JOHN CARMACK

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Early Life

One of the most high-profile and highly respected figures in game development and computer engineering today, John Carmack was born in 1970, and got his first taste of computing in his hometown of Shawnee, Kansas, where he took a course on the TRS-80 computer and quickly moved on to an obsession with the Apple II. A gifted student, Carmack excelled in school and was put in a gifted program, but struggled under the weight of his parents' expectations, with his mother assuming his interest in computing would become a rigorous academic pursuit with the goal of landing a job in IBM. This contrasted with Carmack's love for video games, as he spent his time reading source code for games like Ultima in order to create his own cheats, and in online discussions through BBS. (Kushner, 2003) Carmack was entranced by the book *Hackers: Heroes of the Computer Revolution* and was a heavily contributing factor to his rebellious streak, adapting its hacker ethics and principles, and dreaming one day to be a held in the same esteem as the Steve Wozniaks and the Ken Russells he had read about. Carmack experimented with explosives in his backyard with his high-school friends, accumulating in a school heist where he and his friends applied thermite to a window of their school's computer lab after sneaking on the grounds late one night, with the goal of stealing Apple IIs. This plan was foiled when one of them set off a silent alarm. For this, Carmack spend a year in a juvenile detention center, with a psychiatrist giving the assessment that "[the] Boy behaves like a walking brain with legs... no empathy for other human beings." (Kushner, 2003)

After finishing high-school with a 4.0 GPA, Carmack spent just two semesters at the University of Missouri-Kansas City attending classes in Computing, but Carmack chose not to take the conventional path:

> It was frustrating because I clearly knew what I wanted to be doing but it wasn't available to me at the time. It was always: if you want to do computers you need to go to MIT then you go work at a corporation as an engineer and follow "the path". But I dropped out of college and started my own company. (Althoff, n.d.)

Carmack became a freelance game developer, and sold his games to SoftDisk, a small company in Shreveport, Louisiana. The company quickly invited him for an interview

after he submitted a trilogy of games called *Dark Designs* for Apple II which he also ported to PC within two weeks (Carmack, Twitter, 2014). Carmack decided to take the job after he met John Romero, who Carmack felt an immediate connection with through their shared "nerdy" hobbies and Romero's programming talent. He also met developers Tom Hall and Adrian Carmack, who would also later play a pivotal role in id Software. At SoftDisk, the group developed games for *Gamer's Edge*, a monthly disk publication that was led by Romero. While still being employed by SoftDisk, the group would develop *Commander Keen* for Apogee Software, which was most notable for Carmack's adaptive tile refresh technique. This allowed for the tracking of moved graphical elements and screen scrolling, and the innovation was forced by the limited graphical performance for games in IBM-compatible general-purpose computers at the time compared to gaming consoles. (Spectrum, 2002). After they got their first royalty cheque (thanks to *Commander Keen*'s shareware model, suggested by Apogee), the group formed a new company, *id Software*, on February 1st 1991 (Romero, 1997).

Early Days of id

Some of the first games developed at id were *Hovertank 3D* and *Catacomb 3-D*, the first 3D games the group developed. The games used an engine Carmack developed in just 6 weeks, and used ray-casting to produce 3D graphics (in which the player would essentially be playing on a 2D top-down plane, with the on-screen graphic being rendered with respect to the position of the player and the angle of their vision), with *Catacomb 3-D* adding texture mapping to the walls shown on screen. (Kushner, 2003, p. 66) (Vandevenne, 2020). id, now free of their contractual obligations to SoftDisk, wanted to move on from the kid-friendly titles they had made in the past, and decided to create a 3D remake to *Castle Wolfenstein*, a 2D maze-like game for which they bought the copyright of for just $5000 (Campbell, 2019). The game was built on-top of *Catacomb 3-D*'s engine, with in-game additions such as doors and wall-decorations, and made the engine more efficient, with graphics now in 256 color VGA. The game was released on May 5, 1992, using the shareware model, and is to this day lovingly referred to as the "grandfather of first-person shooters" (1up, 2016).

Doom

While the rest of the team were working on the sequel to *Wolfenstein 3-D*, Carmack decided to experiment with the 3D engine of *Shadowcaster*, a game developed by Raven Software, which had introduced advances such as sloped floors, diminished lighting and walls of varied heights (Grilliopoulos, 2016). The engine that Carmack would produce from this would be *id Tech 1*, colloquially known as the *"Doom Engine"*. From a collaborative software engineering perspective, the development of *Doom* had many rocky moments, with conflicts between Carmack and Hall over features that Hall wanted to implement but Carmack refused, as well as general reception to Hall's designs (Kushner, 2003, pp. 124-131) This resulted in the firing of Hall, to be replaced by developer Sandy Petersen. The engine moved on from the ray-casting of *Wolfenstein* to using binary-space partitioning to determine what was displayed on screen, which allowed them to both include and build upon the improvements *Shadowcaster* had introduced. By 1993, so much hype was built around the release of *Doom* (which had missed its planned release date), that the University of Wisconsin–Madison FTP network, which the team had intended to release the game on, had to resort to kick all users off the network waiting to download the game so that *id* could actually upload it first. After the upload was complete, the entire University network crashed. *Doom* multiplayer was almost immediately banned from many university networks due to how much the demand was crippling their networks. (Kushner, 2003) By the end of 1995, Doom was installed on more PCs than even Windows 95, with Bill Gates considering buying *id Software* outright. The shareware model had made *Doom* a viral success and cultural phenomenon, propelling both Carmack and Romero to global fame in both the software and game development worlds.

Further Advances at id

Carmack was made massively wealthy from the success of both *Wolfenstein* and *Doom*, even giving one his Ferrari 328 GTB away later as a prize for a *Quake* (Helgeson, 2013) tournament. He would later meet his wife, Katherine Anna Kang, at the 1997 *Quake* Convention. Carmack remained the principle architect of game-engine after game-engine at *id* through the '90s and '00s, with most significant pushes forward in 3D game development post-*Doom* while at *id Software* being:

- **id Tech 2** – The engine used for *Quake (1996)* and *Quake II (1997)*, designed maps by preprocessing elements in order to reduce the demand on what would now be considered low-powered CPUs, and was a true 3D game-engine (unlike id Tech 1). This drastically reduced the number of polygons that needed to be rendered in-game at any one time. This also incorporated Z-buffering to ignore polygons out of sight of the player. This was also one of the first game-engines to support 3D hardware acceleration.
- **Id Tech 4** – Most notable for its use in *Doom 3 (2004)*, this engine introduced "Carmack's Reverse", a technique used for rendering shadows in real-time.
- **Id Tech 5** – This engine was used for *Rage (2010)*, and used Carmack's MegaTexture technique, which rendered one massive texture across the complete (typically outdoor) polygonal map to allow for less demanding outdoor and visually varied outdoor scenes.

Oculus and Beyond…

While Romero had been fired from *id* in 1996 and went on to create found the company *Ion Storm*, Carmack remained with *id* until 2013. Carmack had branched out to VR development, joining *Oculus VR* as CTO in August, 2013, but decided to leave *id* entirely, due to a conflict with *ZeniMax* over the use of Oculus headsets for their games (*ZeniMax* is the parent company of both *id* and *Bethesda Softworks*). (Wilhelm, 2013). This would also lead to a high-profile lawsuit between the two companies, with *ZeniMax* accusing *Oculus* of theft of intellectual property, with Carmack's employment at *Oculus* being one of the most contentious issues. (Gilbert, 2018). Carmack also founded *Armadillo Aerospace* in 2000, winning NASA's Northrop Grumman Lunar Lander Challenge (NG-LLC) in 2008 and 2009, earning the company $850,000 in awards. (Michels, 2009). Carmack would later say that he used the code he wrote for Inertial Measurement Units (IMUs) for guided rockets at *Armadillo Aerospace* as a basis for tracking user movement in *Oculus* headsets (Carmack, 2017).

Impact

The technological advances that Carmack created have completely transformed both 3D rendering and the games industry, especially considering how far his software

pushed (relatively) low-power consumer PCs through the '90s and '00s to produce results in 3D graphics that people found hard to imagine at the time. Carmack described *Doom* as being "something that really didn't need to be sold, so much, because it almost sold at a glance" (Kohler, 2013), which demonstrates how much his work reverberated. Reading about his career up to this point, and knowing that he is still not only working in VR but has also branched to Artificial General Intelligence, that is, human-like AI (Lawler, 2019), really puts into perspective what he is still capable of in the future.

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