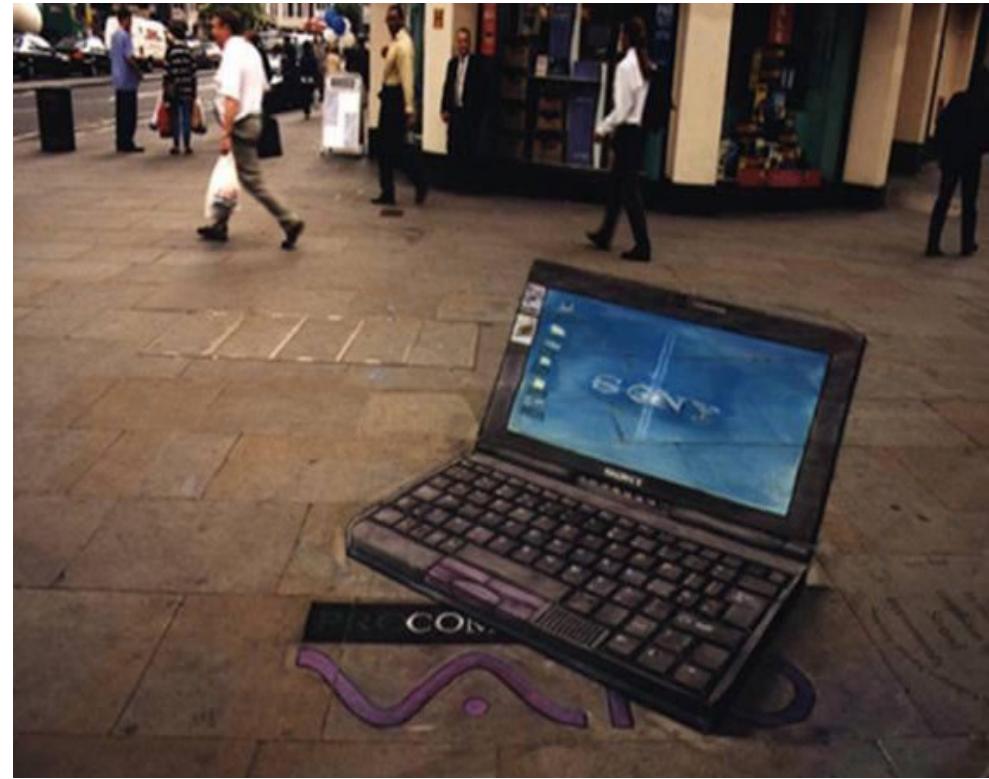
Depth

- Your depth perception is an important part of your vision. It helps you see objects in three dimensions and understand how far away they are from you.
- Depth is important to represent 3D shapes in 2D surface or screen. And give realistic feeling of the 3D representation.
- How human eyes can realize the depth in 2D images...?

What elements give you the feeling of depth in these images?



What elements give you the feeling of depth in these images?



Depth..



What elements give the feeling of depth

1. Volume

Unlike flat objects, 3D objects appear to have volume, and therefore indicate depth.

2. Size

According to the rules of perspective, the farther an object is, the smaller it looks. For that reason, when you draw similar objects in different sizes, the observer can conclude that smaller objects are farther away, thus create a sense of depth.



What elements give the feeling of depth

3. Overlapping

A body concealing part of another body indicates that the body it is hiding is farther away.

4. Position/Height

When the base of objects is positioned higher on they look farther away.



What elements give the feeling of depth

5. Focus and edges:

Foreground objects have hard edges, and therefore in focus. Background objects have soft edges, and therefore blurry.



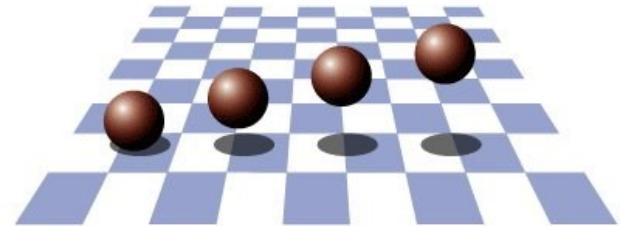
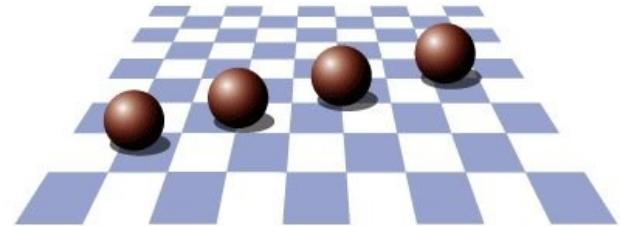
What elements give the feeling of depth

6. Shadow

7. Saturation

The farther an object is, the less saturated its color is.

In other words, its color is less rich, bright, or intense, therefore becoming dull or neutral.



What elements give the feeling of depth

8. Transitions (gradient) in brightness values can be used to give the sense of depth.





