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The Impact of Doom on the History of Game Engines

The evolution of the development of games and game engines through history represents not only major expansion of the gaming industry, but a cornerstone in the development of modern interactive media. Serving as the technological framework upon which contemporary video games are built, these engines provide an essential infrastructure for rendering, physics simulation, asset management, and input handling, enabling developers to create increasingly complex and immersive experiences. From these historical developments, id Software's *Doom* (1993) is a contender for a spot among the most influential gaming industry developments of all time. By introducing innovative rendering techniques, a modular architecture, and unprecedented support for user-generated content, *Doom* revolutionized both the technological and cultural landscape of game development. Its contributions to the field not only radicalized reusable game engines but also established industry standards that continue to affect design and application of game engines in the contemporary gaming industry.

The earliest video games made were tightly coupled to the hardware for which they were designed. This led to Games like *Pong* (1972) and *Space Invaders* (1978) were hardcoded with minimal abstraction, making these unique systems and projects almost impossible to reuse for new designs, like many other games of their time. These early games lacked the modularity seen

in later systems, as every aspect from input handling to visual rendering was implemented from scratch, specifically for the constraints of their target platforms (Game Engine Gems). By the 1980's, games had seen a large improvement in the modularity of the architecture. Games like *Pacman* (1980) had begun to implement reusable code for game logic and input to aid in level design and game creation. The concept of a modular engine was still absent, as the abstraction had been done for immediate convenience and not for longevity in easy of use.

The transition to a more generalized 'engine' came later in the 80's and early in the 90's with sophisticated game architecture. Games like *Wolfenstein 3D* by id Software implemented advanced and revolutionary techniques for the time, including a rudimentary rendering engine capable of raycasting, a computationally efficient method for simulating 3D environments in real-time. The separation of game logic from rendering in *Wolfenstein 3D* served as an early example of modularity in game design. This new expansion allowed the developers to rewrite different aspects of the game without completely overhauling the system. Though *Wolfenstein 3D* played a major role in putting id Software on the map, it was their subsequent release, *Doom* (1993), that truly established the modern idea of a game engine, combining modular architecture with unprecedented technical innovations (Game Engine Architecture and Comparative Study).

The release of *Doom* by id Software in 1993 marked a new era in video game history, not only as a cultural phenomenon but as a technological milestone that redefined game engine design. Built on the id Tech 1 engine, *Doom* introduced revolutionary advancements in real-time rendering, modular architecture, and community engagement through modding, all tenants of modern game development. At its core, *Doom* leveraged a 2.5D rendering engine to simulate 3D

environments with unprecedented efficiency. Techniques such as raycasting, texture mapping, and light shading enabled the creation of immersive, fast-paced gameplay while maintaining performance on hardware with limited computational power. Unlike its predecessor, *Wolfenstein 3D*, which featured flat, simplistic visuals, *Doom* implemented height variations, dynamic lighting, and texture-rich environments that offered an illusion of depth and complexity on the 2.5D canvas (Game Engine Design and Implementation). This innovation pushed the boundaries of what was achievable in real-time graphics and set a new benchmark for visual fidelity in games.

One of *Doom*'s most significant contributions was its modular architecture. The game separated its core engine from its game assets, which were stored in WAD (Where's All the Data) files. This design allowed developers to reuse the engine for new projects with minimal changes. Additionally, the modularity allowed for efficient updates and expansion, laying the groundwork for modern game engines like Unreal and Unity, which aim for maximum reusability and adaptability across genres and platforms. *Doom* additionally was one of the first games to give its player base tools for creating custom content. By granting users access to WAD files and providing detailed documentation, id Software had a modding community that extended the game's lifespan and influence. This approach not only democratized content creation but also demonstrated how user-generated content could drive community engagement and innovation, a principle later adopted by platforms like Steam Workshop.

Doom also pioneered networked multiplayer gameplay, introducing the term "deathmatch" to the gaming lexicon. Players could connect via local networks to compete in fast-paced, real-time combat, an unprecedented feature for its time. The technical challenges of

synchronizing game state across multiple systems highlighted the growing importance of networking in game engine design, paving the way for the multiplayer architectures seen in contemporary engines (ACM Proceedings on Game Development). Beyond its technical achievements, *Doom* catalyzed the growth of the first-person shooter (FPS) genre and inspired a generation of game developers. The game's success demonstrated the potential of game engines as reusable platforms, shifting industry focus from single-game solutions to modular tools that could support entire franchises. Notably, id Tech 1 became the foundation for several subsequent titles, including *Heretic* and *Hexen* (Game Engine Architecture and Comparative Study).

The history of game engines is a testament to the evolving nature of video game development, reflecting the technological and creative milestones that have shaped the gaming industry. From the hardcoded designs of early games like *Pong* and *Space Invaders* to the modular and reusable systems introduced in the 1990s, the trajectory of game engine evolution highlights the importance of abstraction, scalability, and innovation. *Doom*'s id Tech 1 engine not only introduced unprecedented visual fidelity through 2.5D rendering but also set a new standard for game engine design by separating core functionality from game assets. This modularity enabled reusability, fostering the development of future games and engines while inspiring a vibrant modding community that redefined player engagement. Furthermore, *Doom*'s implementation of networked multiplayer gameplay underscored the growing significance of connectivity in game design, laying the groundwork for modern multiplayer systems. The legacy of *Doom* extends far beyond its technical achievements. Its influence can be seen in the design philosophies of engines like Unreal and Unity, which continue to build upon the principles of modularity, performance optimization, and community involvement. By bridging technological

innovation with cultural impact, *Doom* not only shaped the future of game engines but also solidified its place as a pivotal moment in video game history.

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