

Chris Butcher

The Technical Genius Behind the Original Halo Trilogy

From a very early age, Chris Butcher was a perfect recipe for success. His working life is one of passion, drive and performance. His major contributions to many of Bungie's original games, especially Halo: CE and Halo 2, helped define the FPS game genre for years to come. His work as a design lead in producing Halo's combat AI systems raised the bar on FPS AI to a standard which had never been seen before. Chris himself, in reference to his work on in-game actor combat AI said that he and his team spent "8 years on 30 seconds" of Halo 1 and Halo 2's game play. Little details matter and are in essence what keeps players coming back year after year to the original games. I know that every time I boot up one of the game's campaign modes, the in-game enemies and allies never fail to surprise me with their behavior and innate responsiveness. That's some achievement given Halo: CE came out in the year **2001**.

Chris Butcher, at eight years of age, was already taking high school mathematics and science classes. A feat which makes me wonder what I was doing at that age. When Chris was just 10 years old, he began a degree in Mathematics and Computer Science at the University of Massey in New Zealand (as Chris is a Kiwi). Despite under-performing in Project and People Management modules, Chris seemed to consistently out-do his peers in everything else and at 15 years of age graduated and took on another four year course in Science. Its very safe to say that Chris Butcher was what would be referred to as a child-prodigy. A quick look at his LinkedIn today informs us that he has his specialties in AI, Multiplayer Networking, Distributed Systems, Game Design, Game Engine Architecture and Multi-threading. A very qualified man to be sure.

After building experience in embedded systems and low level programming at Iconix Ltd, he took a job with Bungie Studios in the year 2000. Very quickly in Bungie he became an outstanding figure with his work on Artificial Intelligence, Real-time Graphics and Multiplayer Architecture for Oni and Halo: CE. His work on implementing the underlying architecture for Multiplayer over LAN with Halo: CE is particularly notable. In a conversation with howstuffworks.com, Chris goes into detail about the network design challenges he's faced over the years as Development Lead on the Halo series. The multiplayer system in Halo: CE allowed multiple Xbox consoles in a LAN to run the same game-world/simulation. However a big challenge to overcome was how to make sure that events in a running client such as an explosion or bullet trajectory were exactly mirrored in every other client within the LAN. In other words, the simulations needed to all be synchronised. He and his team overcame this challenge by implementing something called Synchronous Networking within the software. This meant that in each running game-world, all player instigated events will always yield the same in-game response. For example, the unpredictable spray of an assault rifle's fire on a one consoles game-world will produce the exact same bullet trajectories on every other console in the LAN. So, by implementing the game's codebase with this in mind, Bungie was able to produce a very responsive and very fast-paced multiplayer environment. The responsiveness would be owed to the fact that data broadcasted on the LAN would be lightweight and quick to decode as all that is ever exchanged between clients on the network are inputs to the simulation and not their resulting consequences.

Butcher of course played a leading role in these design decisions and heavily developed his skills in distributed systems and in multiplayer architecture. Another major feature that

Butcher has contributed to from the start is Halo's combat AI systems. That is, the behavior of in-game enemy combatants and of friendly forces. After leading AI design for CE, Butcher then lead the way for a revolutionary in game combat AI system within Halo 2. Butcher and team took one of the first steps in video game history towards a technique for implementing NPC behaviors now known as behavior trees. Within this system, a specific tree is made for each type of friendly and hostile in game actor. The essence these trees is that each in game actor adopts a certain behavior based on stimuli within the game's simulation and within the actors proximity. For example, if a grenade lands close to an enemy trooper, an elite perhaps, the immediate reaction should be to jump out of the explosive range. These stimuli can also be chained together (hence the tree) so that if an enemies shields are down but there is no cover nearby that enemy will attempt a last stand or a charge. However if there is cover nearby, the enemy will instead run for it, regenerate and attack again. A system of this kind had not been implemented before within the genre and makes the AI of Halo 2 still stand up strong to this day.

An issue encountered with the aforementioned system though was that behavioral trees would have to be implemented for every actor within every combat situation for every in-game mission. This of course yields an impractical amount of manual work for very complex AI systems. Once again the team at Bungie innovated to overcome this obstacle when developing Halo 3, their most successful title to date. For each type of in-game actor, 100s of standard behaviors were constructed in their respective behaviorl trees (there are roughly 14 types of enemy unit). Then, the only thing developers would have to do in each combat situation was to set a sort of global task for enemy forces. So say a player and his teammates manage to gain 100 yards of territory on a certain in-game battlefield. Once the players are established in this certain zone, it triggers a change in the global enemy task. In this case, for argument's sake, the enemy forces would retreat and try to reorganize themselves before the next assault by the player. However, when the enemy team is retreating, each type of unit will react to various in-game stimuli as per their own behavioral tree which will trigger a behavior that temporarily overwrites the unit's individual objective of retreat (assigned by the global task). This gives a very realistic simulation of a global battlefield as units will not just blindly retreat if such a global enemy task is given but will perhaps lob a grenade or two if the player is close enough or give suppressing fire to protect his squad mates if they're under threat from the player all while at the same time trying to accomplish the global task. Such an AI system was received very well by fans and techies alike and was one of the first FPS games in the world to implement it effectively. No wonder Halo 3 became one of the fastest selling video games of all time at its launch (though this was due to a myriad of other factors as well, like the incredible marketing campaign).

With Butcher's team contributing an amazing amount to the game play of the original Halo Trilogy, he earned himself a place on the board of directors at Bungie and has served as the Technical Director for Destiny from 2007 to 2014 and is now the Engineering Director for the studio where he works on the fundamental in-house tools and infrastructure that allows Bungie to create the immersive experiences that they consistently do.

But that is not the limit of Butcher's abilities. More recently within Destiny, he lead the design and implementation of the games unique networking architecture whereby players from around the world may randomly encounter each other in an otherwise sparsely populated environment. Despite some critical flak at launch, the game proved to be once again a resounding success for Bungie thanks to the smooth and responsive game play as a

result of the tenure of Chris Butcher and his Colleagues as extremely well versed engineers in the spheres of distributed systems, multiplayer architecture and artificial intelligence.

In conclusion, Chris Butcher has been a cornerstone in one of the world's most famous and successful game studios. How did he become this cornerstone? From a very young age and evidently at present, he is and has always been an incredibly driven and dedicated developer. He is a developer with not one but many specialties. He has been unafraid to adapt to new paradigms, to innovate and to pioneer new methods of game design. His skill as a software developer of intricate multiplayer and Artificial Intelligence systems is matched only by his creativity and passion for what he does. He serves an inspiration to myself (and presumably other software developers out there) not only because he has built major parts of my favorite game trilogy of all time but also because as a developer he is highly maneuverable, logically driven and a team oriented worker. To quote the man himself, he said once in an interview at GDC08 that he's "not a massive fan of specialisation. Robert Heinlein once said that 'specialisation is for insects'. What's great about game development is that we get to cross-train. So one of the things we look for in an engineer is not pure engineering power but an appreciation for the group effort".