Epic Games: Pioneers in Iteration

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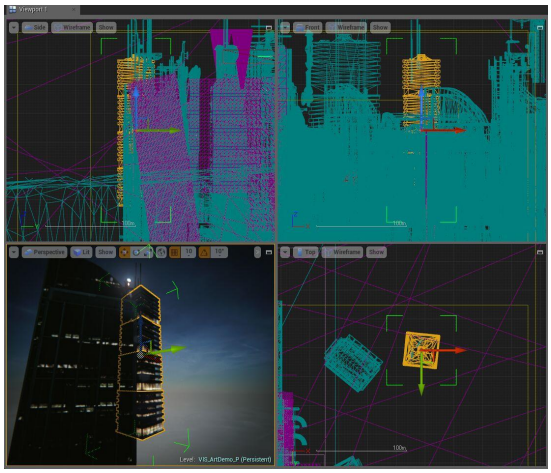
The expansion of the technological world has continuously required innovation. Innovation drives the explosion of new and revolutionary ideas and these ideas change our world, year after year. Epic Games has emerged as a pioneer in innovation. From the development and improvement of their Unreal Engine software to the improvement of ingame currency, markets, and overall gaming improvements in Fortnite, Epic Games has continually shown how their use of the engineering design process and iteration drives the technological world forward.

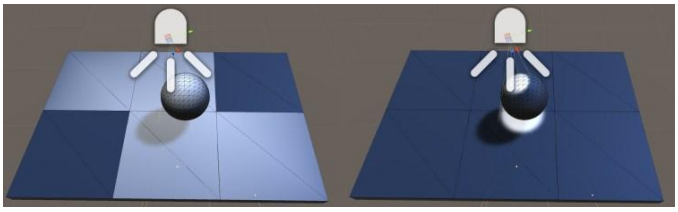
Unreal Engine Logo. Credit: Lewis Dean, Epic Games

Epic Games focuses on the acquisition of data in order to iterate and improve their products. A great example of this process is their game development software Unreal Engine. Epic Games first developed Unreal Engine in 1998 and have continued to improve upon the software, recently releasing Unreal Engine 5. The first generation of Unreal Engine, developed primarily by Tim Sweeny, tried to solve the problems of the quality of other game development softwares at that time. Tim Sweeny called game development softwares such as OpenGL and Direct3D “extremely problematic, buggy and untested” (Sweeny). To solve these problems, Tim Sweeny relied on CPU calculations for software rendering but eventually took advantage of specialized graphic cards to speed up the process. A notable component of the first generation of Unreal Engine was its integrated level editor, UnrealEd. UnrealEd supported solid geometric construction in realtime and would become a primary focus for future generations of Unreal Engine. The third and final core component of Unreal Engine was realtime ingame modification. Players and game developers could now modify their games through UnrealEd and a subsequent programming language, UnrealScript. This open sourcing of UnrealEngine quickly provided a thriving fanbase for Unreal Engine and it also provided a source of data that Tim Sweeny and Epic Games could use to steadily improve and update Unreal Engine.



An example of the innovative solid geometric construction in real-time that was developed in UnrealEd. Credit: Epic Games

While Unreal Engine 2 did have some new software improvements, Unreal Engine 3, which debuted in 2006, had much more revolutionary innovations. This third-generation update brought new advancements in lighting and shadowing calculations, with these calculations now being done per-pixel instead of per-vertex. These calculation improvements were huge. Per-vertex lighting was really only applicable for faraway objects as these objects needed less detail but close-up objects were shown unrealistically. Light was not concentrated on single spaces on the object but was instead shown on the whole object, often rendering the object and the environment as a whole lighted on all sides, providing an unrealistic experience. Per-pixel lighting calculations changed all of this. Now, objects could be properly lighted and realistic and hyper-detailed environments could now be made.



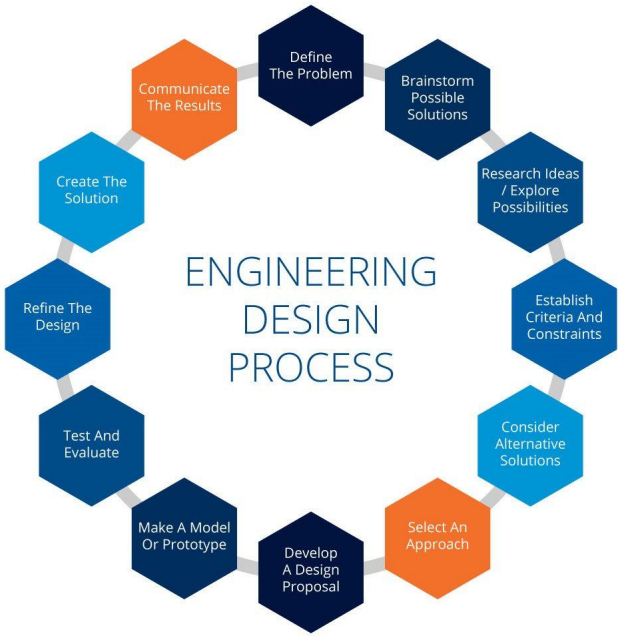
Per-Vertex lighting(left) compared with Per-Pixel lighting(right). Per-Pixel lighting allowed for more realistic simulations and environments. Credit: Jason Weimann, Unity3D

Games such as *Gears of War, Assassin's Creed, Mass Effect, Mortal Kombat,* and *Tom Clancy's: Rainbow Six Siege* were all made using Unreal Engine 3 and have all developed into multi-million dollar franchises, with large fan bases and huge development teams. These huge blockbuster hits could not have existed without the development of Unreal Engine 3 and its innovative system simulations. A huge turning point in the lifetime of Unreal Engine 3 was the development of the Unreal Development Kit. This allowed, for the first time, for Unreal Engine 3's capabilities to be available for the general public in order to publish and sell games, and

shortly after, mobile games and app compatibility was also pushed out to UDK. Suddenly, the entire public could make high quality games and publish them using UDK, providing an explosion in game development. This explosion led to more user data and usage data being available to Epic Games, which allowed for the improvement of Unreal Engine 3 to the next generation, Unreal Engine 4, which was released in March of 2014. In March of 2015, Epic Games released UE4 for free and all updates for free to all users in return for data on user usage and a selective royalty schedule. This allowed Unreal Engine 4 to be used exponentially more than in the past, providing more opportunities for game development while also giving Epic Games a vast amount of user and usage data to update and improve Unreal Engine further, with the newest generation of Unreal Engine, Unreal Engine 5, on track to be fully released in early 2022, also expected to take advantage of this newly available user data.

Unreal Development Kit Logo. Credit: Epic Games

The engineering design process used by Epic Games for the production of Unreal Engine and its subsequent generations matches our team's engineering design process. Just as Epic Games uses data and user metrics to inform potential innovations and changes to implement and iterate into its Unreal Engine software, our team uses data to inform changes to our robot. We assess and analyze how our robot performs in competitions and matches and use this information to tweak and improve our robot design. If our robot is slow compared to other robots, we try to switch to different weight designs to improve speed and acceleration. If our robot is experiencing high amounts of friction, we try to make our robot as frictionless. The engineering design processes used by Epic Games and 5327V prioritize iteration and consistent and continual improvements to base designs to ensure the best possible products come out of the process.



The Engineering Design Process that we use. In particular, we focus on refining designs in a feedback-iteration loop. Credit: TWI Global

Participation in VEX robotics prepares us for future careers as the feedback loop of iteration that we use to improve our robot is the same feedback loop of innovation that is used in the corporate world. The engineering design process that we use everyday includes innovation and iteration feedback loops and both of these processes are used extensively in the real world. Companies such as Apple, Microsoft, Samsung, Facebook, Google, and, of course, Epic Games utilize iteration feedback loops to continually improve their products. Through learning what each step of the engineering design process contains and how to properly apply the steps, our team is ready to tackle the complex problems of today and produce solutions of the future.

VEX ROBOTICS COMPETITION

Participating in VEX Robotics Competition allows us to develop and hone our skills in the engineering design process in order to become proficient in the process and flourish and function in the corporate and real world and become STEM leaders. Credit: VEX Robotics, Inc.

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