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About the Atos Scientific Community

The Atos Scientific Community – co-chaired by Thierry Breton and Hubert Tardieu, Advisor Atos CEO – brings together more than 135 of the best business technologists from all Atos geographies and businesses. With their rich mix of skills and backgrounds, community members work together to anticipate upcoming technology disruptions and craft Atos’ vision of the future business challenges our clients will face.

As ‘creators of change’ who take a proactive approach to identifying and anticipating game changing technologies, our Scientific Community members ensure Atos’ clients always get the best solution available – both for today and for the future.

Atos Scientific Community members participate in a wide range of Atos activities:
• Crafting Atos’ Vision on the evolving world of business, society and technology through the publication of its Ascent Journey series; providing insights to technology trends and how businesses can use technology to grow and transform.
• Contributing to the Ascent Magazine and Ascent Look Out trends report, Atos’ biennial collaborative horizon scanning publication.
• Mentoring the Atos IT Challenge, a competition encouraging the next generation of IT talents from universities across the world.
• And, in addition to solving clients’ business challenges, they also support patent creation, participate in innovation workshops with clients and partners, and develop cutting-edge proofs of concepts.

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How is the Gaming industry positioned within Entertainment?

“Before long, billions of people around the world were working and playing in the OASIS every day. Some of them met, fell in love, and got married without ever setting foot on the same continent. The lines of distinction between a person’s real identity and that of their avatar began to blur.

It was the dawn of new era, one where most of the human race now spent all of their free time inside a video game.”

“Ready Player One”, Ernest Cline

Ready Player One, written by Ernest Cline describes a dystopian future in which humankind spent most of their time playing in OASIS, a VR video game. Despite not being a hopeful world, the truth is that most of the technologies described in the book already exist or will be possible in the near future.

Pokémon GO has demonstrated in 2016 the impact of video games, mobile and social engagement becoming the most relevant phenomena around entertainment, more than 100 million downloads and $268 million of total revenue in one month.

However, even before Pokémon GO, video games have been a solid business and an essential part of the mainstream in entertainment: video game usage statistics estimate that there were 155 million video game players in 2015 in the USA (48% of the population), each spending 6.5 hours per week, though still far from the 30 hours watching traditional television; it is growing every year and it is clear that video games are an increasingly important media and entertainment activity.

USA Game Facts

![USA Gamers Map]
Video games have become the third entertainment business in terms of profits ($91.5 billion in 2015) after television and editorial activities (books), surpassing movies ($89 billion in 2015) with annual expected growth above 10%. However, video game activities are not just related to playing. The use of Internet video channels dedicated to retransmit video games such as YouTube or Twitch are getting increasingly popular, especially among young people. Some entertainment channels have recently had more viewers than the finals of the NBA (National Basketball Association) or MLB (Major League of Baseball). For example, the finals of the game League of Legends were watched by 36 million people in the US, compared to 31 million for the NBA Finals, or 22 for MLB. The most important technology companies, including Microsoft, Google, Facebook and Amazon have recognized the business potential of video games and have focused part of their strategy here (HoloLens, Magic Leap, Oculus Rift, Twitch).

From a business perspective the gaming industry has been heavily involved in many of the core IT issues in recent years. In the fight against piracy, where other sectors such as music or video have been highly disrupted, the gaming industry has introduced new business models such as free to play, freemium or SaaS services, and has been a pioneer in social engagement and ensuring player loyalty. Gaming has been highly successful where other sectors have not and it is worth studying and learning from its success.

This document describes both the business and technological evolution of the video game industry, and how it has transformed its business model to become the reference for the entertainment industry, the main aspects of their innovative evolution focusing on new trends for enhancing user experiences, and finally describing the possible opportunities using gaming references for IT in the near future.

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The Influence of Games on Business

The evolution of the gaming industry demonstrates that it has succeeded where other practices many times have failed.7

Two big trends have made the video games industry more and more relevant to other businesses:

- The emergence of an experience-centric economy
- The rise of the digital economy

A number of lessons learned in the video game industry over the last few decades as experience-centric digital goods become relevant and interesting to consider whenever we look at how to address these trends in more generic businesses.

The emergence of an experience-centric economy

As explained in a Harvard Business Review article “Welcome to the Experience Economy” the overall economic model has transitioned from a product economy to a service economy during the 20th century, and has been increasingly progressing from a service-centric economy to an experience-based economy, where the end value to the customer is measured in terms of lasting impression instead of objective accounting value. More and more businesses seek customer satisfaction as the ultimate KPI over the simple delivery of what has been requested.

We can take inspiration from the way Apple design their stores, and package their products in luxury boxes, ensuring that beyond the quality of the product and the brilliance of the service, every Apple customer lives the experience of being part of the Apple cultural phenomenon. As one of the most successful and iconic companies of the digital economy, Apple repeatedly sets the standard on how to deliver a sleek and stimulating experience.

From Apple’s perspective, it is noteworthy that video games contribute one fifth of the popularity of the AppStore (21.8% in 20159), which is only one side effect of the ever increasing pre-eminence of video games in our culture.


The rise of the digital economy

Over the last two decades, our entire economic landscape has been deeply transformed. What, in 1995, looked like an interesting experimental technology has now become ubiquitous in our lives, from a consumer perspective as much as from a professional perspective.

While, in 2016, we are far from having an entirely digital economy, it’s become increasingly rare to find sectors where digital has not become at the very least useful, and in some sectors at best indispensable. Entire parts of our economy have arisen from this transformation to digital economy: Google, Facebook, but also the new billion-club app makers, from grounded-in-reality services such as Uber or Tinder up to digital-exclusive like WhatsApp or Instagram, and also video games: Pokémon GO, Minecraft, Candy Crush or Clash Royale.

Entire sectors have been profoundly reshaped by this trend: photography, movies, music, posts, telecoms, publishing, etc., while most others have had to adapt and include digital in their offer: food and high-street distribution, news, automotive, etc.

The economy of selling virtual goods is holding well. The digital economy’s contribution to GDP in the G-20 is anticipated to reach $6.6 trillion a year, or 7.1 percent of total GDP in “The Infrastructure Needs of the Digital Economy”.

Virtually every brick-and-mortar company has had to build, develop and now needs to sustain and improve digital channels, from customer acquisition and marketing to procurement and customer support. This has created new needs for companies to employ digital specialists such as web developers, community managers, software engineers, up to Chief Digital Officer to lead and drive that new business capacity.

“"The digital economy is developing rapidly worldwide. It is the single most important driver of innovation, competitiveness and growth'".

Video games are Digital Experiences

In this context of the dual rise of an experience economy and digital economy, it becomes interesting to realize that an entire sector has been dedicated specifically to deliver digital experiences: the video games industry.

Even more, they have been doing this for much longer than anyone else. When the digital economy was not even a business topic in the mid-80s, video games were already focused on providing experiences through digital. What the video-games industry has been discovering or inventing through the following decades has served as a template or inspiration to other sectors once the digital economy and the appetite for experience delivery has suddenly become mainstream.

There are a variety of domains where games have been exploring and pioneering solutions that can appear obvious today, but were not at the time. We are going to review some examples of how the video games industry has pioneered or improved on business practices.

Digital Driven Business Models

“"The digital economy is developing rapidly worldwide. It is the single most important driver of innovation, competitiveness and growth".

The importance of the digital economy

11. https://www.bcgperspectives.com/content/articles/telecommunications_public_sector_infrastructure_needs_digital_economy/
The Evolution of Gaming Both a Model and an Opportunity for the IT Industry

Software as a Service

Through the 2000s, game developers started to realize that by creating games that rely heavily on online features (as broadband was becoming more and more a commodity instead of a luxury), they would dramatically increase their resilience to piracy, and keep capturing a majority of the revenue generated by how successful their products would be.

Considering this, the video games industry created new business models based on pay-per-use defining two current trends in all sectors: centralized (cloud based) hosting services, and motivation for consumption improving the user experience by incorporating additional features (premium) and social engagement. From the technical point of view video games were able to adapt to network conditions at that moment, then minimizing data switching and distributing the load between the server and the client12.

The result was the massive development of MMO (Massive Multiplayer Online) games and paid subscription models that have been one of the most important references to a successful Software as a Service model.

Security and IP protection

One very key issue that an all-digital economy faces is the protection of Intellectual Property. Digitalizing a product means that this product can be stored extremely easily, in next to infinite quantity, distributed worldwide in a matter of seconds, and reproduced at virtually no cost without any quality loss.

At the forefront of IP protection, game companies have had inventive approaches to ensure that their products would only be consumable by genuine purchasers. They created all sorts of hidden code tricks to prevent users from playing pirated games, by degrading the experience.

One of the ways the game industry found to fight against piracy were closed systems, i.e. gaming consoles. At the same time though, the audience for the online-enabled game became more and more important. Between the Counter-Strike (Valve, 1999) or Starcraft (Blizzard Entertainment, 1998) online games, a whole part of the games industry realized that online games were harder to pirate efficiently, as two factors made the attempt unattractive: on one hand, more and more game logic was controlled on the server-side, not readily available for hackers to reverse-engineer; on the other, online games’ main appeal is to be able to play with other people, and in every matchmaking situation, the more people there are in the same system, the easier and more efficient the matchmaking process becomes.

Digital-driven Business Models

As explored above, video games have had to deal with piracy much earlier than many other industries that were not dealing with a fully digital delivery chain. This led video game companies to understand the customers' expectations towards a very volatile media, which could be made accessible and reproduced at will and without quality loss with marginal costs. Many video game companies still pirate by trademarks and games, so video games companies started to experiment with business models that would secure a revenue stream in the digital age.

• Closed Systems: In the nineties and millennial decades, closed systems (i.e. consoles) proved to be the choice of major publishers, where PC gaming was systematically put behind as a secondary development platform, due to higher piracy rates and much lesser return on investment.

• Subscription-based: Another approach was the subscription-based business model, initiated by large online games, able to ask for a recurring fee thanks to two main factors: the control of the content, delivered from publisher-controlled server farms, and the evolution of content over time, justifying a periodic contribution.

• Free-to-play model: This model rose to fame alongside social networks and mobile. The intent was to tackle a much larger, untapped market potential that was either repelled by the time-consuming toll of deep game experience or simply not interested in strongly immersive context offered at the time. Casual gaming started slowly in the 2000s, to become one of the key offerings of the industry, by removing the barrier to entry of initial payment.

• Sponsorship and advertising: These have been also present in all the previous models. Sponsorship by trademarks and product placement is mainly present in AAA titles (high quality and budgeted games) and different kinds of advertising are also present free-to-play and in indie games.

Social Engagement

One key element of engagement of online video games has been the opportunity to interact in real-time with either friends at a distance, or perfect strangers from across the globe, but also for the companies with their customers; first within the games themselves, but also increasingly outside of them, in online forums that allowed people sharing the same interest for a game to exchange and debate. This created online communities as early as the very first online games (MUDs) in the late seventies, early eighties, when online interactions were only known and used by a fringe population of scientists and gamers.

By the mid-nineties, the democratization of online gaming and open-source forum tools started to allow the multiplication of communities focusing on a specific game, and very early on, video games companies understood the potential for monitoring, and then interacting with their customers directly, without the prism and filtering of advertisement or marketing.

Now, online community management is a key component of any company concerned with their customers’ interests, and a unique way to leverage the digital tools to establish a two-way conversation. Community Managers in game communities are often considered advocates of the players to the development team, and therefore have the potential to relay the pressing issues in need of fixing in a very efficient way.
Customer Intelligence

Free to play business models called for a whole new approach to game design, forcing game makers to rethink the way the experience would shape up for players and identify how to increase loyalty and monetization. Suddenly, by providing a free game with optional payment options, it became essential to hook players from the very first seconds, and never let them go until they would fork out some money.

Video games started very early on to make extensive use of data to understand players’ behaviors to minimize the risk of losing players along the way, and maximize the chances of them reaching for their wallet. A whole set of techniques were developed to ensure that players would be loyal to the game, as the free-to-play offer made it easier than ever to access the experience, but also making the cost of leaving non-existent.

If a player pays 90€ up front for a game, regardless of how much the game is played afterward, the developer gets the maximum return. If a player doesn’t pay anything to play a game, it’s within the game experience itself that there is a need to motivate the player to purchase something in the in-game store. The free-to-play model has this advantage over the pay upfront model, that there is no upper limit to how much can be spent by any individual. This means that a minority of very engaged players (usually much less than 5%) will pay enough money to offset the other 95% who won’t spend a dime.

Big Data has become a strong tool to manage the huge amount of data generated from customer use and social interactions. Considering free-to-play models the real business is not the subscription fees, but the information related to monetization, recommendation and advertisement.
An Enhanced Interactive Experiences through Gaming

Video games have been an innovative platform for developing user interfaces and interactive systems. Since its inception, video games have been used to enhance the user experience, making it more realistic and easing interaction with themselves. Technological improvements in usability (user interfaces, HMI, HUD), increased realism in simulators and 3D computer generated systems have allowed their use for training in enterprise and military environments. During the last years the main challenges faced by the gaming industry has been focused on enhancing experiences by new technologies, new social interactions and creating unique contents.

Technology, social features and narrative are the pillars of the video games, this section will describe current trends and future enhancements to create even more realistic and immersive experiences.

Technology and Perception

Gaming has been key in the creation of new user experiences. Immersive experiences, new ways to interact when playing and improved interfaces based on the second screen are some of the current technologies used to achieve this. Current innovations will develop in coming years, changing drastically the interfaces between users and the games experience considering both in terms of perception and interaction.

We could say that our perception of “reality” is changing, at least in gaming terms with VR (Virtual Reality), MR (Mixed Reality) and AR (Augmented Reality) now the main focus for improving gaming experiences. With new hardware that includes wide field views and reduced latencies interest has increased. All major companies in the sector, and even major Internet players, are investing heavily in them. HoloLens (Microsoft), Oculus Rift (Facebook), Magic Leap (Google), HTC Vive or PlayStation VR (Sony), are only some names that will impact the market.

Oculus VR reopened the debate and interest in VR. The acquisition of the company by Facebook also created new expectations and helped to support its development. VR has been mainly considered for gaming but it’s clear that Facebook has thought to use it beyond gaming. As referred by Ender Analysis report13 “Shifts in the games industry: mobile, consoles and VR”, it’s expected to evolve to provide more realist experiences by AR/MR/VR technologies. Its great potential has been shown providing a new experience by its 360-degree projection and for instance, the BBC proved this experience using Oculus Rift in the 2014 Commonwealth Games14.

The traditional 3D Holography technology, which consists of projecting images, has experienced an important development over the last years. However, it seems that now, the new technologies will enable to “bring” 3D elements into the real world. In this regard, Microsoft is working on HoloLens which promises to go one step beyond VR providing the ability to view and interact with the real world and 3D computer-generated elements.

In the same way, Magic Leap technology raises the possibility of “bringing Magic” to the real world, integrating computer-generated elements and promising a really surprising level of realism. To achieve the level of promised realism Magic Leap seems to use a revolutionary technology that projects images into the retina with a surprising level of detail. Google has become one of the investors of the project. WETA Workshop (the company behind the creatures of Lord of the Rings films) is also involved and relevant people joining the project such as the sci-fi author Neal Stephenson have created a huge expectation around it.

**Enhanced Interactive Experiences**

When we mix this with the improvement of technologies such as 3D, Holographic, 4K/8K, new graphical engines (GPUs), enhanced environments (Microsoft IlumiRoom) and 3D Audio Systems (Biaural ASMR Sound) we expect to have a really improved immersive experience. This is also linked to new ways to interact with the gaming devices.

Classical gaming interfaces have been developed during the last years (specific chairs, keyboards, mouse or gamepads), but there have appeared many other initiatives trying to improve the way we interact with video games, as we interact with virtually generated worlds. Each sense, each relevant biometric parameter is taken into account in order to enhance the whole experience.

As an example of the new user interfaces, there are some promising projects like FOVE which provides improved experience by tracking eye movement during interaction with video games.

The improvements in cameras and software have facilitated the use of gestures as one of the standard inputs to games (Microsoft Kinect). So far, this is occurring more in casual gaming than hardcore gaming but improvements will ease the introduction to both. We already see cameras that allow the separation of the background from the front image and make it easier to recognize facial expressions and emotions, or systems such as the HP Sprout which try to mix the physical and virtual worlds. This is a clear case when technologies go from gaming to real business use cases very quickly.

In terms of audio interactions we can consider speech recognition systems, increasingly widespread because of virtual assistants (Apple Siri, Microsoft Cortana, Amazon Alexa or Google Assistant), but there are also technologies that allow the analysis of emotions through speech or other expressions such as crying or laughing. There are also initiatives related to the senses of taste and smell senses the most promising ones are related to haptic interfaces (sense of touch).

Haptic interfaces have been used in video games for more than 3 decades, during which time the stimulus has been achieved mainly through the integration in control devices (Jump Pack Sega, Nintendo or Sony DualShock rumble pack). However, the feeling obtained was very basic, just feeling some movement. In the new generation of video games haptic interfaces will enable an enhanced sense of immersion in VR systems. The haptic interfaces in these systems are often implemented using gloves (Gloves Omnit), active surfaces or haptic arms (PHANTOM), the type of stimuli obtained ranging from friction or resistance, to the sense of movement which will dramatically increase the virtual immersive experience.

There are some other initiatives to enrich user experience based on biometrics considering heart rate or respiration which would allow detecting the user status in order to adapt the gameplay or experience.
Social Experience

Gaming has always had a social component, sharing experiences and competing have been one of the key elements in the development of video games. The creation of multiplayer games was one of the first social elements emerging following the expansion of the Internet in the 90s and 00s, and one of the keys for the future success of social networks, especially regarding collaboration and content monetization.

Social components are a driving trend for the gaming industry, at this moment inconceivable without social interactions. Pokémon GO has demonstrated the possible impact of an innovative social game, including location features and AR interface. It has impacted even the habits of people, signboards restricting the game driving or in different places as museums or parks.

Social features have been key also for games like League of Legends; it was estimated by 2014 that there were 67 million players monthly which generated of $7.2 B for Tencent\(^\text{15}\) (owner of Riot Games). There are many social and multiplayer games, MMO (Massive Multiplayer Online games) or MOBA (Multiplayer Online Battle Arena) could be the clearest examples, but mobile platforms and Social Networks had enabled a new type of social collaborations: Candy Crush (King $2.26 B in 2014\(^\text{16}\)) which implements specific social features, and Clash of Clans or Clash Royale (Supercell $2.3 B in 2015\(^\text{17}\)).

The projected worldwide revenue in 2014 related to social gaming in Facebook was $ 3.1 B\(^\text{18}\). However, despite this huge amount, more than a gaming platform, Facebook has become an integrated social gaming platform, usually for tablets and mobile phones. The intended effect in many cases is to cause a viral effect spreading the game through social network contacts. Line, the messaging app, bases part of its business model in social gaming\(^\text{19}\). There are dedicated gaming platforms for each console (Xbox Live, PlayStation Network and Nintendo Network) and application markets (Apple’s AppStore and Google Play) to allow some social and collaborative elements. Steam, has also achieved a significant success in the sale of games to traditional platforms.

There’s also a social component to sharing experiences, people like to share and consume these gaming contents so there’s also a space for Gaming as a spectator. It’s the case of eSports, linked directly to social behaviors and entertainment mainly supported by YouTube and Twitch (acquired by Amazon for over $1B\(^\text{20}\)).
In terms of broadcasting gaming videos there have been two different approaches. First YouTube was the ideal platform for sharing gameplays just as videos and Youtubers have become extremely popular with millions of followers and annual earnings in some cases. On the other hand, Twitch, created in 2011 as a spin-off of Justin.tv, specialized in live streaming of gameplays, but also including some additional features to interact with viewers using interactive chats, awards and micropayments. Some interesting data about Twitch: 36 million people watched the final of League of Legends in 2015, 21 million of people watched the presentations E3 in 2015, and even more surprising, in 2014 Twitch became the fourth streaming service in US after Netflix, Google/YouTube and Apple. These new habits are leading the transformation of entertainment of the new generations.

Gaming video contents are growing and could be real competitors to traditional broadcasters in the near future, so it’s expected that there will be some movements in the traditional entertainment industry: major companies broadcasting eSports? ESPN or Turner Broadcasting are already covering these events. Anything is possible.

Dynamic Narrative

We have described how technology provides new experiences and interactions, how social features allow sharing these experiences. But which is really key lies in how this history is built, how the experience becomes unique depending on the decisions and the environment.

Dynamic and interactive narrative is where the storyline changes in function of different inputs. These inputs may be explicit actions by the user/viewer or other inputs of any number of other sources (biometrics, social media, context, user profile, etc. or random). In the video gaming world most content is interactive and dynamic and much of the rendering of the animation is done in real time. This allows the content being produced to “fit” with the storyline up until that moment. For non-animated content this is much more difficult to achieve because typically the content cannot be created in real time as it is snippets of audio and/or video that are retrieved in response to inputs. Therefore it is far more difficult to ensure narrative coherence. Is someone’s hair combed the same way from one scene to the next? Was one of the characters who appear in that scene eliminated previously?

Because of this, currently dynamic content and media (especially games) are almost entirely reliant on animation. While computer graphics qualities are constantly improving there are, at least currently and for the near future, limitations on how close we can come to recreating natural scenes, especially those involving humans. Therefore an emerging area of interest could be Content Oriented Broadcasting in which building blocks of media are created in ways that allow them to be composed and/or adapted in real time and personalized for everyone according to the context, profile, actions, etc. of them and others. The core of this idea would be a language that permitted that these blocks could be related/associated temporally and logically.

Increasingly we have the ability to influence narrative through implicit feedback whether it is at an individual level or at an aggregated level. Inputs could be based on, for example, user profile and preferences, context and wearables, the interactivity of other users (whether individual or aggregate) or social media.

Context information could include weather or time of day (different narratives for a rainy Monday morning than for a sunny Saturday afternoon), device, location and movement (at home, in a moving car, in the country or in the city, ...), related to current events, etc.

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Especially interesting are the possibilities for wearables and biometrics. Devices that can measure changes in physiological indicators, such as heart rate, body temperature, pupil dilation or galvanic skin response (GSR – the conductance of the skin affected by sweat production) can be used to measure response to environmental stimuli and thus create exciting new possibilities for adaptive content and narratives that react to the emotional response of an individual, or even a social-network connected group of individuals.

**Narratives can be programmed specifically to elicit a series of emotional responses** allowing content creators to be able to “script emotion”, enabling a common emotional response, but delivered through a unique personalized experience.

While narrative and storytelling have always been an important part of the gaming industry, consider role playing games for example, in the last few years this is becoming more important with games such “The Last of Us” or the more recent “Until Dawn” stretching the boundaries between games and storytelling. New more immersive devices and technologies will only accentuate this trend towards dynamic and interactive storytelling. One of the issues that this entails is, in a certain sense, loss of control on the part of the author. A filmmaker controls the entire story from start to finish. But with dynamic content as opposed to traditional storytelling, the author needs to accept, a loss of absolute control. The user experience, the story itself, is no longer written in stone and will depend on multiple factors which may not be under the control of the author.
Gaming Opportunities for IT

How to leverage new technologies and architecture models

As described before, video games have been a reference for developing innovative technologies, social engagement and new business models, but what are the opportunities for the wider IT industry and how could they be applied? There are two possible areas to consider: the implementation of gaming and gamification techniques as a way to improve the current way of working, and the identification of synergies between gaming technologies and IT.

Gaming: Improved way of working

Different organizations face decidedly different scenarios in which gaming could be used. When implemented correctly, games and/or gamification can have a long-term benefit for an organization. Games currently have been introduced into fields like healthcare, employee engagement, sustainability, education, collaboration, knowledge management and organizational design, there’s a lot more where they could be useful considering Enjoying and competitive elements. Although scenarios in these markets vary widely, some themes in which gaming can be used recur more frequently than others.

Gaming: Improved way of working

Awareness

Games can be used to facilitate learning and improve awareness within an organization. By using games to facilitate some form of learning, we can boost learning efficiency. They facilitate a way of ‘learning on the job’, which (according to the 70/20/10 Model for Learning and Development) is that we learn most successfully from doing it ourselves. Games can also be used to improve awareness within an organization when introducing a new way of working or a new way of thinking (e.g. a new system). Games can help get employees more intrinsically motivated to embrace this change by showing why this change is necessary. So they could get them conscious on their ‘incompetence’ and facilitate them towards becoming ‘consciously competent’.

Change management

Change is very common within organizations. With the use of games it would be possible to encourage people to adopt and facilitate in new ways of working or thinking. After employees have been facilitated in the organization becoming more aware on why a change is necessary, games can be used to secure and continue this change. Games can help people get their jobs done in a much motivating way, because they can give them meaningful decisions and choices. According to Daniel Pink this is one of the requirements to get people intrinsically motivated.

We see the need for some new way of working or way of thinking when introducing some innovation within an organization. With the need for change, it is important to think about some sustainable change to raise the success rate of this new innovation. Most behavior change programs only focus on creating awareness, but this is “only one part of a behavior change program”. For a behavior change to be sustainable, psychological knowledge can play a central role. This knowledge should be used to not only create awareness, but also to continue and secure the new behavior making the change sustainable.

Gamification, the use of game elements in a non-gaming context, is often used to continue and secure some new behavior triggering and rewarding the target audience is important in such a phase of a change management process to enable some form of intrinsic motivation, such that the need for external triggers and incentives will eventually fade.

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Process efficiency

Games can be used to rationalize processes and speed up process selection by helping us make decisions. By creating a better process efficiency, it's possible to help organizations achieve their business objectives more efficiently and employees will get a better mastery on their jobs. Even when designing for a new or more efficient process within an organization, this process can be played and defined. This way people can experience the process and find ways to make it more efficient in a safe environment.

Collaborative work

Collaboration is something that is paramount for many organizations. Using games we can collaborate better. By favoring help and knowledge sharing within businesses, we can stimulate collaborative work among different divisions and even among different organizations.

28 Penenberg (2010): How video games are infiltrating and improving every part of our lives
As described in business and technology sections, Gaming has been developed in most of the cases in parallel to IT. At this moment some of the most relevant IT technologies could contribute to improve Gaming performance or could be developed considering previous gaming experiences.

### Big Data & Analytics

Big Data and Social Analytics are basic tools in the creation of sustainable business models for successful games. Video games have been a reference to the development of social interactions and a very important source of information for analysis in social networks. There are a lot of tools for analyzing data related to video games: models of social relationship, loyalty, monetization, learning difficulties or curves. Data analysis is an essential element for Gaming (Supercell generates 4TB of daily data concerning its players\(^30\)). The implementation of Big Data solutions and the role of Data Scientists have been key in most of the successful videogame companies, and represent one of the pillars to ensure the effectiveness of video games at this moment\(^31\). The analytical models, particularly related to patterns of behavior, social interactions, churn and customer acquisition is an element directly related to Big Data/Business Intelligence techniques and therefore could be clear opportunities for IT companies.

### Cloud Infrastructure

Consumer gaming has a clear seasonal component, therefore it’s essential that associated cloud architectures are flexible and elastic to support peaks and increased demand\(^32\). There are examples where a lack of foresight on the demand side may jeopardize the success of a video game that has required years of work and millions of euros of investment (PS4 Driveclub\(^33\)). The application of capacity analysis and provision of infrastructure cloud has a direct implementation for gaming considering IT cloud experiences, in fact there are specific offers of cloud services for video games companies from the most important cloud hosting\(^34\) and it would be an opportunity for IT companies\(^35\).

### Software as a Service

Gaming as a Service or Cloud Gaming is a relatively new gaming model but it has a huge business potential. The idea behind Cloud Gaming is providing Gaming experience through virtualized cloud platforms that allow the execution of video games remotely. Playcast was the first on demand gaming service using cable or IPTV infrastructure in 2010, it was acquired by Gamefly in 2015 and supports Amazon Fire TV and Samsung SmartTV platforms. Sony released PlayStation Now in 2014\(^36\) which allows execution of PS3 games in the cloud, and will also support Samsung SmartTV platforms\(^37\). It’s a really promising model and not just vendors, but Gaming companies like Tencent are exploring this way\(^38\), so it’s expected to grow during the next years.

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The Evolution of Gaming Both a Model and an Opportunity for the IT Industry

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Since the 90s video games have been played by small groups of players in different networks. New games and technologies have provided additional infrastructure but the idea of multiplayer leagues still remains. This approach is aligned with swarm computing concepts, distributed infrastructure and intelligence. By the use of swarm computing it would be possible to improve user experience, time response and obtain relevant data in order to solve traditional Game as a Service problems.

Video games have been a user experience focused platform from the very beginning, different games and interaction has allowed the development of different joysticks, steering wheels, or gesture based devices, and in terms of user interfaces there have been a number of different ones to interact with video games. As described in before user experience is evolving to provide a more realistic and immersive experience, so video games could be a clear opportunity to test these technologies for business.

Mobile platforms have been a success for video games (37% of the Global Gaming Market in 2016) and an ideal environment for new models of interaction with the user. Regarding business opportunities, mobile platforms have developed user experiences based on technologies like AR, being as relevant as Pokémon GO.

As described in previous sections, video games have always been a social platform and have been the first approximation to social networks, now they are integrated with them and represent an opportunity to create new interaction models and identify new business opportunities and improve loyalty. Slack, the popular social enterprise network is a clear example of these synergies, a bankrupt gaming startup that was re-used as a team collaboration platform in a different business context.
Machine Learning and Deep Learning

Artificial Intelligence is one of the pillars of characters designed to interact, and defining the game behavior depending on our actions and learning patterns\(^39\). The game scenarios and decisions as well as the learning elements have become increasingly complex, so the actions of certain characters do not just change the interactions, but rather the whole game environment leading to completely different stories and new narrative forms, such as described in previous section. Artificial Creativity is also a concept behind this storytelling and creation\(^40\). Potential development around artificial intelligence, machine learning and deep learning is clear for IT, there could be many synergies, analyzing what gaming can provide to IT development in many different areas: decision models, machine learning, bots or virtual assistants. GAN (Generative Adversarial Network) for example, is a new concept taken from games and implemented in general AI frameworks like TensorFlow. Demis Hassabis, founder of DeepMind (the company behind AlphaGo) and former videogame developer, explains how its technology, developed from video games, is nowadays in the core business of Google\(^41\) and increasingly in many other business.

Machine learning algorithms have been tested and trained using games because it’s easy to measure the evolution and results. Once AI has beaten top human players in classical games like Chess or Go, the next challenge are video games. DeepMind has announced a project with Blizzard to develop AI environment around StarCraft 2, it will be an incredible challenge, as AI should play like human players using image recognition and machine learning techniques to determine winning conditions and strategies\(^42\).

Procedural Generation

Video games developers have been always very ambitious, trying to create huge scenarios and worlds, going beyond computer resources. As memory has limited the size of the scenarios many games from Rogue (1980) to Minecraft (2011) or No Man’s Sky\(^43\) (2016). Demoscene\(^44\) creations or game dynamic algorithms have used these techniques. Most of the implementations have been in video games, however there’s a huge potential in IT business. The clearest use case could be entertainment (films) where these techniques have been already used\(^45\), architecture or maps have also with a great potential, but these processes could be used in any process requiring huge amount of data: simulations, testing, etc.

Graphics Process Unit (GPU)

Video games have been a pioneer in terms of real time rendering and 3D processing. As 3D video games became really popular in the 90s and early 00s it was necessary to develop dedicated cards to process graphics without CPU impact. GPUs had a massively parallel architecture to process images and graphics and had been proven to be really efficient processing general purpose algorithms. As result of this GPUs are used in HPC (High Performance Computing) and are at the core of Machine Learning and Deep Learning processing. It’s a clear example of synergy between video games and IT.

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VR/MR/AR and Wearables

As described in previous section video games technologies are increasingly oriented towards interaction with the environment (real or virtual worlds). Technologies such as VR, MR or AR, along with the development of biometric techniques and haptic interfaces have opened the potential to interact with virtual or real elements and therefore the potential development of 3D technologies and Wearables in Gaming. The application of these technologies for IT remains a challenge, however there are clear opportunities like 3D Design\(^{46}\), simulation and training\(^{47}\) in remote or dangerous environments.

There are a lot of opportunities in the manufacturing industry, architecture\(^{48}\) and the military that will benefit from some of the technologies currently used in video games such as drone operations. It would allow an incomparable opportunity to interact with newly designed elements, for testing and seeing how they will work in the real world. Wearable and haptics could have a clear usage in healthcare allowing doctors interact and operate from remote locations or provide more accurate tools or in rehabilitation process\(^{49}\).

Automation & Robotics

Video games have incorporated elements of automation and robotics since its inception. As indicated in the section of Machine Learning and Deep Learning, there have always been characters that have interacted with the user, so the synergy for customer support activities using virtual assistants is clear. In terms of automation, considering the agility and changes required by continuous evolutions and features, new scenarios and the interaction of characters, automated tests are key. Gaming companies have developed solutions to verify the correct execution and balance of the video games after each change in the most automatic possible way. Riot Games from League of Legends, emphasizes the need for this kind of tests\(^{50}\); so considering the complexity of video games, the synergy of these experiences should be applicable to IT.

Agile and DevOps

Agile development is the standard for video games as they are continuously evolving\(^{51}\). Working in small and productive teams, producing intermediate versions to obtain feedback and integrate products from different teams (game programming, narrative, graphics, AI, testing, …) is the way video game’s companies work. DevOps is also in Gaming core business, having the end-to-end control of product life cycle, continuous integration, automated tests, bug fixing, deployments or cloud environments. As a clear example of this approach, there’s a new trend in gaming, some development teams are releasing payed versions very early in the development cycle. Those pre-alpha or early-alpha versions bring in quite a lot of money which makes financing projects less of an all-or-nothing approach as games that do not get the required backing are stopped early in the process.

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\(^{46}\) https://en.wikipedia.org/wiki/Procedural_generation#Film
\(^{47}\) http://venturebeat.com/2013/09/06/this-is-how-elon-musk-designs-rocket-in-immersive-3d-virtual-reality
\(^{50}\) http://www.dezeen.com/2015/04/22/virtual-reality-architecture-more-powerful-cockaine-oculus-rift-by-hefdat-
dai-oliver-de-mangel-vr-nation
\(^{51}\) http://www.upmc.com/Services/rehab/rehab-institute/services/Pages/robotics-gaming.aspx
Payments and Cryptocurrencies
As indicated in previous section video games have been a model of innovation in terms of new business models, there are potential areas of synergies with payment platforms or micro-payment services. A clear area to be developed is related to crypto-currencies, its adoption is remarkable at this moment in gambling and online casinos, but still to be developed both in IT and Gaming.

Trust and Security
Gaming has had a significant development of cryptographic systems. Video games and consoles have traditionally been cracked, piracy has existed from the very beginning and has generated large profits on the sale of pirated games, consoles or modchips. This has allowed the development of cryptographic hardware and software techniques by manufacturers which have made it possible that the latest generation of consoles have been less vulnerable (XBox One or PS4). It does not mean that the Gaming industry has not suffered attacks of any other type, such as the PlayStation Network outage in 2011. It shows that even considering significant security developments, other traditional IT aspects cannot be neglected, and represents a clear opportunity for the sharing capabilities between the IT and Gaming.

Gaming and IT Synergies
Identifying synergies between the IT and Gaming are a clear opportunity to face the Digital Transformation of companies. The areas of development focus on two pillars, on the one hand the adoption of gaming techniques to improve the social experience, training and change management, and on the other hand identifying technological synergies, which in many cases are aligned with base digital transformation: analytics, cloud, VR/ AR, artificial intelligence their application to multiple areas such as Automation or Robotics.

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Video games have been considered as something not really serious, even with suspicion, however “few things are as serious as video games”. Video games represent one of the most attractive markets at the moment, with annual growth rates above 10%, they could be seen as a reference for Digital Markets. The launch of Pokémon GO represents a clear example of the impact on society, especially among the new generations. They have a huge potential from business and sociological point of view.

Video games have been a reference both in the technological development and the creation of new business models and monetization. Video games have led to the adoption of new creative models, including new artistic expression that could not be faced in other disciplines, such may be the case of narrative models, enriched by their potential for generating dynamic environments, the adoption of new social features, and of course their ambitious monetization models. In the medium-term these technological challenges open up a new universe of possibilities, both for consumers and enterprises. Gaming experiences will be one of the pillars of Digital Transformation: technologies applied by gaming such as Big Data (analyzing and predicting user interactions and transactions), SaaS (Cloud and Pay-per-Use), Media and Broadcasting (Video and Entertainment systems), Social Engagement (Social Networks and Gamification), Mobile devices, VR/MR/AR or Artificial Intelligence (Machine Learning and Deep Learning) are just examples of the huge potential of video games developments which could be used in other markets.

We have seen the use of gaming in several business areas, from simulation and training to strategy planning. We have also seen gaming technologies moving from the original gaming areas to the IT business ones. Games and business feel the consumerization process easing the sharing of innovation between the consumer and enterprise world, aiming to leverage Digital Transformation in traditional IT companies: gamification, learning support, simulations, agile methodologies and extensive enterprise adoption of gaming technologies should be in the agenda of any CxO.

Ready Player One described a future where life had been subsumed by games, where real life is just the boring bits you need to do when you aren’t playing. But instead gaming, gamification and gaming-related technologies can enhance and enrich both our personal and working lives. We are moving to a future with the possibility for more rewarding and creative entertainment, improved support for education, training and service, more motivated workers and more efficient businesses with flatter organisational structures and new business models.

Conclusion

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Atos SE (Societas Europaea) is a leader in digital transformation with circa 100,000 employees in 72 countries and pro forma annual revenue of circa €12 billion. Serving a global client base, the Group is the European leader in Big Data, Cybersecurity, Digital Workplace and provides Cloud services, Infrastructure & Data Management, Business & Platform solutions, as well as transactional services through Worldline, the European leader in the payment industry. With its cutting edge technologies, digital expertise and industry knowledge, the Group supports the digital transformation of its clients across different business sectors: Defense, Financial Services, Health, Manufacturing, Media, Utilities, Public sector, Retail, Telecommunications, and Transportation. The Group is the Worldwide Information Technology Partner for the Olympic & Paralympic Games and is listed on the Euronext Paris market. Atos operates under the brands: Atos, Atos Consulting, Atos Worldgrid, Bull, Canopy, Unify and Worldline.

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