***Biography of a Software Engineer***

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**Introduction**

Software Engineering is the systematic approach of applying engineering concepts and processes to the manufacture and distribution of software applications and programs (Laplante, 2007). It has been a discipline of study since the mid 1960’s when the term was coined by Margaret Hamilton (among others) (NASA, 2003), who used the discipline to aid in the landing of man on the moon in 1969. Since these early days of the discipline many hundreds of thousands of software engineers have emerged using the discipline to create, perfect and distribute software applications. One of these many is a man by the name of John Cormack. Cormack is an American software engineer and designer. He co-founded the video game company “id Software” and was a lead programmer on many of their leading titles and their sequels, including but not limited to “Doom”, “Quake” and “Wolfenstein 3D”. He is well known for making many advancements in 3D computer graphics, including his most well-known algorithm “Carmack’s Reverse Algorithm” which defines shadow volumes in a 3D graphical environment. He is well known for revolutionising first-person gameplay and as a result has made a massive impact on the video game industry as a whole.

**Personal Life & Career**

Carmack was born in Shawnee Mission, Kansas and grew up in Kansas City (Orndorff, 2008), He was interested in computers at an early age and was introduced to the world of video games when playing Space Invaders at an arcade in the late 1970’s. This growing love led him to attempt to break into his local high school to steal Apple II’s from the school’s computer labs, further leading to him being sentenced to a year in a juvenile home (Kushner, 2003). He attended the University of Missouri-Kansas City for two semesters before dropping out to become a freelance programmer.

A Louisiana software company, “Softdisk”, hired Carmack to work on software for the Apple II that they were building at the time, which introduced him to John Romero, another founder of id Software, alongside other key developers that helped found id. Upon the distribution of the software they were developing, Carmack, Romero and others left Softdisk to co-find id.

At id Carmack popularised and pioneered many development techniques in Computer Graphics including “adaptive tile refresh”, a software application that allowed id’s side scrolling game *Commander Keen* bypass the lack of ability for computer hardware to enable scrolling and created a way to efficiently redraw each frame required when the player moved the character (Kushner, 2003). He also pioneered the use of “ray-casting”, a method of generating 3D models and their subsequent rendering, which is now used worldwide in both the video game and film animation industries. Furthermore, he invented “surface caching”, the method of speeding up the rendering of environments in the id game Quake, an important aspect in a high paced game that Quake was penned to be (Kushner, 2003).

**Carmack’s Reverse**

Shadow Volume is a 3D graphical technique to add shadows to a rendered scene in a 3D environment, initially proposed by Frank Crow (Crow, 1977). The technique pioneered by Carmack was that of Carmack’s Reverse Algorithm, that makes use of the stencil buffer technique, an additional buffer between the colour buffer and “Z-buffer” in computer graphics, which is now generally considered the most efficient way to develop shadows in even modern 3D graphical generations.

Carmack’s Reverse is a variation of a shadow volume algorithm that was popularised by id’s game Quake 3 it improves on Tim Heidmann’s algorithm in which the entire environment is put in shadow and light sources are calculated by drawing rays from the source of light to where in the environment they will cover. This came with problems however as shadow volumes fill a large amount of the space and as a result takes a lot of the fill-time for the environment, putting a lot of pressure on the system hardware, and can lead to errors where the computer’s “eye” can show shadows that block the vision of the player, creating a difficulty to create shadows for all camera angles.

Carmack’s Reverse Algorithm helped fix these issues by, instead of covering the whole environment in shadow initially, counting shadow surfaces behind the object casting the shadow rather than in front of it. This took the same amount of time and allowed Heidmann’s algorithm be used for all camera angles and prevented shadows being cast in front of the “eye” as all shadows were being created behind the objects rather than in front of them. John Carmack discovered this algorithm in 2000 during the id development of Quake 3 (Kilgard, 2009).

**Fast Inverse Square Root**

***Reference List***

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