

Recall the past to understand the future: The Spirit of “Platform” Business Seen in the Nintendo Famicom and the Sony PlayStation

PlayStation: Early Efforts in the Creation and Development of the Digital Entertainment Market

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My name is Ken Kutaragi. Today, I would like to take the opportunity to speak to you as a visiting professor at the business school of this university. It was a real pleasure to listen to Mr. Uemura just now. In fact, some thirty years ago I used to work alongside Mr. Uemura as a fellow technician regularly. At the time he oversaw a development line at the Nintendo offices here in Kyoto, which I used to visit on a weekly basis. I can tell you that, his way of talking is just the same as it was all those years ago, so I mainly enjoyed listening to him speak again today.

Back then I was a researcher at Sony. So, you might wonder why it was that I started working with Mr. Uemura. Well, in 1983 the original Famicom had come out. I have two sons myself, and at the time if I was to ask them if there was something that they wanted for a present, they would say they wanted a Famicom. Sony had also released products such as the HitBit (MSX), but they wouldn't ask me for one of those. It was apparent what kids wanted. Even looking at the Famicom from the perspective of a technician I was really impressed. Other machines might cost 50,000 yen, and yet their characters would move one pixel at a time across the screen. Meanwhile, the characters on the Famicom would run very smoothly and responsively.

As a researcher, I was also often attending conferences, and in 1986 I went to one that was particularly sensational, known as SIGGRAPH, which stands for Special Interest Group on Computer GRAPHics. This conference was established for discussing 3D computer graphics. You might normally think of a conference as involving a lot of

professor types coming together and speaking, but about half of the attendees at this conference were creators or nerdy types. There were hardware people, and software people as well. There were artists, and there were people developing fantastic technology, and they got together in order to put on demos and debate topics. It was that kind of event.

At that particular SIGGRAPH, a simply incredible short film was shown. The film was by the company Pixar, which today is under Disney's umbrella. Pixar's John Lasseter had made this film, which was titled *Luxo Jr.* Luxo is the name of a desk lamp brand, and in the film, you have a large and a small desk lamp representing a parent and a child. The parent and child lamps move in this amazing, human-like manner in the film. You can watch it even today on YouTube and such places, and you can see how they manage to get human emotion, a story that actually makes you feel something, into a very short film. The way things go in Hollywood, is you have a script, you want to tell a particular story, and that is why you make a movie. Here though, you have, for the very first time, people using the latest in computer graphics in order to create an entertaining short film. That is what *Luxo Jr.* represented.

When I saw this film, I felt my outlook on things undergo a radical shift. Until now, I saw “computer graphics” from the perspective of the graphics that appear on a computer. So, you think about things such as how to make sharper looking text and the like. But those very same computer graphics, when put to work by somebody from an entertainment background, could be used to create

such beautiful stories. I realized that this might change everything. Well, that is what I thought, but it was 1986. You have to understand that back then, computers in companies still had green text, and even if you wanted to have something move the best you could hope for would be having something jump along in eight-dot units. And of course, having something drawn in real time was practically unthinkable. Nintendo had managed to pull it off with their machine, but really, we were still at the stage technically where we could not create CGI such as Pixar's.

So, how did they do it? The trick was to slowly make the video one frame at a time, spending tens of minutes per frame created. What really impressed me, however, was the incredible creativity of the creators. Satoshi Tajiri was mentioned earlier, and I think what we see here is not a limitless possibility, but rather the appearance of a medium that did not exist until now. That is, we have the birth of a method of expression that did not previously exist. Hollywood, with its strong ties to SIGGRAPH, was the first to respond to this development. Hollywood saw that computer graphics offered the opportunity to make something different from anything that had come before. So, they took this new tool and started using it in their films. Consequently, you have the CGI that was used in movies like *The Abyss*, and *Terminator*. The very first example is actually a movie called *Tron*, where they had bikes zooming over a wireframe surface.

Once you get to the second half of the 80s, you see more and more films on the level of the *Terminator* franchise using digital technology. There was some really nice-looking work coming out then, and the famous company behind it, which specialized in CGI, was known as Silicon Graphics. This company had finally managed to achieve a new level of graphics, but with a workstation the size of a freezer. And of course, it was not in real time. We are still talking about the painstaking creation of frames one at a time.

Actually, at the Sony Research Laboratory, I actually had the chance to tinker a little with a computer that was similar to the one used by Silicon Graphics. It cost about ten million yen for a single unit. But given that making big budget movies took hundreds of millions of yen that price was not out of reach for Hollywood. They could buy tens of units costing ten million each and use them to create the CGI they needed. And so, over the second half of the 80s and through the 90s, you see Hollywood and Silicon Valley working together to achieve ever greater advances in the field

of computer graphics. We saw a lot of innovative forms of CGI appear at this time, and it was during this period that I started to think that it would be amazing if we could one day have such computer graphics moving in real-time. A little later there actually was a company that put out a computer capable of rendering in real-time. It cost around thirty million yen.

As I later found out, at that period, the production team at Square Enix making the movie *Final Fantasy* purchased several of these computers and were apparently researching the possibility of making a game machine for home use that would be able to create similar looking graphics. I didn't know this then, but I similarly thought that it would be great if one day we could develop a machine for home use that would be able to render computer graphics in real-time. Of course, with a single machine costing around thirty million yen, it was simply not something I could look into seriously.

Another problem was that even if you purchased a computer that could render in real-time, you couldn't just have a game machine use what you created *as is*. As Mr. Uemura mentioned earlier, with games, the timing of when buttons are pushed is critical. At the time, you might have been able to make a real-time image, but there would still be a delay of a few milliseconds between when you pressed the button and when the image actually changed.

As an example, Matsushita Electronics (today is known as Panasonic), used one of these giant computers in order to develop a system that could show you the interior of a kitchen. You had to wear a head-mount display that was much larger than the ones you have today, and if you did something like look up at a shelf, then it would take a small delay until the image actually moved in response. This would cause you to feel queasy. You can't have something like this in a game. At the very least, you need the machine to respond the very moment that you press a button.

The idea of having real-time CGI in a home-use game machine was just so unthinkable that I didn't even speak about it to anyone at Sony. However, I did think that, as a researcher, this was something I wanted to do someday. And at the same time, I had the realization that maybe computers were now a new "medium" in the entertainment realm. If you think about music, for example, when a new media are created you have all kinds of associated music that become possible, right?

Computers weren't created for the sake of entertainment, and until now had been used for work purposes only. Yet maybe they possessed the potential, as I discussed just now in the case of Hollywood, for some incredible possibilities. I thought, wouldn't it be amazing if we could bring together computers and entertainment? Wouldn't that be something cool? So, this idea, of bringing together computers and entertainment, creating a genre called "computer entertainment," was in my mind with the development of the PlayStation.

As to where the name for the PlayStation came from, the computer I mentioned before, the one by Silicon Graphics, was something we called a WS, a "Work Station." This was a computer which existed for the purpose of doing work. And for an engineer, such a computer was the stuff dreams are made of. You could buy an IBM PC or an NEC PC98, but a workstation was just too expensive, it was out of reach. But you knew that it was amazing. In the English-speaking world, a workstation means a place where you do work. Thus, we took this inspiration for naming the PlayStation. It's a place where you "create play" in a sense.

My initial motivation was to create this fusion of computers and entertainment, to create a new domain where previously nothing had existed. Nintendo and Sega had designed and developed the fantastic genre of the video game. What I wanted to do with computer entertainment was take on the task of opening up that new ground, broadening it further. Like Nintendo, Sega, and various PC engines were continuing in the ongoing work of developing video games; I didn't see our task at Sony as just one of jumping into an existing area as a contributor. Instead, I wanted to see us open up a new frontier, to be pioneers that would really enlarge the world of digital entertainment. That was my motivation.

At the time there was a lot of talk in the media about the "war of the consoles," but we thought that was quite strange. From our perspective, we weren't trying to compete inside a fixed area, but rather we were trying to expand this new medium as a whole. Nevertheless, that was hard to get across to outsiders. That's not to say there wasn't some merit to our work being understood in this way. Both Nintendo, as well as ourselves at Sony, I think, spent no money on advertising. We got so much free publicity regarding this so-called "war," that I'd like to say thanks to *Famicom Tsushin Magazine* for that one!

Well, you can joke about it like this, but we had decided to launch our own attack on this area, and so on the third of December 1994, we launched the PlayStation. The time leading up to release was tough. It was a serious crunch. Even a month before release we still hadn't finalized the hardware. Production only started three weeks prior to release. We used CDs as the medium for the games, and they were fine when playing the game. However, while checking, someone innocently put an ordinary music CD in the machine and found that the music skipped. I was really quite upset about that. I thought that you just had to be able to listen to CDs on the machine properly; that if the music skipped, it could look bad for the Sony brand. That's how things are sometimes. All we could do was work our way through these kinds of problems one at a time.

Around the same period, Namco was making *Ridge Racer* for release on our console. I went to have a look at it because it was about to be finished, and what did I see but that the race courses weren't working, and the cars were floating in the air. You start to wonder: "Is this really going to be OK?" We got the PlayStation out to market on time, but the whole way it was touch-and-go, dealing with lots of potential show-stoppers.

Up until then, in 2D game machines you normally had movement going horizontally, right? Well, you did have games like *Zelda*, where clearing a screen meant you shifted to an entirely new screen. However, you didn't really have this concept of "space," I guess you could say. It hadn't been necessary to think about it because games were in 2D. They also were not using a limitless 2D dimension, but a 2D dimension that is bound within a strict frame. That makes the nature of the game very easy for the player to understand.

Conversely, as Mr. Tajiri has pointed out, there is that potential challenge of figuring out just how interesting a game can be squeezed into those given limits. Mr. Tajiri's *Pokémon* was made within such limitations, and it is really fantastic for what it is. It's the same with traditional arcade games. For example, in the case of *Street Fighter*, although there are two characters rather than one, you had a 2D space within which you had to try and fight it out. That was what was allowed for by the kind of technology we had in that period.

What happens when you shift to 3D though? Well, everything changes. If you turn around, something is there.

Just turn yourself around a little bit, and what is on the screen will change, and it will *keep on changing*. That's bad enough for creators, but there's also the question of just what kind of game you can even make. What is the nature of a game in a 3D space? The technology behind having three dimensions on screen might be surprising, but until that point, nobody had really made such games. In fact, the majority of creators, or rather, almost *all* creators at that time were saying that it just wasn't possible to make 3D games.

On the other hand, you had the people over at Hollywood who thought this 3D stuff is fantastic, and although they were, of course, making something that has a very different form to games, they were starting to push the technology into all kinds of new directions. Also, even within the world of games, the situation with arcade games was a little different. From around the beginning of the 90s, Sega and Namco had arcade cases out that cost around one to two million yen. If we get into a discussion of why they charged this amount, well the story could end up quite long, but basically, at the time, America's defense industry required computer graphics. Flight simulators for planes and helicopters required images that would move in real time, so there was demand for computers such as those made by Silicon Graphics, which cost tens of millions of yen. At the time we also saw the end of the Cold War between the USA and the Soviets and an easing of military tensions. Therefore, what happened then was that such companies now had to find civilian uses for technologies they had produced for military demand. Sega and Namco thought that they might be able to use this technology, and purchased it from American companies, making them an astonishing one or two million-yen arcade games. That is where we first see the emergence of titles like *Virtual Fighter* and *Ridge Racer*. Of course, then, nobody thought that such technology would end up in the homes of ordinary people. Probably it was Sega and Namco in particular who never foresaw this development. For them, if their machines could be compared to what was available in the home it would be a problem. For us at Sony, however, we were watching developments closely the whole time. From our perspective, technology had reached this point already, so maybe it was only a matter of time. What can I say? Here I think it was a question of how large you wanted to dream, how ambitious you were. We had a big vision, and that's what guided us in the development of the PlayStation.

Actually, one of the first things we did was go and see

Namco. A person from their arcade department basically told us that what we were doing was impossible. Then we told them to come and see for themselves. When they saw the real thing, they were pretty shocked, and the next day they asked us to let *them* make it. This wasn't something for home use, they claimed. This needed to be done for sale in arcades.

Sega as well was located close to Sony, so we went and saw them too. Surprisingly we were curtly shown the door. The impression they gave was that they could make it themselves. Well, it is possible that they actually were working on something at the time. There were things going on like that.

From the perspective of somebody involved in home-use game machines, it hadn't yet even been two years since the Super Famicom came out. At that stage, it wasn't impossible to think about what would be next, but it wasn't easy either. A 3D game developer in Silicon Valley by the name of Trip Hawkins, who had founded EA, had made another company called a 3D0, which stood for "Three Dollar Organization"; the idea being that the royalties on their games would be three dollars. I went to the US on behalf of Sony to take a look at what they were doing. I went with the expectation of seeing real-time 3D movement, but it wasn't real-time at all, just the playing of what was on the CD-ROM. When I asked Trip: "Hey, this isn't real-time, right?" I was told not to be stupid, that, of course, there was no way it could be in real-time. "Yes, of course," I said. And so, I smiled as I came back to Japan.

In the end, we decided that we should try and make the machine ourselves. It was fun, but I was in the research laboratory, where we had had to work out the whole thing from scratch. It was up to us to design it, from the computer graphics chip to the CPU. And not only that, but we had the complications of asking different people from here and there to collaborate with us on different parts of the design. This kind of framework is nothing out of the ordinary today, with the world of the internet. At that time, however, nobody was doing it. Everything was taking place in secret, vertically integrated, with absolutely no know-how getting out. As it happened, when developing the PlayStation, we used graphics ideas from a researcher at Toshiba, combined those with ideas from a Sony researcher specializing in information processing, and then had the manufacturing itself done by an unknown American company. The graphics, the CPU, there were all these different components which were tackled by different teams in different places. I say teams, but it was always this or that particular person who you dealt with. It worked on a level of trust, because

everyone knew each other, and could tell if somebody was up to the job, or if they were just talking. You'd find the person you could rely on for a task, and, because you were both engineers, you could skip stuff like budgeting. You'd just make it yourself. Once you bring in subcontractors, you need money, but you don't if you just do it yourself.

Practically everybody had thought that it couldn't be done, so there were not many people willing to work with us, but we got who we could and somehow got the machine out to market. Namco's *Ridge Racer* came out, and Takara Tomy's development company Tamsoft produced *Battle Arena Toshinden*. From Sega, we had *Virtual Fighter*. What was amazing about *Virtual Fighter* was that it was the game which most got across that feeling of space. You could do stuff like turn around and kick and so on, and that really changed everything. People could see that this was something special.

What was good about using CD-ROMs as the medium was that they had a lot of storage. This did, however, end up leading to people making mistakes with memory usage. This might sound strange, but basically what happened was that because we had a large volume of storage available, you had people wanting to put in a lot of pretty images. It was true that the memory could handle this. However, you could then end up with a game that was merely showing off those pretty images, which doesn't have any merit as a game.

Why then did we use CD-ROMs? The biggest reason was that they were *cheap*. They cost only tens of yen. They were also fast to make. The scariest thing for makers is to have a lot of inventory, even when storage cartridges can degrade because they are made of plastic, leaving you with nothing but a dust jacket. So, we used CD-ROMs for a very different reason than what most people think. It was nothing to do with memory size, but rather the fact that they were fast to make, cheap, and easy to break down when no longer needed. We thought that if we used something like this we could change the model of game circulation.

When kids want something, they want it right away. But stores didn't always know when a game would arrive. Nintendo and Sega didn't even know when a product might be ready. Back then it took two months to make semiconductors. While you were messing around getting these cartridges ready, the copies that kids had finished playing with would end up in the second-hand stores. That might be fine enough from the standpoint of the child, but it means less profit for creators and publishers. However, if you used CDs, you were looking

at just two days to print them, even back then. You could set up the system so that if you came into the store on a Friday, they could respond like a restaurant taking your order: "coming right up!" With kids, coming in during the week, you could just ask them to come again on the weekend. That was the way we changed the model of game circulation.

Previously, game machines had all kinds of restrictions, meaning that you couldn't make a game unless you had a serious amount of talent. But by expanding the breadth of expression in games, what we achieved was the opening up of the field to new creators. They might be people with backgrounds in film, people who write scripts or scenarios; they might be coming from a music background, etc. There's this mixture of different approaches.

These people are all adults, so what they want to do is make things which they themselves could enjoy resulting in the creation of entertainment oriented towards adults. In Japan, you still see many games released that are marketed to families. In the western market, however, we saw this shift. Rather than the market changing though, it's probably more accurate to say that the creators changed. This, of course, is not a change which occurred because of the PlayStation alone. It's something which began with the PC. Microsoft had been putting a lot of effort into this area for years. In a sense, there was an unleashing of the power of computers, an increase in accessibility, and so we saw creators making all kinds of new software. And now with the PlayStation 4, it's basically a PC, isn't it? It runs the same type of software that you find on a PC. It's the same with the Xbox. The Xbox, the PlayStation, PCs, these today all basically have the same shared network platform, and so the market has expanded a great deal.

Consider eSports, which are really hot right now. There was a period where eSports was basically just competitive network gaming in countries like Korea. Taking that as a base, you then saw gamers form teams to compete with each other. Professional gamers started to face off in games like, for example, *League of Legends*, with other people spectating on the games. This began to be referred to as eSports, and now it is steadily growing in countries outside Japan. The market is now in the billions. There is a vast amount of money and participants involved. What is particularly surprising is that these people are gamer nerds, right? People who used to hang around game centers are

now becoming professional game players, with the names of the players and teams becoming extremely famous. The tournaments for these games are held in various countries, including the US, China, etc., and the players are treated like sports pros, coming into the countries on sports visas. This has started to get underway now in Japan as well, but it was somewhat slower out the gate. Anyway, companies such as PlayStation and Nintendo are now expanding the world of entertainment into entirely new areas. That's the present situation.

I'd just like to shift now to what is going to happen in the future. Let me start with a question: How large do you think the game market is today? It is a 12 trillion-yen market. In comparison, the combined world movie industry is only a few trillion yen in size, the music industry two or three trillion. So, the game industry has already surpassed both music and movies, and what is more, it is still growing. With growing industries you see large numbers of creators getting involved, which is the case here. On top of that, while game players used to be thought of as people playing solitarily in their own houses, today they are playing on the net, or even in real sports arenas. So, what will come next? We'll just have to keep reading *Famicom Tsushin Magazine* and "watch this space," so to speak.

What about virtual reality? Well, actually it has been around for quite some time. It started around 30 years ago. But it was heavy and expensive. Today it has finally come down to a price range where you might be able to afford it. This week Oculus stated that you would be able to borrow their VR set for \$200 USD making it look like the real thing is finally arriving. Assuming that everyone here hasn't yet had a chance to play around in VR? Probably, you will find it interesting, but you might feel uncomfortable wearing a headset and actually trying to do something.

Meanwhile, although it's not really on sale just yet, there is something else that might just be the next big thing. Augmented Reality; AR. What's different about AR is that it doesn't block out your vision. Rather than removing what you can typically see, it overlays computer images onto the actual vision of the scenery around us. It has really advanced recently, such that even if you were to turn your head, for example, the CGI will smoothly stay stuck where it is supposed to be. I am reminded of the hologram of Princess Leia from the original *Star Wars*. You can see an image that looks as though the real thing is standing there.

Things which once sounded pretty far-out are now reaching the price point where they might just be purchasable for home use. This is potentially very destructive. We might end up looking back at today as the time when we used to walk around with our faces down, swiping at the glass. Playing Pokémon with this new technology can be pretty dangerous! If you aren't careful, you can end up getting in trouble with somebody. On the other hand, if it is real, like AR, then that kind of danger should decrease, right? If it is dangerous, then other people can let us know. The future might end up looking like that.

One other thing that I thought was amazing was a recent graduation thesis written by a student at UC Berkeley in San Francisco. Basically, this student used the old Mario Bros. game for the purposes of their research, getting an AI to play the game at a human level. With a typical AI, if Mario was, for example, to hit a wall on the left side of the screen, he would just jump up and down on the spot, and that would be it. He would jump forever in an endless loop. But what about this AI? Well, the student gave this AI a sense of curiosity, in a way. Human beings are the same, aren't we? If you run into a wall or find a box that we just can't seem to open, then don't we try and find a different approach? That's because we have curiosity. By adding curiosity to the AI program, it actually performs really well. According to the thesis, Mario was learning all kinds of things, grabbing coins, and making it all the way to the flag. This in itself is impressive, but what is really amazing is that we hadn't really considered the importance of this thing we call curiosity until now. It's something to think about isn't it, how cool it would be if we could get AI to be curious.

Also, what was really shocking recently was the performance of the AlphaGo AI developed by DeepMind, which is part of Google. This AI managed to do what people had thought was utterly impossible, due to the infinite number of possibilities that exist, which was to beat a human being in the game of Go. And not just once. It won several times. As to why this is possible, apparently, they had it learn from games played by human beings. If that was all they did, then it wouldn't be something new. But what DeepMind also did was to create multiple copies of the AlphaGo AI, and after having them study all of the recorded games of pros in Go, they had the AI train further by just playing each other. Apparently, the AI did a thousand times more games between copies of itself than were imputed records of human games. By taking this approach, some impossibly good strategies started to emerge, and

finally, the AI was capable of beating Korea's famous world champion, who had to admit near total defeat. This was quite shocking in a number of different ways. Until that time most people thought it was impossible. As it happens, by way of this easily understandable method, where you have the AI play itself, and learn with a kind of curiosity, they were able to achieve the "supposedly" impossible, and in a very short time. Again, it's like human beings. You can't learn something without curiosity. They tried to mimic this feature of our thinking and were able to pull off this achievement. Needless to say, it wasn't as simple as that, but actually involved a lot of work, but the thesis basically boils it down to this point.

What is even more amazing about this story, is that after having their AI win against the world champion, DeepMind stated that having proven their point, they were finished with Go. They were not going to continue further development of the AI to play Go. So, what does that mean for AlphaGo, going forward? They will write a paper. That sounds good. But they have something more impressive lined up next. A popular eSports game is *Starcraft II*. Basically, DeepMind

announced recently that they are going to jump into *Starcraft* next. What they have done is gone to the publisher of *Starcraft*, Blizzard Entertainment, and asked them to put out a program that would help the AlphaGo AI learn to play. They gave the okay. From the fall of this year, when you play this game some API will be attached that exists for the purposes of helping Google's AI learning program. Using a cloud-based system, they are going to have the AI study in detail all of the games played by pro teams around the world. Once at a certain point when they feel that the AI has learned a respectable amount, they will strengthen it further through self-learning, and eventually, they may release a team that human beings simply cannot compete against. Well, it's all very well so long as this remains within the world of games, but you can't help but wonder what will happen as this technology increasingly enters the real world. As to why they chose *Starcraft* this time, DeepMind had the following to say: they are doing it as part of their attempt to simulate the real world. This is because games are the easiest to understand. It's a little bit of a scary way to end but I'll have to wrap it up here. Thank you all for listening.