

### Case History: Pac Man

Pac Man is the supreme all-time champion of coin-operated arcade games. More Pac Man arcade machines were produced and more quarters were spent playing it than any other game in history. Pac Man merchandise and paraphernalia of all kinds garnered huge earnings all over the world, and the game inspired an animated-television series and a top-ten hit song in the U.S. The tremendous success of the original game paved the way for a long line of sequels and re-workings that continue to be made even to the present day. Pac Man was more than a huge commercial success, though. It was a landmark in the history of video game design. The game exhibited new design ideas that had never been seen before and that would be hugely influential in the future of the field. These innovations germinated not only from many unique design choices, but also from a new philosophy of and approach to game design employed by Pac Man's creator, Toru Iwatani.

The story of Pac Man begins at Namco Limited in Japan. The company was founded as Nakamura Manufacturing Limited in Tokyo in 1955, operating two coin-operated mechanical rocking horses on the roof of a department store. Over the next twenty years, Namco built bigger and bigger rides and expanded into all areas of the mechanical games and amusement industry. The seminal event in the history of Pac Man occurred in 1974 when Namco acquired Atari Japan from Atari Corporation of the U.S., officially entering the coin-operated video game market. The company had already

released some pinball and other mechanical arcade-style games, and plunged into developing video games in both the US and Japan in the late 70's.

Toru Iwatani was born January 25, 1955 in Tokyo. He was 22 when he came to Namco straight out of college in 1977. Initially, Iwatani didn't know what exactly he would do at Namco, although it seems that at some time both he and the amusement giant had intended for him to work on pinball games. Iwatani had received a very general education. He had no formal instruction in computer programming or any kind of design. Once when asked how he first became interested in computers, Iwatani responded, "I don't have any particular interest in them. I'm interested in creating images that communicate with people...My contribution...just happened to take the form of video games." It was video games that Iwatani somehow ended up working on at Namco.

Iwatani said that his ideas for games often started with just a word, and this was the case with Pac Man. The word in this case was "taberu," which means to eat. Iwatani wrote the word down in a sketchbook one day and began tracing other ideas around it. A now-mythical episode from the annals of video game history details how all of those swirling ideas corporealized into Pac Man. One day at lunch or dinner, depending on who tells the story, Iwatani removed one slice from a pizza and began to eat. He glanced at the overhead view of the remaining pizza - one wedge missing - and saw the outline of the shape of the central figure of his materializing video game. Iwatani admits that he is the originator of the story but has never been too explicit about its factuality. He also attributes some of the inspiration for the Pac Man shape to the square-ish Japanese character for the word mouth, which when rounded out and viewed through an abstract eye looked much like the pizza in the epic tale.

With these revelations, a legendary circular, yellow dynamo was almost complete, but there still was the need for a name. The name selection and the final solidification of the character were actually achieved in the same step. Japanese folklore reportedly details the exploits of “Paku,” a creature with a tremendous appetite who ate ghosts and monsters to protect children. Iwatani says that “paku paku” is a related slang expression in Japanese for the motion of a mouth opening and closing. From the stem of these words came the name Puck Man, which is what the game was called in Japan.

Armed with his hungry main character, Iwatani and a now-nameless programmer set to work on the game in 1979. Iwatani made the design decisions and relayed them to the programmer who implemented them. Iwatani described the process this way: “We tried out each feature as we went along. If it wasn't fun or didn't add anything to the game's complexity, we dropped it.” The character that would captivate players all over the world waited inside Iwatani's head and his sketchbook, but much remained to be done. It is worth noting that there were many ways that the game could have gotten from this tiny idea to its full-fledged form. The path that Iwatani took resembled the fleshing out and execution of a movie or short story rather than a mere technological toy.

Iwatani knew that the object of the game would be to eat. His initial vision was Pac Man placed in a screen full of food that he had to eat, but he eventually reasoned that in such a scenario, “the purpose of the game would be obscure,” and so he placed the food within a maze that Pac Man would have to navigate so that “whoever played the game would have some structure.” He reduced the food into little pellets because engineers told him that detailed pictures of all sorts of culinary delights all over the

screen would leave no room and no power for the actual movement of the game. So, the stage was set: Pac Man would move around a maze eating pellets.

For obvious reasons, this didn't seem particularly exciting to Iwatani. So, he invented enemies "to inject a little excitement and tension," and give Pac Man and the player a bit of a challenge in their attempt to eat all the pellets in the maze. The enemies were four ghosts who roamed the maze and ended the day for Pac Man if he came into contact with them. Presumably, the ghosts were inspired by the "Paku" legend. Something was missing, though. Iwatani had envisioned Pac Man as an insatiable and unstoppable eater. He knew the ghosts belonged in the game, but their presence conflicted with his vision of "the design of the spirit (kokoro [in Japanese]), or the energy forces, of Pac Man." There was an incompatibility between this spirit and the fact that Pac Man had to avoid, to run from, the ghosts as he tried to eat all the food. To resolve the conflict, Iwatani invented the energizer pellets. He placed one in each corner of the maze. When Pac Man ate an energizer, the ghosts would become vulnerable for a time, and Pac Man could eat them. Iwatani was satisfied that this represented an appropriate design of Pac Man's spirit, that Pac Man would be "the hunter as well as the hunted."

The "kokoro" of the ghosts concerned Iwatani as well. What is spoken of and critiqued and studied today as a game's "Artificial Intelligence" Iwatani called "personality." In fact, he saw this as his greatest challenge and called it "the heart of the game." Iwatani knew that if the ghosts all chased Pac Man in a straight line, the game would quickly become "tiresome and flat." He returned to his sketchbook, where he began diagramming possibilities for the attack strategy of the ghosts. Soon, he posed some possibilities to the programmer and they began experimenting on the game itself.

Here, as always, Iwatani was focused on the game player's emotion and subjective internal response to the game. He pondered humanistically over the effect that the ghosts' behavior would have. He early on envisioned the possibility of Pac Man being completely surrounded by the ghosts, a highly charged situation of the kind he felt would inevitably draw a player into the game. The four enemies were supposed to create just such friction and excitement, but Iwatani felt that constant tension and continual pressure would be "too stressful" for a person. Slowly, through experimentation, Iwatani crafted what he was looking for, a pattern that produced the excitement he desired, but also modulated that excitement to relieve the problems that Iwatani believed would result if Pac Man was "constantly under attack." The final concept actually had a perfect analogue in his sketchbook: an undulating curve. Iwatani called it the waved attack. The ghosts would "attack and then they'd retreat. As time went by they would regroup, attack, and disperse again. Gradually the peaks and valleys in the curve of the wave become less pronounced so that the ghosts attack more frequently." Something amazing was happening here. Iwatani was looking inside the game player's head and in doing so he wasn't just inventing patterns, he was wiring up the invisible connection that would attach so many millions of people around the globe to his game so tightly.

It wasn't enough for Iwatani that the ghosts now had a collective personality, though. He wanted each ghost to have its own individual style. Ideas of all kinds made their way into his sketches and the tests he ran with the programmer. In the end he settled on four that he felt would maximize the challenge while still creating the cycles and balance of responses that he desired for the player. Each ghost received a name that reflected the personality Iwatani had concocted for it. Shadow took the obvious

approach. He looked for the shortest, most direct path to where Pac Man was at any given time and took it. Speedy was faster than the other ghosts but couldn't always seem to locate Pac Man very precisely. Bashful was tricky, as he would often move the opposite way if Pac Man was coming towards him, but might then quietly sneak around the other side to trap Pac Man between himself and another one of the ghosts. Pokey was nearly impossible to figure out as he would generally try to stay in Pac Man's vicinity, but beyond that his movements were seemingly crazy and random. Often a wrong turn by Pokey would allow Pac Man to escape from seemingly certain destruction in yet another of Iwatani's carefully executed manipulations of the forces of tension and relief that the ghosts generated. Translation and revision eliminated the clues to the ghosts' methods in the U.S. version of the game, where they were known as Inky, Blinky, Pinky, and Clyde. Even so, their distinctive individuality was easily recognizable and was one of Iwatani's proudest achievements in creating the game.

The one other cornerstone that Iwatani held to while designing the game was that he wanted it to be enjoyable for women in addition to men (who so far were the only ones playing video games). He thought that women "would like pretty...colors," so each of the ghosts was drawn in a different, bright color. He thought that women did not enjoy violence and war, so he tried to make his game comical and fun rather than gory and action-packed. He made the game-play simple - just a single joystick that directs Pac Man up, down, left, or right - because he believed that women would be impatient with and intimidated by complicated controls. Looking through the eyes of feminism today, Iwatani's ideas might seem offensive or condescending, but regardless of their veracity or

political correctness, they were nonetheless a powerful and steadfast factor in his concept of the game design.

All of these developments seem so obvious and intuitive now, but at the time they were quite complex and time-consuming for Iwatani and his programmer to work through. The ideas previously described slowly appeared one by one as Iwatani did repeated cycles of testing and inventing. The development period, from beginning to the game's completion, lasted approximately a year and five months, which at the time was quite a long time to spend developing a video game. In the end, five people in total would work on Pac Man – Iwatani and the programmer plus three more. A hardware engineer put the program onto the actual circuit boards that would comprise the video game machine. Someone was brought in to write the music for the game. Finally, a designer joined the team to create the “packaging,” the graphics that would adorn the game's case and promotional materials.

So, upon completion in 1980 the game was released as Puck Man in Japan. Almost immediately it was a phenomenon that one had to wait in long lines to try. The impact of Puck Man was so large that the country began running short of the 100-yen coins it took to play the game because the coins were all sitting inside Puck Man machines. Namco quickly realized it had a major hit on its hands and rushed to introduce the game in America. It was licensed to Bally/Midway for release in the U.S. Bally/Midway thought that young ruffians would be likely to scratch out the ‘P’ in Puck Man and replace it with an ‘F,’ so the name was changed to Pac Man. The game immediately caught on in America just as it had in Japan. By the end of its first year in release, 100,000 Pac Man machines had been sold to arcades around the world. Before

the craze was over, that number grew to over 300,000. Huge numbers of pirated and spin-off Pac Man games were produced as well. Sequels (Ms. Pac Man) and updates (Pac Man Plus) appeared the very next year and the Pac Man legacy had begun.

The success of Pac Man was no coincidence. First and foremost, its success centered around the Pac Man character. This simple choice was one of Iwatani's greatest innovations in the field of game design. For some reason it had never occurred to anyone that graphics-based video games needed or could have characters. Prior to Pac Man, the vast majority of video games could be described as mechanical mini-scenarios. In Space Wars, Asteroids, and Galaxian the player controlled a space ship. In Space Invaders it was a tank-like vehicle, and in Speed Freak and Death Race it was a car. The aim in each was to use that mechanical device to destroy all oncoming foes and obstacles. Pac Man was one of the very first games with personality, with a pulse. Controlling a creature instead of a ship gave the game a totally different feeling. Once video games had characters they could have stories, emotions, character development, and so many other dimensions that mechanical mini-scenarios like Asteroids could not. Ms. Pac Man added cinematic scenes between certain levels of the game in which the characters would independently play out some comical action while the player watched. It was the first game to incorporate such "cut scenes." This and Pac Man's success in franchising outside the video arcade were both attributable to a simple fact: no game before the Pac Man series contained anything or anyone that a person would have wanted or cared to watch act independently.

The other huge contribution that Iwatani brought to game design was his philosophy, which others were forced to emulate after the remarkable success of Pac

Man. He designed the game as if he were writing a children's book and not an electronic amusement box. His considerations were not just mechanical and technological – he wanted the game to speak to people in the way that a movie does. To most game designers of the time, the quality of the graphics and the effect of being as futuristic as possible was the ultimate goal. In effect they sought only to maximize the *technology* of their particular video game, a situation analogous to a movie director who spent all of his time trying to make the movie projector show a more realistic image and threw the film together as an afterthought. Iwatani's approach considered so many more aspects of the video game experience. To design a great game, he said, "You must understand people's souls and be creative enough to imagine things that can't be thought or imagined by others... You shouldn't compromise with the first easy idea that comes to mind. In the last analysis, you must enjoy making people happy." Today video games are viewed in many circles as a medium of vast possibilities, and it was Toru Iwatani who first opened the door to some of those possibilities that were not purely technological in nature.

Pac Man's design and impact were influenced by culture, technology, and business. Essentially, culture and technology had conspired to limit the creative horizons of previous game designers in a way that they did not for Iwatani. The vast majority of popular and important games before Pac Man were designed by Americans who had their roots in the world of computers. The nearsightedness of these designers in thinking of the process of game design as an attempt to continually improve video game technology for its own sake was instilled in them by the cult of technology worshippers and tech nerds that they had been working for and with for their entire careers. The technology itself, the circuits and processors and wires and the science behind it that they were so

steeped in, blinded them to many of the important concerns in designing a great video game. Iwatani had no experience with computers or the tradition of technological research and development when he began designing video games. His focus was not on the technology and so he was able to think in a different way than these early game designers. Similarly, the Japanese culture allowed Iwatani to think in a different way about game design than the American culture allowed. American cultural stereotypes dictated that the video game, as a piece of electronic hardware, was an arena for masculine play – for blowing up space ships and racing cars. Video game playing was not an activity for women to engage in and the appropriate subject matter for video games was very narrowly defined. Robert Mullane, the president of Bally/Midway when it was offered the North American license for Pac Man, was going to decline the option. Looking through the American cultural lens he saw Pac Man as too silly and cartoonish to appeal to American video game players. His fellow executives convinced him to reconsider, but the fact remains that the process and the content of Iwatani's game design would never have been allowed in America. The influence of business would later change that when the American video game industry saw the millions of dollars Pac Man was raking in and rushed to adapt future game-design decisions in an attempt to produce more blockbusters. So, all of these broad influences were factors in the conception and reception of Pac Man, but the game was such a powerful global phenomenon that by the time it had made its mark, technology, culture, and business had all been seriously influenced by Pac Man as well.

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